Triplet-Triplet Absorption Spectra of Organic Molecules in Condensed Phases

Ian Carmichael and Gordon L. Hug

Radiation Chemistry Data Center, Radiation Laboratory, University of Notre Dame, Notre Dame, IN 46556, U.S.A.

We present a compilation of spectral parameters associated with triplet-triplet absorption of organic molecules in condensed media. The wavelengths of maximum absorbance and the corresponding extinction coefficients, where known, have been critically evaluated. Other data, for example, lifetimes, energies and energy transfer rates, relevant to the triplet states of these molecules are included by way of comments but have not been subjected to a similar scrutiny. Work in the gas phase has been omitted, as have theoretical studies. We provide an introduction to triplet state processes in solution and solids, developing the conceptual background and offering an historical perspective on the detection and measurement of triplet state absorption. Techniques employed to populate the triplet state are reviewed and the various approaches to the estimation of the extinction coefficient of triplet-triplet absorption are critically discussed. A statistical analysis of the available data is presented and recommendations for a hierarchical choice of extinction coefficients are made. Data collection is expected to be complete through the end of 1984. Compound name, molecular formula and author indexes are appended.

Key words: condensed phase; data compilation; extinction coefficients; glass, organic; lifetimes; photophysical processes; review; solution; triplet states; triplet-triplet absorption.

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1. Introduction

In 1971, as part of the classic volumes on organic molecular photophysics edited by the late J.B. Birks, Labhart and Heinzelmann contributed a review[1] which contained an extensive compilation of spectral data relevant to the absorption of light by the excited triplet state of organic molecules in condensed phases. The energies of absorption maxima in both fluid solution and in various glasses and solids were recorded together with the corresponding extinction coefficients where known. This compilation was neither limited to a specific class of compounds nor to a particular experimental method as had been the case with previous reviews[2,3]. Data on the polarization properties of triplet-triplet absorption transitions in rigid matrices were also listed, and a bibliography of theoretical calculations on and assignments of triplet spectra was given. A short discussion of all techniques then currently in use for both transient excitation and extinction coefficient determination was provided and the importance of correct identification of the absorbing species was highlighted.

Some years later Bensasson and Land produced a review[4] on the physical properties of excited states which also contained a compilation of extinction coefficients of triplet-triplet absorption maxima for a range of organic molecules, some of biological importance, in solution. This review was limited to those measurements made by the comparative energy transfer technique introduced by Land[5] and subsequently developed together with several coworkers. Some previous data obtained under similar experimental conditions, but by different approaches, were also listed by way of comparison. These reviews have served to illustrate the ubiquitousness and importance of the triplet state in a wide variety of photochemical and photophysical phenomena, under conditions ranging from steady illumination to pulse radiolysis.

With the availability of commercial laser flash photolysis equipment and nanosecond pulse radiolysis facilities and the subsequent explosion of time-resolved studies monitored by light absorption, the need for routine identification of transients has become crucial. One of the main transients observed in organic nonaqueous solution in such experiments is the triplet state. Whether this state is itself under investigation, or whether the purpose of study is to eliminate or implicate the triplet state as a precursor for a longer-lived species such as a free radical, a compilation of spectral characteristics of triplet-triplet absorption is of great value.

The quantification of such photophysical processes as intersystem crossing requires the knowledge of the triplet state concentration. One method to obtain this information relies on the existence of a dependable estimate of the extinction coefficient for triplet-triplet absorption[6]. This then can lead to the determination of the quantum yield for triplet formation and, subsequently, if the appropriate lifetime data, ideally measured under closely similar experimental conditions, is available, to the calculation of the rate of intersystem crossing. However, while the qualitative shapes of the transient absorption spectra are relatively routinely measured, though often unsatisfactorily reported[7], the determination of reliable extinction coefficients is both more difficult and tedious. Clearly an evaluation of the existing extinction data is in order.

For these reasons we have undertaken the compilation and critical evaluation of information relative to the triplet-triplet absorption spectra of organic molecules in condensed phases. In the course of laying the foundations of this work we have published three bibliographies[8-10] citing the relevant works in the literature up through the end of 1984. These lists were produced with the assistance of our local bibliographic data base[11], and it is our intention to provide regular updates to this series whenever the number of appropriate references accumulated is sufficient. From these bibliographic lists we have culled the data presented in the main body of this work, the table of the wavelengths of maximum absorbance (λ_{max}) and extinction coefficients (ϵ_{max}), where determined. Attention has been paid to the critical evaluation of these data as discussed below. In the comments associated with each entry in the table are found numerous other relevant data such as triplet state lifetimes, energies and energy transfer rate constants. No effort has been expended on this data to provide a comparable evaluation of these numbers which must thus be regarded as simply the authors' reported values. The subject of this work is then triplet-triplet absorption spectra of organic molecules in condensed media, i.e. solution, glass, liquid and solid. Gas phase studies are not included. For completeness, and to enhance the usefulness of the present document we have also scanned the literature for the period rather thoroughly covered in the work of Labhart and Heinzelmann. However we have addressed neither the compilation nor the evaluation of theoretical calculations on the triplet-triplet absorption process and provide no update to that section of their review.

We begin with a conceptual introduction to the photophysical processes involved in triplet-triplet absorption, followed by an historical perspective on the discovery and characterization of the triplet state. In Sec. 2. we provide a discussion of the methods commonly used for populating the excited triplet state focusing on the differences between photolysis and radiolysis and the problems and advantages inherent in each technique. The various methods which have been used for the estimation of the extinction coefficient of triplet-triplet absorption are critically analyzed in Sec. 3. Seven principal approaches are outlined, numerous required corrections and precautions are pointed out, possible extensions are illustrated and each technique is evaluated in the light of its advantages or disadvantages. Several less used methods are catalogued in Sec. 3.8. A discussion of the data evaluation procedure follows in Sec. 4. The arrangement of the principal data table, Table 6, is presented in Sec. 5. and lists of abbreviations and symbols used are given.

Since this compilation derives from part of a series of computer accessible numerical data bases under construction at the Radiation Chemistry Data Center, we are able to include, in an automatic fashion, a number of indexes which we hope will enhance the usefulness of this work. We have provided a compound name index, a molecular formula index and an author index.

1.1. Conceptual Background

Triplet states can be generated in several ways. We will discuss the direct intramolecular photoproduction of triplet states in the process of introducing the general photophysical scheme, saving until later photosensitization and pulse radiolysis techniques, where the triplet energy is transferred intermolecularly from the triplet manifold of another solute or the solvent, respectively. When an organic molecule, M, is excited, it is most likely to go to an excited singlet state,

1.1 $\quad {}^1M + h\nu \rightarrow {}^1M^*, \quad k_{ex}$

where k_{ex} is the intensity dependent excitation rate. The excited singlet state, ${}^1M^*$, will then decay via several independent processes, again both intermolecular and intramolecular. Intramolecularly it can undergo photochemistry, with rate constant k_{pc}, intersystem crossing, k_{isc}, internal conversion, k_{ic}, or fluorescence, k_f.

These decay channels are represented by the following four processes:

1.2 $\quad {}^1M^* \rightarrow \text{products}, \quad k_{pc}$

1.3 $\quad {}^1M^* \rightarrow {}^3M^* + \text{heat}, \quad k_{isc}$

1.4 $\quad {}^1M^* \rightarrow {}^1M + \text{heat}, \quad k_{ic}$

1.5 $\quad {}^1M^* \rightarrow {}^1M + h\nu_f. \quad k_f$

In the usual kinetic scheme these processes are independent, and the singlet state decays exponentially with a rate constant,

$$k_S = k_{pc} + k_{isc} + k_{ic} + k_f, \tag{1.1}$$

which is equal to the inverse of the measured fluorescence lifetime. Triplet states are thus generated directly by the intersystem crossing process, *1.3*. The quantum yield, Φ_T for production of the triplet state in this scheme is simply given by

$$\Phi_T = k_{isc}/k_S\,. \tag{1.2}$$

Schematically, these elementary processes may be summarized in the energy level diagram displayed in Fig. 1.

Depending on the frequency of the incident radiation, the initial state achieved in the absorption event, *1.1*, may lie in the vibrational manifold associated with the first electronically excited state (S_1) or that of a higher singlet (S_n). Rapid *radiationless deactivation* (*vibrational relaxation* and *internal conversion*) soon (rate constant $10^{11}-10^{13}$ s^{-1}) leads to population of S_1 (Kasha's Rule[12]),

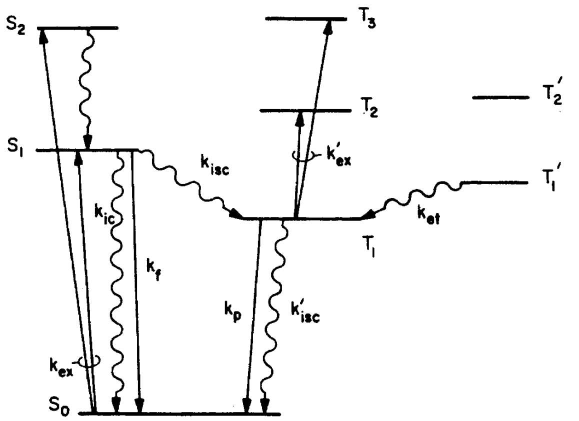

FIG. 1. Rate processes connecting electronic energy levels.

though in exceptional cases radiative emission from S_2 has been observed[13]. These processes are of course in competition with intersystem crossing and photochemistry from the higher excited singlet states, but because of the high rates of internal conversion, this competition is generally ineffective.

Figure 1 also provides an illustration of the decay channels available to the triplet state (again within the above simplified model). Triplet states once formed can undergo similar processes to those of the singlet state. The intramolecular processes are again photochemistry, with rate constant k'_{pc}, (reverse) intersystem crossing, k'_{isc}, and phosphorescence, k_p.

1.6 $^3M^* \rightarrow \text{products},$ k'_{pc}
1.7 $^3M^* \rightarrow {}^1M + \text{heat},$ k'_{isc}
1.8 $^3M^* \rightarrow {}^1M + h\nu_p.$ k_p

The intramolecular decay is usually observed to be exponential with a decay rate constant of

$$k_T = k'_{pc} + k'_{isc} + k_p. \tag{1.3}$$

Phosphorescence is almost always absent in fluid media because of collision-induced intersystem crossing.

Energy transfer from the singlet manifold, process *1.3*, is, of course, spin-forbidden, but the presence of several small interactions, both intramolecular and intermolecular, serve to make the process weakly allowed. Such radiationless transitions may lead to an excited vibrational level of the lowest triplet state (T_1) or that of a higher electronic origin (T_n). Rapid radiationless deactivation (vibrational relaxation and internal conversion) within the triplet manifold soon (rate constant $\sim 10^{11}\ s^{-1}$) leads to population of the lowest electronic state, T_1, though in exceptional cases triplet-triplet fluorescence has been observed[14]. Again these processes compete with (reverse) intersystem crossing and photochemistry and again this competition is generally ineffective. In addition, once thermal equilibration has occurred, a further deactivation channel is open, provided the necessary thermal energy is available.

1.9 $^3M^* + \text{heat} \rightarrow {}^1M^*.$ k''_{isc}

This process leads to a type of delayed fluorescence.

In the presence of radiation of a suitable frequency, the relaxed triplet excited state, $^3M^*$, can again absorb photons populating higher triplet states with characteristic probabilities,

1.10 $^3M^* + h\nu' \rightarrow {}^3M^{**}.$ k'_{ex}

This process, then, is triplet-triplet absorption, $T_n \leftarrow T_1$ in terms of the symbols used above, the subject of the present compilation.

1.2. Historical Perspective

The discovery of the nature of the "phosphorescent state" of photoexcited organic molecules as the triplet and its detection in absorption have led to the development of triplet-triplet absorption spectroscopy as an important tool in quantitative photochemistry and in the study of photophysical and, more recently, radiation chemical processes in general. But it was really with the study of phosphorescence that the history of triplet states of organic molecules began. The origin of phosphorescence was a research puzzle until Lewis and Kasha ascribed the phosphorescing state to an excited state with a total electronic spin of 1, namely a triplet excited state[15]. Throughout the early history of the phenomena implicating the triplet state (up to and including the Lewis and Kasha work and indeed for many years thereafter) phosphorescence spectra and decay characteristics remained the primary method of studying these transient states. However even before the nature of the phosphorescing state was assigned to the triplet state, Lewis and coworkers had recorded that state in absorption[16]. Such early work employed high intensity continuous light sources and was limited by the lifetime of the metastable state to viscous media.

By maintaining a boric acid glass at low temperature and monitoring the bleaching of the ground state absorbance, Lewis et al. were able to estimate the extinction coefficient of the phosphorescing state of fluorescein relative to that of the ground state. This was the first use, in the study of the triplet state, of the method we designate singlet depletion, employed here in specially favourable circumstances since distinct spectral regions of transient and ground state absorption could be found. Some years after the clarification of the states participant in triplet-triplet absorption, again using a photostationary technique, McClure[17] recorded transient spectra of a number of aromatic molecules in EPA glass at liquid nitrogen temperature. To deduce the extinction coefficients of the observed transitions he introduced the new method of intensity variation.

A big breakthrough in the absorption studies of triplet states came when Porter and Windsor[18] applied the then recently developed technique of flash photolysis[19,20]. The introduction of this excitation source allowed the facile detection of triplet-triplet absorption in fluid media, thus extending considerably not only the range of materials and solvents open to investigation but also the time scale available for observation. Studies of triplet states in fluid solution on the microsecond time range, which is generally inaccessible to phosphorescence monitoring, now became possible. Porter and Windsor[21] were able to obtain an absorption spectrum for anthracene in liquid hexane and used the singlet depletion criterion to estimate extinction coefficients far in excess of McClure's values. (Improvements in the intensity variation technique later confirmed that the original measurements by this method were indeed in error.)

The introduction of the technique of electron pulse radiolysis[22-25] and its use to produce triplet states of organic molecules by Dainton et al.[26] provided access to a wider range of compounds by removing the limitation formerly imposed by low quantum yields of intersystem crossing. It was, however, four years before Land[5] was able to report extinction coefficients using this excitation source, through the development of an estimation method involving triplet energy transfer. (See Sec. 3.1. for details).

Finally the late 1960's brought the introduction of pulsed laser techniques[27] to the study of triplet states. Further developments in this equipment, namely the application of Q-switching, together with advances in the associated hardware for photoelectric detection eventually brought flash photolysis to the nanosecond time scale[28]. Shorter lived transients such as the carbonyl triplets[29] in fluid solution could now be studied. Picosecond pulse photolysis techniques[30], made possible through the phenomenon of mode-locking, have also been used to study triplets[31,32] on the picosecond timescale. The much wider availability of commercial nanosecond laser flash photolysis equipment, together with the inherent lower cost of associated detection apparatus, make the nanosecond work much more extensive and the derived data more reliable.

Based on the number of entries corresponding to each of the four principal excitation techniques, Table 1 summarizes their introduction and development over five year spans. However we expect that the numbers in the 80–84 row will be underestimated due to unavoidable timelags in our collection procedure. (Abbreviations are explained in appended list).

Roughly parallel to the development of new and faster techniques for the population of the triplet state has been the growth of the associated methods for estimating the extinction coefficient of the transient population. Singlet depletion and intensity variation initially deployed in photostationary experiments, as mentioned above, have been extended as needed to accommodate the use of pulsed sources. The kinetic method has been used with modulated excitation sources, while relative actinometry and energy transfer techniques were also popularized with the introduction of flash photolysis and pulse radiolysis. Several other comparative techniques based on electron and hydrogen atom transfer have also been developed and exploited mainly with the help of laser facilities. Sec. 3. presents a critical discussion of these methods, and here we trace the growth in the application of these methods to the study of the triplet state in Table 2 below. This table lists the number of entries in the data base per 5-year period for several popular methods. (Again an explanation of the symbols used can be found in the lists appended to Sec. 5.)

TABLE 1. Excitation methods per 5-year period

Period	LP	FP	PR	PS	Total[a]
50–54	0	19	0	32	51
55–59	0	75	0	9	84
60–64	0	88	4	11	104
65–69	23	166	63	193	452
70–74	121	222	80	45	569
75–79	443	218	75	26	795
80–84	768	174	67	32	1046
Total	1355	962	289	350	3103

[a] Horizontal totals reflect the presence of entries assigned to methods other than those specifically indicated in the vertical columns.

TABLE 2. Extinction methods per 5-year period

Period	ET	SD	TD	RA	KM	IV	Total[a]
50–54	0	3	0	0	0	3	6
55–59	0	17	0	0	0	0	17
60–64	0	11	0	0	0	0	11
65–69	28	54	11	3	12	22	173
70–74	73	45	19	8	31	0	185
75–79	93	49	37	28	7	1	255
80–84	96	75	68	28	13	1	320
Total	290	225	135	67	63	27	972

[a] Horizontal totals again reflect the presence of entries assigned to methods other than those specifically indicated in the vertical columns.

2. Methods for Populating and Detecting the Triplet State

There are two basic methods for achieving substantial triplet state populations: photolysis with light in the visible or, more commonly, ultraviolet spectral regions and radiolysis with ionizing radiation, usually high energy electrons. In fluid solution, where the triplet state lifetime is on the order of microseconds, both techniques are generally applied in a pulsed form. In low temperature glasses, where triplets can endure for up to about 30 seconds, steady irradiation can be usefully employed.

Experimental setups for the detection of triplet-triplet absorption spectra differ greatly, but there are at least two elements common to almost all of these experiments. First of all every experiment has an "exciting" source to produce triplet state species. Second, each experiment has a "monitoring" light source to probe their absorbance. In laser photolysis setups the laser often provides both monitoring and exciting light when used with suitable frequency multiplication and light path adjustment. Additionally, if a complete spectrum is desired, the laser pulse can be used to generate a continuum as a monitoring source.

Details of the detection equipment will not be given. We mention only the following historical development. In the earliest flash photolysis systems the transient spectrum was photographed, and the changes in optical density laboriously converted from densitometer measurements of the exposure intensity. With the growth of efforts to discern the mechanism of the various rate processes involved, kinetic spectroscopy using photomultipliers became popular. Here the decay of the transient is monitored at a particular wavelength. When this pattern has been recorded at several observational wavelengths, the entire spectrum may be judiciously reconstructed. More recently the introduction of vidicon, and later reticon, detectors has offered a way to fulfil both of the above functions simultaneously.

We discuss the two primary excitation sources, starting with pulse radiolysis, focusing on the special features of each method, and mention some problems encountered in the respective detection process.

2.1. Generation of Triplets by Pulse Radiolysis

In the technique of pulse radiolysis the sample is irradiated by short bursts of ionizing radiation. Most commonly, pulses of high energy (1–20 MeV) electrons extracted from a linear accelerator or Van de Graaff generator are employed. Initially, the usable pulse width was of the order of a few microseconds, but steady improvement in equipment design soon made the nanosecond regime attainable.

2.1.1. Theoretical Concepts

The deposition of energy from these injected electrons does not discriminate among the chemical components of the systems irradiated. Thus in a dilute solution, which is almost always employed in the study of triplet-triplet absorption, the radiation is absorbed almost exclusively by the solvent, S, which is consequently ionized,

2.1 $$\mathrm{S} \rightsquigarrow {}^2\mathrm{S}^+ + e^-,$$

to give solvent radical cations and electrons. The subsequent mechanism of solute excitation depends to a large extent on the properties of the solvent.

In polar solvents, such as water and the lower alcohols, the ionized electron is rapidly thermalized and readily solvated. Thus on the nanosecond time scale the reactive species are the various oxidizing and reducing radicals and radical ions formed from the solvent. These intermediates are also stabilized by solvation. Correspondingly, solute radical ions (and other redox or radical addition products) are predominantly produced by pulse radiolysis in polar solvents.

If the solvent lacks the driving force for electron and (radical) ion solvation, by virtue of its nonpolar character, then radical recombination will promptly occur. In room temperature hexane, for example, the electrons are largely (90%) captured by their parent cations, the particles being unable to escape from their mutual Coulombic attraction. While this geminate recombination is complete within a few nanoseconds, those electrons which do escape recombine homogeneously over a much longer microsecond timescale. With the addition of an electron (or hole) acceptor, A, these processes can be intercepted to produce solute radical ions.

2.2 $$e^- + \mathrm{A} \rightarrow {}^2\mathrm{A}^-,$$

2.3 $${}^2\mathrm{S}^+ + \mathrm{A} \rightarrow {}^2\mathrm{A}^+ + \mathrm{S}.$$

These species then recombine to give both singlet and triplet solute excited states.

2.4 $${}^2\mathrm{A}^+ + {}^2\mathrm{A}^- \rightarrow {}^3\mathrm{A}^* \; ({}^1\mathrm{A}^*) + \mathrm{A}.$$

In general the solvent radical cation can also participate in this neutralization process,

2.5 $${}^2\mathrm{S}^+ + {}^2\mathrm{A}^- \rightarrow {}^3\mathrm{A}^* \; ({}^1\mathrm{A}^*) + \mathrm{S}.$$

Further triplets may then be formed by intersystem crossing from the singlet manifold.

A further complication ensues in the above scheme if the solvent itself possesses long-lived excited states, for example benzene (but note that the triplet state lifetime in neat benzene is strongly dependent on the purity of the liquid[33]). Electron attachment

2.6 $$e^- + \mathrm{S} \rightarrow {}^2\mathrm{S}^-,$$

is followed by *solvent* radical ion recombination to give *solvent* excited states.

2.7 $${}^2\mathrm{S}^+ + {}^2\mathrm{S}^- \rightarrow {}^3\mathrm{S}^* \; ({}^1\mathrm{S}^*) + \mathrm{S}.$$

Energy transfer may then occur from the excited states of the solvent molecules to those of the solute in a spin-selective fashion.

2.8 $${}^1\mathrm{S}^* + \mathrm{A} \rightarrow \mathrm{S} + {}^1\mathrm{A}^*,$$

2.9 $${}^3\mathrm{S}^* + \mathrm{A} \rightarrow \mathrm{S} + {}^3\mathrm{A}^*.$$

Again intersystem crossing may augment the solute triplet yield.

The above simplified picture has been debated in the literature for several years. Clearly each individual solvent must be carefully examined to determine the extent to which a given process contributes to the overall triplet yield. Within these limitations the scheme presented serves as an extremely useful guideline.

2.1.2. Special Considerations for Pulse Radiolysis

The absorption intensity of a transient created by such pulses of electrons depends both on the dose per pulse and the G value (100 eV yield) for that transient in addition to its intrinsic extinction coefficient at the monitoring wavelength. For a typical triplet with $G = 2$ say, to obtain an optical density of 0.1 at a wavelength where the extinction coefficient is on the order of 10^4 L mol^{-1} cm^{-1} over a path length of 1 cm, requires a dose per pulse in excess of 2.5 Gy (1 Gy≡1 gray = 1 J kg^{-1}).

Van de Graaff generators with pulse widths on the order of a few nanoseconds can produce bursts of 3 MeV electrons to give a maximum dose of about 20 Gy. Care must be taken in quantitative work to ensure a sufficiently low dark charge to beam charge ratio when operating under conditions of high dose per pulse or high pulse repetition rate.

Single-pulse generators such as the Febetron eliminate the dark current problem completely and can deliver doses of up to 5000 Gy in a 25 ns pulse of 2 MeV electrons. Problems arise from the lack of penetration depth of such electrons. If they are stopped within the sample severe space charge distortions of the dose distribution result[34]. In addition spurious optical effects on the microsecond time scale have been observed[35] in typical experimental geometries, presumably due to pressure waves generated by the radiation source.

The incremental acceleration of electron by repeated traversal of microwave fields in a linear accelerator has proved to be the most versatile source of ionizing radiation for transient spectroscopy. Coupled with powerful computerized signal averaging techniques to reduce noise, the characteristics of reproducible ~5 ns pulses of ~20 MeV electrons delivering a dose per pulse of ~100 Gy has made this the method of choice for irradiation of fluid samples. Certain problems specific to optical detection of intermediates created by nanosecond pulse radiolysis have been summarized by Hunt et al.[36]. More recently, modern technology has enabled the resolution of the fine-structure components of linear accelerator pulses, pushing the domain of excitation by this method into the picosecond time range. This is much in analogy to the development of mode-locked lasers, though quantitative work on this timescale still remains problematic due to instabilities in the integrated yield arising from pulse to pulse jitter in both the electron beam and the analyzing light.

Electron linear accelerators produce their own source of analyzing light. Broad band (ultraviolet to infrared) Cerenkov radiation, emitted by electrons traveling above the speed of light pertinent to the solvent under study can be used for the detection of transients. A stroboscopic pulse radiolysis system capable of picosecond time resolution which implements this light as a probe has been reported[37].

The principal advantage of the technique of pulse radiolysis then lies in the possibility of populating the excited triplet state of molecules which have intrinsically low efficiency for intersystem crossing. Note however that to study species with short excited state lifetimes, substantial concentrations (~0.1 mol L^{-1}) of solute are required. For the simple reason of solubility this problem can set a limitation on the usefulness of the technique.

Extensive reviews of the development of this field and the instrumentation required have been provided by Dorfman[38] and Hunt[39].

2.2. Generation of Triplets by Photolysis

The sources of light employed to excite molecules to the triplet state are quite varied. Intense steady-state sources have been a popular excitation source for samples in glasses; long triplet state lifetimes allow large steady-state concentrations of triplets to build up. Conventional flash lamps have provided most of the triplet-triplet absorption spectra recorded up to the middle 1970's. Their short, but intense, pulses make them ideal for studying spectra and kinetics on the μs time scale, which is in the range of the lifetimes of many triplets in fluid solution. In order to study shorter lived triplets such as those of aromatics ketones, it is most convenient to use Q-switched lasers[29] to get into the nanosecond time range. Recently mode-locked lasers have been used to study triplets (including rise times) in the picosecond time range[40]. Nonpulsed lasers (continuous wave lasers) have also been used in much the same fashion as conventional steady-state light sources.

2.2.1. Theoretical Concepts

Triplet states are generated in two ways by photons. In the first method, exemplified in Sec. 1.1. of the above introduction, the compound under study, irradiated within its ground state absorption band, absorbs the photon as in process *1.1*, going first to a singlet excited state. The excited molecule then undergoes intersystem crossing, process *1.3*, to reach the triplet state.

Should the efficiency of this process be low, another technique is available[41]. In this method another molecule, M_1 with a suitable intense ground state absorption and high quantum yield for subsequent triplet state formation is added to the solution (usually in excess). This species intercepts the light energy and transfers it via the intermediary of a triplet state to the triplet state of the compound under study, M_2 during collisions.

2.10 $${}^3M_1^* + {}^1M_2 \rightarrow {}^1M_1 + {}^3M_2^*.$$

At least in dilute solution, excited singlet states are usually too short lived to participate in an analogous singlet-singlet energy transfer, though several examples have been documented[42]. This photosensitization technique will generally be successful provided the triplet energy of the sensitizer (donor) is at least 8–12 kJ mol^{-1} greater than that of the acceptor[43,44]. Given a suitable energy difference as a driving force, it is usually assumed that triplet-triplet energy transfer proceeds with unit efficiency. However this assumption is often erroneous and detailed kinetic analysis is then required to produce valid estimates of the triplet state concentration of acceptor molecules formed and its temporal evolution. Such corrections are discussed in Sec. 3.1.2. If the acceptor itself absorbs the incident radiation further adjustments must be made to the estimated extinction coefficients.

2.2.2. Special Considerations for Photolysis

Steady-state light sources have often been used with a modulator. In some cases the modulation of the light source has been used to enhance the signal/noise ratio of the signal[45], enabling the study of very low triplet concentrations. This is particularly effective when combined with a phase-sensitive detection system[46]. In other cases a modulated light source has been used in connection with the kinetic method to measure extinction coefficients[47,48]. Modulated moderate intensity light sources are also useful if the sample under study is susceptible to photodecomposition by more intense pulse techniques[49].

The advent of laser flash photolysis with relatively monochromatic pulses greatly enhanced the accuracy to which the total energy absorbed by a species in solution could be measured. Previously, conventional flash techniques with intense but polychromatic sources, had made this estimation difficult. This feature enabled, in principle, substantial improvements in the results derived from both the pulsed intensity variation and relative actinometry methods discussed below (Secs. 3.8.3. and 3.4. respectively).

The monitoring light sources that measure the spectrum of the transients have not been nearly as varied in type as have been the exciting sources. They are usually a fairly weak source, for instance of the arc-lamp type. Sometimes the sources have been pulsed to increase their intensity or modulated as part of phase-sensitive detection systems[46].

A more salient feature of analyzing beams is their spatial arrangement with reference to the path of the exciting light. Both in-line (front-face) and crossed beam (right-angle) geometries are popular. This arrangement of the exciting and monitoring beams can be of crucial importance when using photons to generate the triplet states. The concentration of triplets is central to the determination of extinction coefficients, but this concentration varies along the exciting beam according to Beer's Law. When right-angle monitoring is used, the particular region sampled, along the exciting beam, is one in which the concentration is uniform along the direction of the monitoring beam. Thus kinetics (especially second-order kinetics) can be measured accurately, but spectra are more difficult to obtain since the region sampled will not in general be near the front face of the cell where the concentration of transients is greatest.

In-line monitoring of the triplets has the disadvantage that the observation is along a gradient in the concentration. Unless the concentration of the triplets is kept low, for example with the optical density of triplet absorption < 0.05,[50] the kinetics can be severely distorted when looking at second-order reactions[51]. In-line monitoring, however, has an advantage in that it is possible to easily access the region of high concentration of triplets near the surface of the cell on which the exciting light is incident. On the other hand the usual way of calculating concentration from the optical density, in regions where the ground state does not absorb,

$$\Delta OD = \varepsilon_T^* \, [{}^3M^*] \, \ell , \tag{2.1}$$

will not be meaningful because of the variation in $[{}^3M^*]$ with the distance across the cell along the exciting light beam. An early work by Ross[52] provided an estimate of the effect of such nonuniform triplet concentrations on the absorption spectrum recorded during steady-state experiments in glasses. In that study it was concluded that while the general features of the spectrum should be preserved, band to band distortion was not ruled out. Further corrections are discussed in Sec. 3.

There are indeed several other possible sources of spectral distortion. If there is substantial singlet depletion, i.e. removal of ground state molecules in the path of excitation, the resulting difference spectra can offer only a limited guide to triplet-triplet absorption maxima in the vicinity of regions of negative ΔOD. On the other hand, this effect can be very useful because it can often give a quantitative indication of the amount of ground state population that has been converted into triplets. This is the basis for the method of measuring extinction coefficients of triplet-triplet transitions discussed in Sec. 3.2. However due to possible distortions, while we retain difference spectra that are clearly removed from the singlet depletion region in this compilation, we do not report maxima of spectra near the singlet depletion region of uncorrected spectra.

Light scattering of the monitoring beam can cause distortions in the form of the spectral shape and can also shift the position of the spectra in some cases. The intensity of scattered light varies as $1/\lambda^4$ and so becomes a problem in the ultraviolet. In addition conventional monitoring sources usually have very low output in the ultraviolet, and thus they are susceptible to light scattering from the more intense visible regions. The effect on the spectra can be seen by the following example. The experimental optical density is given by

$$\Delta OD_{exp} = \log_{10}\{ (I_0 + I_s) / (I + I_s') \}, \tag{2.2}$$

where I_0 is the incident light which is measured before the pulse, I_s is the intensity of the visible scattered light that is measured along with I_0, I is the true intensity of the transmitted light through the solution containing the transient, and I_s' is the excess scattered light from the visible that is measured along with I. ΔOD_{exp} is the experimentally measured optical density which is just the equal to the logarithm (to the base ten) of the total intensity measured before the pulse divided by the intensity at some specific time during the decay of the transient. The true optical density is given by

$$\Delta OD_{true} = \log_{10}(I_0/I). \tag{2.3}$$

ΔOD_{true} can be written in terms of ΔOD_{exp} as

$$\Delta OD_{true} = -\log_{10}\{ (1 + I_s/I_0) \exp(-2.3\Delta OD_{exp}) - (I_s'/I_0)\}. \tag{2.4}$$

If we consider an example in which scattered light constitutes 50% of the incident and also the transmitted beams, then $(I_s'/I_0) = 1 = (I_s/I_0)$. If we also assume $\Delta OD_{exp} = 0.01$, then $\Delta OD_{true} \sim 0.02$. For a second example take the same numbers except for $(I_s'/I_0) = 0.996$. This would mean that not as much light is being scattered from the visible while the transient is present. $\Delta OD_{true} \sim 0.018$

in this case. These examples illustrate the general behavior of excess scattered light on the true spectrum. This effect is often seen on the "blue" side of absorption peaks in the ultraviolet, namely the "blue" side of the uncorrected spectra is suppressed.

Distortions of the spectra can also arise from improper overlap of the analyzing and exciting beams. Proper overlap means that the analyzing beam should go only through the region of the cell that is excited and that the cell should be excited across the total width of the cell in right angle apparatus. In a right-angle setup, if the cell is not excited over the whole width, then the optical path is not the same as the path through the excited region of the cell[53]. This does not lead to a distortion, but it leads to an incorrect concentration of the transient. The distortion of the spectra due to incorrect overlap comes when the analyzing beam samples regions of the cell that contain no excited molecules. In effect this extra light is scattered light, and the equations that Bazin and Ebbesen[53] derive for the relationship between the true optical density and the experimental optical density are very similar to Eq. (2.4) above for scattered light. Such distortions can lead to large errors in measuring extinction coefficients.

Novel sources of nonuniform concentration of transients are hot spots generated in a sample photolyzed by a pulse of laser light (T. W. Ebbesen and M. Bazin, unpublished data). The equations derived by Ebbesen and Bazin in this extension are similar to those reported in their earlier work[53] and indicate the possibility of large effects because lasers can cause very severe nonuniformities in transient concentration.

Extensive reviews of the development of pulsed photolytic techniques and the instrumentation involved have been provided by Porter and West[54] and West[55].

2.3. Miscellaneous Methods

While there exist other methods for the formation of the triplet states of organic molecules, for example enzymolysis[56] and thermolysis[57], we know of no reports concerning the estimation of the extinction coefficients of triplet-triplet absorption in these ways and of none in which new spectra, otherwise unobserved, have been recorded.

3. Methods for Measuring Extinction Coefficients

We discuss seven principal techniques currently in use for the determination of the extinction coefficient for triplet-triplet absorption. Special problems, extensions of the basic method, and advantages and disadvantages of each approach are documented. Several features (e.g. required corrections) are common to more than one technique. To avoid repetition these items are detailed only on their first occurrence. The various methods are presented approximately in order of number of entries in our database, energy transfer being the most frequently adopted approach. Miscellaneous methods are collected in Sec. 3.8.

3.1. Energy Transfer (ET) Method

3.1.1. Description of Method

The energy transfer method is currently one of the most widespread methods of measuring extinction coefficients. It was originally used for measuring extinction coefficients of triplet states generated by pulse radiolysis[5] and later extended to include population by pulsed laser photolysis[58]. Energy transfer methods have been criticized because of uncertainties in the probability of transfer. However over the past few years this method for measuring triplet state extinction coefficients has been improved and can now yield reliable results when used carefully.

The basic idea of the method is quite simple[4]. Two compounds are placed in a cell. One compound, R, has a triplet state whose extinction coefficient is well-known. The other compound, T, is the compound whose extinction coefficient is to be determined. In the ideal experiment, one of the triplet states (either R's or T's) is initially populated, and the other triplet state is not populated. The compound with the initially populated triplet is chosen so that it can act as the triplet donor of the pair of triplet states. It does not matter whether R or T acts as the triplet donor. After the donor triplet is populated it can then transfer its energy to the acceptor triplet. This is done by collisional quenching involving the exchange interaction[59]. In the ideal experiment where the triplet lifetimes of the isolated molecules are infinite on the time scale of the quenching experiment, every donor triplet molecule produces exactly one acceptor triplet molecule. The "one donor triplet yielding one acceptor triplet molecule" is the heart of the method because it allows one to get a handle on the persistent problem of measuring extinction coefficients of transients, namely determining the concentration of the transient. So in the ideal experiment the initial concentration of the donor triplet is equal to the final concentration of the accepter triplet and so

$$\epsilon_T^* = \epsilon_R^* \,(\, \Delta OD_T \,/\, \Delta OD_R \,). \qquad (3.1)$$

In this equation ϵ_T^* is the unknown extinction coefficient, and ϵ_R^* is the reference extinction coefficient and the superscript "*" refers to the excited state. The meaning of the ΔOD's depends on whether T or R is functioning as the donor. The ΔOD of the compound serving as the donor is set equal to the ΔOD extrapolated back to time zero, and the ΔOD of the compound serving as the acceptor is set equal to the ΔOD at infinite time.

3.1.2. Kinetic Corrections

Corrections need to be made for several things when the conditions are not as described above. One problem occurs because the probability for transfer from donor, D, to acceptor, A, is not always unity. In addition to populating the acceptor triplet, the donor triplet can decay by other paths. In well degassed solutions, the most likely path is by unimolecular, radiationless decay to the ground state. The kinetic scheme is often modelled by the following reactions:

Scheme I

3.1 $^3D^* \rightarrow {}^1D,$ k_D

3.2 $^3D^* + {}^1A \rightarrow {}^1D + {}^3A^*,$ k_{et}

3.3 $^3A^* \rightarrow {}^1A,$ k_A

Ignoring the last process, the probability of transfer, P_{tr}, is

$$P_{tr} = k_{et}[^1A] \,/\, (k_{et}[^1A] + k_D). \tag{3.2}$$

The concentration of the acceptor is reduced by this factor. So an equation analogous to Eq. (3.1) can be written with

$$\epsilon_A^* = \epsilon_D^* \,(\,\Delta OD_A \,/\, \Delta OD_D\,) \,/\, P_{tr}. \tag{3.3}$$

In order to make this correction one has to know k_D and $k_{et}[^1A]$. The unimolecular decay rate constant of the donor, k_D, is just the rate constant of the decay of the donor triplet measured in the absence of the acceptor, but with all other conditions similar to those in the actual energy transfer experiment. If the acceptor is then added to the cell, the combination $k_D + k_{et}[^1A]$ can then be measured as an effective first-order decay rate constant of the donor triplet. This effective first-order rate constant is the sum of the donor's unimolecular decay rate constant and the pseudo first-order, energy transfer rate constant, $k_{et}[^1A]$. With the measurement of $k_D + k_{et}[^1A]$ and k_D, P_{tr} can be calculated using Eq. (3.2).

Two precautions are often taken when applying this kinetic correction factor. First, care is taken to eliminate second-order decay of the donor triplets. These processes could complicate the kinetic scheme. Second, $k_D + k_{et}[^1A]$ is often measured by checking both the decay rate constant of the donor absorption and also the inverse rise time of the acceptor triplet. If the kinetic scheme is as simple as the model assumed above, these two rate constants should be the same. If they are not, complicating factors have probably entered the analysis.

The rise time of the acceptor is often obscured by the decay of the acceptor. For instance, the rise and decay kinetics of the acceptor in Scheme I is given by

$$[^3A^*] = W \times \{\exp(-k_A t) - \exp(-k_{et}[^1A]t - k_D t)\}, \tag{3.4}$$

where

$$W = [^3D^*]_0\, k_{et}[^1A] \,/\, (k_D + k_{et}[^1A] - k_A), \tag{3.5}$$

and where $[^3D^*]_0$ is the initial triplet concentration of the donor. If k_A is not small compared to the argument of the second exponential in Eq. (3.4), then the growth of A will be complicated by the first term in Eq. (3.4).

When k_A is not small compared to $k_{et}[^1A] + k_D$, a modification to Eq. (3.3) is often used[60]. The maximum of the decay curve represented by Eq. (3.4) is the one unique feature of the curve. The time at which this point is reached is found by differentiating Eq. (3.4) and setting the derivative to zero. This time is given by

$$t_{max} = \frac{\ln\{k_A/(k_{et}[^1A] + k_D)\}}{k_A - k_{et}[^1A] - k_D}. \tag{3.6}$$

This time, t_{max}, and the measured $\Delta OD_A(t_{max})$ can be used to find the ΔOD_A needed for Eq. (3.3) in the following manner. First one can calculate $[^3A^*]$ at t_{max} for the Eqs. (3.4,3.5). Second one can calculate $[^3A^*]$ as $t \rightarrow \infty$ under the Eqs. (3.4,3.5) for $k_A = 0$, that is no decay of $^3A^*$. Taking the ratio of these two results gives a simple correction factor, and the final result is

$$\Delta OD_A = \Delta OD_A(t_{max}) \times \exp(k_A t_{max}). \tag{3.7}$$

This is the ΔOD_A that is to be used in Eq. (3.3) to obtain the sought for ϵ_A^*. In order to do the kinetic correction in Eq. (3.7), an extra rate constant, k_A, must be obtained in addition to the rate constants needed to calculate P_{tr}. If $[^3A^*]$ cannot be directly populated, then k_A must be obtained from a fit to the two-exponential decay given by Eq. (3.4).

3.1.3. Uncertainty in Probability of Transfer

Even after the two kinetic corrections are made, there still remains an uncertainty in the energy transfer method. This uncertainty involves the probability of transfer. With the two kinetic corrections already discussed, account can be taken of the unimolecular decay of both the donor, Eq. (3.3), and the acceptor, Eqs. (3.3,3.7). Nothing can be done in this scheme if the acceptor deactivates the donor without the acceptor itself being excited.

3.4 $^3D^* + {}^1A \rightarrow {}^1D + {}^1A,$ k_{DA}

Eq. (3.2) would have to be modified by the pseudo first-order rate constant, $k_{DA}[^1A]$ to read

$$P_{tr} = k_{et}[^1A] \,/\, (k_{DA}[^1A] + k_{et}[^1A] + k_D). \tag{3.8}$$

The concentration dependence of this process and the qualitative kinetics are the same as that in Scheme I alone, and, on a routine basis, it is not easy to check whether this type of deactivation of $^3D^*$ is occurring.

3.1.4. Special Problems in Radiolytic Excitation

There are special problems with both photoexcitation and radiolytic excitation methods. In pulse radiolysis, benzophenone has been the most widely used triplet donor. The benzophenone triplet can either transfer its energy to the acceptor via reaction *3.2* in Scheme I or it can abstract a hydrogen from the solvent and form a ketyl radical.

3.5 $(C_6H_5)_2CO + C_6H_6 \rightarrow (C_6H_5)_2COH + C_6H_5.$

By varing the concentration of the acceptor, the amount of benzophenone ketyl radical will also vary. The absorption spectrum of the ketyl radical is well-known[5], and variations in its spectrum reflect the competition between reactions *3.2* and *3.5*.

The first problem with the radiolytic method arises out of one of its strengths. One of the attractive features of the method is that the extinction coefficient of the ketyl radical can be independently and reliably measured by pulse radiolysis. As a general rule it true that measurements of extinction coefficients in aqueous solution of radicals will be more reliable when measured by pulse radiolysis than by flash photolysis. This is due mainly to the existence of reliable G values of the radicals in aqueous solution and also due to the fact that in radiolysis, uniform concentrations of the transients can be generated throughout the cell. The problem arises precisely because the well established extinction coefficient of the ketyl radical is known in water; whereas the radiolytic generation of triplets can be done only in hydrocarbon solvents where radiolytic yields are not at all well established. The procedure that is used is that the extinction coefficient of the ketyl radical in the hydrocarbon solvent is calculated from the extinction coefficient in water by assuming that the oscillator strength is independent of solvent[61].

The second special problem with the pulse radiolysis is that there is part of the ketyl radical population that cannot be scavenged. The unscavengeable fraction of ketyl radicals can be quite large. In applications it is assumed that the unscavengeable fraction is constant, independent of the acceptor concentration.[4]

The third special problem with the radiolysis method is that ketyl radicals themselves are often reactive with the acceptors. This is not a problem with hydrocarbons, but with quinones and acridines the method cannot be used[4].

There are pulse radiolytic methods, of course, which do not involve the competitive step of ketyl radical formation. In these methods, a potential triplet donor, for example biphenyl, is present at roughly 100 times the acceptor concentration. The donor triplets are formed by energy transfer from the solvent triplets. This pulse radiolysis technique is more analogous to the flash photolytic method in that it does not require competition between two reactive paths with the subsequent formation of two transients which may or may not interfere with one another.

3.1.5. Special Problems in Flash Photolysis

The complications unique to the photolytic method are bound up with the production of nonuniform distributions of transients according to Beer's Law. Using the differential form of the law, namely that $\Delta I = -2.3\epsilon_D[^1D]I\Delta x$, one can see that the number of photons absorbed in a volume of unit cross section and of depth Δx (during unit time) is equal in magnitude to abs(ΔI). To convert this number, abs(ΔI), of excited molecules into a concentration that varies with x across the cell, one must divide the number of excited molecules by the volume (1 unit cross section $\times$ Δx) containing them. In addition one needs to multiply by the duration of the exciting pulse, Γ_p, and by the triplet quantum yield, Φ_T, which results in

$$[^3D^*](x) = 2303\ \epsilon_D\ [^1D]\ I_p(x)\ \Gamma_p\ \Phi_T(D). \tag{3.9}$$

In Eq. (3.9), $I_p(x)$ is the intensity of the photolyzing light at x, $[^1D]$ is the concentration of the absorbing species whose extinction coefficient at the exciting frequency is ϵ_D. When the x-dependence of $I_p(x)$ is displayed, using the integrated form of Beer's Law, $I = I_0\exp\{-2.3\epsilon_D[^1D]x\}$, Eq. (3.9) becomes

$$[^3D^*](x) = 2303\ \epsilon_D\ [^1D]\ I_p^0\ \exp(-2.3\epsilon_D\ [^1D]\ x) \times \Gamma_p\ \Phi_T(D), \tag{3.10}$$

where I_p^0 is the incident intensity of the photolyzing light. When $[^1D]$ and ϵ_D are small enough, ie.

$$\epsilon_D\ [^1D]\ x \cong 0.05, \tag{3.11}$$

then the exponential in Eq. (3.10) is approximately unity and $[^3D^*](x)$ is roughly constant across the cell[50]. This is the usual technique to obtain uniform concentration distributions in flash photolysis. However, this technique often fails when the absorbance of the resulting transient is low because then a larger concentration of donor is needed than is allowed by condition (3.11).

When no light is absorbed by the acceptor, the nonuniform distribution does not present a problem even at concentrations where Eq. (3.11) is no longer valid. The following discussion is for a linear arrangement of the monitoring and photolyzing light. Placing the excited state concentration given by Eq. (3.10) into the differential form of Beer's Law for the monitoring light intensity, I_m, the effective optical density,

$$\mathrm{OD} = \log_{10}(I_m^0/I_m), \tag{3.12}$$

is found by integration to give

$$\mathrm{OD}(\lambda_m) = \epsilon_D^*(\lambda_m)\left\{\frac{([^3D^*]_{x=0} - [^3D^*]_{x=\ell})}{\epsilon_D(\lambda_p)[^1D]\ell}\right\}\ell, \tag{3.13}$$

where quantities without asterisks refer to the ground state, and ℓ is the optical path length of the cell. Even though Eq. (3.13) does not look immediately like the conventional formula for an optical density, namely $\mathrm{OD} = \epsilon_D^*[^3D^*]\ell$, it can be understood as such if the quantity in curly brackets is interpreted as an effective concentration. From Eq. (3.13), it can be seen that the effective concentration, in front-face experiments, is equal to the difference between the true triplet concentrations at the front and back faces of the cell divided by the optical density of the solution at the exciting wavelength, λ_p. Note that this interpretation of an effective concentration keeps intact the important relationships between extinction coefficient and optical density, namely that they are proportional to each other and that the λ_m-dependence of the right-hand side of Eq. (3.13) is only in the factor ϵ_D^*. (In most of the equations in this work we will use the traditional form for the optical density, but it should be kept in mind that for front-face alignment the concentration of the transient refers to an effective concentration defined by the expression in curly brackets in Eq. (3.13)).

The complications arise when the acceptor starts to absorb the exciting light directly. Even when the quantum yield of direct triplet formation is zero for the acceptor, problems can enter. Because of the problem of extrapolating the donor absorbance accurately back to zero time when an acceptor is present, the initial optical density can be taken from a measurement before the acceptor is added to the cell. Then an inner filter effect[50] can occur just as is common in emission spectroscopy[62]. The basic equations for numbers of the excited state species now become

$$[{}^3A^*](x) = 2303\ P_{tr}\Phi_T(D)\Gamma_p\ \epsilon_D\ [{}^1D] \times I_p^0 \exp\{-2.3(\epsilon_D\ [{}^1D] + \epsilon_A\ [{}^1A])x\} \quad (3.14)$$

and Eq. (3.10). There is no inner filter effect with only the donor in the cell, Eq. (3.10); so after integrating the differential form of Beer's Law using separately Eq. (3.10) and Eq. (3.14) and dividing the two resulting equations, one obtains Eq. (3.15) which is a modification to Eq. (3.3).

$$\epsilon_A^*(\lambda_m^A) = C_{inner}\epsilon_D^*(\lambda_m^D)\ (\Delta OD_A\ /\ \Delta OD_D)\ /\ P_{tr}, \quad (3.15)$$

where

$$C_{inner} = N_{inner}\ /\ D_{inner}, \quad (3.16)$$

$$N_{inner} = \{\ \epsilon_D(\lambda_p)\ [{}^1D]\ \ell\ \} \times (1 - \exp\{-2.3\epsilon_D(\lambda_p)\ [{}^1D]\ell - 2.3\epsilon_A(\lambda_p)\ [{}^1A]\ell\}), \quad (3.17)$$

$$D_{inner} = \{\ \epsilon_D(\lambda_p)\ [{}^1D]\ \ell + \epsilon_A(\lambda_p)\ [{}^1A]\ \ell\ \} \times (1 - \exp\{-2.3\epsilon_D(\lambda_p)\ [{}^1D]\ \ell\}), \quad (3.18)$$

and λ_p is the exciting wavelength. The terms $\epsilon_D(\lambda_p)\ [{}^1D]\ell$ and $\epsilon_D(\lambda_p)\ [{}^1D]\ \ell + \epsilon_A(\lambda_p)\ [{}^1A]\ \ell$ are easily accessible to measurement because they are just the usual optical densities of the unexcited solutions at the exciting wavelength and thus can be measured with an ordinary absorption spectrometer. This correction is not necessary when the absorbance of the donor is measured in the presence of the acceptor because inner filter effects will be the same for both the donor and acceptor triplet, and both will cancel. Even when the absorbance of the donor is measured separately, as long as the concentration of the donor is such that

$$\epsilon_D(\lambda_p)\ [{}^1D]\ \ell >> \epsilon_A(\lambda_p)\ [{}^1A]\ \ell, \quad (3.19)$$

C_{inner} will approach unity and Eq. (3.3) will hold.

When the quantum yield for direct triplet formation in the acceptor is not zero, the corrections for the acceptor absorbing the exciting light are even more complicated. In order to present the results simply, we assume that both the donor and acceptor absorbances are made with both species present, eliminating the correction of type containing C_{inner} in Eq. (3.15). With this qualification, the basic concentration equations, for the case where the acceptor absorbs and forms triplets directly, are

$$\begin{aligned}[{}^3A^*](x) &= 2303\ P_{tr}\Phi_T(D)\epsilon_D[{}^1D]\Gamma_p\ I_p^0 \times \exp\{-2.3(\epsilon_D[{}^1D] + \epsilon_A[{}^1A])x\} \\ &\quad + 2303\ \Phi_T(A)\ \epsilon_A\ [{}^1A]\ \Gamma_p\ I_p^0 \times \exp\{-2.3(\epsilon_D\ [{}^1D] + \epsilon_A\ [{}^1A])x\}\end{aligned} \quad (3.20)$$

and

$$[{}^3D^*](x) = 2303\ \Phi_T(D)\ \epsilon_D\ [{}^1D]\ \Gamma_p \times I_p^0\exp\{-2.3(\epsilon_D\ [{}^1D] + \epsilon_A\ [{}^1A])x\}. \quad (3.21)$$

Using these equations with Beer's Law gives the equation

$$\epsilon_A^* = \epsilon_D^*\ (\Delta OD_A\ /\ \Delta OD_D) \times \frac{\Phi_T(D)\epsilon_D\ [{}^1D]}{P_{tr}\Phi_T(D)\epsilon_D\ [{}^1D] + \Phi_T(A)\epsilon_A\ [{}^1A]} \quad (3.22)$$

which is the analog of Eqs. (3.3,3.15).

3.1.6. Summary of Advantages and Disadvantages

In summary, the energy transfer method has an advantage over the singlet depletion method in that it does not depend on overlaps of the ground-singlet and triplet-triplet absorption spectra. In addition using the pulse radiolysis excitation method, independent reference extinction coefficients can be obtained because of accurate dosimetry in radiolysis experiments. However the accuracy of the method is only as good as the reference extinction coefficients. The disadvantages and limitations of the energy transfer method have been discussed above. The most troublesome problem is the uncertainty in the probability of transfer. This is mainly manifested in the process of collisional deactivation without energy transfer, namely reaction *3.4*.

3.2. Singlet Depletion (SD) Method

3.2.1. Description of Method

If the measurement of the change in OD due to the population of the triplet state can be extended into a spectral region in which the starting material (singlet) absorbs, then another technique is generally available for the estimation of the extinction coefficient of triplet-triplet absorption. This is the method of singlet depletion.

The precision of the technique can be considerably enhanced if the accessible region is one in which the underlying singlet absorption is sharply structured, as will be seen below.

Assuming that all the molecules which are pumped out of the starting ground state, S_0 either return to S_0 or populate the lowest triplet state, T_1 within the time scale of the observations, then the change in optical density may be simply expressed as

$$\Delta OD = (\epsilon_T^* - \epsilon_S)\ [{}^3M^*]\ \ell, \quad (3.23)$$

where $[{}^3M^*]$ is the concentration of the triplet state at the time of observation and ℓ is the optical path length of the monitoring beam in the sample (which can usually be determined with reasonable precision).

From the resulting difference spectrum (ΔOD as a function of observational wavelength), the triplet-triplet spectrum may be reconstructed in a number of ways which are documented in Sec. 3.2.2.

It is often assumed that a region of the conventional ground state absorption spectrum ($S_n \leftarrow S_0$) can be located (and accessed for excitation) where the triplets formed on excitation will not absorb. Thus if the change in optical density, ΔOD_S, due to singlet depletion at this wavelength, λ_1, is measured, then

$$\Delta OD_S(\lambda_1) = -\epsilon_S [^3M^*] \ell, \qquad (3.24)$$

assuming, of course, all find their way to the lowest excited triplet state, T_1. The triplet extinction follows simply by using the value of $[^3M^*]$ from Eq. (3.24) and by observing the change in absorbance, ΔOD_T, at some further wavelength, λ_2, where the ground state molecule is known not to absorb.

$$\Delta OD_T(\lambda_2) = \epsilon_T^* [^3M^*] \ell. \qquad (3.25)$$

If it is assumed that the nascent triplet state does not absorb in the spectral region where the singlet depletion is monitored, then an upper limit to ϵ_T^* will be derived. In many cases this assumption will be unjustified and the more complicated procedures documented below must be adopted to recover correct quantitative estimates of $[^3M^*]$ and thus ϵ_T^*.

3.2.2. Reconstruction of True Triplet-triplet Absorbance

Labhart[45] recasts equation (3.23) to give the optical density, OD_T, due to triplet-triplet absorption as

$$OD_T \equiv \epsilon_T^* [^3M^*] \ell = \Delta OD + \epsilon_S [^3M^*] \ell. \qquad (3.26)$$

It is then possible, by trial and error, to find a value of $[^3M^*]$ such that OD_T shows no evidence of the peaks in the original singlet absorption spectrum. If $[^3M^*]$ is chosen to be too large, then the peaks of the predicted triplet spectrum will coincide with those of the underlying singlet. Too small a value for $[^3M^*]$ aligns the peaks of the triplet spectrum with troughs in the singlet absorbance. Upper and lower limits for $[^3M^*]$ are thus readily established.

Dawson[63] assumes that the triplet extinction coefficient did not change between the wavelength of the peak, λ_1 of a strong singlet absorption and an adjacent trough, λ_2. This gives an equation for $[^3M^*]$ in terms of the ΔODs and the ground state extinction only.

$$\ell [^3M^*] = \frac{\Delta OD(\lambda_1) - \Delta OD(\lambda_2)}{\epsilon_S(\lambda_2) - \epsilon_S(\lambda_1)} \qquad (3.27)$$

The resulting value for the concentration of triplets may be checked, in a similar fashion through the region of overlapping singlet absorption. Bowers and Porter[64] had previously derived an equation similar to Eq. (3.27). In that work the wavelengths, λ_1 and λ_2, were chosen to bracket a strong singlet absorption and the value for ϵ_T^* was again assumed constant in this range. Unfortunately their Eq. 1 contains a misprint with extinction coefficients instead of ΔOD's in the denominator.

By utilizing the change in OD at both troughs neighboring a strong singlet peak, and at the peak itself, Hadley and Keller[65] obtain three simultaneous equations for $[^3M^*]$ and the triplet extinction at the three wavelengths in question. These are

$$\Delta OD(\lambda_i) = \{\epsilon_T^*(\lambda_i) - \epsilon_S(\lambda_i)\} [^3M^*] \ell \;;\; i=1,2,3. \qquad (3.28)$$

Assuming that the triplet extinction changes linearly over the spanned wavelength range provides a fourth relation,

$$\frac{\epsilon_T^*(\lambda_1) - \epsilon_T^*(\lambda_2)}{\epsilon_T^*(\lambda_3) - \epsilon_T^*(\lambda_2)} = (\lambda_1 - \lambda_2)/(\lambda_3 - \lambda_2), \qquad (3.29)$$

which is sufficient to allow solution for $[^3M^*]$. An alternative choice for the observation wavelengths is made by Pavlopoulos[66]. Assuming that the triplet extinction coefficient varies linearly

$$\epsilon_T^*(\lambda) = A + B\lambda \qquad (3.30)$$

over the region between the onset of a ground state absorption band, λ_a, and the isosbestic point in the difference spectrum, λ_c, and recording the change in optical density at these wavelengths and also at some intermediate wavelength, λ_b, again leads to a set of equations which may be solved for the triplet concentration. Noting that, at the isosbestic point,

$$\epsilon_T^*(\lambda_c) = \epsilon_S(\lambda_c) \qquad (3.31)$$

these equations may be written as

$$\Delta OD(\lambda_a) = (A + B\lambda_a) [^3M^*] \ell, \qquad (3.32)$$

$$\Delta OD(\lambda_b) = \{(A + B\lambda_b - \epsilon_S(\lambda_b)\} [^3M^*] \ell, \qquad (3.33)$$

and

$$\epsilon_S(\lambda_c) = A + B\lambda_c, \qquad (3.34)$$

and A,B and $[^3M^*]$ may be recovered.

The success of these methods obviously depends on the existence of accessible spectral regions where $S_n \leftarrow S_0$ and $T_n \leftarrow T_1$ transitions overlap, which is often found to be the case.

3.2.3. Corrections for Triplet Decay

As long as no (irreversible) photochemistry has occurred upon excitation, no corrections for triplet decay are required. In a pulsed laser experiment, after the excited singlet has decayed, the original population will be distributed between the ground state and the triplet state only. Changes in OD at the depletion and observation wavelength should thus simply be measured after equivalent time delays.

3.2.4. Summary of Advantages and Disadvantages

Obviously, if other channels are open (eg. photochemical) *and* can be quantified, appropriate corrections can be made — but these complications would greatly reduce the usefulness of this method and detract from its principal advantage, its simplicity. This simplicity rests in the fact that no detailed knowledge is required concerning the rate constants of the various participating elementary radiationless processes.

Though this method is free from kinetic considerations one practical weakness remains. In the singlet depletion region no precise knowledge of the triplet absorption profile can be gained without recourse to one of the approximation schemes discussed above. Only at an isosbestic point in the difference spectrum can a certain value of the triplet extinction coefficient be given. The values at other wavelengths are critically dependent on the functional form for $\epsilon(\lambda)$ chosen above.

3.3. Total Depletion (TD) Method

3.3.1. Description of Method

It is often assumed that by simply increasing the intensity of a pulse of exciting radiation complete conversion of a suitably small ground state concentration to the triplet manifold is possible, provided, of course, that the quantum yield of intersystem crossing is not negligibly small. Thus $[^3M^*]$ is simply set equal to $[^1M]$.

Kinetic considerations based on a simple two-state model for the population of the triplet state may be used to justify the assumption of complete conversion[67]. In this model the intermediacy of the excited singlet state is neglected and the excitation process is modelled by two kinetic equations,

$$\frac{d[^1M]}{dt} = -2303\epsilon_S I_p(t)\Phi_T[^1M] \tag{3.35}$$

and

$$\frac{d[^3M^*]}{dt} = +2303\epsilon_S I_p(t)\Phi_T[^1M]. \tag{3.36}$$

The excitation rate, k_{ex} has been explicitly defined as

$$k_{ex} = 2303\ \epsilon_S\ I_p(t) \tag{3.37}$$

to clearly exhibit its intensity dependence, ϵ_S is the extinction coefficient of the ground state at the photolyzing wavelength and optically thin samples are assumed. Solving these equation for $[^3M^*]$ with the initial conditions $[^1M] = [^1M]_0$ and $[^3M^*] = 0$ gives

$$[^3M^*] = [^1M]_0(1 - \exp\{-2303\epsilon_S I_p \Phi_T t\}) \tag{3.38}$$

for the concentration of triplet at time, t, after a pulse of constant intensity, I_p, is turned on. In the limit of infinite excitation intensity the exponential vanishes and Eq. (3.38) collapses to give the initial concentration of the ground state. Notice that the triplet state is not allowed to decay in this model.

If it is assumed that the ground state is totally depleted then a lower limit can be set on the extinction estimation. While this assumption may indeed be valid for systems studied by conventional flash photolysis[18,68] it does not hold, in general, when laser pulses of a few (or a few tens of) nanoseconds duration are employed[69]. Under such conditions kinetic limitations become important and the participation of S_1 must be accounted for. Below we formulate a model which adequately encompasses such features.

3.3.2. A Three-state Excitation-deactivation Model

To describe the detailed time development of the population of an excited state, Processes 1.1 — 1.8 may be modelled by a set of three coupled kinetic equations

$$\frac{d[^1M]}{dt} = -k_{ex}[^1M] + (k_f + k_{ic})[^1M^*] + k_T[^3M^*], \tag{3.39}$$

$$\frac{d[^1M^*]}{dt} = k_{ex}[^1M] - k_S[^1M^*], \tag{3.40}$$

and

$$\frac{d[^3M^*]}{dt} = k_{isc}[^1M^*] - k_T[^3M^*]. \tag{3.41}$$

Note that loss by photochemical processes has been explicitly neglected. For several choices of pulse shape these equations may be solved analytically. For example, for a square pulse of width, Γ_p, the triplet concentration at some time, t, after the pulse, is given by[69]

$$\begin{aligned}[^3M^*]_t = {} & [^3M^*]_{\Gamma_p}\exp\{-(t-\Gamma_p)k_T\} \\ & + \{k_{isc}/(k_S-k_T)\}[^1M^*]_{\Gamma_p} \\ & \times (\exp\{-(t-\Gamma_p)k_T\} - \exp\{-(t-\Gamma_p)k_S\}),\end{aligned} \tag{3.42}$$

where $[^3M^*]_{\Gamma_p}$ and $[^1M^*]_{\Gamma_p}$ are the end-of-pulse values of the triplet and excited singlet state concentrations respectively. In the limit of an infinitely short (δ-function) pulse, as the excitation intensity grows toward infinity and when the sampling time, t, is sufficiently long that the excited singlet has decayed then

$$[^3M^*]_t / [^1M]_0 = \Phi_T\ . \tag{3.43}$$

However, for a finite pulse width there will exist a finite end-of-pulse concentration of both T_1 and S_1 regardless of the excitation intensity. Indeed, in the limit of infinite excitation rate (or, equivalently, intensity) we find[69]

$$\begin{aligned}[^3M^*]_t = {} & [^1M]_0\frac{k_{isc}}{(k_T+k_{isc})} \\ & \times\{ (1-\exp\{-(k_T+k_{isc})\Gamma_p\}) \exp\{-k_T(t-\Gamma_p)\} \\ & + (k_T+k_{isc}\exp\{-(k_T+k_{isc})\Gamma_p\}) \\ & \times \frac{\exp\{-(t-\Gamma_p)k_T\}-\exp\{-(t-\Gamma_p)k_S\}}{k_S-k_T}\}\ .\end{aligned} \tag{3.44}$$

Only in the limit of sufficiently fast singlet decay (or sufficiently long pulse duration) can complete conversion be attained. For a small number of systems examined previously (polycyclic aromatic hydrocarbons) we find[69] that 95% conversion can be expected only when

$$\tau_S \leqslant \Phi_T\Gamma_p/2. \tag{3.45}$$

If this inequality is not satisfied for the system under study then a systematic error will be introduced into the extinction coefficient of triplet-triplet transitions if the concentration of the absorbing triplet is simply set equal to that of the starting ground state. The method will afford, in general, only a lower limit of the true extinction coefficient.

3.3.3. Corrections for Triplet Decay

In a pulsed laser experiment the change in optical density at the wavelength of observation will be a function of time. Usually these changes are extrapolated back to "zero" time (i.e. immediately after the pulse) by assuming a simple single exponential decay of the triplet absorbance. This point should of course be checked and for this purpose the initial ground state concentration should generally be kept as low as possible. Complications in the decay curve due to triplet-triplet annihilation may thus be avoided.

3.3.4. Summary of Advantages and Disadvantages

The principal advantage of the total depletion method is that it offers a simple direct estimate of the triplet concentration and hence of the triplet-triplet extinction coefficient.

Empirically, the approach to total depletion is inferred from a saturation in the ΔOD at some monitoring wavelength as the excitation intensity rises. The assumption then is that the asymptote toward infinite intensity represents complete conversion. Unfortunately, especially in laser photolysis, many other sources of this apparent saturation are possible. Multiphotonic processes[70] including biphotonic ionization[71,72] and excited state absorption[71-73] have been shown to produce a similar behavior. In order to reduce the chance of interference from such spurious phenomena a partial saturation method has been developed[71] which is discussed below in Sec. 3.7. However even when these and other complications such as photochemical decomposition can be avoided one basic problem still remains. The desired conversion to the triplet state may be kinetically unattainable within a typical pulse duration[69], although the observed ΔOD may still appear to saturate.

3.4. Relative Actinometry (RA) Method

3.4.1. Description of Method

The basic principle of the technique defined here as relative actinometry is simple[74]. A comparison is made between the change in optical density produced in some solvent, S_T at some wavelength, λ_1 upon excitation of the triplet, T for which the extinction coefficient, ϵ_T^* is required and that change produced under comparable conditions (but in a separate sample) in some reference triplet, R of known extinction coefficient, ϵ_R^* at some wavelength, λ_2 (not necessarliy equal to λ_1) in another solvent, S_R. The concentrations of the ground state precursors of T and R are adjusted, based on a knowledge of their respective absorption spectra so that the same number of excitation photons are absorbed by both sample and reference.

If ΔOD_R is the observed change in optical density due to the formation of the triplet state, R and ΔOD_T that change for T, then, if $\Phi_T(R)$ is the (known) quantum yield for intersystem crossing in the reference compound in the same solvent, S_R in which the extinction coefficient ϵ_R^* was determined (under the same conditions of excitation), then the extinction coefficient of the unknown triplet state is given by

$$\epsilon_T^*(\lambda_1) = \frac{\Delta OD_T\ \Phi_T(R)}{\Delta OD_R\ \Phi_T(T)}\,\epsilon_R^*(\lambda_2), \tag{3.46}$$

where $\Phi_T(T)$ is the quantum yield for intersystem crossing leading to the triplet state of unknown extinction (and again measured in the appropriate solvent, S_T under similar excitation conditions).

3.4.2. Corrections for Singlet Depletion

As written, Eq. (3.46) requires that the ground state depletion (in OD) is negligible at the respective wavelengths of observation. Thus either the starting singlets do not absorb appreciably at λ_1 and λ_2 respectively or the excitation intensity is kept low. This latter factor weighs significantly in the use of a laser source in this technique. Considerable care must be taken to ensure that all the excitation beam is channeled into the appropriate photophysical processes and none is lost to $S_n \leftarrow S_1$ (biphotonic) absorption for instance, if this process does not exclusively lead to population of the triplet manifold.

If such singlet depletion is, in fact, a problem, it will be evidenced by the presence of curvature in a ΔOD vs intensity plot. Restricting the excitation intensity to the initial linear region is then recommended. The extrapolation of ΔOD's observed in a nonlinear regime is problematical since the curvature may also be due to other effects.

Often the respective singlet ground states also absorb the monitoring radiation. The extinction coefficients appearing in Eq. (3.46) may be altered to take this feature into account to give

$$\{\epsilon_T^*(\lambda_1)-\epsilon_S^T(\lambda_1)\} = \frac{\Delta OD_T\Phi_T(R)}{\Delta OD_R\Phi_T(T)}\{\epsilon_R^*(\lambda_2)-\epsilon_S^R(\lambda_2)\}, \tag{3.47}$$

where ϵ_S^T is the extinction coefficient of the ground state absorption ($S_n \leftarrow S_0$), eventually leading to the triplet, T, at the indicated wavelength. The extinction coefficient, ϵ_S^R, is similarly defined for the reference compound.

3.4.3. Corrections for Triplet Decay

Comments entirely similar to those presented in Sec. 3.3.3., applicable to the technique of total depletion are again relevant to the method of relative actinometry.

3.4.4. Corrections for Laser Excitation

The achievement of an equal initial excitation population in both sample and reference is usually performed by matching starting ODs in a separate "conventional" spectrometer. If a laser is then employed to populate the respective transients, questions of bandpass differences should be addressed. These are, in general, difficult to answer. However, to be most suitable the relevant photophysical properties (such as the spectral band shapes) of both sample and reference should be comparable.

3.4.5. Extensions

Obviously, if the initial ODs are different but known then the differential excitation probability may be accounted for by the inclusion of a simple multiplicative factor in either of Eq. (3.46) or Eq. (3.47), whichever is appropriate to the experimental situation.

There is also no need to restrict the reference to another triplet-triplet absorption. The benzophenone ketyl radical, for which formation quantum yields are known, has also provided a useful actinometer.

Recently an interesting extension of the relative actinometry method has been presented[75] which removes the need for a knowledge of the quantum yields for triplet formation. The triplet populations formed in both the sample and the reference cells are scavenged by biacetyl and the intensities of the resulting phosphorescence are compared. The extinction coefficients are then related by

$$\epsilon_T^*(\lambda_1) = \frac{\Delta OD_T\ I_p(R)}{\Delta OD_R\ I_p(T)}\,\epsilon_R^*(\lambda_2). \qquad (3.48)$$

The ratio, $I_p(R)/I_p(T)$ of the phosphorescence intensities then takes the place of that involving the triplet yields, though assumptions as to the extent of conversion of individual triplets must be confirmed or kinetic considerations cannot be obviated.

3.4.6. Summary of Advantages and Disadvantages

The principal disadvantage in the technique of relative actinometry as outlined above is the required knowledge of the respective quantum yields for intersystem crossing. Indeed, the method is most commonly used to determine these yields given estimates of the triplet-triplet extinction coefficients[76]. If the quantum yields are known (and not inferred from those measured or estimated in disparate experimental circumstances as is unfortunately common), if the ΔOD can be satisfactorily extrapolated and if the appropriate precautions are taken when singlet depletion is a complicating factor, then this technique should yield extinction coefficients of comparable accuracy of those derived from the other methods documented here.

3.5. Intensity Variation (IV) Method

3.5.1. Description of Method

The intensity variation method was one of the first techniques to be used to measure extinction coefficients of triplet states[17]. The initial application gave results which turned out to be several orders of magnitude too low. Later applications of the method[77,78], however gave values that were in accord with those results obtained with different techniques.

The derivation of the method is again based on the kinetic equations for Processes *1.1 — 1.8*, given by Eqs. (3.40) and (3.41). However, conventionally, a steady-state approximation for both singlet and triplet excited states is made and the depletion of the ground state is specifically neglected leading to

$$[^3M^*]/[^1M] = 2303\ \tau_T\ \epsilon_S\ I_p(x)\ \Phi_T. \qquad (3.49)$$

Here τ_T is the measured triplet lifetime, for example the measured phosphorescence lifetime in glassy solutions and the concentrations are measured at some volume element in the cell at distance, x, along the optical path, from the point of incidence of the photolyzing light. Φ_T is the probability of forming the triplet state from the lowest excited singlet. To obtain extinction information then, it is thus necessary to know the quantum yield for intersystem crossing, Φ_T.

At the time of the inception of this technique, the triplet yield could be related to experimentally measured values in several ways[17]. In particular, it could be related to the ratio, R, of the fluorescence to phosphorescence quantum yields and also to the total luminescence quantum yield, Φ. If internal conversion takes place from the singlet state but no intersystem crossing occurs from the triplet to the ground state then

$$\Phi_T = \Phi/(R + 1). \qquad (3.50)$$

If the reverse is true, then

$$\Phi_T = (R + 1 - R\Phi)/(R + 1). \qquad (3.51)$$

If only intersystem crossing from the singlet state occurs, then

$$\Phi_T = 1/(R + 1) = 1 - \Phi_f. \qquad (3.52)$$

Currently many other approaches are in use for determining Φ_T. These methods have been comprehensively reviewed most recently by Wilkinson[79].

Using Beer's Law for the intensity variation with x, one gets, for an in-line arrangement of the monitoring and photolyzing light, in a manner analogous to the pulsed excitation results of Eqs. (3.9,3.10) that

$$OD = \epsilon_T^* \Phi_T I_p^0 (1 - \exp\{-2.3\epsilon_S [^1M] \ell\}) \times 10^3. \qquad (3.53)$$

In this equation, everything is assumed known except for the extinction coefficient of the triplet. The intensity, I_p^0, is varied, and from the slope of the plot of OD vs I_p^0, one can calculate the extinction coefficient.

The derivation given above follows closely that of Keller and Hadley[77]. They take Eq. (3.53) one step further and assume that the exponential makes no contribution because of a large OD of the ground state at the exciting wavelength. However this is not likely to be the usual case because OD's are usually of the order of unity or lower; in which case the exponential cannot be ignored.

McClure[17] used a modification of this derivation in which the initial concentration, $[^1M]_0$ appeared instead of the concentration of ground state, $[^1M]$ in the steady-state mixture as the denominator of the lefthand side of Eq. (3.49). This lead to a more complicated expression for the conversion to the triplet state. In particular, the intensity dependence varied as $1/(1/I + \text{constant})$. This equation reduces to the one given above when the concentration of triplet is low and when the ground state is not depleted significantly in the steady-state. However because of this dependence, McClure chose to plot 1/OD vs. $1/I_p^0$. In effect this means that he was emphasizing the OD at infinite I_p^0; whereas Keller and Hadley were able to extrapolate their OD vs I_p^0 plots easily to zero I_p^0 which is in conformity to the assumptions of the method.

3.5.2. Summary of Advantages and Disadvantages

This method has been applied to glassy systems with weak steady-state illumination. Under these conditions this method is at its best because neither the energy-transfer nor the singlet-depletion methods can be used.

Beyond these conditions, the method becomes cumbersome. Like some of the other methods photochemistry can cause problems. However in addition one needs a very complete knowledge of the photophysics of the molecule before one can use the method. First of all one must decide which of the three cases to use for Φ_T in Eqs. (3.50–3.52). Then the triplet lifetime and the ratio, R, of fluorescence and phosphorescence yields must be known under conditions of the experiment. That is the minimum information that must be available in addition to the intensity variation measurements. For some of the forms of Φ_T, the absolute luminescence yield must also be known. Finally if the method is to be used, the 1/OD vs. $1/I_p^0$ is more susceptible to extrapolation errors than plotting OD vs. I_p^0.

3.6. Kinetic Method (KM)

3.6.1. Description of Method

Another approach employed to estimate the triplet extinction coefficient, closely related to the intensity variation technique of Sec. 3.5., is termed here the kinetic method. This method was developed originally in conjunction with phosphorescence studies[80], and later, independently, applied to triplet-triplet absorption spectroscopy[47,48,81]. The basis of this technique also lies in Eqs. (3.40–3.41). It is convenient for the present derivation to rewrite these as

$$\frac{d[^1M^*]}{dt} = k_{ex}\{[^1M]_0 - [^1M^*] - [^3M^*]\} - k_S[^1M^*], \quad (3.54)$$

and

$$\frac{d[^3M^*]}{dt} = k_{isc}[^1M^*] - k_T[^3M^*], \quad (3.55)$$

where k_S and k_T are defined in Eqs. (1.1) and (1.3) respectively and $[^1M]_0$ is the initial concentration of solute.

In the photostationary state it is assumed that $d[^1M^*]/dt = 0$ which implies

$$[^1M^*] = k_{ex}\{[^1M]_0 - [^3M^*]\} / (k_{ex} + k_S). \quad (3.56)$$

Then, from equation (3.55) and using the fact that $[^3M^*]_0 = 0$,

$$[^3M^*] = \gamma\,[^1M]_0 \frac{1 - \exp\{-(\gamma + k_T)t\}}{\gamma + k_T}, \quad (3.57)$$

where the (excitation intensity dependent) constant γ is given by

$$\gamma = \frac{k_{ex}\,k_{isc}}{k_{ex} + k_S}. \quad (3.58)$$

At long times, i.e. $t >> (\gamma + k_T)^{-1}$ equation (3.57) may be reduced to

$$[^3M^*]_\infty = \frac{\gamma\,[^1M]_0}{\gamma + k_T}. \quad (3.59)$$

Defining the (excitation flux dependent) rise time of the triplet-triplet absorbance, τ_r as

$$\tau_r = \frac{k_S + k_{ex}}{k_{ex}(k_T + k_{isc}) + k_T k_S} \quad (3.60)$$

and the triplet decay time as

$$\tau_T = 1/k_T, \quad (3.61)$$

then equation (3.59) for the photostationary triplet concentration may be recast as

$$[^3M^*]_\infty = [^1M]_0 (1 - \tau_r / \tau_T). \quad (3.62)$$

Thus determination of the growth time of triplet absorption and its decay time after cessation of excitation allows the straightforward estimation of the triplet concentration.

Assuming that the monitoring beam does not significantly deplete the ground singlet state (through transitions to higher singlet states for example) then the relation

$$OD_T = \epsilon_T^*\,[^3M^*]_\infty\,\ell \quad (3.63)$$

is valid and ϵ_T^* may be estimated.

3.6.2. An Alternative Derivation of the Kinetic Method

As opposed to the technique of intensity variation, the kinetic method is inherently a nonstationary approach. It is thus not clear that the traditional method[47,48,80] of solving equations (3.54) and (3.55) using the steady state approximation, as described in Sec. 3.6.1., is valid. In fact it turns out that this approximation is unnecessary and leads to an unsatisfactory conceptualization. Thus the following is a more elaborate derivation than is usually given. From this derivation it can be easily seen how the usual equations arise and under what conditions the usual equations apply.

The scheme and mechanism are identical to the intensity variation method. However the kinetic method is a time-dependent method. The photolyzing light is turned on as a very long square pulse. Initially the triplet signal builds up after the pulse is switched on. This build-up is taken to be exponential with a characteristic time, τ_r. When the light of the pulse is turned off at the end of the square pulse, the triplet decays with a lifetime of τ_T, given by Eq. (3.61). These two lifetimes can easily be measured as indicated above, the derivation of the kinetic method relates them to the fraction of triplets in a steady-state mixture that has evolved during the duration of the photolyzing pulse.

A consistent derivation of Eq. (3.57), with a rise time given by Eq. (3.60), starts with a solution of the Eqs. (3.54,3.55) for the initial conditions $[^3M^*]_0 = [^1M^*]_0 = 0$. The general solutions are given by

$$[^1M^*] = -G_-\exp\{m_+t\} + G_+\exp\{m_-t\} + \alpha \quad (3.64)$$

$$[^3M^*] = -Z_+G_-\exp\{m_+t\} + Z_-G_+\exp\{m_-t\} + \beta, \quad (3.65)$$

where

$$m_\pm = -(k_{ex}+k_S+k_T)/2 \pm 1/2^*\surd\{(k_{ex}+k_S-k_T)^2 - 4k_{ex}k_{isc}\}, \quad (3.66)$$

$$G_\pm = \frac{\alpha(k_{ex} + k_S + m_\pm) - k_{ex}\beta}{m_- - m_+}, \quad (3.67)$$

$$Z_\pm = (k_{ex} + k_S + m_\pm)/k_{ex}, \quad (3.68)$$

$$k_S = k_f + k_{isc} + k_{ic}, \quad (3.69)$$

$$\alpha = k_Tk_{ex}[^1M]_0/(k_{ex}k_T + k_{ex}k_{isc} + k_Sk_T), \quad (3.70)$$

and

$$\beta = \alpha k_{isc}/k_T. \quad (3.71)$$

It can be seen immediately that this derivation gives results that are quite different in general from the results of the standard derivation of Sec. 3.6.1. The results given by Eqs. (3.64—3.71) hold for the duration of the square pulse, given the conditions of no triplets and excited singlets at the beginning of the pulse.

In order to make further progress in reducing the double exponential behavior of the general results in Eqs. (3.65, 3.66) to the single exponential rise time expression of Eq. (3.60), it is necessary to make several approximations. The first step is to remove the radical in Eq. (3.66) by making an appropriate expansion. There are several ways in which this can be done. The most convenient way is to rewrite the radical as

$$\surd\{(k_{ex} + k_S + k_T)^2 - 4(k_{ex}k_T + k_{ex}k_{isc} + k_Sk_T)\}, \quad (3.72)$$

to then extract a factor of $(k_{ex} + k_S + k_T)$, and finally to expand the remaining radical, $\surd[1-Y]$, where

$$Y = \frac{4(k_{ex}k_T + k_{ex}k_{isc} + k_Sk_T)}{(k_{ex} + k_S + k_T)^2}. \quad (3.73)$$

The expansion is allowed if $Y < 1$. Y must be $\leqslant 1$ or the radical will be imaginary. After making the expansion,

$$m_+ \sim -\frac{k_{ex} + k_S}{(k_{ex} + k_S + k_T)\tau_r} + O(1) \quad (3.74)$$

and, as always,

$$m_- = -(k_{ex} + k_S + k_T) - m_+, \quad (3.75)$$

where τ_r is defined by Eq. (3.60). From Eqs. (3.74, 3.75), it can be seen that if

$$(k_{ex} + k_S) >> k_T, \quad (3.76)$$

then

$$m_+ \sim -\tau_r^{-1} \quad (3.77)$$

and

$$m_- \sim -(k_{ex} + k_S + k_T) + \tau_r^{-1}. \quad (3.78)$$

The value of m_+ is exactly what is required of one of the exponentials in Eq. (3.65) if the simplified theory of Sec. 3.6.1. is to be obtained. Furthermore, since m_- contains the measured fluorescence rate constant, one expects it to be too fast to see on the time resolution of most instrumentation conventionally employed in the kinetic method. Mathematically, this empirical requirement that $m_- >> m_+$ can be written as

$$(k_{ex} + k_S) >> \tau_r^{-1} \quad (3.79)$$

since one can neglect k_T in Eq. (3.78) for m_- by the condition in Eq. (3.76). So ignoring the second exponential in Eq. (3.65), Eq. (3.65) can be written as

$$[^3M^*] \sim \beta\{1 - (Z_+G_-/\beta)\exp(m_+t)\}. \quad (3.80)$$

If conditions can be found such that the coefficient of the exponential, Z_+G_-/β, can be shown to be one, then under those conditions Eq. (3.57) will hold. Using the definitions of Z_+ and G_- and applying the conditions in Eqs. (3.76, 3.79) to the expression for Z_+G_-/β becomes

$$Z_+G_-/\beta = \{k_{ex} - (\tau_r^{-1}-k_T)k_T/k_{isc}\}/k_{ex}. \quad (3.81)$$

This does reduce to one if

$$k_{ex} >> (\tau_r^{-1}-k_T)k_T/k_{isc}. \quad (3.82)$$

Thus Eq. (3.65) reduces to the traditional result of Eq. (3.57) under the approximations in Eqs. (3.76, 3.79, 3.82).

Even though the standard result holds, the standard justification does not necessarily hold. Applying the three approximations in Eqs. (3.76, 3.79, 3.82) to the ratio of G_-, the coefficient of $\exp\{m_+t\}$ in Eq. (3.65) for $[^1M^*]$, to α, the time-independent part of $[^1M^*]$ in the same equation, gives

$$G_-/\alpha = \{k_{ex}/(k_{ex} + k_S)\} \times (k_{isc}/k_T). \quad (3.83)$$

Only if this expression is small does the steady-state condition for $[^1M^*]$ hold. The second factor on the r.h.s of Eq. (3.83) is equal to β/α by Eq. (3.71), and β/α is the ratio of the time-independent concentrations of the triplet to singlet. This ratio is not likely to be small in a glass where k_T may be quite slow and where k_{isc} will still have to be large enough compared to the natural fluorescence lifetime or no triplet will be able to form. The only way for the time-dependent part of $[^1M^*]$ to be small would be for the first factor on the r.h.s. of Eq. (3.83) to be small. This means that the excitation rate constant, k_{ex}, must be very small compared to the decay rate constant for the singlet state, k_S.

3.6.3. Summary of Advantages and Disadvantages

The parallel derivations of the intensity variation technique in Sec. 3.5.1. and the traditional approach to the kinetic method outlined in Sec. 3.6.1. suggest the close kinship of these two methods[81]. Both are usually applied to studies in glassy systems because of the inherent mechanical limitations of rotating sector excitation devices which require long triplet lifetimes. The kinetic method has some advantage over the intensity variation technique in that not as many assumptions need be made about the photophysics involved. Rather this information is obtained directly.

3.7. Partial Saturation (SM) Method

3.7.1. Description of the Method

Recently a method[71] was developed that makes use of the large photon fluxes available with lasers. It is different from the total depletion method, which was discussed in Sec. 3.3., but the final form of the descriptive equations is very similar to the expressions employed in that approach. Originally the technique was devised for a situation other than triplet-triplet absorption, but the method has been applied in this field in the last few years.

The basic equation of the method is derived from a two-state model of the excitation process, where the two states considered are the ground state and the triplet state. In the partial saturation method, the ground state may become significantly depleted, and its kinetic behavior can no longer be ignored. The two kinetic equations for the excitation process in this model are given by Eqs. (3.35) and (3.36). Combining the solution given in Eq. (3.38) for the initial conditions $[^1M] = [^1M]_0$ and $[^3M^*] = 0$ with the expression for optical density change given by Eq. (3.23) gives

$$\Delta OD = a(1-\exp\{-bI_p\}), \tag{3.84}$$

where

$$a = (\epsilon_T^* - \epsilon_S)[^1M]_0 \ell \tag{3.85}$$

and

$$b = 2303\epsilon_S t \Phi_T \cdot \tag{3.86}$$

We will refer to Eq. (3.84) as Lachish's equation for identification purposes. The intermediate excited singlet does not appear in the equations even though it is the state that is initially populated by the radiation. Eq. (3.84) is used by fitting the data to the two-parameter functional form. The excitation intensities must be high enough so that the plot of ΔOD vs. I_p reaches a nonlinear region, a partial saturation region, or the method will not work. When the exponential in eq. (3.84) is expanded in low I_p, the leading term is linear in I_p with a coefficient proportional to (a × b). There is no constant term, so a and b cannot be determined separately, and thus the ϵ_T^* also cannot be determined independently of Φ_T.

Even though one must use fairly high intensities to reach the nonlinear region, the intensities are lower than those needed to obtain total depletion. Herein lies the advantage of the method over the total depletion method whenever photochemistry is involved.

3.7.2. An Alternate Model for Photoexcitation

In order to see under what conditions the singlet can be ignored in a kinetic model of excitation, we solve a more complete model for the excitation process[82]. The equations in this model will apply only while a square pulse of intensity I_p is on, and the decay of the triplet state will be ignored, as was also done in the two-state model described in Sec. 3.7.1. Such a model for excitation can be written as the following rate equations:

$$\frac{d[^1M]}{dt} = (k_f + k_{ic})[^1M^*] - k_{ex}[^1M], \tag{3.87}$$

$$\frac{d[^1M^*]}{dt} = k_{ex}[^1M] - k_S[^1M^*], \tag{3.88}$$

and

$$\frac{d[^3M^*]}{dt} = k_{isc}[^1M^*]. \tag{3.89}$$

Notice that these equations are simply Eqs. (3.39—3.41) with $k_T=0$ (chosen to correspond with the two-state model above).

The solution to these kinetic equations, using the same initial conditions as in Sec. 3.7.1., together with $[^1M^*]_0=0$, is

$$[^1M] = \Xi((\lambda_2-k_{isc})\exp\{-\lambda_2 t\}/\lambda_2 + (k_{isc}-\lambda_3)\exp\{-\lambda_3 t\}/\lambda_3), \tag{3.90}$$

$$[^1M^*] = \Xi(-\exp\{-\lambda_2 t\}+\exp\{-\lambda_3 t\}), \tag{3.91}$$

and

$$[^3M^*] = k_{isc}\Xi(\exp\{-\lambda_2 t\}/\lambda_2 - \exp\{-\lambda_3 t\}/\lambda_3 + (\lambda_2-\lambda_3)/\lambda_2\lambda_3). \tag{3.92}$$

The definitions of the symbols used in Eqs. (3.90), (3.91), and (3.92) are

$$\Xi = k_{ex}[^1M]_0/(\lambda_2-\lambda_3), \tag{3.93}$$

$$\lambda_2 = (X+Y)/2, \tag{3.94}$$

$$\lambda_3 = (X-Y)/2, \tag{3.95}$$

where

$$X = k_{ex} + k_f + k_{ic} + k_{isc} = k_{ex} + k_S \tag{3.96}$$

and

$$Y = \sqrt{(X^2 - 4k_{isc}k_{ex})}. \tag{3.97}$$

In order to relate this to Lachish's equation, one can expand Eq. (3.92) in a systematic fashion. This is done by rewritting Eq. (3.97) as

$$Y = X \surd(1 - 4k_{\rm isc}k_{\rm ex}/X^2) \tag{3.98}$$

and expanding everything as a power series in

$$\gamma = k_{\rm isc}k_{\rm ex}/X^2. \tag{3.99}$$

The series is valid if

$$k_{\rm isc}k_{\rm ex} < (k_{\rm ex} + k_{\rm S})^2. \tag{3.100}$$

The lowest order term in such an expansion is

$$[^3M^*] \sim [^1M]_0(1 - \exp\{-\lambda_3 t\}) + O(\gamma). \tag{3.101}$$

This is almost in the form of Lachish's equation. Using the inequality of Eq. (3.100)

$$\lambda_3 \sim k_{\rm ex}k_{\rm isc}/(k_{\rm ex} + k_{\rm S}). \tag{3.102}$$

If the further assertion that

$$k_{\rm ex} << k_{\rm S} \tag{3.103}$$

holds, then

$$\lambda_3 \sim k_{\rm ex}k_{\rm isc}/k_{\rm S} = k_{\rm ex}\Phi_{\rm T} \tag{3.104}$$

and Eq. (3.101) finally reduces to

$$[^3M^*] = [^1M]_0(1 - \exp\{-k_{\rm ex}\Phi_{\rm T}t\}). \tag{3.105}$$

Since $k_{\rm ex}$ is proportional to $I_{\rm p}$ by Eq. (3.37), Eq. (3.105) is equivalent to Lachish's equation.

Thus in order for the two-state model for exciting the triplet state to be valid the condition in Eq. (3.103) must hold. This means that $k_{\rm ex}$ must be in general much smaller than 10^8 s^{-1}. Two examples of photon densities can be used to illustrate whether this is a reasonable expectation or not. In one report[67] the onset of saturation occurred with pulses of 1.2×10^{-8} einsteins/cm^2, and in another experiment[72] nonlinearity was observed at 0.2 MW/cm^2. Taking a moderate absorbance of the ground state of $\epsilon_{\rm S} = 5000$ L mol^{-1} cm^{-1}, these two measurements translate into $k_{\rm ex}$'s of 1.4×10^7 s^{-1} and 6.7×10^7 s^{-1}, respectively. However the photon intensities in these two experiments are too large for the condition in Eq. (3.103) to be well-satisfied if the singlet lifetime is 10^{-8} s. So in such cases, the a and b parameters obtained by fitting the Lachish equation to the experimental data may not be related to the experimental quantities that they are supposed to represent in Eqs. (3.85) and (3.86).

3.7.3. Summary of Advantages and Disadvantages

The partial saturation method is basically a curve-fitting technique. In order to get extinction coefficients from the Lachish formula, high enough intensities must be reached for the ΔOD vs $I_{\rm p}$ curves to exhibit nonlinearities. However if the power densities and ground state $\epsilon_{\rm S}$'s are such that $k_{\rm ex}$ is of the order of $k_{\rm S}$, then the more exact formula Eq. (3.92) must apply, but it is not simply related to $\epsilon_{\rm T}^*$. If the adverse condition of $k_{\rm ex} \sim k_{\rm S}$ applies, but the formula $\Delta OD = a(1-\exp\{-bI\})$ is used anyway, it is still likely that some fit will be obtained since the exact equation looks, in form, something like the Lachish equation. However the meaning of the extinction coefficients obtained by this method will be in doubt.

If this method can be used in an intensity region where the Lachish formula is valid, then the method has distinct advantages over the total depletion method. The advantages lie in that one can operate in some intermediately intense laser excitation regions that may not be plagued with multiphotonic effects such as intensity quenching due to excitation by the laser of the excited states,[73] multiphotonic ionization or photochemistry via the excited states,[72,83,84] or other true multiphotonic processes.[70]

The problem of course is whether a suitable intermediate excitation intensity range does exist for the molecular system under study. This will depend on the laser intensity, $I_{\rm p}$, the ground state extinction coefficient, $\epsilon_{\rm S}$, and the singlet state lifetime, $k_{\rm S}^{-1}$; all of these are components of the condition in Eq. (3.103). If the intensity is too small, no extinction coefficients can be obtained by the method since ΔOD vs $I_{\rm p}$ must exhibit some nonlinear behavior. However this nonlinear behavior must be due only to saturation, not to the nonlinear processes listed in the last paragraph. Furthermore the intensity must be low enough so that $k_{\rm ex} << k_{\rm S}$ or the simple formula will not apply.

3.8. Miscellaneous Methods for Measuring Extinction Coefficients

3.8.1. Electron Spin Resonance (ESR)

Most of the methods used to measure triplet extinction coefficients try to avoid the difficult problem of measuring the triplet concentration directly. On the other hand the ESR method tackles this problem directly. The method makes use of the property that molecules in the triplet state are paramagnetic and thus have an esr signal[85].

Brinen and coworkers[86,87] and Alfimov et al.[88] have developed this method. The former workers make use of an equation[89] which relates the concentration of triplets, $N_{\rm T}$, which has selection rule $\Delta m = 2$ to the concentration of a free radical, $N_{\rm r}$, which has selection rule $\Delta m = 1$. These concentrations are related by the following formula

$$N_{\rm T} = N_{\rm r}(15/8)\ \{(h\nu)^2/(D^2+3E^2)\}\ (I_{\rm T}/I_{\rm r}), \tag{3.106}$$

where $I_{\rm T}$ and $I_{\rm r}$ are the integrated microwave absorptions of the triplet and radical, respectively, $h\nu$ is the microwave energy, and D and E are the zero-field splitting parameters of the triplet. The factor containing D and E can be evaluated using the method of Kubo and Tomita[90] which relates it to the first moment, μ_1, of the triplet esr spectrum by the formula,

$$\mu_1 = (4\pi/7)(D^2+3E^2)\nu/(h\nu)^2. \tag{3.107}$$

The advantage of this method is that it attempts to determine the triplet concentration directly. A disadvantage is that the Eq. (3.106) is derived for a uniform concentration of triplets, but the concentration from optical excitation is governed by Beer's Law. One way to minimize the effects of this last problem is to use small concentrations. Then the variable concentration represented by Eq. (3.10) can be expanded to keep only the first term, and the concentration is roughly constant[50].

3.8.2. Other Comparative Techniques (ELT,HAT,RF)

In the energy transfer technique there is the transfer of triplet energy from (to) a donor (acceptor) compound with known extinction coefficient to (from) the acceptor (donor) whose extinction coefficient is sought. Particularly with the development of nanosecond pulsed laser and electron sources the possibility of quantifying other photochemical quenching has been realized. Thus the extinction coefficient of the triplet state of 5-nitro-2-furoic acid has been estimated relative to the radical cations of various amines from which it has abstracted an electron[91] (ELT). Hydrogen atom abstraction (HAT) by ketone triplets leads to the corresponding ketyl radicals for which extinction data is often independently obtainable. Photoreduction of benzophenone by lactams has been used in this fashion to evaluate the triplet properties of the ketone[92]. These approaches assume of course that some estimate of the amount of conversion of the triplet state can be obtained and that appropriate corrections can be made for the absorbance accompanying the production of the associated ionic and radical species.

The basis of another comparative method (RF) rests in the observations of Lavalette et al.[93] They have noted that the oscillator strength of the principal triplet-triplet absorption peaks in a series of aromatic hydrocarbons remains roughly constant for a given molecule in a range of solvents. Apart from a (usually small) refractive index correction, this consistency is expected on theoretical grounds, and the result serves as a basis for another useful comparative technique.

To estimate the oscillator strength, f, associated with a particular triplet-triplet absorption band, the area under the absorption profile expressed as a function of wavenumber must be measured. Note also that the extinction coefficient must first be known. Thus if we integrate the identity of Eq. (3.26)

$$\int \mathrm{OD}(\nu)\,\mathrm{d}\nu = \int \epsilon_{\mathrm{T}}^{*}\,[{}^{3}\mathrm{M}^{*}]\,\ell, \tag{3.108}$$

$$= \alpha_{\mathrm{n}} f\,[{}^{3}\mathrm{M}^{*}]\,\ell, \tag{3.109}$$

where the constant of proportionality, α_{n}, contains only fundamental constants and the solvent refractive index.

Using Eq. (3.26) once more to eliminate the unknown product, $[{}^{3}\mathrm{M}^{*}]\,\ell$, gives an equation relating the oscillator strength to the area under the experimentally determined OD curve scaled to the maximum value of the extinction coefficient for the band.

$$\frac{\epsilon_{\mathrm{T}}^{*}(\nu_{\mathrm{max}})}{\mathrm{OD}(\nu_{\mathrm{max}})} \int \mathrm{OD}(\nu)\,\mathrm{d}\nu = \alpha_{\mathrm{n}} f. \tag{3.110}$$

If the empirical OD curve is normalized to unit maximum absorbance and the enclosed area termed Σ, then

$$\alpha_{\mathrm{n}} f = \epsilon_{\mathrm{T}}^{*}(\nu_{\mathrm{max}})\,\Sigma. \tag{3.111}$$

Thus for some compound in a certain solvent, if either the oscillator strength is known or if the extinction coefficient is available *and* an appropriate area can be measured, then simply repeating this area measurement in subsequent solvents allows the determination of the corresponding extinction coefficients.

We note again that strictly this procedure ignores the variation in refractive index in a set of solvents. A number of experimental difficulties also arise. Often the complete spectral shape for a given electronic band cannot be detected. Thus some extrapolation of the observed OD is usually necessary. Often, the assumption of "triangular" bands is made, and the area is approximated as the product of the height and halfwidth, δ, (i.e. full width at half maximum). In terms of the area, Σ, defined above this simplification amounts to a direct comparison of halfwidths.

$$\alpha_{\mathrm{n}} f = \epsilon_{\mathrm{T}}^{*}(\nu_{\mathrm{max}})\,\delta. \tag{3.112}$$

Preferably, some extrapolation of the observed OD should be attempted. Commonly the bands are assumed to be symmetrical around their maxima (as a function of wavenumber). Obviously, the OD observed must be strictly attributable to the unknown triplet state or else corrections such as those documented in the foregoing sections must be assessed. Also the electronic nature of the band must remain reasonably intact in the disparate solvating environments.

3.8.3. Pulsed Intensity Variation

The formulation of the intensity variation technique presented in Sec. 3.4. above, with its steady-state assumptions, is adequate under conditions of steady illumination[77] or conventional flash photolysis[78]. With nanosecond pulsed excitation, however, a time-dependent solution of the corresponding kinetic equations must be sought. Such a solution, for low intensity, is possible for a square pulse within the context of the simple two-state model given in Eqs. (3.35—3.38) above. If the pulse is of width, Γ_{p} and the excitation rate, k_{ex}, is as in Eq. (3.37), then we find[82]

$$[{}^{3}\mathrm{M}^{*}]_{\Gamma_{\mathrm{p}}}/[{}^{1}\mathrm{M}]_{0} \sim \Gamma_{\mathrm{p}}\Phi_{\mathrm{T}}k_{\mathrm{ex}} - (\Gamma_{\mathrm{p}}\Phi_{\mathrm{T}}k_{\mathrm{ex}})^{2}/2. \tag{3.113}$$

Triplet decay within the pulse has been specifically neglected. For a fixed pulse width a linear variation of ΔOD with pulse intensity is thus expected at low intensities. The slope of this line is proportional to the product of the triplet yield and the required extinction coefficient[94]. This approach has recently been adopted[95] to suggest a refinement of the triplet extinction coefficient for benzophenone, a commonly used reference value.

Solution of the three-state model given in Eqs. (3.39–3.41) again with the assumption of no triplet decay during the pulse leads to a more complex limiting behavior. The end-of-pulse triplet concentration is given by[82]

$$[{}^3\mathrm{M}^*]_{\Gamma_p}/[{}^1\mathrm{M}]_0 \sim \Gamma_p\Phi_T k_{ex} + k_{ex}\Phi_T \exp(-k_S\Gamma_p)/k_S + O(k_{ex}^2)\,. \qquad (3.114)$$

It thus appears that even at low intensities a further requirement must be met to achieve correspondence with the simple result presented above; the rate constant for singlet deactivation must be sufficiently fast to reduce the contribution of the second term in Eq. (3.114). Otherwise a false estimate of the extinction coefficient will be obtained. However, empirically, the change in optical density upon laser photolysis is recorded after the induced fluorescence has subsided. Thus a more suitable comparison with the two-state result of Eq. (3.113) is provided by the long-time solution of the three-state approach which is[82]

$$[{}^3\mathrm{M}^*]_\infty/[{}^1\mathrm{M}]_0 \sim \Gamma_p\Phi_T k_{ex} - (\Gamma_p\Phi_T k_{ex})^2/2 + k_{ex}^2(\Phi_T^2-\Phi_T)\{\Gamma_p/k_S + \exp(-k_S\Gamma_p)/k_S^2\}. \qquad (3.115)$$

This expression differs from the commonly used limiting form of Eq. (3.113) only in terms of second order in k_{ex}. Thus, provided no curvature is observed in plots of ΔOD against intensity, the simple relation

$$[{}^3\mathrm{M}^*]/[{}^1\mathrm{M}]_0 \sim \Gamma_p\Phi_T k_{ex} \qquad (3.116)$$

will be valid.

The principal disadvantage of this technique is, of course, that Φ_T must be known. This problem is weighed against the fact that at low intensities complications such as photochemistry can be alleviated.

4. Evaluation Procedure

4.1. General Methodology

The above discussions of the problems encountered in the application of the various types of excitation sources in Sec. 2. and, in particular, of the advantages and disadvantages inherent in the methods employed to determine the extinction coefficients of triplet-triplet absorption bands listed in Sec. 3., serve as a framework for a scientific evaluation of the wavelength maxima and extinction coefficient data presented in Table 6.

Thus we have pointed out various precautions and corrections required in each method and have outlined their respective domains of applicability. It was initially intended to develop an automatic evaluation procedure based on a quality indicator derived from a list of requirements which, ideally, would have to be satisfied to ensure sound application of the experimental extinction techniques. Unfortunately, in the course of extracting data in the primary literature, we regularly encountered inadequate reporting of experimental methodology. This deficiency should hopefully be remedied in the future if the guidelines for the presentation of photochemical and photophysical data issued by IUPAC[96,97] are routinely followed. For the purposes of the present compilation we have had to judge the data firstly on a case by case basis as they were converted for entry into our database and save any global comparison until this compilation was near completion. This procedure represents, then, a first step in our evaluation.

Many decisions and interpretations had to be made merely to get the data into our structured data file. Insufficient information was often present in a given work to fulfil even the minimum requirements for tabulation. In this case similar articles by the same authors could often be found and some extrapolation made to glean the necessary data for entry into the table. If this extrapolation was very great, it was documented in the comments column. A most common inadequacy was failure to mention the solvent system used.

A problem central to the kinetic spectroscopy of transients is the identification of the absorbing species. We indicate the method(s) adopted, where these were reported, in the comments for each entry in the main data table. Often, however, comparison with an earlier spectrum of the same molecule or a closely similar compound is implied (if not stated), and this comment has not been included. Of course we are careful to note or eliminate bands which have been interpreted or proven by later authors to be due to other species. Oxygen quenching, the susceptibility of the transient to aeration or oxygenation of the ambient medium, has been most widely quoted as an identification method. Unfortunately the decay rates of many transient species are reduced in the presence of oxygen either through photochemical quenching or energy transfer. For triplet states, the most likely process is thought to be[98]

4.1 $${}^3\mathrm{M}^* + {}^3\mathrm{O}_2 \rightarrow {}^1\mathrm{M} + {}^1\mathrm{O}_2^*.$$

Another popular technique involves the sensitization of (by) the transient by (of) well characterized triplet state species. In this method it is implicitly assumed that only ${}^3\mathrm{D}^* \rightarrow {}^3\mathrm{A}^*$ transitions are effective in transferring energy to (from) the triplet states of known acceptors (donors). However, both ${}^3\mathrm{D}^* \rightarrow {}^1\mathrm{A}^*$ energy transfer[99] and ${}^1\mathrm{D}^* \rightarrow {}^3\mathrm{A}^*$ energy transfer[100] have been reported, though the latter is quite rare. These two approaches are most reliable when some estimate of the quenching rates involved is given or when multiple references have been used, for example in an effort to bracket the triplet energy of the unknown sample.

If the absorption can be followed in a glassy matrix, and if the observed transient lifetime matches the decay of phosphorescence, then a triplet state can be confidently assigned. This technique is particularly useful carried out at a number of distinct wavelengths. Corresponding decay times would thus eliminate the possibility of multiple transients. Again in glassy samples, if the transient can be detected by ESR techniques, then the presence of $\Delta m =$

2 transitions in the ESR spectrum provides convincing evidence of its triplet nature. Another interesting technique involves an additional monitoring of a fluorescence signal. If the square of the transient absorbance can be correlated with the intensity of delayed luminescence arising from triplet-triplet annihilation, then a triplet state source is likely[94].

Simply observing a first-order decay of the absorption signal on a time scale appropriate for triplet disappearence under the conditions used, has been cited by some authors as evidence for triplet state participation. Radicals often vanish through second order processes and can be longer lived. But this method is obviously not free from criticism. Over the course of this work we have formed the impression that serious identification strategies are only attempted when the assignment is either novel or questionable.

Another example of a problem encountered in the data extraction phase is the precise chemical nature of the triplet species, for instance the state of ionization especially when the solvent is water. This problem was addressed by collecting pK_a's (or pK_b's) of the triplet conjugate acids (or conjugate bases), by including these in the comments and then by analyzing which triplet species should be present at the pH specified.

As we have stated previously, there exists a good deal of agreement among the values reported by various workers, using different excitation methods for the wavelength maxima of the triplet-triplet absorption spectrum of a particular compound in a particular environment. Solvent shifts in λ_{max} are also consistently documented in general. An exception however is found in the values of λ_{max} derived from uncorrected difference spectra. As a difference spectrum approaches the singlet depletion, SD, region, ΔOD drops precipitously. This effect can add spurious maxima and/or greatly shift maxima that occur in or near the SD region. For this reason we have attempted to avoid quoting maxima near the SD region which have been clearly obtained directly from difference spectra. Also we have not attempted to locate such peaks on published difference spectra. Indeed we have often simply omitted mention of original articles which record spectral data derived solely from such difference spectra. This criterion, unfortunately, means that we have excluded more data relevant to such molecules as porphyrins and chlorophylls than was our original intent. Most reports of triplet-triplet absorption in these compounds contain only uncorrected difference spectra and, in addition, such spectra occur almost entirely in the SD region.

Unfortunately, the relative reproducibility revealed in the various measurements of λ_{max}, is not present in the corresponding estimations of the extinction coefficient, ϵ_{max}. Data for the same molecule in different solvents are of course subject to a wide scatter. However, data for the same solvent/molecule system, but obtained by different measurement techniques, are still inconsistent. Two of the principal methods employed to determine the extinction coefficient of triplet-triplet absorption, the energy transfer method, ET, (see Sec. 3.1.) and that of relative actinometry, RA, (see Sec. 3.4.) as well as a number of the less widespread approaches (see Sec. 3.8.2.) are comparative techniques. Ideally the data derived from these methods should form a network within which questions of internal consistency both within a given technique and across a range of approaches could be answered. A number of problems remain which currently prohibit the achievement of such a goal. Usually authors mentioned the standards that they used for reference in some detail. However quite often the authors would quote a standard that was measured in a totally different solvent. The reference ϵ may have been measured in a similar solvent, but this does not automatically guarantee that it will be unchanged in the solvent that the authors found convenient to study. A good deal of work has been done to document[93] that this apparent neglect of solvent effects underlies much of the apparent discrepancies between ϵ_{max} measured in different laboratories (even if this determination is performed by the same technique). In fact it was shown that the use of oscillator strengths would serve to be a better guide to relating the absorption spectrum of a solute in one solvent with its spectrum in another solvent[93].

This empirical rule that oscillator strengths are relatively independent of solvent has a theoretical justification. Most of the well-studied spectra are allowed transitions; thus solvent effects, being first- or second-order perturbations, will not contribute a very large fraction to the transition matrix elements, which are directly related to oscillator strengths and not to ϵ's. In order to deal with this problem for this compilation, we made a special effort to report, in the comments for comparative methods, both the reference ϵ used in addition to the solvent which was used to get that particular reference ϵ and the relevant oscillator strengths if given.

In summary, then, roughly 30% of the entries in the Table contain extinction information. Of these, about 40% are relative measurements which can be checked for internal consistency. Data derived from other techniques lie outside of this network, and their quality must be judged accordingly.

4.2. A Statistical Analysis

4.2.1. Statistical Test of Solvent and Temperature Effects

As a further step in a quantitative evaluation of the triplet-triplet extinction coefficients, we undertook a short statistical analysis of the data. One of the first things that strikes an observer of the extinction coefficient measurements is that there is a large variation between the values derived for most compounds for which multiple determinations exist. The question arises as to whether these variations are so large as to swamp more systematic scatter arising for example in solvent effects. Some progress[101] has already been made in evaluating photophysical and photochemical data by ignoring solvent effects and by treating all the variation between measurements as random.

To judge whether or not the systematic variations can be ignored, we ran a series of statistical tests on one of the key compounds. The approach chosen was a *t* test which gauges the validity of the hypothesis that two sample distributions had the same mean. The test assumes that the variances of the two sample distributions are the same, but unknown. The procedure is described by Ostle and Mensing.[102] A test statistic, T, is used in the method, and T is defined by

$$T = (\langle X_1\rangle - \langle X_2\rangle)/\sqrt{\{S^2(1/n_1 + 1/n_2)\}}, \quad (4.1)$$

where S^2 is the estimate of the common variance given by

$$S^2 = \{(n_1-1)s_1^2 + (n_2-1)s_2^2\}/(n_1+n_2-1) \quad (4.2)$$

and where $\langle X_i\rangle$, n_i, and s_i are the mean, size, and sample standard deviation, respectively, of the ith sample. The critical region of the test is given by

$$\mathrm{abs}(T) \geqslant t_{(1-\alpha/2)(n_1+n_2-2)}. \quad (4.3)$$

t is obtained from tables of Student's *t*-distribution, and $\alpha \times 100\%$ is called the level of significance of the test. The level of significance is the probability that one will reject a true hypothesis for the given test procedure. Traditionally, the acceptance or rejection of hypotheses is based on a 5% level of significance, or even on a 1% level if it is really important to avoid rejecting a true hypothesis. The test is done by first calculating T, from Eq. (4.1) and then checking to see whether the calculated T falls in the region defined in Eq. (4.3) for the chosen level of significance. If T falls in this region, then the hypothesis is rejected.

Five such *t*-tests were run on the anthracene data using 31 measurements. The 2800 value was discarded because of a systematic error in the measurement, and another value was discarded from these initial tests because no solvent conditions were given. Five separate tests were run, but tests were made on three general areas. First the data was tested to see if the measurements in polar environments and nonpolar environments had different means. Second it was tested whether measurements at low-temperature and room temperature had the same means. Third it was tested whether measurements in benzene vs other nonpolar solvents were different.

In all of the five specific tests for anthracene, the hypotheses that "the means are equal" in all cases could not be rejected at the 5% level of significance. In fact the observed values of the test statistics were just significant at the "levels of significance" ranging from 14 to 30%, see Table 3. These values, being in the range of 14 to 30%, are well above the traditional levels of 5% or 1%. This implies that if one chooses to reject the hypotheses that "the means are equal", then one runs quite a large risk, 14 to 30%, of rejecting a true hypothesis.

The simple sequence of *t*-tests just described is only one way to test for the equality of a series of means. It can lead to several problems; one of which is the problem of transitivity of the means. This problem is that if one tests means two-by-two it is possible to find no significant differences from the tests even when the differences are present. This could happen if not all possible pairs are tested. However if all pairs of means are tested two-by-two then it becomes more likely that a mistake will enter in the form of a rejection of a true hypothesis.[103]

In order to circumvent the problems of doing a large number of two-by-two tests, but yet being able to test all the means, one can use an *F*-test along the lines of a technique called Analysis of Variance (ANOVA). The specific test we chose is described on pp. 123–5 of Ostle and Mensing[102] with the ANOVA for an unequal number of experimental units described[102] on pp. 295–7. The hypothesis to be considered is that "the means of all the groups are equal" as opposed to the alternate hypothesis that "at least one of the group means is different than the other means." In the ANOVA technique one compares the variation *within* the groups to variations *among* the groups. If the variation among the groups is significant relative to that within the group, then the hypothesis that the means are equal is rejected.

For the ANOVA, we chose five groups related to solvent and temperature among the anthracene measurements. The five groups were polar-RT, polar-LT, benzene-RT, cyclohexane-RT, and nonpolar-RT. RT and LT refer to room temperature and to low temperature, respectively. The nonpolar group did not contain any benzene or cyclohexane data. With this five-level classification of the same 31 measurements of anthracene as in the *t*-tests, we obtained an F-ratio of about 1. This indicated that the hypothesis was not to be rejected at the usual levels of significance. However since there may be extreme values that are significantly affecting this result, we used Chauvenet's criterion (see Sec. 4.2.2.) on the data to check for such outliers. The value of 118000 failed and was rejected. With this revision of the data groups we performed the ANOVA again and obtained the traditional ANOVA table given in Table 4.

TABLE 3. *t* tests of solvent effects in anthracene

Dual comparisons	No. in samples	*t* test statistic	*f*[a] /%
Polar / Nonpolar (RT[b])	9/16	1.06	30
Polar (RT) / Polar (LT[c])	9/6	1.61	14
All (RT) / All (LT)	25/6	1.21	24
Benzene / other Nonpolar	6/10	1.09	30
Benzene / Cyclohexane	6/5	1.17	28

[a] Comparison is statistically significant at *f* %.
[b] Room temperature.
[c] Low temperature (usually 77 K).

TABLE 4. ANOVA table for anthracene[a]

Source of Variation	Degrees of Freedom	Sum of Squares /× 10^9	Mean Square /× 10^8	F Ratio
Mean	1	111	1110	—
Among Groups	4	1.11	2.78	1.15
Within Groups	25	6.05	2.42	—
Total	30	111	—	—

[a] Excluding outlier.

The F-ratio of 1.15 was compared to an F-distribution with 4 and 25 degrees of freedom and was found to be not significant at the traditional levels. The F-ratio would have to be about 3 before one could reject the equality of the group means at a 5% level.

Both the t-tests and the ANOVA have limitations. They complement each other in the sense that the ANOVA assumes that all of the groups have the same variance, but each t-test makes a separate assumption about the equality of the variances of the means that it is testing. The ANOVA is more limited in this sense, but it has the advantage that it tests the means only once as discussed above.

One feature that is shared by both tests is the assumption of an underlying normal distribution. It is relatively easy to test whether the large distribution of 30 measurements used in the ANOVA is normal or not. The procedure we chose was the Kolmogorov-Smirnov test, described in a textbook by DeGroot[104] on pp. 465–8. The largest difference, D_n^*, between the empirical distribution function and the distribution from a standard normal distribution was 0.10 for the data used in the ANOVA above. Following through the rest of the procedures for the Kolmogorov-Smirnov test, we found a tail region of over 90%, which is very far from the 5% or 1% tails traditionally used in rejecting the hypothesis that the distribution is normal.

Another assumption of the statistical models underlying the t-tests and the ANOVA is that the variances of the normal distributions of the groups being tested are equal. One can also test this assumption if one uses an F-test. The F statistic chosen[102] is

$$F = s_1^2/s_2^2 \tag{4.4}$$

where the rejection region of the test is

$$F \geqslant F_{(1-\alpha/2)(n_1-1,n_2-1)} \tag{4.5}$$

or

$$F \leqslant F_{(\alpha/2)(n_1-1,n_2-1)}. \tag{4.6}$$

As before s_i and n_i are the sample standard deviation and size of the ith sample, respectively, and the F's on the righthand sides of Eqs. (4.5,4.6) are taken from tables of the F-distribution with n_1-1 and n_2-1 degrees of freedom. The variances of the five pairs of groups in Table 3 were tested using this test, and none of the five tests showed any statistically significant result.

In summary the t-tests and the ANOVA both failed to detect differences between the means of the groups of anthracene measurements based on solvent and temperature. This does not imply that the measurements all truly come from the same distribution and that there are no solvent or temperature effects. But it does indicate that, given the data in the literature, we cannot reject the hypothesis that *there is no statistically significant difference between the means of the various solvent-temperature groups.*

4.2.2. Mean ϵ and Confidence Intervals

Based on the results of the statistical tests of solvent and temperature effects on anthracene, we proceeded with the statistical analysis by ignoring these effects. We studied the 32 compounds that had five or more measurements at a particular wavelength. The number five was chosen because it allows reasonable statistics to be done, such as using Chauvenet's criterion.

Since the samples were taken from a distribution whose mean and variance are both unknown, we used the t factor to calculate the confidence interval.[102] The assumption made here is that the sample is distributed normally with unknown mean and variance. The 95% confidence interval was calculated from

$$CI = t_{0.975(N-1)} \times s / \sqrt{N}, \tag{4.7}$$

where s is the sample standard deviation and N is the number of measurements. The values of $t_{0.975(N-1)}$ were taken from tables of the t-distribution. The calculated means of the samples of measurements on the various compounds are given in Table 5 along with the calculated 95% confidence intervals.

In an attempt to critically evaluate the data, we chose Chauvenet's criterion to examine the individual measurements on each of the 32 compounds. The guiding principle[105] of Chauvenet's criterion is that individual measurements should not inordinately influence the calculation of the mean of a sample. If an individual measurement has a much larger (or smaller) deviation from the mean than any other measurements, then it will pull the value of the mean toward it to a much greater extent than other measurements pull the mean toward themselves. Measurements that do affect the mean in such an unwanted fashion can be identified and eliminated from the sample if desired. The explicit form is such that if the deviation from the mean, d_i, is greater than q, where q is given by

$$1 - \{1/s\sqrt{(2\pi)}\} \times \int_{-q}^{+q} \exp\{-y^2/(2s)\}\, dy = 1/(2N), \tag{4.8}$$

then the ith measurement can be eliminated from the calculation of the mean. This is Chauvenet's criterion.

Chauvenet's criterion gives a more flexible procedure than simply discarding measurements that are 2 (or some other fixed number of) standard deviations away from the mean.[101] For the same sample standard deviation, s, a sample with $N=5$ would throw away measurements that had $d_i \geqslant 1.68 \times s$. However, a sample with $N=30$ would not throw away a measurement unless $d_i \geqslant 2.39 \times s$. This implies that the criterion is much more tolerant of large deviations in large samples than it is in small samples, which is just another way of saying that the mean of a small sample is more sensitive to a large deviation than is the mean of a large sample.

TABLE 5. Average extinction coefficients

Compound Name (λ_{max}/nm)[a]	No.	$<\epsilon>$ /L mol^{-1} cm^{-1}	95% confidence interval	ϵ(benzene)[b] /L mol^{-1} cm^{-1}	ϵ(cyclohexane)[b] / L mol^{-1} cm^{-1}
1. Acridine (440)	12	23900	±3250 (±14.%)	24300	31500
2. Anthracene (430)	31	61000	±5670 (± 9%)	45500	64700
3. Benz[*a*]anthracene (490)	10	23300	±4190 (±18.%)	20500	28800
4. Benzo[*a*]coronene (570)	5	22300	±4170 (±19%)	——	——
5. Benzophenone (525)	17	7640	±1050 (±14.%)	7630	——
6. Biphenyl (360)	8	36600	±6300 (±17.%)	27100	42800
7. Carbazole (425)	6	14000	±3110 (±22%)	——	——
8. 3-Carbethoxypsoralen (450) [c]	7	4620	±1870 (±40%)	——	——
9. *β-apo*-14′-Carotenal (480)	4	120000	±9840 (± 8%)	——	——
10. Chloranil (510)	5	6810	±1170 (±17%)	——	——
11. Chrysene (580)	7	30000	±13700 (±46%)	——	——
12. Dibenz[*a*,*h*]anthracene (580)	6	21600	±10000 (±46%)	——	——
13. 9,10-Diphenylanthracene (445)	6	16500	±2230 (±13%)	——	——
14. DPB (390)	5[d]	52600	±8890 (±17%)	——	——
15. DPH (420)	7	112000	±5390 (± 5%)	——	——
16. DPO (440)	7	189000	±22900 (±12%)	——	——
17. Duroquinone (490)	10	6180	±1330 (±21.%)	6950	5330
18. Methylene Blue$^+$ (420)	4	10800	±3760 (±35%)	——	——
19. Methylene Blue$^+$, protonated (370)	4	13800	±1910 (±14%)	——	——
20. C_{17}-aldehyde (440)	7[d]	59600	±6640 (±11%)	——	——
21. Naphthalene (415)	16	22500	±5230 (±23%)	13200	24500
22. Naphthalene-d_8 (415)	6	23500	±11700 (±50%)	——	——
23. 5-Nitro-2-furoic acid (490)	5[d]	20700	±1550 (± 7%)	——	——
24. Phenanthrene (490)	10	26900	±6500 (±24%)	15700	25200
25. Pyrene (415)	5	36400	±14700 (±40%)	20900	30400
26. 1-Pyrenecarboxaldehyde (440)	10[d]	18400	±311 (± 2%)	——	——
27. 11-*cis*-Retinal (450)	6	49700	±20300 (±41%)	——	——
28. *all-trans*-Retinal (450)	14	71000	±3420 (± 5.%)	——	——
29. TMPD (620)	5	15300	±6610 (±43%)	——	12200
30. Triphenylene (430)	9	12700	±4120 (±32%)	——	——
31. Ru(byp)$_3^{2+}$ (370)	5	27600	±1830 (± 7%)	——	——
32. Zinc(II) phthalocyanine (480)	5	33300	±15400 (±46%)	——	——

[a] Nominal wavelength maximum (large environmental and instrumental shifts are often present).

[b] Data from R. Bensasson and E.J. Land, Trans. Faraday Soc. **67**, 1904 (1971).

[c] 450 nm not necessarily a maximum.

[d] Average computed from one paper only. Scatter in the data for these compounds is likely due to real solvent and temperature effects.

The measurements that do not satisfy Chauvenet's criterion for the 32 compounds studied are marked in Table 6. These values are not included in the averages listed in Table 5. There are two other type of measurements that we have excluded from the averages in Table 5 and have marked in Table 6.

The first includes measurements that are commonly acknowledged to contain systematic errors. In this class we have marked only values from some of the first papers to measure extinction coefficients of triplet-triplet absorption. These values are uniformly too small by an order of magnitude or so.

The second type of measurement that we have excluded from averages in Table 5 are measurements in mixed crystals, neat liquids and micelles. These measurements are also uniformly low compared to other measurements. In this case however, we believe the values are low for a good physical reason. It seems likely that there are intermolecular interactions between the chromophores that are causing the hypochromic effect. This intermolecular effect is well studied in DNA (see Chase and Rhodes[106] for a theoretical review). A similar effect is still likely in mixed crystals. Depending on the host, intermolecular communication between the guest molecules is possible.

4.2.3. Discussion of Statistical Results

The above statistical analysis can be summarized as follows: Based on the statistical tests on the anthracene data, we found no statistically significant solvent or temperature effects. Furthermore the data for anthracene appear to follow a normal distribution. Generalizing these two statistical results to all the compounds, we calculated means and 95% confidence intervals for those compounds with more than five measurements. In addition we chose again Chauvenet's criterion to tag outliers in the data.

However, as is well known from other varieties of molecular spectroscopy, solvent and temperature effects do in fact exist. The question then arises as to how the statistical results obtained above should be viewed.

To support the view that solvent and temperature effects are significant in this data, one only needs to look at Table 6 and see how the extinction coefficients often go up, particularly in glasses at low temperature. So the data do in fact show systematic variations due to solvent and temperature. Furthermore the compounds tagged with superscript "d" in Table 5 are reported in single papers and should therefore give some indication of the solvent effect because systematic errors due to different laboratories are "blocked out", in the statistical sense. Finally the widely used standards[61] listed in the last two columns of Table 5 show a significant deviation between cyclohexane and benzene which might not be expected to be so large because of the similarity of the physical properties of these two solvents.

The conflict between the lack of statistically significant solvent effects and the appearance of them in the several forms as listed above can be rationalized, of course. The resolution of the conflict most likely lies in the random experimental errors in the difficult measurements and in the various systematic errors between laboratories and methods. These errors are large enough so that the discrepancies between measurements within solvent groups are comparable to or larger than fluctuations among solvent catagories. A quantitative test of this was given above in the ANOVA procedure on the anthracene data.

The sources of these systematic errors due to methods have already been discussed extensively in Sec. 3. For convenience we list some of the more prominent conclusions here again. Singlet depletion (SD) gives an upper bound due to underlying triplet absorption. Total depletion (TD) gives a lower bound due to lower triplet concentrations either from competing photophysical (multiphotonic) or photochemical processes or from insufficient laser pulse length. Results from the energy transfer (ET) technique can be either high or low due to lack of unit probability of energy transfer (high when the unknown is the triplet donor and low when the unknown is the triplet acceptor).

The systematic errors due to variations between laboratories may partially be accounted for by the systematic errors incurred by the choice of method, but an additional source is to be found among the various procedures adopted in different laboratories. Some of the more prominent of these include improper overlap of monitoring beam with exciting beam,[53] monochromator slits too wide for sharp spectra (particularly important for the aromatic hydrocarbons, leading extinction coefficients being too low),[50] different standard extinction coefficients for relative methods like energy transfer and relative actinometry, improper calibration of monochromator (making these standards even more tenuous in relative methods and throwing off the singlet wavelength where the standard ϵ is measured in singlet depletion measurements), and insufficient number of wavelength measurements to clearly define the absorption peaks.[7] Many of the commonly used reference extinction coefficients are unfortunately for compounds with particularly sharp spectra such as anthracene.

4.3. Tentative Standard ϵ's

Taking into account that experimental errors, both methodological and instrumental, seem to induce variations in the data that are greater than, or of the same order as, the solvent effects, it is tempting to use the average extinction coefficients in Table 5 as standards. We feel it would be premature to do this at this time. However lacking further analysis, we would recommend that these values represent some of the best ϵ's that are available at this time.

Until further analysis can be performed, we recommend that a hierarchy of values be used. First we would still recommend the Bensasson-Land values[61] in the last two columns of Table 5 if the solvents used are benzene or cyclohexane. The only exception to this is that 7220 L $\mathrm{mol}^{-1}\ \mathrm{cm}^{-1}$ should be used for benzophenone in benzene.[95] For these measurements great care was taken to make these values stand as bench marks. Our only reservation is that these measurements were made using primarily the energy transfer method and are susceptible to its weaknesses. The measurements are also susceptible to the usual instrumental errors, but great care seems to have been taken to avoid the instrumental pitfalls in these two works.

On the next level of the hierarchy of values, we tentatively recommend the average values in Table 5. These values are not equally recommended and should only be used in a nested hierarchy. The hierarchy we recommend can be used as follows: First, for compounds that have values in one of the last two columns of Table 5, use the average ϵ's only for solvents that are not benzene or cyclohexane. Second, use the average values of ϵ for all other compounds with exceptions being made for the compounds with confidence intervals exceeding ±30%. Third, average ϵ's for compounds with large confidence intervals of over ±30% should not be used as a standard in a relative measurement of an unknown extinction coefficient (or quantum yield) unless no other compound with a more reliable standard can be used.

At this point it should be noted that the average ϵ's with their accompanying confidence intervals are not always consistent with the values in the last two columns of Table 5. This is true even for the compounds with confidence intervals of less than ±30%. The most notable example is the Bensasson-Land value[61] for anthracene in benzene which falls outside the computed 95% confidence interval. The suggested hierarchy is set up to favor the Bensasson-Land values in this case.

Of the 10 compounds in Table 5 with confidence intervals exceeding ±30%, most have small sample sizes. The sources of the large confidence intervals vary somewhat among the compounds. Over half of these compounds are aromatic hydrocarbons with sharp peaks that sharpen even further at low temperature. With the small sample sizes, our assumptions of normality and comparable experimental variations vs. solvent variations may not hold for these compounds. For example in the case of chrysene there are only 7 measurements. Of these, three are measurements in low temperature glasses and have $\epsilon > 36000$ L mol^{-1} cm^{-1}. Another of the 7 measurements was an early[107] measurement that seems unusually low at 8800 L mol^{-1} cm^{-1}. For chrysene Chauvenet's criterion does not help because of the particular scatter of the data. Furthermore there seems to be a well-founded physical reason for the scatter, namely sharper spectra at lower temperature, violating our assumption that temperature effects are comparable with experimental errors.

Another of the 10 compounds with larger than $\pm 30\%$ confidence intervals that is not well represented by the average ϵ's is 11-*cis*-retinal. Like the aromatic hydrocarbons, it has a large confidence interval. In addition some workers[108] believe in a common triplet state for some polyene trans and cis isomers. If this were so in the all-trans and 11-cis isomers of retinal, then 11-*cis*-retinal should have an $\epsilon \sim 70000$ L mol^{-1} cm^{-1}. This points to the two values[109] of 27000 L mol^{-1} cm^{-1} as either suspiciously low or as showing unusual solvent effects.

A word should be said about the decision to cut the recommended ϵ's to compounds with $\pm 30\%$ confidence intervals. First of all, $\pm 30\%$ is roughly on the most pessimistic limits of reported "error" limits by the authors of papers reporting extinction coefficients. In fact rarely are error bars stated as being more than $\pm 25\%$. However after spending much time evaluating the data, we tend to favor the more pessimistic estimates. In addition the average ϵ's with confidence limits of less than $\pm 30\%$ tend to fall close to or between the Bensasson-Land values in the last two columns of Table 5.

As mentioned above the recomended hierarchy of values is only tentative and is contingent on further work. It was hoped that further evaluation could be done using the principle that oscillator strengths do not change with solvent. Although this approach is promising, it is difficult to carry out on a large scale because one must have complete spectra in each solvent. Another approach that seems more feasible is a global fit[101] using the recommended values obtained to correct all the ϵ's obtained from relative measurements. Using a consistent set of values as standards for the relative measurements should in itself be an improvement over the present analysis.

5. Arrangement of the Data Table

Table 6, the data table, contains over 3000 entries. These are grouped under the name of the compound to which they pertain. The compounds themselves are numbered and listed alphabetically, with secondary attention being paid to numerical substituent locations. Common names are employed and we rely on the use of a compound name index, which contains both synonyms and inverted names, and a molecular formula index to help locate specific data.

Multiple entries which occur for a particular compound are further ordered alphabetically by the solvent name or abbreviation. Final questions of tabular precedence are settled by appeal to the serial number accorded to each paper upon acquisition for our local bibliographic database.[11]

In addition to specifying the ambient medium, the "solvent" column reports, in parentheses, the temperature at which the measurement was carried out. If no temperature is shown then room temperature may be assumed unless otherwise noted in the comments.

The slash (/) in the "method" column separates the excitation method from the extinction determination technique. An explanation of the abbreviations used for each is given below. Occasionally the only reported data has been obtained as an average of unquoted primary values from different methods. In this case both methods are included and separated by an ampersand.

The third column contains the heart of the compilation: the wavelength(s), λ_{max} of maximum triplet-triplet absorbance together with the corresponding extinction coefficient(s), ϵ_{max}, where estimated. Multiple entries are presented in order of decreasing wavelength (i.e. in increasing energy). We highlight the following use of two superscripts:

^{a} implies that data have been obtained by computer-assisted digitization[110] from a spectrum in the cited reference,

^{b} implies that the (wavelength, extinction coefficient) pair are not necessarily related to a spectral peak.

Other superscripts are used as indicated in the footnotes.

The fourth column, the "comments" column, collects information from a number of separate items in our database. In the table this construction is evidenced by the presence of semicolons (;) delimitating the items. Primary comments comprise an identification technique if reported. This is indicated by a preceding ‡. If this symbol is absent then no attempt to verify the nature of the transient, other than by similarity to a previous measurement, is mentioned in the article from which the data have been taken. Other comments, such as relative intensities in multiply peaked spectra, if stated or derived from a figure in the original work are included next. When a comparative method has been used to determine the extinction coefficient, the data relative to which the estimation has been made (if reported) are present in a set form giving both wavelength and extinction coefficient of the standard employed, as well as the solvent in which these values were obtained. Details of any additional assumptions, such as triplet yields in the relative actinometry technique, which were made by the original authors to enable the comparison, are also included. Further specification of, for example, the solvent system, e.g. ratio of mixture, etc. are then given together with any other information relevant to the evaluation of the data in the wavelength-extinction column.

The remainder of the comment is constructed in a fixed format from entries for triplet state lifetimes (μs), pH of solution, half-life of transient (if second order processes are present and unsubtracted), oscillator strength of reported transition, rate constant for energy transfer to (or from) the species indicated earlier in the comment and rise-time of the triplet-triplet absorption. We note here again that these associated data, while relevant to the study and characterization of triplet states in general, have not been subjected to a procedure of critical evaluation.

The last column contains the serial number which may be used to locate the reference in the list provided subsequent to the table.

5.1. Lists of Abbreviations

We have made use of the following abbreviations in the body of the Table. These are mainly confined to the "Method" column though some do appear in the "Comments" column.

a. Triplet State Population Method

CWL	Continuous wave laser excitation
FP	Flash photolysis
LP	Laser photolysis (pulsed)
MOD	Modulated excitation (e.g. rotating sector)
PR	Pulse radiolysis
PS	Photostationary
–ET	(coupled with energy transfer)

b. Extinction Coefficient Estimation Method

COM	See comments
ELT	Electron transfer
ESR	Electron spin resonance intensity
ET	Energy transfer
HAT	Hydrogen atom transfer
IV	Intensity variation
KM	Kinetic method
PIV	Pulsed intensity variation
RA	Relative actinometry
RF	Constant oscillator strength
SD	Singlet depletion
SM	Partial saturation
TD	Total depletion

In addition, to conserve space, a number of solvents and mixtures have been abbreviated. These are mainly confined to the "Solvent" column and are listed below.

AOT	Di-(2-ethylhexyl) sodium sulfosuccinate
BuOH	Butanol (isomer unspecified)
1-BuOH	1-Butanol
tert-BuOH	*tert*-Butyl alcohol
DFMeOH	Di(trifluoromethyl)methanol
CTAB	Cetyltrimethylammonium bromide
CTAC	Cetyltrimethylammonium chloride
DDDAB	Didodecyldimethylammonium bromide
DMF	Dimethyl formamide
DMSO	Dimethyl sulfoxide
DODAC	Dioctadecyldimethylammonium chloride
DTB	Dodecyltrimethylammonium bromide
EPA	Diethyl ether/Isopentane/Absolute ethanol (5:5:2)
EtOH	Ethanol
Et_2O	Diethyl ether
MCH	Methylcyclohexane
MeOH	Methanol
3-MH	3-Methylhexane
3-MP	2-Methylpentane
MTHF	Methyltetrahydrofuran (isomer unspecified)
2-MTHF	2-Methyltetrahydrofuran
PFMCH	Perfluoromethylcyclohexane
PMMA	Poly(methylmethacrylate)
PPFO	Potassium perfluorooctylsulfonate
PrOH	Propanol (isomer unspecified)
1-PrOH	1-Propanol
2-PrOH	2-Propanol
PVA	Poly(vinyl alcohol)
SDS	Sodium dodecyl sulfate surfactant
SHS	Sodium hexadecyl sulfate surfactant
SPFO	Sodium perfluorooctanoate
THF	Tetrahydrofuran

5.2. Lists of Symbols

The following symbols, used in the body of the text are collected here for convenience.

a. Conversion probabilities

Φ	total luminescence yield
Φ_f	quantum yield of fluorescence
Φ_T	quantum yield for triplet state formation
$\Phi_T(A)$	quantum yield for triplet state formation in triplet energy acceptor, A
$\Phi_T(D)$	quantum yield for triplet state formation in triplet energy donor, D
$\Phi_T(R)$	quantum yield for triplet state formation in reference compound, R
$\Phi_T(T)$	quantum yield for triplet state formation in unknown compound, T
P_{tr}	probability of triplet-triplet energy transfer

b. Extinction coefficients

ϵ_A	extinction coefficient for ground (singlet) state of energy acceptor, A
$\dot{\epsilon}_A$	extinction coefficient for excited (triplet) state of A
ϵ_D	extinction coefficient for ground (singlet) state of energy donor, D
$\dot{\epsilon}_D$	extinction coefficient for excited (triplet) state of D
$\dot{\epsilon}_R$	extinction coefficient for excited (triplet) state of reference triplet, R
ϵ_S	extinction coefficient for ground singlet state, S, of arbitrary molecule
$\dot{\epsilon}_T$	extinction coefficient for excited (triplet) state of unknown triplet, T

c. Intensities

$I_p(R)$	intensity of sensitized phosphorescence from reference compound
$I_p(T)$	intensity of sensitized phosphorescence from unknown compound
I	true transmitted light intensity

I_0	incident light intensity
I_m	intensity of monitoring light
I_m^0	incident intensity of monitoring light
I_p	intensity of photolyzing light
I_p^0	incident intensity of photolyzing light
I_s	scattered light intensity in absence of excitation
I_s'	scattered light intensity in presence of excitation

d. Miscellaneous

A_r	integrated microwave absorbance of reference radical
A_T	integrated microwave absorbance of triplet state
ℓ	optical path length (of monitoring beam)
x	measure of distance on along monitoring path
τ_T	triplet state lifetime
τ_r	(excitation rate dependent) rise time of triplet-triplet absorption
$[M]$	concentration of M
$[M]_0$	concentration of M at time zero
$[M]_\infty$	concentration of M at long times
$[M]_{x=0}$	concentration of M at front face of cell
$[M]_{x=\ell}$	concentration of M at rear of cell

e. Molecular species

^1A	singlet ground state of energy acceptor, A
$^1A^*$	singlet excited state of A
$^2A^-$	radical anion of A
$^3A^*$	triplet excited state of A
^1D	singlet ground state of energy donor, D
$^1D^*$	singlet excited state of D
$^3D^*$	triplet excited state of D
^1M	singlet ground state of arbitrary molecule, M
$^1M^*$	singlet excited state of M
$^3M^*$	triplet excited state of M
$^3M^{**}$	higher triplet excited state of M, reached by TTA
^1S	singlet ground state of solvent molecule, S
$^1S^*$	singlet excited state of S
$^2S^+$	radical cation of S
$^2S^-$	radical anion of S
$^3S^*$	triplet excited state of S

f. Molecular states

S_0	molecular (singlet) ground state
S_1	lowest excited singlet state
S_n	higher excited singlet state
T_1	lowest triplet (excited) state
T_n	higher excited triplet state

g. Optical densities

OD	optical density
OD_T	OD ascribed to triplet state absorbance
ΔOD	change in OD on excitation
ΔOD_A	change in OD of acceptor (triplet) extrapolated to long times
ΔOD_D	change in OD of donor (triplet) extrapolated to time zero
ΔOD_S	change in OD due to isolated singlet decay
ΔOD_T	change in OD due to isolated triplet growth

h. Rate constants

k_A	rate constant for acceptor triplet state deactivation
k_D	rate constant for donor triplet state deactivation
k_{DA}	rate constant for ET without acceptor excitation
k_{et}	rate constant for triplet energy transfer
k_{ex}	rate constant for ground state photo-excitation
k_{ex}'	rate constant for excited state photo-excitation
k_{ic}	rate constant for internal conversion in the singlet manifold
k_{isc}	rate constant for singlet to triplet inter-system crossing
k_{isc}'	rate constant for triplet to singlet inter-system crossing
k_{isc}''	rate constant for T_1 to S_1 intersystem crossing
k_p	rate constant for phophorescence
k_{pc}	rate constant for photochemistry from S_1
k_{pc}'	rate constant for photochemistry from T_1
k_S	rate constant for singlet state deactivation
k_T	rate constant for triplet state deactivation

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7. References to Text

[1] H. Labhart and W. Heinzelmann, "Triplet-Triplet Absorption Spectra of Organic Molecules," in *Organic Molecular Photophysics*, Vol. 1, J. B. Birks, Editor (Wiley, New York, 1973) p. 297.

[2] J. B. Birks, *Photophysics of Aromatic Molecules* (Wiley-Interscience, London, 1970).

[3] A. K. Chibisov, Russ. Chem. Rev. **39**, 891 (1970).

[4] R. Bensasson and E. J. Land, "Physical Properties of Excited States: A General Method for Measuring Triplet-Triplet Extinction Coefficients, Singlet-Triplet Intersystem Crossing Efficiencies, and Related Parameters," in *Photochemical and Photobiological Reviews*, Vol. 3, K. C. Smith, Editor (Plenum Press, New York, 1978) p. 163.

[5] E. J. Land, Proc. R. Soc. London, Ser. A **305**, 457 (1968).

[6] W. Heinzelmann and H. Labhart, Chem. Phys. Lett. **4**, 20 (1969).

[7] J. C. Scaiano, J. Photochem. **18**, 395 (1982).
[8] I. Carmichael and G. L. Hug, Radiat. Phys. Chem. **20**, 119 (1982).
[9] I. Carmichael and G. L. Hug, Radiat. Phys. Chem. **20**, 179 (1982).
[10] I. Carmichael and G. L. Hug, Radiat. Phys. Chem. **26**, 229 (1985).
[11] W. P. Helman and A. B. Ross, Radiat. Phys. Chem. **16**, 425 (1980).
[12] M. Kasha, Discuss. Faraday Soc. (9), 14 (1950).
[13] J. B. Birks, Chem. Phys. Lett. **17**, 370 (1972).
[14] G. D. Gillespie and E. C. Lim, J. Chem. Phys. **65**, 2022 (1976).
[15] G. N. Lewis and M. Kasha, J. Am. Chem. Soc. **66**, 2100 (1944).
[16] G. N. Lewis, D. Lipkin, and T. T. Magel, J. Am. Chem. Soc. **63**, 3005 (1941).
[17] D. S. McClure, J. Chem. Phys. **19**, 670 (1951).
[18] G. Porter and M. W. Windsor, J. Chem. Phys. **21**, 2088 (1953).
[19] R. G. W. Norrish and G. Porter, Nature **164**, 658 (1949).
[20] G. Porter, Proc. R. Soc. London, Ser. A **200**, 284 (1950).
[21] G. Porter and M. W. Windsor, Discuss. Faraday Soc. (17), 178 (1954).
[22] M. S. Matheson and L. M. Dorfman, J. Chem. Phys. **32**, 1870 (1960).
[23] R. L. McCarthy and A. MacLachlan, Trans. Faraday Soc. **56**, 1187 (1960).
[24] J. P. Keene, Nature **188**, 843 (1960).
[25] J. W. Boag and R. E. Steel, *British Empire Cancer Campaign Report 38, Part II*, 1960, p. 251.
[26] F. S. Dainton, T. J. Kemp, G. A. Salmon, and J. P. Keene, Nature **203**, 1050 (1964).
[27] R. M. Danziger, K. H. Bar-Eli, and K. Weiss, J. Phys. Chem. **71**, 2633 (1967).
[28] R. McNeil, J. T. Richards, and J. K. Thomas, J. Phys. Chem. **74**, 2290 (1970).
[29] G. Porter and M. R. Topp, Proc. R. Soc. London, Ser. A **315**, 163 (1970).
[30] P. M. Rentzepis, Science **169**, 239 (1970).
[31] N. Mataga, and N. Nakashima, Spectrosc. Lett. **8**, 275 (1975).
[32] R. M. Hochstrasser, D. L. Narva, and A. C. Nelson, Chem. Phys. Lett. **43**, 15 (1976).
[33] R. V. Bensasson, J. T. Richards, and J. K. Thomas, Chem. Phys. Lett. **9**, 13 (1971).
[34] C. Willis, O. A. Miller, A. E. Rothwell, and A. W. Boyd, Radiat. Res. **35**, 428 (1968).
[35] D. C. Walker and S. C. Wallace, Chem. Phys. Lett. **6**, 111 (1970).
[36] J. W. Hunt, C. L. Greenstock, and M. J. Bronskill, Int. J. Radiat. Phys. Chem. **4**, 87 (1972).
[37] J. E. Aldrich, P. Foldvary, J. W. Hunt, W. B. Taylor, and R. K. Wolff, Rev. Sci. Instrum. **43**, 991 (1972).
[38] L. M. Dorfman, "Pulse Radiolysis," in *Techniques in Chemistry*, 3rd Edition, Part II, Vol. 6, G. G. Hammes, Editor (Wiley-Interscience, New York, 1974) p. 463.
[39] J. W. Hunt, "Early Events in Radiation Chemistry," in *Advances in Radiation Chemistry*, Vol. 5, M. Burton and J. L. Magee, Editors, (Wiley-Interscience, New York, 1976) p. 185.
[40] V. Sundstrom, P. M. Rentzepis, and E. C. Lim, J. Chem. Phys. **66**, 4287 (1977).
[41] M. Chessin, R. Livingston, and T. G. Truscott, Trans. Faraday Soc. **62**, 1519 (1966).
[42] J. T. Dubois and M. Cox, J. Chem. Phys. **38**, 2536 (1963).
[43] H. L. J. Baeckstroem and K. Sandros, Acta Chem. Scand. **12**, 823 (1958).
[44] G. Porter and F. Wilkinson, Trans. Faraday Soc. **57**, 1686 (1961).
[45] H. Labhart, Helv. Chim. Acta **47**, 2279 (1964).
[46] U. B. Ranalder, H. Kaenzig, and U. P. Wild, J. Photochem. **4**, 97 (1975).
[47] M. V. Alfimov, I. G. Batekha, Y. B. Sheck, and V. I. Gerko, Spectrochim. Acta **27**, 329 (1971).
[48] D. Lavalette, C. R. Seances Acad. Sci., Ser. B **266**, 279 (1968).
[49] T. F. Hunter and A. I. Younis, J. Chem. Soc., Faraday Trans. 1 **75**, 550 (1979).
[50] C. A. Parker, *Photoluminescence of Solutions* (Elsevier, Amsterdam, 1968).
[51] J. W. Boag, Trans. Faraday Society **64**, 677 (1968).
[52] I. G. Ross, J. Opt. Soc. Am. **44**, 40 (1954).
[53] M. Bazin and T. W. Ebbesen, Photochem. Photobiol. **37**, 675 (1983).
[54] G. Porter and M. A. West, "Flash Photolysis" in *Techniques in Chemistry*, 3rd Edition, Part II, Vol. 6, G. G. Hammes, Editor (Wiley-Interscience, New York, 1974) p. 367.
[55] M. A. West, Photochemistry (Specialist Periodical Reports, Chem. Soc., London) **8**, 3 (1977).
[56] G. Cilento, Acc. Chem. Res. **13**, 225 (1980).
[57] N. J. Turro, P. Lechtken, G. Schuster, J. Orell, H. C. Steinmetzer, and W. Adam, J. Am. Chem. Soc. **96**, 1627 (1974).
[58] J. T. Richards and J. K. Thomas, Trans. Faraday Soc. **66**, 621 (1970),
[59] D. L. Dexter, J. Chem. Phys. **21**, 836 (1953).
[60] C. Capellos and B. H. J. Bielski, *Kinetic Systems* (Krieger, Huntington, N.Y., 1980).
[61] R. Bensasson and E. J. Land, Trans. Faraday Soc. **67**, 1904 (1971).
[62] T. Takemura, P. K. Das, G. Hug, and R. S. Becker, J. Am. Chem. Soc. **100**, 2626 (1978).
[63] W. R. Dawson, J. Opt. Soc. Am. **58**, 222 (1968).
[64] P. G. Bowers and G. Porter, Proc. R. Soc. London, Ser. A **299**, 348 (1967).
[65] S. G. Hadley and R. A. Keller, J. Phys. Chem. **73**, 4351 (1969).
[66] T. G. Pavlopoulos, J. Opt. Soc. Am. **63**, 180 (1973).
[67] R. Bensasson, C. R. Goldschmidt, E. J. Land, and T. G. Truscott, Photochem. Photobiol. **28**, 277 (1978).
[68] H. Linschitz and K. Sarkanen, J. Am. Chem. Soc. **80**, 4826 (1958).
[69] I. Carmichael and G. L. Hug, J. Phys. Chem. **89**, 4036 (1985).
[70] M. R. Topp, Appl. Spectrosc. Rev. **14**, 1 (1978).
[71] U. Lachish, A. Shafferman, and G. Stein, J. Chem. Phys. **64**, 4205 (1976).
[72] M. M. Fisher, B. Veyret, and K. Weiss, Chem. Phys. Lett. **28**, 60 (1974).
[73] S. Speiser, R. van der Werf, J. Kommandeur, Chem. Phys. **1**, 297 (1973).
[74] H. Lutz, E. Breheret, and L. Lindqvist, J. Phys. Chem. **77**, 1758 (1973).
[75] A. Corval, P. Jardon, and R. Gautron, J. Chim. Phys.-Chim. Biol. **79**, 335 (1982).
[76] B. Amand and R. Bensasson, Chem. Phys. Lett. **34**, 44 (1975).
[77] R. A. Keller and S. G. Hadley, J. Chem. Phys. **42**, 2382 (1965).
[78] W. G. Herkstroeter and D. S. McClure, J. Am. Chem. Soc. **90**, 4522 (1968).
[79] F. Wilkinson, "Triplet Quantum Yields and Singlet-Triplet Intersystem Crossing," in *Organic Molecular Photophysics*, Vol. 2, J. B. Birks, Editor (Wiley, New York, 1975) p. 95.
[80] V. A. Smirnov and M. V. Alfimov, Kinetica Kataliz. **7**, 583 (1966).
[81] D. Lavalette, J. Chim. Phys. **66**, 1853 (1969).
[82] G. L. Hug and I. Carmichael, J. Photochem. **31**, 179 (1985).
[83] M. S. Grodowski, B. Veyret, and K. Weiss, Photochem. Photobiol. **26**, 341 (1977).
[84] B. Veyret, S. G. Davis, M. Yoshida, and K. Weiss, J. Am. Chem. Soc. **100**, 3283 (1978).
[85] C. A. Hutchinson, Jr., and B. W. Magnum, J. Chem. Phys. **29**, 952 (1958).
[86] J. S. Brinen, J. Chem. Phys. **49**, 586 (1968).
[87] J. S. Brinen and M. K. Orloff, J. Chem. Phys. **51**, 527 (1969).
[88] M. V. Alfimov, N. Y. Buben, A. I. Pristupa, and V. N. Shamshev, Opt. Spectrosc. **20**, 232 (1966).
[89] I. V. Aleksandrov and K. K. Pukhov, Opt. Spektrosk. **17**, 944 (1964).
[90] R. Kubo and K. Tomita, J. Phys. Soc. Jpn., **9**, 888 (1954).
[91] T. J. Kemp and L. J. A. Martins, J. Chem. Soc., Faraday Trans. 1 **77**, 1425 (1981).
[92] R. V. Bensasson and J.-C. Gramain, J. Chem. Soc., Faraday Trans. 1 **76**, 1801 (1980).
[93] D. Lavalette, R. Bensasson, B. Amand, and E. J. Land, Chem. Phys. Lett. **10**, 331 (1971).
[94] L. J. Andrews, A. Deroulede, and H. Linschitz, J. Phys. Chem. **82**, 2304 (1978).
[95] J. K. Hurley, N. Sinai, and H. Linschitz, Photochem. Photobiol. **38**, 9 (1983).
[96] A. A. Lamola and M. S. Wrighton, Pure Appl. Chem. **54**, 1251 (1982).
[97] A. A. Lamola and M. S. Wrighton, Pure Appl. Chem. **56**, 939 (1984).
[98] B. Stevens and B. E. Algar, Ann. N.Y. Acad. Sci. **171**, 50 (1970).
[99] R. G. Bennett, R. P. Schwenker, and R. E. Kellogg, J. Chem. Phys. **41**, 3040 (1964).

[100]V. L. Ermolaev and E. B. Sveshnikova, Opt. Spectrosc. **28**, 324 (1970).
[101]F. Wilkinson and J. G. Brummer, J. Phys. Chem. Ref. Data **10**, 809 (1981).
[102]B. Ostle and R. W. Mensing, *Statistics in Research*, 3rd. edition (The Iowa State Univ. Press, Ames, 1975).
[103]*SAS User's Guide: Statistics*, 1982 edition (SAS Institute, Cary, NC, 1982).
[104]M. H. DeGroot, *Probability and Statistics* (Addison-Wesley, Reading, MA, 1975).
[105]A. G. Worthing and J. Geffner, *Treatment of Experimental Data* (Wiley, New York, 1943).
[106]W. Rhodes and M. Chase, Rev. Modern Physics **39**, 348 (1967).
[107]G. Porter and M. W. Windsor, Proc. R. Soc. London, Ser. A **245**, 238 (1958).
[108]H. Hamaguchi, H. Okamoto, and M. Tasumi, Chem. Lett. (4), 549 (1984).
[109]R. Bensasson and E. J. Land, Nouv. J. Chim. **2**, 503 (1978).
[110]G. L. Hug, NSRDS-NBS 69 (National Bureau of Standards, Washington, DC, 1981).

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1.	**Acenaphthene**				
	Benzene	LP-ET	422	‡Triplet ET from acetophenone	82A292
	EtOH (293 K)	FP	433		68E098
	EtOH (77 K)	MOD/KM	430, 6000 ± 1500		737055
2.	**Acenaphthylene, *cis*-photodimer**				
	Benzene (293 K)	LP-ET	455	‡Oxygen quenching and triplet ET from benzophenone and acetophenone; $\tau_T = 2.2\ \mu s$	82A292
3.	**Acenaphthylene, *trans*-photodimer**				
	Benzene (293 K)	LP-ET	455	‡Triplet ET from acetophenone; $\tau_T = 0.12\ \mu s$	82A292
4.	**1-Acenaphthyl-1-phenylethylene**				
	Benzene	LP-ET	502^a 424^a	‡Triplet ET from xanthone and oxygen quenching; $\tau_T = 0.087\ \mu s$	84B007
5.	**1′-Acetonaphthone**				
	Water/*tert*-BuOH	FP	510^a	Solvent mixture contains "1-5%" *tert*-BuOH for solubility; very broad diffuse band; pH ~6	767189
6.	**2′-Acetonaphthone**				
	Benzene	PR/ET	430, 10500	ϵ relative to benzophenone ketyl radical in cyclohexane ($\epsilon_{max} = 3700$ L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Heptane	LP	424 404 384	Most intense peak at 424 nm	78A268
	Water/*tert*-BuOH	FP	440^a	Solvent mixture contains "1-5%" *tert*-BuOH for solubility; shoulder at 420 nm; pH ~6	767189
7.	**Acetone**				
	Acetonitrile (296 K)	FP	~302	‡Phosphorescence decay; $\tau_T = 47 \pm 6\ \mu s$	717489
	Liquid paraffin	FP	324	Solvent viscosity was 0.19 N·s/m^2	58E001
	Methylene chloride	LP	240	‡Phosphorescence decay and oxygen quenching; $\tau_T = 6.3\ \mu s$	84B051
	Water	LP/ET	300^b, 600 ± 100	ϵ relative to sodium 1,5-naphthalenedisulfonate in water ($\epsilon_{445} = 9900$ L mol^{-1} cm^{-1}); kinetic correction made in ET measurement; $\tau_T = 5.0\ \mu s$; $k_{et} = 3.6 \times 10^9$ L mol^{-1} s^{-1}	82B045
8.	**Acetophenone**				
	? (81 K)	FP/SD	330, 1300	‡Phosphorescence decay; glass was either 1:3:3 1-methylPrOH to Et_2O to isooctane or 1:9 MCH to mixture of EtOH and MeOH; $\tau_T = (1 \pm 0.1) \times 10^4\ \mu s$	77B022
	Acetonitrile	LP/RA	320^a, 12600^a	ϵ relative to benzophenone in cyclohexane ($\epsilon_{533} = 7630$ L mol^{-1} cm^{-1}, assuming no solvent effect from benzene), and taking all the triplet yields to be unity	737198
	Cyclohexane	LP/ET	449^a, 1800^a 406^a, 2100^a	‡Oxygen quenching, triplet ET to naphthalene, and quenching by piperylene; ϵ relative to naphthalene in cyclohexane ($\epsilon_{412.5} = 22600$ L mol^{-1} cm^{-1}); $\tau_T = 0.23\ \mu s$	717179
	Cyclohexane	LP/RA	441^a, 1900^a 401^a, 2100^a	ϵ relative to benzophenone in cyclohexane ($\epsilon_{533} = 7630$ L mol^{-1} cm^{-1}, assuming no solvent effect from benzene), and taking all the triplet yields to be unity; there was a more intense maximum <300 nm	737198

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	EtOH	LP/ET&RA	323^a, 6300^a	ϵ relative to naphthalene in cyclohexane ($\epsilon_{412.5}$ = 22600 L mol^{-1} cm^{-1}), assuming no solvent effects, for ET method; ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 10300 L mol^{-1} cm^{-1}), assuming no solvent effects and taking Φ_T(acetophenone) = 1 = Φ_T(benzophenone), and ϵ relative to benz[*a*]anthracene in cyclohexane (ϵ_{480} = 25100 L mol^{-1} cm^{-1}), assuming no solvent effects and taking Φ_T(acetophenone) = 1 and Φ_T(benz[*a*]anthracene) = 0.82, for RA method; there was a shoulder at ~495^a nm.; τ_T = 0.14 μs	717179
	Liquid paraffin	FP	281.5 265	Solvent viscosity was 0.03 N·s/m^2	58E001
	Water	FP	335	τ_T = ~100 μs	727098
	Water	LP/RA	337^a, 13100^a	ϵ relative to benzophenone in cyclohexane (ϵ_{533} = 7630 L mol^{-1} cm^{-1}, assuming no solvent effect from benzene), and taking all the triplet yields to be unity	737198
9.	**Acetophenone, conjugate acid**				
	Sulfuric acid	LP	359^a	5 mol L^{-1} H_2SO_4; solvent was 4:1 water to acetonitrile; pK$_a$ 0.63 ± 0.07	84E456
10.	**2-Acetoxy-2-methyl-1-phenyl-1-propanone**				
	Benzene	LP	440 410 330	‡Phosphorescence decay, oxygen quenching (1.6 × 10^9 L mol^{-1} s^{-1}); relative intensities (3:3:10); τ_T = 1.9 ± 0.2 μs	80E642
	Cyclohexane	LP	440 410 330	‡Phosphorescence decay, oxygen quenching; relative intensities (3:3:10); τ_T = 1.9 ± 0.2 μs	80E642
11.	**Acetylacetone**				
	EtOH/MeOH (118 K)	FP	480	Solvent was 3:1 EtOH to MeOH	68B005
12.	**1-Acetylanthracene**				
	EtOH (93 K)	PS	500		66B001
13.	**9-Acetylanthracene**				
	? (81 K)	FP/SD	426, 20000	‡Phosphorescence decay; glass was either 1:3:3 1-methylPrOH to Et_2O to isooctane or 1:9 MCH to mixture of EtOH and MeOH; τ_T = (2.8 ± 0.3) × 10^4 μs	77B022
	Acetonitrile	LP	421^a	Delay 320 ps	84B154
	EPA (77 K)	FP	429	τ_T = 2.95 × 10^4 μs	82E338
	Toluene	LP	410	‡Oxygen quenching; rise time of 0.02 ± 0.004 ns	777635
14.	**4-Acetylbiphenyl**				
	? (81 K)	FP/SD	435, 130000	‡Phosphorescence decay; glass was either 1:3:3 1-methylPrOH to Et_2O to isooctane or 1:9 MCH to mixture of EtOH and MeOH; τ_T = (1.7 ± 0.2) × 10^4 μs	77B022
15.	**3-Acetyl-9,10-epoxy-9,10-dihydrophenanthrene**				
	1,2-Dichloroethane	LP	395	†Oxygen quenching	79A177
16.	***N*-(2-Acetylphenyl)acetamide**				
	EtOH	LP	430	‡Oxygen quenching (5.6 × 10^8 L mol^{-1} s^{-1}); τ_T = 10 μs	78E308
	Hexane	LP/TD	450, 8900	τ_T = 8.5 μs; oscillator strength = 0.18	78E308
	Water	LP	430	‡Oxygen quenching (2.2 × 10^9 L mol^{-1} s^{-1}); ionic strength 0.01 mol L^{-1}; τ_T = 6.5 μs; pH 7.5	78E308
17.	***N*-(2-Acetylphenyl)formamide**				
	EtOH	LP/RF	450, 9000	‡Oxygen quenching (2.2 × 10^9 L mol^{-1} s^{-1}); ϵ relative to *N*-(2-acetylphenyl)formamide in hexane (ϵ_{450} = 8100 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; τ_T = 10 μs	78E308

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	Hexane	LP/TD	450, 6500		78E308
	Hexane	PR-ET/RA	450, 8100	‡Triplet ET from benzene; ϵ relative to naphthalene in hexane (ϵ_{max} = 24500 L mol^{-1} cm^{-1}) assuming same ET rate from benzene; τ_T = 7.7 μs; oscillator strength = 0.18	78E308
	Water	LP	450	‡Oxygen quenching (3 × 10^9 L mol^{-1} s^{-1}); ionic strength 0.01 mol L^{-1}; τ_T = 4.1 μs; pH 7.5	78E308
	Water	LP	450	τ_T = 7 μs; pH 6.5	78E308
18.	***N*-(2-Acetylphenyl)-*N*-methylacetamide**				
	EtOH	LP/RA	430, <1100	ϵ relative to naphthalene in hexane (Φ_T = 0.8, ϵ_{max} = 24500 L mol^{-1} cm^{-1}) taking Φ_T = 0.6 for *N*-(2-Acetylphenyl)-*N*-methylacetamide in EtOH; τ_T = 0.2 μs	78E308
	Hexane	LP	420	τ_T = 0.2 μs	78E308
	Hexane	PR-ET/RA	420, 1200	‡Triplet ET from benzene; ϵ relative to naphthalene in hexane (ϵ_{max} = 24500 L mol^{-1} cm^{-1}) assuming same ET rate from benzene; τ_T = 0.2 μs; oscillator strength = 0.02	78E308
	Water	LP	430	‡Oxygen quenching (6 × 10^8 L mol^{-1} s^{-1}); ionic strength 0.01 mol L^{-1}; τ_T = 7 μs; pH 7.5	78E308
19.	***N*-(2-Acetylphenyl)-*N*-methylformamide**				
	1-PrOH	LP	445	τ_T = 0.3 μs	78E308
	EtOH	LP/RA	445, <1100	ϵ relative to naphthalene in hexane (Φ_T = 0.8, ϵ_{max} = 24500 L mol^{-1} cm^{-1}) taking Φ_T = 0.6 for *N*-(2-Acetylphenyl)-*N*-methylformamide in EtOH; τ_T = 0.6 μs	78E308
	Hexane	LP	420	τ_T = 0.2 μs	78E308
	Hexane	PR-ET/RA	420, 850	‡Triplet ET from benzene; ϵ relative to naphthalene in hexane (ϵ_{max} = 24500 L mol^{-1} cm^{-1}) assuming same ET rate from benzene; τ_T = 0.2 μs; oscillator strength = 0.02	78E308
	Water	LP	445	‡Oxygen quenching (5.2 × 10^8 L mol^{-1} s^{-1}); ionic strength 0.01 mol L^{-1}; τ_T = 8.8 μs; pH 7.5	78E308
20.	**3-Acetyltriptycene**				
	Cyclohexane (289.5 K)	LP	550		83E483
21.	***N*-Acetyl-L-tryptophanamide**				
	Water	LP	460	Buffered; pH 7.0	81A232
22.	**Acridan**				
	EtOH (93 K)	PS	520	Shoulder at 580 nm	69E214
23.	**Acridine**				
	2-PrOH	LP	983 ± 5 440 ± 1		83E392
	Acetonitrile	LP	978 ± 2 434 ± 1		83E392
	Argon (13 K)	CWL	425.1	Infrared vibrational structure also observed	79B043
	Benzene	FP/TD	520^a, 2000^a 440, 25000 435, 12000^a 375^a, 3000^a 355^a, 10000^a 340^a, 7000^a	Uncertain correction of estimated peaks for SD; τ_T = 10^4 μs	677498
	Benzene	FP/SD	440, 80000^c	Delay 93 μs	677259
	Benzene	PR/ET	440, 24300	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Benzene	FP/TD	442, 27000		776258
	Benzene (296 K)	LP	990 870^a 781^a 699^a 518^a 440	Shoulder at 415 nm	81E147
	Benzene	LP	980 ± 2 442 ± 1		83E392
	CCl_4	LP	981 ± 2 442 ± 1		83E392
	Cyclohexane	PR/ET	432.5, 26300	ϵ relative to biphenyl in cyclohexane ($\epsilon_{361.3} = 35400$ L mol^{-1} cm^{-1}); author reported mean of 2 measurements (this one and another with a different ref. cmpd.) as 28800 ± 7200 L mol^{-1} cm^{-1}	680727
	Cyclohexane	PR/ET	432.5, 31300	ϵ relative to naphthalene in cyclohexane ($\epsilon_{412.5} = 22600$ L mol^{-1} cm^{-1}); author reported mean of 2 measurements (this one and another with a different ref. cmpd.) as 28800 ± 7200 L mol^{-1} cm^{-1}	680727
	Cyclohexane	PR/ET	432.5, 31500	ϵ relative to benzophenone ketyl radical in cyclohexane ($\epsilon_{max} = 3700$ L mol^{-1} cm^{-1}); reference ϵ obtained by starting from $\epsilon_{max} = 3220$ L mol^{-1} cm^{-1} for this ketyl radical in water and assuming the f of the ketyl radical is independent of solvent; final ϵ obtained from a simultaneous least squares fit to data from several compounds	71E360
	EtOH	FP	440	Broad absorption < 290 nm also assigned to triplet; a band at 520 nm, which had been assigned to the triplet in water [61E008], was seen to decay at a different rate and was not assigned to the triplet in EtOH	66A003
	EtOH	FP/ET	440, 18500 424^b, 8900	Triplet ET from eosin and proflavine; ϵ relative to eosin in EtOH ($\epsilon_{580} = 9400$ L mol^{-1} cm^{-1}) and proflavine in EtOH ($\epsilon_{550} = 11000$ L mol^{-1} cm^{-1})	716235
	EtOH	FP	985 870 778 440	Most intense peak at 440 nm	776227
	EtOH	LP/ET	440, 22500	ϵ relative to Methylene Blue cation ($\epsilon_{860} = 27000$ L mol^{-1} cm^{-1}); solvent and temperature assumed; $\tau_T = 14$ μs	78E394
	Hexane	LP	435	145 ps delay	79B007
	Hexane	LP	980 ± 2 430 ± 1		83E392
	Hexane	LP	433 407	Delay 320 ps	84B154
	Isooctane	LP	430 408^a	A band was also observed at 511^a nm, but a similar band at 530 nm in MeOH was assigned to a precursor of the triplet state; rise time of 0.01 ns	767261
	MeOH	LP	983 ± 5 438 ± 1		83E392
	PMMA (77 K)	PS	440 420	Band seen at 480 nm and was attributed to a photoproduct	70E291
	PMMA (293 K)	FP	438 418	$\tau_T = 1.9 \times 10^4$ μs	70E291
	PMMA	FP	980 863^a 776^a 702^a 480^a 441^a	Shoulder at 424 nm; 441 nm peak 10 times more intense than any other peak	82E561
	PVA	FP	980^a 870^a 780^a 450^a	Most intense peak at 450 nm; $\tau_T = 23.8 \times 10^3$ μs	776227

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	Water	FP	443	pK_b = 8.4; *a peak reported at 520 nm was later* [66A003] shown to decay at a different rate than the 440 nm peak in EtOH; pH Basic	61E008
	Water (296 K)	FP-ET/ET	443, 14500	‡Triplet ET from naphthalene-1,5-disulfonate; ϵ relative to proflavine conjugate acid in water (ϵ_{549} = 5700 L mol^{-1} cm^{-1}); τ_T = ~450 μs; pH 10.86	80B057
	Water	FP/TD	443 353^b, 7000	ϵ method assumed from text; pH 12.0	80F001
	Water (296 K)	FP/ET	880 443, 20000 ± 2000	ϵ relative to proflavine in water (ϵ_{549} = 8000 L mol^{-1} cm^{-1}); pH Basic	81E147
	Water	LP	855^a 746^a 694^a 510^a 441^a	Most intense peak at 441 nm; pH 12.7	81E552
	Water (296 K)	FP/TD	880, 1800^a 753^a, 1100^a 689^a, 730^a 657^a, 470^a 521^a, 1500^a 443, 19400 ± 1400	Shoulder at 420 nm; pH Basic	81E147
	Water	LP	983 ± 5 862^a 775^a 658^a 443 ± 1	pH ~13	83E392
	tert-BuOH	FP/TD	436, 26000		776258
24.	**Acridine-*d*$_9$**				
	Benzene	FP/TD	442, 26000		776258
	Fluorene-*d*$_8$ (240 K)	MOD	450	Single crystal	83F334
25.	**Acridine Orange, conjugate monoacid**				
	EtOH	FP/TD	490, 135000	pH Acidic	727073
	EtOH/Et$_2$O (90 K)	PS/SD	1270, 54000^a 1050^a, 16000^a 645, 10500^a 540, 10000^a 390, 4000^a 285, 57000^a 245, 18000^a 205, 16000^a	Solvent was 2:1 EtOH to Et$_2$O	57B001
	Glycerol (293 K)	FP	670^a 620^a 580^a	Solvent has added glucose	776171
	MeOH	FP/TD	610, 9400 560, 9200	pK_a(MeOH) = 11.2; τ_T = 105 μs; pH Acidic	79E219
	PMMA (77 K)	PS	1208^a 654^a 549^a	Relative intensities (10:3:3); shoulders at 1090^a and 1002^a nm; solvent contains 2-chloroethanol; pH 4.0	69B007
	Water	FP/TD	530, 9500 480, 14000 280, 35000	τ_T = ~3000 μs; pH 3	747187
26.	**Acridine Orange, free base**				
	EtOH	FP/TD	410, 42000	pH Basic	727073
	MeOH	FP/TD	550, 7800 410, 39900	τ_T = 285 μs; pH Basic	79E219
	PMMA (193 K)	PS	530	Shoulders at 630 and 545 nm	59B001
	PMMA (77 K)	PS	1210 1100 1020 650		65B004

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Water	FP/TD	550, 7000 410, 37000 270, 40000	‡Triplet ET to acridine; neutral form; an absorption was observable out to 900 nm; $\tau_T = 3.3 \times 10^3$ μs; pH 12	71B002
27.	**Acridine Yellow, conjugate monoacid**				
	Boric acid (77 K)	PS	1000 620		65B004
	Glycerol (293 K)	FP	660^{a} 550^{a}	Solvent has added glucose	776171
	PMMA (77 K)	PS	1000^{a}	Shoulders at 575^{a} and 532^{a} nm; solvent contains 2-chloroethanol; pH 4.0	69B007
28.	**Acridine, conjugate acid**				
	Water (296 K)	FP-ET/ET	490, 5500	‡Triplet ET from naphthalene-1,5-disulfonate and to Methylene Blue; ϵ relative to proflavine conjugate acid in water (ϵ_{549} = 5700 L mol^{-1} cm^{-1}); pK_a = 5.6; τ_T = 670 μs; pH 1.0	80B057
	Water (296 K)	LP-ET/TD	770 490, 7700 ± 800	‡Triplet ET from disodium naphthalene-1,5-disulfonate; pH Acidic	81E147
29.	**9(10*H*)-Acridone**				
	Benzene	LP/ET	620, 37800	‡Triplet ET to anthracene, oxygen quenching; ϵ relative to anthracene in benzene (ϵ_{430} = 45500 L mol^{-1} cm^{-1}); τ_T = 20 μs	766377
	EtOH (300 K)	FP	580 310		81E649
	Pyridine	LP	605^{a}	‡Triplet ET to anthracene; H-bonded species; τ_T = 3.3 μs	766377
30.	**Acriflavine cation**				
	EPA (77 K)	PS	640 540	‡Phosphorescence decay; EPA was 8:3:5 Et_2O to isopentane to EtOH; "trypaflavine"	63F021
	Glycerol (293 K)	FP	620^{a} 550^{a}	Solvent has added glucose	776171
	MeOH	FP/TD	620, 8600	Peak at 490 nm obscured by singlet absorption (authors); τ_T = 110 μs; pH Basic	79E219
	PMMA (193 K)	PS	555 530	Shoulders at 650 and 505 nm	59B001
	PMMA (77 K)	PS	1300 1190 1080 940 800 650		65B004
	PMMA (77 K)	PS	1060^{a} 679^{a} 541^{a}	Relative intensities (10:3:3); shoulder at 952^{a} nm; solvent contains 2-chloroethanol; pH 4.0	69B007
31.	**Alloxazine**				
	EtOH	LP/SD	500, 13000 438^{a}	‡Phosphorescence decay at 77 K; 438 nm peak may be distorted by SD; τ_T = 13 μs	737439
	Water	LP	550 420	‡Oxygen quenching; τ_T = 9 μs; pH 2	737439
	Water	LP	560 420	‡Oxygen quenching; τ_T = 9 μs; pH 6	737439
	Water	LP/RA	550, 7000 400^{a}, 12600^{a} 275^{a}, 28000^{a}	‡Oxygen quenching; energy transfer to oxygen; lifetime measured at 560 nm; ϵ relative to anthracene in cyclohexane (Φ_T = 0.71, ϵ_{423} = 64700 L mol^{-1} cm^{-1}) and using Φ_T = 0.31 for alloxazine in water; shoulder around 360 nm; τ_T = 9.1 μs; pH 2.2; k_{et} = (1.7 ± 0.2) × 10^{9} L mol^{-1} s^{-1}	777617

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
32.	**Amiloride**					
	Water	LP/ET	400	6300	‡Triplet ET from benzophenone; pH was not specified and the pK_a of the triplet was not determined so the state of protonation of the triplet is uncertain; ϵ relative to benzophenone in water (ϵ_{520} = 5800 L mol^{-1} cm^{-1}); τ_T = 40 μs	84A227
33.	**9-Aminoacridine**					
	Water	LP	885^{a} 826^{a} 794^{a} 476^{a}		Most intense peak at 476 nm; pH 12.7	81E552
34.	**1-Amino-4-anilinoanthraquinone**					
	Benzene	PR-ET/ET	550	27000	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene assuming ground state dimerization; τ_T = 8.3 μs; E_T = 123 - 151 kJ mol^{-1}; k_{et} = 3.3 × 10^{9} L mol^{-1} s^{-1}	761122
35.	**2-Aminoanthracene, conjugate acid**					
	Water/Alcohol	FP	424 400^{a}		Solvent was 1:1 water to alcohol; pK_a 3.3; pH 1.25	68B008
36.	**1-Aminoanthraquinone**					
	Benzene	PR/ET	550^{b}	2000	‡Triplet ET from triplet donors and triplet ET to triplet acceptors; ϵ relative to naphthalene in benzene (ϵ_{425} = 13200 L mol^{-1} cm^{-1}); τ_T = 5 μs	720392
37.	**2-Aminoanthraquinone**					
	Benzene	PR/ET	599^{a}	7140^{a}	‡Triplet ET from triplet donors and triplet ET to triplet acceptors; ϵ relative to naphthalene in benzene (ϵ_{425} = 13200 L mol^{-1} cm^{-1}); τ_T = 5 μs	720392
38.	**6-Amino-7*H*-benz[*de*]anthracen-7-one**					
	2-PrOH	LP	610^{a} 570^{a} 515^{a}		Shoulder at 540 nm; half-life = 3.7 ± 0.2 μs	757427
	Benzene	LP	617^{a} 579^{a} 540^{a}		‡Oxygen quenching (1.2 × 10^{9} L mol^{-1} s^{-1}); half-life = 2.3 ± 0.1 μs	757427
39.	**2-Aminobenzoic acid**					
	EtOH (93 K)	PS	472^{a} 395^{a}		Shoulder at 435^{a} nm	66B001
40.	**4-Aminobenzoic acid**					
	EtOH (93 K)	PS	412^{a} 364^{a}			66B001
41.	**3-Aminobenzophenone**					
	Propylene glycol (203 K)	FP	561^{a} 455^{a}		‡Phosphorescence decay	67E105
42.	**4-Aminobenzophenone**					
	Propylene glycol (203 K)	FP	638^{a} 466^{a}		‡Phosphorescence decay	67E105
43.	**4-Aminobiphenyl**					
	Toluene/EtOH (77 K)	MOD	438^{a}		Glass was 19:1 toluene to EtOH	719059
44.	**2-Aminofluorene**					
	EtOH/Et$_2$O (77 K)	MOD/KM	425	10600 ± 4200	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Toluene/EtOH (77 K)	MOD	430^{a}		Glass was 19:1 toluene to EtOH; shoulder at 466^{a}	719059

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
45.	**1-Amino-4-hydroxyanthraquinone**					
	Benzene	PR-ET/ET	500	28000	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene assuming ground state dimerization; τ_T = 6.7 μs; E_T = 123 - 176 kJ mol^{-1}; k_{et} = 3.0 × 10^9 L mol^{-1} s^{-1}	761122
46.	**4-Amino-4'-hydroxybiphenyl**					
	EtOH/Et$_2$O (77 K)	MOD/KM	425	24000 ± 9600	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Toluene/EtOH (77 K)	MOD	428[a]		Glass was 19:1 toluene to EtOH	719059
47.	**2-Amino-3-(4-methoxy-6-benzothiazolyl)propionate ion**					
	Water	LP/ET	370	8000	‡Oxygen quenching and triplet ET to crocetin; ϵ relative to crocetin in water (ϵ_{470} = 75000 L mol^{-1} cm^{-1}); ϵ considered an upper limit; τ_T = 64 μs; pH 13; k_{et} = 1.7 × 10^{10} L mol^{-1} s^{-1}	84A024
	Water	LP/TD	370	5000	‡Oxygen quenching and triplet ET to crocetin; ϵ considered a lower limit; pH 13	84A024
48.	**1-Amino-4-(*N*-methylamino)anthraquinone**					
	Benzene	PR-ET/ET	575	27000	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene assuming ground state dimerization; τ_T = 3.6 μs; E_T = 97 - 123 kJ mol^{-1}; k_{et} = 4.2 × 10^9 L mol^{-1} s^{-1}	761122
49.	**7-Amino-4-methylcarbostyril**					
	EtOH	FP/ET	600[b] 430[b] 350[b]	46200 ± 4500 7050 ± 700 28800 ± 2900	ϵ relative to anthracene in EtOH (ϵ_{420} = 75000 L mol^{-1} cm^{-1}); there were no distinct maxima between 350 and 600 nm; k_{et} = (1.4 ± 0.5) × 10^{10} L mol^{-1} s^{-1}	747049
50.	**3-Amino-*N*-methylphthalimide**					
	Benzene	FP	450		Lifetime limited by aeration; τ_T = 0.260 μs	757522
	EtOH	FP/TD	495	1100	Lifetime limited by aeration; τ_T = 0.920 μs	757522
	Water	FP	540		Lifetime limited by aeration; τ_T = >1 μs	757522
51.	**4'-Aminomethyl-4,5',8-trimethylpsoralen**					
	EtOH	LP/ET	460[a]	24200	‡Triplet ET to retinol; ϵ relative to retinol (ϵ_{ref} unspecified); quenched by ground state (10^9 L mol^{-1} s^{-1}); τ_T = 100 μs	80E156
52.	**1-Amino-7-nitrofluorene**					
	EPA (77 K)	PS	770[a],570[a]			78E057
53.	**1-Amino-4-nitronaphthalene**					
	Benzene	LP	470		‡Oxygen quenching (2.0 × 10^9 L mol^{-1} s^{-1}); τ_T = 1.5 μs	776195
	EPA (77 K)	PS/KM	650 480 440	2730 ± 135 7500 ± 375 28000 ± 14000	‡Phosphorescence decay; τ_T = (1.88 ± 0.11) × 10^5 μs	78E057
	PMMA	FP	665 470		Relative intensities (2:5)	776195
	PMMA (123 K)	FP	665		‡Phosphorescence decay; τ_T = 1.5x10^5 μs	776195
	PVA (123 K)	FP	695[a]			776195
54.	***trans*-4-Amino-4'-nitrostilbene**					
	Glycerol triacetate	LP	772			78B088
	Glycerol triacetate (198 K)	LP	760			78B088
55.	***N*-[2-(3-Amino-1-oxopropyl)phenyl]formamide**					
	EtOH	LP	460		‡Oxygen quenching (3 × 10^8 L mol^{-1} s^{-1}); τ_T = 1 μs	78E308
	Water	LP	435		‡Oxygen quenching (2 × 10^9 L mol^{-1} s^{-1}); ionic strength 0.01 mol L^{-1}; τ_T = 3.4 μs; pH 7.5	78E308

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
56.	**9-Aminophenanthrene**				
	Toluene/EtOH (77 K)	MOD	473^a	Glass was 19:1 toluene to EtOH; shoulder at 431^a nm	719059
57.	**2-Amino-4-[3*H*]pteridinone**				
	Water	LP/HAT	550, 2000 385^b, 2770 360^a, 4700^a 325^b, 3780	‡Oxygen quenching (1.3 × 10^9 L mol^{-1} s^{-1}); hydrogen abstraction from guanosine; ϵ_{550} relative to semireduced radical in water (ϵ_{480} = 2300 L mol^{-1} cm^{-1}); ϵ_{385} and ϵ_{325} are at isosbestic points in difference spectrum; 400 ns delay; τ_T = 2.3 ± 0.2 μs; pH 9.2	81E151
	Water	LP	460	400 ns delay, pK_a = 9.5-10; τ_T = 0.5 μs; pH 12	81E151
	Water	LP	600 415	100 ns delay; τ_T = 0.3 μs; pH 9.2	81E151
58.	**2-Aminopurine**				
	Acetonitrile (300 K)	FP	430	‡Oxygen quenching and quenching by 2,4-hexadienol; τ_T = 83 ± 10 μs	756270
	Water (300 K)	FP	405	‡Oxygen quenching and quenching by 2,4-hexadienol; τ_T = 55 ± 4 μs	756270
59.	**2-Aminopyridine**				
	2-PrOH (163 K)	FP	390^a	‡Phosphorescence decay; τ_T = ~1.8 × 10^3 μs	78E062
	EPA (107 K)	FP	390	‡Phosphorescence decay; τ_T = ~2.6 × 10^3 μs	78E062
60.	**4-Aminopyridine**				
	EPA (103 K)	FP	395	‡Phosphorescence decay; τ_T = ~4.0 × 10^4 μs	78E062
61.	**Aniline**				
	EPA (77 K)	FP	420^a 320^a	‡Phosphorescence decay; 320 nm was the more intense peak	69E215
62.	**1-Anilinonaphthalene**				
	Cyclohexane	LP	550		77E543
	MeOH/Water	LP	580	‡Quenching by oxygen and *trans*-stilbene	82E359
63.	**Anisole**				
	Water	LP	252^a	Lifetime was measured at pH 7.5; there was a broad maximum between ~350 and ~430 nm; shoulder at 279^a nm; spectrum is the difference between spectra at 20 ns and 15 μs; τ_T = 3.3 ± 0.2 μs; pH 8.5	757161
64.	**Anthracene**				
	Acetonitrile	FP	438^a 400^a	Relative intensities (2:1); solvent contains dimethylmercury	78A324
	Anthracene	PR	630^a 610^a 570^a 540^a	Triplet exciton	80E230
	Benzene	FP	430		58E002
	Benzene	FP	430	A value was given for an "integrated extinction coefficient" of 35000, but no details were provided; τ_T = 2900 μs	60E005
	Benzene	PR/ET	427.5, 71500	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 10300 L mol^{-1} cm^{-1})	690087
	Benzene	PR/ET	427.5, 61300	ϵ relative to naphthalene in benzene (ϵ_{max} = 17500 L mol^{-1} cm^{-1})	690087
	Benzene	PR/ET	430, 45500 408^a, 15600^a 391^a, 3700^a	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene; λ_{max} originally quoted as 432.5 nm but corrected in [757282]	71E360
	Benzene	PR	427.5		720206
	Benzene	FP/SD	428.5, 53000 ± 1900	ϵ method assumes linear variation of triplet spectrum in SD region	767147

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Benzene	LP/SD	431	69000	ϵ is upper limit (authors)	80B090
	Benzene	LP/ET	431	42000 ± 4000	‡Triplet ET from benzophenone; ϵ relative to benzophenone in benzene (ϵ_{533} = 7200 L mol^{-1} cm^{-1}); k_{et} = 0.49 × 10^9 L mol^{-1} s^{-1}	80B090
	Benzonitrile	LP/RF	429^a 405^a	24000 ± 1500 10200^a	ϵ relative to anthracene in toluene ($\epsilon_{428.5}$ = 42000 L mol^{-1} cm^{-1})	83F075
	Benzophenone (77 K)	PS-ET	441 415		Relative intensities (1:1); sample was a single crystal	64B005
	Benzophenone (77 K)	PS	442.5		Single crystal; from polarization measurements, the 442.5 nm band was assigned $^3B_{3g} \leftarrow {}^3B_{1u}$; the $T_1 \leftarrow S_0$ absorption of benzophenone starting at 413.4 nm obscured the shape of the second T-T band of anthracene	68B004
	Benzophenone (303 K)	PR	435		Solution; triplet ET from benzophenone; k_{et} = (1.6 ± 0.1) × 10^9 L mol^{-1} s^{-1}	700114
	Bromobenzene	FP	436		Half-life = 430 ± 50 μs	58E002
	Bromobenzene	FP	439		A value was given for an "integrated extinction coefficient" of 32500, but no details were given; τ_T = 1590 μs	60E005
	CTAB	LP	420		Aqueous micelles	83N082
	Chlorobenzene	FP	431		Half-life = 790 ± 150 μs	58E002
	Chloroform	FP	430			58E002
	Cyclohexane	FP	425		τ_T = 160 μs	62E009
	Cyclohexane	PR/ET	420	57200 ± 14300	ϵ relative to benzophenone ketyl radical in water ($\epsilon_{537.5}$ = 3220 L mol^{-1} cm^{-1}), assuming this value for $\epsilon_{542.5}$ in cyclohexane	680727
	Cyclohexane (77 K)	PS	468.2 431.0 425.2 418.1 402.0 381.0 316.5			69E211
	Cyclohexane	PR	427.5			710617
	Cyclohexane	PR/ET	422.5 402^a	64700 19800^a	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); reference ϵ obtained by starting from ϵ_{max} = 3220 L mol^{-1} cm^{-1} for this ketyl radical in water and assuming the f of the ketyl radical is independent of solvent; final ϵ obtained from a simultaneous least squares fit to data from several compounds; shoulder at 388^a nm; λ_{max} originally quoted as 425 nm but corrected in [757282]	71E360
	Cyclohexane	FP/SD	422.5	85700 ± 3200	ϵ method assumes linear variation of triplet spectrum in SD region	767147
	Cyclohexane	LP/RF	423	52500	ϵ relative to anthracene in benzene (ϵ_{431} = 42000 L mol^{-1} cm^{-1}) assuming oscillator independent of solvent	80B090
	Cyclohexane	LP/SD	423	69500	ϵ is upper limit (authors)	80B090
	Decalin	FP	430		τ_T = 2630 μs	60E005
	Dioxane	PR	425 410			650006
	EPA (77 K)	PS/IV	427	2800^c ± 130	‡Phosphorescence decay; ϵ is too low; 1st transition assigned as $^3L_a \rightarrow {}^3C_b$	51E001
	EPA (77 K)	PS/SD	427.0 404.0	45000 12000	ϵ's are lower limits; τ_T = < 1 × 10^5 μs	54B001
	EPA (77 K)	PS/KM	516^a 497^a 481^a 467^a 428^a 402^a	1600^a 800^a 2100^a 1300^a 52800^a 14100^a	Solvent, temperature and extinction method assumed from earlier work; polarization also measured	69E213
	EPA (77 K)	PS/IV	427	58000	λ_{max} assumed from previous work; ϵ estimated by extrapolation to infinite excitation rate	69E212
	EPA (77 K)	FP/SD	427.3	⩾90000		69F389

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — *Continued*

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Epoxy plastic (296 K)	LP	420 390		686058
	EtOH	FP	420.0 398.0	$\tau_T = 150 \pm 45$ μs	54E001
	EtOH (93 K)	PS	427 403	Relative intensities (10:3)	66B001
	EtOH	FP/ET	440^{b}, 2300 426^{b}, 21000 424^{b}, 36000 421, 52000 420^{b}, 49000	Triplet ET from eosin and proflavine; ϵ relative to eosin in EtOH ($\epsilon_{580} = 9400$ L mol^{-1} cm^{-1}) and proflavine in EtOH ($\epsilon_{550} = 11000$ L mol^{-1} cm^{-1})	716235
	EtOH	FP/SD	420, 75000 ± 5000 400, 28000 ± 2000 376, 5750 ± 400 356, 3350 ± 250 335, 2250 ± 150	$\tau_T = 3000 \pm 2000$ μs	747049
	EtOH	FP/TD	419, 50000 ± 5000		756293
	EtOH (77 K)	MOD	424	Halfwidth 380 cm^{-1}	777538
	EtOH	FP/TD	420, 60000		776258
	EtOH	FP-ET/RA	694^{b}, 52	ϵ relative to anthracene in EtOH ($\epsilon_{421} = 52000$ L mol^{-1} cm^{-1})	78E019
	EtOH	LP/ET	420, 63500	ϵ relative to Methylene Blue cation ($\epsilon_{660} = 27000$ L mol^{-1} cm^{-1}); solvent and temperature assumed; $\tau_T =$ 25 μs	78E394
	EtOH	LP/SD	421, 54000	ϵ is upper limit (authors)	80B090
	EtOH	LP/RF	421, 48500	ϵ relative to anthracene in benzene ($\epsilon_{431} = 42000$ L mol^{-1} cm^{-1}) assuming oscillator independent of solvent	80B090
	EtOH	LP/COM	418, 72000	Triplet concentration calculated by kinetic simulation and corrected for optical geometry; ϵ value assumes $\Phi_T = 0.7$; oxygen quenching (3.8×10^9 L mol^{-1} s^{-1})	82B121
	EtOH/MeOH (113 K)	FP/TD	425,90000	Solvent was 3:1 EtOH to MeOH	67B004
	EtOH/MeOH (104 K)	PS	426 403	Solvent was 3:1 EtOH to MeOH; polarization also measured; shoulder at 382 nm	68E102
	EtOH/MeOH/2-MTHF (113 K)	FP/SD	885^{a}, 250^{a} 840^{a}, 260^{a} 800^{a}, 160^{a} 787^{a}, 150^{a} 763^{a}, 180^{a} 752^{a}, 110^{a} 730^{a}, 130^{a} 719^{a}, 150^{a} 709^{a}, 130^{a} 699^{a}, 130^{a} 690^{a}, 120^{a} 645^{a}, 130^{a}	Glass was 3:1:4 EtOH to MeOH to 2-MTHF	69B006
	EtOH/MeOH (113 K)	FP/TD	888, 260^{a} 844^{a}, 300 801^{a}, 190^{a} 788^{a}, 190^{a} 764^{a}, 210^{a} 751^{a}, 140^{a} 729^{a}, 160^{a} 719^{a}, 190^{a} 709^{a}, 150^{a} 697^{a}, 180^{a} 687^{a}, 170^{a} 639^{a}, 170^{a} 538^{a}, 540^{a} 516, 3000 504^{a}, 2000^{a} 497^{a}, 2300^{a} 479^{a}, 3600^{a}	‡Phosphorescence decay; shoulders at 657^{a}, 551^{a}, 526^{a}, 486^{a}, 453^{a}, 271^{a}, and 268^{a} nm; 6 electronic transitions were assigned with 0-0's at 888, 516, 425.3, 328.7, 271.3, and 262.4 nm; oscillator strength = 0.002, 0.04, 0.25, 0.03, ~0.01, 0.8	72B001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	EtOH/MeOH (Continued)		463^a, 2900^a 444^a, 5000^a 425.3, 90000 402^a, 25000^a 381^a, 10000^a 328.7, 1400^a 314^a, 2200^a 302^a, 2300^a 262.4, 90000		
	Ethyl acetate	PR	420	0.8 μs delay; G(triplets) estimated assuming ϵ independent of solvent	761080
	Ethylene glycol	FP	469 425 401	Relative intensities (__:10:3); τ_T = 3800 ± 150 μs	61E005
	Glycerol	FP	426.6 402.4	τ_T = 5500 ± 600 μs	54E001
	Glycerol	FP	428	Half-life = 9400 ± 1500 μs	58E002
	Glycerol (283 K)	FP/SD	425, 66800 ± 13400 404, 20700 ± 4140	Lifetime measured at 298 K; τ_T = 18000 μs	65E032
	Heptane	FP	421		58E002
	Heptane/Carbon disulfide	FP	421	Solvent was 9:1 heptane to carbon disulfide	58E002
	Heptane (77 K)	PS	429.5 405		67B007
	Hexane	FP	420.3 398	Half-life = 100 μs	53E001
	Hexane	FP/SD	420.3, 118000^c ± 23600 398.0, 27400^c ± 5480	‡Oxygen quenching; τ_T = 84.0 ± 11 μs	54E001
	Hexane	FP	420	A value was given for an "integrated extinction coefficient" of 46000, but no details were provided; τ_T = 2900 μs	60E005
	Hexane	FP	465 423 400	Relative intensities (__:10:3); τ_T = 910 ± 83 μs	61E005
	Hexane	LP	420 400	250 ns delay; relative intensities (4:1); formed from diethylaniline exciplex; rise time of ~110 ns	776081
	Liquid paraffin	FP	420.0 401.0	τ_T = 370 ± 110 μs	54E001
	Liquid paraffin	FP/SD	468, 2000 424, 71500 401, 24300	Solvent had viscosity of 0.03 N·s/m^2; bands at 424 and 401 nm were assigned to the same electronic transition; oscillator strength = 0.01, 0.4	58E001
	Liquid petrolatum	FP	425	Half-life = 1100 ± 200 μs	58E002
	Liquid paraffin	FP	424	Viscosity of solvent was 0.167 N·s/m^2; τ_T = 9100 μs	62E009
	Liquid paraffin	FP/TD	424^b, 63000 ± 5000		67E031
	MCH	LP	421^a 402^a	421 nm peak was the more intense	82F367
	PMMA (300 K)	FP	423.7 401.1	Relative intensities (100:26); half-life = 1.22 × 10^4 μs	62E010
	PMMA (298 K)	FP/RA	895, 250 ± 50 852^a 807^a 796^a 771^a	‡Decay matches the triplet decay at 424 nm; ϵ relative to anthracene in liquid paraffin (ϵ_{424} = 71500 L mol^{-1} cm^{-1}); τ_T = 3.4 × 10^4 μs	66E085
	PMMA	FP	894^a 851^a 812^a 801^a 776^a 717^a	Shoulders at ~860^a and 640^a nm	71B006
	PMMA (293 K)	LP	426^a 402^a 386^a	426 nm peak was the most intense	747056
	Polystyrene	FP	433	τ_T = 2.6 × 10^4 μs	64E016

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Polystyrene	PR	435		$G\epsilon$ varied with the concentration of anthracene; 72% of the anthracene copolymerizes with polystyrene	672086
	Polystyrene	PR	436^a		$G\epsilon_{436}$ = 10000^a L mol^{-1} cm^{-1} / (100 eV absorbed)	701073
	Propane	FP/TD	422.5,	52000	ϵ assumes OD saturation is equivalent to total depletion	79A346
	THF	FP	428		τ_T = 3770 μs	60E005
	Toluene	LP	430^a 409^a		430 nm was the more intense peak	717126
	Toluene (77 K)	MOD	434		Halfwidth 490 cm^{-1}	777538
	Toluene	LP/RA	428.5,	42000	ϵ relative to anthracene in benzene (Φ_T = 0.72, $\epsilon_{428.5}$ = 42000 L mol^{-1} cm^{-1}) assuming Φ_T = 0.72 for anthracene in toluene	82E451
	Triton X-100	LP	420		Aqueous micelles	83N082
	Water/*tert*-BuOH	FP	420^a		Solvent mixture contains "1-5%" *tert*-BuOH for solubility; pH ~6	767189
65.	**Anthracene-d_{10}**					
	Cyclohexane (77 K)	PS	467.1 445.0 427.5 421.5 413.6 407.0 398.0		Relative intensities (1:1:2:10:6:4:4)	69E211
	EPA (77 K)	PS/SD	426,	115000		68E105
	Et_2O/EtOH/Toluene (77 K)	PS/ESR	425,	75000	‡ESR; solvent was 2:1:1 Et_2O to EtOH to toluene; only most intense visible peak reported; assignment $^3B_{3g} \leftarrow {}^3B_{2u}$; oscillator strength = 0.27	696115
	EtOH/MeOH (104 K)	PS	424 401		Solvent was 3:1 EtOH to MeOH; polarization also measured; shoulder at 382 nm	68E102
	PMMA (298 K)	FP	894^a 851^a 811^a 796^a 760^a		‡Decay matches the triplet decay at 424 nm; τ_T = 8.4 × 10^4 μs	66E085
	PMMA (293 K)	CWL	428^a 404^a		‡Phosphorescence decay; maxima shift to the red with increase in applied pressure; spectrum measured at 5.4 kbar and assigned to the $^3B_{1g}^- \leftarrow {}^3B_{2u}^+$ transition; relative intensities (8:1); at atmospheric pressure principal maximum is at 424 nm; τ_T = 85 × 10^3 μs	76B012
	PMMA (293 K)	CWL	888^a 840^a 785^a 715^a		‡Phosphorescence decay; spectrum measured at 2.0 kbar and assigned to the $^3B_{1g}^+ \leftarrow {}^3B_{2u}^+$ transition; only principal maxima reported here; at atmospheric pressure lowest energy maximum is at 895 nm; τ_T = 85 × 10^3 μs	76B012
66.	**Anthracene/Chloranil**					
	Liquid paraffin	MOD	420		Mull	71E361
67.	**9-Anthraceneacetic acid, methyl ester**					
	Water/Acetonitrile	FP	427^a 404^a		‡Oxygen quenching; solvent 4:1 water to acetonitrile; 427 nm peak was the more intense; τ_T = 59 μs	747389
68.	**Anthracene-9-carboxaldehyde**					
	EPA (77 K)	FP	455		τ_T = 1700 μs	82E338
69.	**Anthracene-9-carboxamide**					
	EPA (77 K)	FP	433		τ_T = 3.96 × 10^4 μs	82E338
70.	**Anthracene-9-carboxylic acid**					
	EPA (77 K)	FP	431		τ_T = 3.45 × 10^4 μs	82E338

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
71.	**Anthracene photodimer**					
	2-MTHF (77 K)	LP	433[a] 408[a]		Delay 1.5 μs; species formed by the photolysis of dianthracene	84B019
	MTHF (100 K)	LP	355[a] 322[a]		‡Oxygen quenching; $\tau_T = 2$ μs	82A006
72.	**Anthracene-tetracene photodimer**					
	MCH	LP	442[a]		Air-saturated solution	82F367
73.	**[2.2](1,4)(9,10)-Anthracenophane**					
	2-MTHF (77 K)	LP-ET	510[a] 480[a] 440[a]		‡Triplet ET from biacetyl	79B050
74.	***anti*-[2.2](1,4)-Anthracenophane**					
	2-MTHF (77 K)	LP-ET	510[a] 475[a]		‡Triplet ET from biacetyl	79B050
75.	***syn*-[2.2](1,4)-Anthracenophane**					
	2-MTHF (77 K)	LP-ET	680[a] 650[a] 500[a] 460[a]		‡Triplet ET from biacetyl	79B050
76.	**Anthraquinone**					
	Benzene	PR/ET	390 370	10200	‡Triplet ET from benzophenone and triplet ET to anthracene; ε relative to benzophenone in benzene ($\epsilon_{532.5}$ = 7630 L mol^{-1} cm^{-1}); $\tau_T = 0.2$ μs	720392
	Benzene	FP	370		‡Oxygen quenching, triplet ET to β-carotene; $\tau_T = 0.11$ μs	81F130
	EPA (77 K)	FP	365[a]		‡Phosphorescence decay; $\tau_T = 3400$ μs	83E016
	EtOH/MeOH (113 K)	FP/TD	370	>2000	Solvent was 3:1 EtOH to MeOH; lower limit assumes total ground state depletion	67B004
	Toluene	LP	371[a]		‡Phosphorescence decay in EPA at 77 K; delay 300 ns	83E016
77.	**Anthraquinone-2,6-disulfonate ion**					
	Water	FP	390		‡Oxygen quenching; $\tau_T = < 1$ μs; pH 7	81F130
78.	**Anthraquinone-2-sulfonate ion**					
	Acetonitrile	LP	579[a] 473[a] 451[a] 378[a]		Delay 40 ns	83B054
	Water	LP	456[a] 411[a] 380[a]		Spectral data extrapolated back to 15 ns; pH ~ 6	83B054
79.	**2-Anthroate ion**					
	Water/Alcohol	FP	434[a] 409[a]		Solvent was 1:1 water to alcohol; pK_a(triplet 2-anthroic acid) 6.0; pH 13	68B008
80.	**1-Anthrol**					
	Cyclohexane	FP	440[a]			767626
	Cyclohexane	LP/ET	440	28300	Triplet ET from perylene; ε relative to perylene in cyclohexane (ϵ_{480} = 13000 L mol^{-1} cm^{-1}); $\tau_T = 295$ μs	777391
	Isooctane	FP	510 439		‡Similarity to 1-anthryl diisopropyl borate spectrum; 510 nm was the more intense peak	717266
81.	**2-Anthrol**					
	Isooctane	FP	442 298		‡Similarity to 2-anthryl diisopropyl borate spectrum	717266
82.	**9-Anthrol**					
	MeOH (300 K)	LP	430			82B102

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
83.	**Anthrone**					
	? (81 K)	FP/SD	341	74000	‡Phosphorescence decay; glass was either 1:3:3 1-methylPrOH to Et_2O to isooctane or 1:9 MCH to mixture of EtOH and MeOH; τ_T = 1800 ± 200 μs	77B022
	Benzene	LP	530[a] 385		‡Triplet ET, oxygen quenching; decay times limited in oxygen saturated solution; shoulder around 420 nm; relative intensities (1:10); τ_T = 0.170 μs; *rise time of* 0.070 ± 0.020 ns	766464
	Benzene	LP	~580		‡Quenching by oxygen, di-*tert*-butylnitroxide, and dienes	82B102
	Hexane	LP	560		Rise time of 0.050 ± 0.020 ns	84E077
	Isooctane	FP	423 395 380		Some bands at 635 and 545 nm bands were unassigned	717266
84.	**1-Anthryl diisopropyl borate**					
	Triisopropyl borate	FP	830 745 688 505 428		428 nm was the most intense peak	717266
85.	**2-Anthryl diisopropyl borate**					
	Triisopropyl borate	FP	520 427.5 405 330			717266
86.	**9-Anthryl diisopropyl borate**					
	Triisopropyl borate	FP	425 403 340 305 282			717266
87.	**9-Anthryl ethenyl ketone**					
	EPA (77 K)	FP	430		$\tau_T = 3.13 \times 10^4$ μs	82E338
88.	**1-(2-Anthryl)-2-(2-naphthyl)ethylene**					
	Benzene	PR/ET	635 ± 3 460 ± 3	62000 ± 9300 50000 ± 7500	‡Oxygen quenching; ε relative to biphenyl in benzene (ϵ_{359} = 27100 L mol^{-1} cm^{-1}); τ_T = 88 μs	84E111
	Bromobenzene	LP	640 ± 3 590[a] 465 ± 3 439[a]		‡Azulene quenching; τ_T = 58 μs	84E111
	MCH	LP	621[a] 567[a] 451[a] 425[a]			84E111
89.	**1-(2-Anthryl)-2-phenylethylene**					
	Benzene	PR/ET	620 ± 3 455 ± 3	41000 ± 6000 60000 ± 9000	‡Oxygen quenching; ε relative to biphenyl in benzene (ϵ_{359} = 27100 L mol^{-1} cm^{-1}); τ_T = 117 μs	84E111
	Bromobenzene	LP	630 ± 3 579[a] 460 ± 3 438[a]		‡Azulene quenching; τ_T = 40 μs	84E111
	MCH	LP	611[a] 559[a] 449[a] 421[a]		Shoulder at 520[a] nm	84E111
90.	**1-(2-Anthryl)-2-(2-thienyl)ethylene**					
	Benzene	PR/ET	630 ± 3 455 ± 3	47000 ± 7000 38000 ± 5700	‡Oxygen quenching; ε relative to biphenyl in benzene (ϵ_{359} = 27100 L mol^{-1} cm^{-1}); τ_T = 19 μs	84E111

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	Bromobenzene	LP	635 ± 3 581^a 460 ± 3	‡Azulene quenching; $\tau_T = 22$ μs	84E111
	MCH	LP	619^a 566^a 448^a 420^a	Shoulder at 527^a nm	84E111
91.	**Astacene**				
	Benzene	PR-ET	580	‡Triplet ET from naphthalene; $\tau_T = 6.2$ μs	80A143
92.	**Astaxanthin**				
	Benzene	PR-ET	580	‡Triplet ET from naphthalene; method not explicit; $\tau_T = 6.2$ μs	81B097
93.	**Auramine O**				
	PMMA (77 K)	PS	1300 1200 1090 700		65B004
94.	**Aurophosphine, conjugate monoacid**				
	Glycerol (293 K)	FP	690^a 610^a 550^a	Solvent has added glucose	776171
95.	**Azulene**				
	Acetonitrile	LP	360	‡Triplet ET from benzophenone, oxygen quenching (8×10^9 L mol^{-1} s^{-1}); $\tau_T = 3$ μs	81F275
	Benzene	LP/ET	360, 4000	‡Triplet ET from benzophenone and other donors, oxygen quenching (6×10^9 L mol^{-1} s^{-1}; ϵ relative to benzophenone in benzene ($\epsilon_{max} = 7600$ L mol^{-1} cm^{-1}) assuming unit transfer efficiency; [84E491] sees no maximum down to 345 nm; $\tau_T = 4$ μs	81F275
	Benzene	PR	<345	‡Triplet ET to perylene and from 1,3-cyclohexadiene; spectrum corrected for SD by monitoring singlet at 620 nm; $\tau_T = 11 \pm 1$ μs	84E491
96.	**Azure A**				
	Water	FP	790	p$K_a = 7.0 \pm 0.1$	67C001
97.	**Azure A cation**				
	Water	FP/SD	840^b, 10000	‡Oxygen and I$^-$ quenching; p$K_b = 6.3$; structure of the spectrum could not be discerned because it was not corrected for SD; pH 9	70E293
98.	**Azure B**				
	Water	FP	800	p$K_a = 7.2 \pm 0.1$	67C001
99.	**Azure C**				
	Water	FP	810	p$K_a = 7.4 \pm 0.1$	67C001
100.	**Bacteriochlorophyll**				
	EtOH/Pyridine	LP/SD	631^a, 18500^a 588^a, 19600^a 515^a, 21500^a 400^a, 46700^a 323^a, 38300^a	‡Triplet ET; solvent was 7:3 EtOH to pyridine; shoulder at 691^a nm; $\tau_T = 74 \pm 4$ μs	733184
	Pyridine	FP/SD	655, 9300 620, 11500 410, 22200	$\tau_T = 85 \pm 13$ μs	60E006
	Pyridine	LP/SD	616^a, 20800^a 512^a, 19500^a 405^a, 41000^a	‡Triplet ET; shoulder at 690^a nm; $\tau_T = 89 \pm 5$ μs	733184

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm, ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
101.	**Benz[*a*]acridine**				
	EPA (77 K)	PS	497 470	Relative intensities (10:9); "1,2-benzacridine"; $\tau_T = 3 \times 10^5$ μs	54B001
	Isopentane/MCH (77 K)	PS	497	$\tau_T = < 5 \times 10^5$ μs	54B001
102.	**Benz[*c*]acridine**				
	EPA (77 K)	PS	510 480	Relative intensities (10:9); "3,4-benzacridine"; $\tau_T = 4 \times 10^5$ μs	54B001
103.	**Benz[*b*]acridin-12(5*H*)-one**				
	EtOH (300 K)	FP/ET	590, 45000 380	ϵ relative to anthracene in EtOH (ϵ_{421} = 52000 L mol^{-1} cm^{-1}); "6,7-benzacridinone"	81E649
104.	**Benzaldehyde**				
	Liquid paraffin	FP	470 364 320 307	Solvent viscosity was 0.03 N·s/m^2; 470 and 364 nm bands were assigned to one electronic transition, and the other two bands were assigned to another electronic transition; relative intensities (11:18:100:86)	58E001
105.	**Benzamide**				
	Liquid paraffin	FP	505 300	Solvent viscosity was 0.19 N·s/m^2; bands were assigned to 2 different electronic transitions	58E001
106.	**Benz[*a*]anthracene**				
	2-MTHF (77 K)	PS/ESR	493, 43600^c 469^a, 22700^{a,c} 441^a, 19200^{a,c}	‡ESR; shoulder at 410^a nm; "1,2-benzanthracene"; oscillator strength = 0.43	68D211
	Benzene	FP	538 488 458 435 402	Relative intensities (10:100:65:50:30); τ_T = 160 ± 13 μs	61E005
	Benzene	PR/ET	490, 20500	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Benzonitrile	LP/RF	490^a, 12000 ± 800 466^a, 9800^a	ϵ relative to benz[*a*]anthracene in toluene (ϵ_{490} = 15000 L mol^{-1} cm^{-1})	83F075
	Cyclohexane	PR/ET	480, 25100 ± 6270	ϵ relative to benzophenone ketyl radical in water ($\epsilon_{537.5}$ = 3220 L mol^{-1} cm^{-1}), assuming this value for $\epsilon_{542.5}$ in cyclohexane	680727
	Cyclohexane	LP	480	‡Rise time of transient was the same as the decay time of the singlet	68B006
	Cyclohexane	LP	540 490 461		70E288
	Cyclohexane	PR/ET	480, 28800	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); reference ϵ obtained by starting from ϵ_{max} = 3220 L mol^{-1} cm^{-1} for this ketyl radical in water and assuming the f of the ketyl radical is independent of solvent; final ϵ obtained from a simultaneous least squares fit to data from several compounds	71E360
	Cyclohexane	LP	543 483 457 429	350 ns delay	737463
	EPA (77 K)	PS	489.0 473.3 459.3	‡Phosphorescence decay; 1st transition assigned as $^3L_a \rightarrow {}^3C_b$	51E001
	EPA (77 K)	PS	489.0 460.8 434	‡Phosphorescence decay; relative intensities (100:58:54); unresolved shoulder at 474 nm; $\tau_T = (3 \pm 1) \times 10^5$ μs	54B001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	EPA (77 K)	PS	710 645 590	Weak bands in the red only studied	67B005
	EPA (77 K)	PS/SD	487.5, 29000 465[a], 18200[a] 433[a], 13600[a]	EPA in this work was 4:4:1 isopentane to Et_2O to absolute EtOH	68E104
	EPA (77 K)	PS	709.2 645.2 589.9 543.5 489.0 471.9 460.8 434.8 411.0 384.0	Relative intensities (7:5:6:4:100:42:70:44:27:20)	69E211
	EPA (77 K)	PS/IV	488, 28800	λ_{max} assumed from previous work; ϵ estimated by extrapolation to infinite excitation rate	69E212
	EtOH (293 K)	FP	540 482		68E098
	EtOH (293 K)	LP	442[a]		697226
	EtOH (77 K)	MOD	486	Halfwidth 440 cm^{-1}	777538
	EtOH	LP	480[a] 450[a] 430[a]	Relative intensities (6:4.2:4); 1.8 μs delay; solution contains Ag ions	78E554
	Heptane (77 K)	PS	487 460 437.4 413 402		67B007
	Hexane	FP	485.0 450.1 429.9		54E001
	Hexane	MOD/SD	480[a], 24500[a] 455[a], 18200[a] 430[a], 13800[a] 360[a], 2800[a] 295[a], 43700[a] 279[a], 31600[a]	Shoulders at 410 nm and 387 nm; τ_T = 100 μs	64E015
	Hexane (300 K)	MOD/SD	531, 2500 481, 26000 455, 21000 427, 17000 407, 9000 360, 2800 345, 3600 302, 40000 274, 30000 247, 24000		69E208
	Isopentane/MCH (77 K)	PS	486.6 459 430	Relative intensities (100:62:55); unresolved shoulder at 472 nm	54B001
	Liquid paraffin	FP/SD	540, 3000 485, 23400 461, 19700 434.5, 12400 415, 8900 315	Solvent had viscosity of 0.03 N·s/m^2; 3 electronic transitions were assigned; all bands belong to the 2nd electronic transition except the bands at 540 and 315 nm; oscillator strength = 0.02, 0.34, —	58E001
	Naphthalene (373 K)	PR	495 475 435	Solution; relative intensities (100:83:66); delay 300 ns; k_{et} = 1.1 × 10^{10} L mol^{-1} s^{-1}	700114

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Nonane (77 K)	PS	490.0 463.6 460.0 432.0 410.0	Relative intensities (100:42:70:44:27:20)	69E211
	PMMA (296 K)	LP	490 460 430		686058
	PMMA (296 K)	PS	488^a 461^a 435^a		68E104
	PMMA	LP	540 490 461		70E288
	Toluene (77 K)	MOD	495	Halfwidth 460 cm^{-1}	777538
	Toluene	LP/ET	490^a, 15000 ± 1000 466^a, 10600^a	ϵ relative to anthracene in toluene ($\epsilon_{428.5}$ = 42000 L mol^{-1} cm^{-1})	83F075
107.	**7*H*-Benz[*de*]anthracen-7-one**				
	1,1,2-Trichloro-trifluoroethane	LP	484^a	‡Oxygen quenching (1.2 × 10^9 L mol^{-1} s^{-1})	757427
	Benzene	LP	490	Half-life = 1.0 ± 0.1 μs	757427
	Benzene (298 K)	LP	500 460		82E204
	MeOH	LP	490^a	Half-life = 1.8 ± 0.1 μs	757427
108.	**Benz[*a*]azulene**				
	Benzene	LP	430		81F275
109.	**Benzene**				
	Cyclohexane	LP/IV	235, 11000	‡Oxygen quenching; 106 ns delay; shoulder ~310 nm (f ~0.12); ϵ assumes Φ_T = 0.23; assignment $2^3E_{2g} \leftarrow {}^3B_{1u}$; oscillator strength = ~0.35	80B023
	EtOH/MeOH (113 K)	FP	429.6 ± 0.5 ~412.5 ± 1.0	‡Phosphorescence decay; glass was 3:1 EtOH to MeOH; band assigned to $^3E_{2g}^- \leftarrow {}^3B_{1u}^+$	69E207
110.	**Benzene-*d*$_6$**				
	3-MP/MCH (103 K)	FP	426.5 ± 0.5 ~412.5 ± 1.0	‡Phosphorescence decay; glass was 1:1 3-MP to MCH; band assigned to $^3E_{2g}^- \leftarrow {}^3B_{1u}^+$	69E207
	EtOH/MeOH (113 K)	FP	425.0 ± 0.5 ~407.5 ± 1.0	‡Phosphorescence decay; glass was 3:1 EtOH to MeOH; band assigned to $^3E_{2g}^- \leftarrow {}^3B_{1u}^+$	69E207
111.	**Benzidine**				
	EtOH (77 K)	MOD/KM	460, 22000 ± 5500	"4,4′-Diaminobiphenyl"	737055
	EtOH/Et$_2$O (77 K)	MOD/KM	460, 49000 ± 20000	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Toluene/EtOH (77 K)	MOD	461^a	Glass was 19:1 toluene to EtOH	719059
112.	**Benzil**				
	Acetonitrile/Water	LP	480^a	Solvent was 88:12 acetonitrile to water by volume	79E690
	Benzil (295 K)	LP	510	Triplet exciton in crystal; halfwidth 2860 cm^{-1}	78E538
	Benzil (77 K)	LP	510	Triplet exciton in crystal; halfwidth 2320 cm^{-1}	78E538
	Liquid paraffin	FP	486.5 380	Solvent viscosity was 0.03 N·s/m^2; bands were assigned to different electronic transitions	58E001
	Polystyrene	PR	469^a	$G\epsilon_{469}$ = 4200^a L mol^{-1} cm^{-1} / (100 eV absorbed); τ_T = 36 μs	701073
113.	**Benzil/Triethylamine**				
	Acetonitrile/Water	LP	600^a	Solvent was 88:12 acetonitrile to water; possible triplet exciplex, but resembles benzil radical cation; τ_T = 0.055 μs	79E690

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
114.	**Benzo[*a*]carbazole**					
	EtOH	FP	680^{a} 569 438 390 365		Most intense peak at 569 nm	766421
115.	**Benzo[*b*]carbazole**					
	EtOH	FP	620^{a} 500 420 345		Most intense peak at 500 nm; shoulder around 475 nm	766421
116.	**Benzo[*c*]carbazole**					
	EtOH	FP	528 380 352		Most intense peak at 528 nm; shoulder around 600 nm	766421
117.	**Benzo[*b*]chrysene**					
	Benzene	MOD	570 530 450		Relative intensities (100:64:39)	71E361
	Liquid paraffin	MOD	570 450		Mull; relative intensities (100:78); shoulder at 530 nm with relative intensity 71; $\tau_T = 53$ μs	71E361
118.	**Benzo[*a*]coronene**					
	2-MTHF (77 K)	PS/ESR	588 423	25500 38800	‡ESR; assignments $^{3}B_{2} \leftarrow {}^{3}B_{2}$, $^{3}A_{1} \leftarrow {}^{3}B_{2}$; oscillator strength = 0.28, 0.18	696115
	EPA (77 K)	PS/SD	571^{a} 420^{a}	25800^{a} 37600^{a}	EPA in this work was 4:4:1 isopentane to Et_2O to absolute EtOH; "1,2-benzcoronene"	68E104
	PMMA (296 K)	PS	568^{a} 418^{a}			68E104
	PMMA (77 K)	PS/SD	568^{a}	21900^{a}	Shoulders at 588^{a}, 532^{a}, and 488^{a} nm; $\tau_T = 4.3 \times 10^6$ μs	69E216
	PMMA (296 K)	PS/SD	568^{a}	20300^{a}	Shoulders at 585^{a} and 538^{a} nm; $\tau_T = 2.9 \times 10^6$ μs	69E216
	PMMA (293 K)	CWL/KM	1090 943 826 588 568 417	~200 18000 36200	Three transitions were identified with the 0-0 bands identified by their extinction coefficients; the lowest triplet state was assigned as $^{3}B_{2}^{+}$, and the excited states were assigned as $^{3}B_{2}^{+}$, $^{3}B_{2}^{-}$, and $^{3}A_{1}^{-}$ in increasing energy; the ϵ_{417} is for the compound in EPA at 77 K; oscillator strength = 0.06, 0.24, 0.19	707230
119.	**Benzoflavine**					
	PMMA (77 K)	PS	1300 1210 1100 930 800 750			65B004
120.	**Benzo[*a*]fluorene**					
	Heptane	FP	620^{a} 600^{a} 440^{a} 405^{a}		Most intense peak at 405 nm	766421
121.	**Benzo[*b*]fluorene**					
	Heptane	FP	620^{a} 441 419 392 377 365		Most intense peak at 441 nm; shoulder around 465 nm	766421
122.	**Benzo[*c*]fluorene**					
	Heptane	FP	490^{a} 350^{a}		More intense peak at 490 nm; shoulder around 460 nm	766421

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
123.	**Benzoic acid**					
	Isopentane/MCH	FP/COM	320, 315^a	~1000	‡Phosphorescence decay; solvent was 5:1 isopentane to MCH; ϵ_{max} was estimated based on Φ_T being 0.99; shoulders at 344^a and 304^a nm; delay 10 μs; τ_T = (2.80 ± 0.10) × 10^6 μs	756077
	Liquid paraffin	FP	310		Solvent viscosity was 0.19 N·s/m^2	58E001
124.	**Benzoin**					
	Benzoin (295 K)	LP	455^a 430^a 390^a		Triplet exciton in crystal	78E538
	Liquid paraffin	FP	476 370		Solvent viscosity was 0.19 N·s/m^2; relative intensities (95:100)	58E001
125.	**Benzo[*c*][1,5]naphthyridine**					
	EtOH/Et$_2$O (77 K)	PS	758 676 610 570 532 505 474 439		Solvent was 3:2 EtOH to Et$_2$O; relative intensities (14:34:43:77:94:100:77:70); E_T = 270 kJ mol^{-1}	80B130
126.	**Benzo[*c*][1,6]naphthyridine**					
	EtOH/Et$_2$O (77 K)	PS	557 525		Solvent was 3:2 EtOH to Et$_2$O; relative intensities (100:85); E_T = 276 kJ mol^{-1}	80B130
127.	**Benzo[*c*][1,7]naphthyridine**					
	EtOH/Et$_2$O (77 K)	PS	571 531 495 435		Solvent was 3:2 EtOH to Et$_2$O; relative intensities (77:100:97:65); E_T = 269 kJ mol^{-1}	80B130
128.	**Benzonitrile**					
	EPA (77 K)	FP	490 430		‡Phosphorescence decay, molecular orbital calculations; ε roughly 200 L mol^{-1} cm^{-1} (method unspecified); τ_T = 3.5 μs	776213
129.	**Benzo[*rst*]pentaphene**					
	Benzene	MOD	490 460		Relative intensities (100:44); "3,4,9,10-dibenzpyrene"; τ_T = 170 μs	71E361
	Cyclohexane	LP	495			70E288
	Cyclohexane	LP	714 694 676 654 637 621 613 581		370 ns delay	737463
	Liquid paraffin	MOD	490 460		Mull; relative intensities (100:45); τ_T = 150 μs	71E361
130.	**Benzo[*ghi*]perylene**					
	Benzene	MOD	570 520 470		Relative intensities (11:23:100); "1,12-benzoperylene"; τ_T = 150 μs	71E361
	Cyclohexane	LP	690 667 637 575 529 483 461		370 ns delay; authors reassign "490" nm band to $T_n \leftarrow T_1$. [686058] suggested that it was $S_n \leftarrow S_1$	737463

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm , ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	EPA (77 K)	PS/SD	467, 40000 ± 4000		68E105
	PMMA (296 K)	LP	465 425		686058
	PMMA (77 K)	PS/SD	465^a, 39900^a		696020
	PMMA (296 K)	PS/SD	463^a, 38900^a		696020
	PMMA (293 K)	CWL/KM	1000, ~150 781, ~500 699 637 568, ~7000 529 493 465, 38300 439	Four transitions were identified with the 0-0 bands identified by their extinction coefficients; the lowest triplet was $^3B_2^+$, and the other states were ($^3A_1^+$), $^3A_1^-$, $^3B_2^-$, and $^3A_1^-$ in increasing energy; the ϵ_{568} is for the compound in EPA at 77 K; oscillator strength = ~10^{-3}, 0.02, ⩾0.07, 0.39	707230
131.	**Benzo[*c*]phenanthrene**				
	Acetonitrile	FP	520	"3,4-Benzphenanthrene"; radical cation also observed at 450 nm; solvent contains dimethylmercury; τ_T = ~200 μs	78A324
	Cyclohexane	LP	517		70E288
	Hexane	FP	517.1		54E001
	Hexane	FP/SD	517, 4800 400, 1580	Bands were assigned to 2 different electronic transitions; oscillator strength = 0.05, 0.03	58E001
	PMMA	LP	517		70E288
132.	**Benzophenazine**				
	Toluene (293 K)	FP	530^a 500^a	‡Phosphorescence decay in EPA at 77 K, oxygen quenching; isomer unspecified	80E778
133.	**Benzophenone**				
	2-PrOH	LP	535	$\tau_T = 0.046 \pm 0.006$ μs	70E288
	Acetonitrile	LP	520 330^a	‡Triplet ET to *cis*-3-methylpent-2-ene; relative intensities (1:2); $\tau_T = 0.71$ μs; $k_{et} = 2.7 \times 10^8$ L mol^{-1} s^{-1}	80B087
	Acetonitrile	LP/HAT	520, 6500 ± 400 320, ~11500	ϵ relative to benzophenone ketyl radical in water (ϵ_{540} = 3220 L mol^{-1} cm^{-1}) assuming ϵ_{ref} unchanged in acetonitrile; hydrogen atom transfer from 2-piperidone ($k_{HAT} = 9.7 \times 10^6$ L mol^{-1} s^{-1}); $\tau_T = 14$ μs	80E416
	Acetonitrile	LP	525	20 ps delay	80A206
	Acetonitrile/Water	LP/RF	520, 6500 315, 11800	Solvent was 9:1 acetonitrile to water; ϵ relative to benzophenone in acetonitrile (ϵ_{520} = 6500 L mol^{-1} cm^{-1})	84B033
	Benzene	FP/HAT	525^b, 6000 ± 3000	‡Specific quenching by heavy metal chelates; ϵ relative to benzophenone ketyl radical in benzene (ϵ_{525} = 7000 L mol^{-1} cm^{-1}); ϵ calculated by estimating that 10% of the triplets form ketyl radicals; $\tau_T = 10 \pm 5$ μs	63E007
	Benzene	PR	530	$G\epsilon_{530}$ = 11700 L mol^{-1} cm^{-1} / (100 eV absorbed); half-life = 2.11 μs	64B006
	Benzene	PR/ET	532.5, 9100	ϵ relative to anthracene in cyclohexane (ϵ_{420} = 57200 L mol^{-1} cm^{-1}); author reported mean of 4 measurements (this one and 3 others with different ref. cmpds.) as 10300 ± 2570 L mol^{-1} cm^{-1}	680727
	Benzene	PR/ET	532.5, 12000	ϵ relative to naphthalene in cyclohexane ($\epsilon_{412.5}$ = 22600 L mol^{-1} cm^{-1}); author reported mean of 4 measurements (this one and 3 others with different ref. cmpds.) as 10300 ± 2570 L mol^{-1} cm^{-1}	680727
	Benzene	PR/ET	532.5, 9700	ϵ relative to benz[*a*]anthracene in cyclohexane (ϵ_{480} = 25100 L mol^{-1} cm^{-1}); author reported mean of 4 measurements (this one and 3 others with different ref. cmpds.) as 10300 ± 2570 L mol^{-1} cm^{-1}	680727
	Benzene	PR/ET	532.5, 10600	ϵ relative to phenanthrene in cyclohexane ($\epsilon_{482.5}$ = 21000 L mol^{-1} cm^{-1}); author reported mean of 4 measurements (this one and 3 others with different ref. cmpds.) as 10300 ± 2570 L mol^{-1} cm^{-1}	680727

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	Benzene	LP	535	$\tau_T = 2.5 \pm 0.3$ μs	70E288
	Benzene-d_6	LP	535	$\tau_T = 3.45 \pm 0.30$ μs	70E288
	Benzene	PR/ET	532.5, 7630	ε relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ε obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Benzene	FP/RA	525, 7000	ε relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 4160 L mol^{-1} cm^{-1}), taking $\Phi_T = 1$ in benzene and $\Phi_{ketyl} = 1$ in cyclohexane; reference ε of ketyl radical was taken as the average of 3220 in water and 5100 L mol^{-1} cm^{-1} in 2-PrOH/water; $\tau_T = 12 \pm 2$ μs	717009
	Benzene	PR	528^a	‡ Triplet ET from benzene; $k_{et} = (1.3 \pm 0.2) \times 10^{11}$ L mol^{-1} s^{-1}	751124
	Benzene	LP	528^a		751124
	Benzene	LP	535	$\tau_T = 3.57$ μs	79A171
	Benzene	LP	525 325		80B021
	Benzene	LP/RA	533, 7200	ε relative to potassium ferrioxalate actinometer assuming $\Phi_T = 1.0$ for benzophenone in benzene	80B090
	Benzene	LP/ET	533^a, 7100 ± 800	‡Triplet ET to naphthalene; ε relative to naphthalene in benzene (ϵ_{425} = 13000 L mol^{-1} cm^{-1})	81A174
	Benzene	LP/PIV	530, 7220 ± 320		83B067
	Benzophenone (303 K)	PR	540	Liquid; if 90% of the absorption at 540 nm is due to triplets and if ε = 10300 L mol^{-1} cm^{-1}, then G(triplets) = 2.2 ± 0.1 triplets/(100 eV absorbed).; half-life = 0.46 μs	700114
	Benzophenone (77 K)	LP	543 450	Triplet exciton in crystal; halfwidth of 543 nm band 2450 cm^{-1}; $\tau_T = \sim 1000$ μs	78E538
	Benzophenone (295 K)	LP	543	Triplet exciton in crystal; halfwidth 3000 cm^{-1}	78E538
	Benzophenone	LP	540^a	‡Phosphorescence decay; absorption monitored by diffuse-reflectance spectroscopy	84E044
	Cyclohexane	LP	535	$\tau_T = 0.30 \pm 0.02$ μs	70E288
	Cyclohexane	PR	535^a		751124
	Dioxane	LP	535	$\tau_T = 0.20 \pm 0.02$ μs	70E288
	Diphenyl ether	LP	~540	$\tau_T = (160 \pm 20) \times 10^{-3}$ μs	78B071
	EPA (77 K)	FP	535		55E002
	EtOH	LP	535	$\tau_T = 0.104 \pm 0.015$ μs	70E288
	EtOH	LP/COM	545, 7300 510^a, 6500^a	ε estimated by scaling by halfwidth of band (3220 cm^{-1}) relative to that in hexane; $\tau_T = 0.08$ μs	79B141
	Heptane	LP	530	Delay 320 ps	84B154
	Hexafluorobenzene	LP	535	$\tau_T = 0.435 \pm 0.40$ μs	70E288
	Hexane	LP/IV	525, 10300 500^a, 9600^a 445^a, 5000^a 310^a, 15000^a	ε estimated assuming $\Phi_T = 1.0$ for benzophenone in hexane, corrected for triplet decay and ketyl radical formation during the pulse, and extrapolated to zero intensity; halfwidth 2650 cm^{-1}; $\tau_T = 0.29$ μs	79B141
	Isopentane (77 K)	FP	543^a 326^a	‡Phosphorescence decay	67E105
	MCH	LP	529^a		757112
	PFMCH	FP	530^a 520^a 319^a	‡Phosphorescence decay; most intense peak was at 319 nm; $\tau_T = 400$ μs	747390
	PMMA (293 K)	FP/RA	606 532, 4200 ± 100	‡Phosphorescence decay; ε relative to benzophenone ketyl radical in 2-PrOH/water (ϵ_{546} = 5100 L mol^{-1} cm^{-1}), assuming Φ_T was the same in PMMA and ethylene glycol and assuming ε for ketyl radical same in 2-PrOH/water and ethylene glycol; delay 100 μs	66E090
	PMMA (80 K)	FP	606 532	‡Decay of absorption was equal to decay of phosphorescence at 293, 220, and 100 K; delay 100 μs	66E090

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	PPFO	LP/SM	520, 2460^c ± 350	Aqueous micelle, potassium perfluorooctylsulfonate; ϵ method needs the assumption of $\Phi_T = 1$ for benzophenone in the micelle since only linear intensity dependence observed; $\tau_T = 7.87$ μs	81N156
	SPFO	LP/SM	520, 2660^c ± 380	‡Phosphorescence decay; aqueous micelle, sodium perfluorooctanoate; ϵ method needs the assumption of $\Phi_T = 1$ for benzophenone in the micelle since only linear intensity dependence observed; $\tau_T = 7.87$ μs	81N156
	Trichlorotrifluoroethane	FP	526 317	‡Oxygen quenching and no hydrogens available in the solvent to form ketyl radicals; $\tau_T = 20$ μs	67B006
	Water	FP	525 315	pH 12.7	727098
	Water	FP	525	Delay 20 μs; $\tau_T = 65 \pm 6$ μs	72A022
	Water	FP	525 315	$\tau_T = \sim 100$ μs; pH Neutral	727098
	Water	LP/HAT	520, 5750 ± 400 320, ~8350	ϵ relative to benzophenone ketyl radical in water ($\epsilon_{540} = 3220$ L mol^{-1} cm^{-1}); hydrogen atom transfer from 2-piperidone ($k_{HAT} = 14.8 \times 10^6$ L mol^{-1} s^{-1}); $\tau_T = 40$ μs	80E416
	Water	LP/RA	520, 5800 ± 400	ϵ relative to naphthalene in cyclohexane ($\epsilon_{414} = 24500$ L mol^{-1} cm^{-1}, $\Phi_T = 0.75$) assuming $\Phi_T = 1$ for benzophenone in water	80E416
	Water/Acetonitrile	LP	525	Solvent was 4:1 water to acetonitrile; 200 ns delay; $\tau_T = 31$ μs; $E_T = 288$ kJ mol^{-1}	82A082
134.	**Benzophenone, conjugate acid**				
	Sulfuric acid	LP	505	5 mol L^{-1} H_2SO_4; solvent was 4:1 water to acetonitrile; pK_a 0.20 ± 0.02; $\tau_T = 0.017$ μs	84E456
135.	**Benzo[*a*]pyrene/DNA**				
	Water	LP	480	‡Oxygen quenching (2.0×10^8 L mol^{-1} s^{-1}); deproteinated calf thymus DNA; $\tau_T = 3.5 \times 10^4$ μs	766403
136.	**Benzo[*e*]pyrene/DNA**				
	Water	LP	560^a	‡Oxygen quenching (1.6×10^8 L mol^{-1} s^{-1}); deproteinated calf thymus DNA; $\tau_T = 1.55 \times 10^4$ μs	766403
137.	**Benzo[*a*]pyrene**				
	Benzene	MOD	475	Called "3,4-benzpyrene" in paper; $\tau_T = 84$ μs	71E361
	Cyclohexane	LP	500 475	‡Rise time of transient was the same as the decay time of the singlet; "3,4-benzpyrene"	68B006
	Cyclohexane (296 K)	FP	465	Shoulder at 440 nm; $\tau_T = 8700$ μs	78A345
	EPA (77 K)	PS	504 477.3 467.9 444	Relative intensities (31:95:100:76); "3,4-benzopyrene"	54D001
	PMMA (77 K)	PS	470 442 419	Named "3,4-benzopyrene" in paper	70E291
	Toluene/EtOH (77 K)	MOD	557^a	Glass was 19:1 toluene to EtOH; shoulders at 606^a, 427^a, and 380^a nm; called "1,2-benzopyrene" in paper	719059
	Water (296 K)	FP	465	Solution contains 2% SDS; shoulder at 445 nm; radical cation also observed ($\lambda_{max} = 550$ nm); $\tau_T = 2.38 \times 10^4$ μs	78A345
	Water (296 K)	FP	470	Caffeine (1%) added as solubilizing agent; radical cation also observed ($\lambda_{max} = 550$ nm); $\tau_T = 2040$ μs	78A345
138.	**Benzo[*e*]pyrene**				
	Benzene	MOD	560	Called "1,2-benzpyrene" in paper; $\tau_T = 120$ μs	71E361
	EPA (77 K)	PS/IV	555, 17800	λ_{max} assumed from previous work; ϵ estimated by extrapolation to infinite excitation rate	69E212
	EPA (77 K)	PS/KM	588^a, 7500^a 555^a, 16100^a 519^a, 9300^a	Solvent, temperature and extinction method assumed from earlier work; polarization also measured	69E213

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	EtOH/MeOH/THF (assumed 77 K)	PS	587.5 558.5 456		Glass was 3:1:4 EtOH to MeOH to THF; the origin of another band was assigned to 392 nm; the 4 bands were assigned to 4 different electronic transitions; T_1 was assigned as $^3B_2^+$, and the other 4 states were assigned as $^3A_1^-$ for 587.5 nm and 456 nm and $^3B_2^-$ for the other 2; "1,2-benzopyrene"	70B003
139.	**Benzo[*f*]quinoline**					
	EPA (77 K)	PS	517 482 ~452		Relative intensities (10:8:5); "5,6-benzoquinoline"; $\tau_T = 2.6 \times 10^6$ μs	54B001
	EtOH/Et$_2$O (77 K)	PS	833 735 662 515 448		Solvent was 3:2 EtOH to Et$_2$O; relative intensities (<5:<5:<5:100:74:49); $E_T = 262$ kJ mol^{-1}	80B130
	Isopentane/MCH (77 K)	PS	510		$\tau_T = 1.8 \times 10^6$ μs	54B001
	PMMA (77 K)	PS	500 470 440		‡Phosphorescence decay (?); $\tau_T = 3.3 \times 10^6$ μs	70E291
140.	**Benzo[*h*]quinoline**					
	EPA (77 K)	PS	500 465 ~440		Relative intensities (10:8:5); "7,8-benzoquinoline"; $\tau_T = 2.1 \times 10^6$ μs	54B001
	EtOH/Et$_2$O (77 K)	PS	500 465 437		Solvent was 3:2 EtOH to Et$_2$O; relative intensities (100:84:55); $E_T = 262$ kJ mol^{-1}	80B130
	Isopentane/MCH (77 K)	PS	505 ~465		Relative intensities (10:9); $\tau_T = 1.4 \times 10^6$ μs	54B001
	PMMA (293 K)	FP	490 460		‡Phosphorescence decay (?); decay was non-exponential, and lifetime was calculated from a terminal 1st-order rate constant; $\tau_T = 1.1 \times 10^6$ μs	70E291
	PMMA (77 K)	PS	490 460 433		‡Phosphorescence decay (?); $\tau_T = 1.9 \times 10^6$ μs	70E291
141.	**Benzo[*f*]quinolizinium**					
	Acetonitrile	FP	575^a		$\tau_T = 125 \pm 5$ μs	81A345
142.	**Benzo[*h*]quinolizinium**					
	Acetonitrile	FP	575^a		$\tau_T = 120 \pm 5$ μs	81A345
143.	**1,4-Benzoquinone**					
	EtOH	LP	450		100 ps delay	79B007
	Water	LP	410		‡Oxygen quenching (2.4 × 10^9 L mol^{-1} s^{-1}); $\tau_T = 0.53$ μs	80B112
144.	**Benzo[*b*]triphenylene/Chloranil**					
	PMMA	PS	620 540 450^a 420^a 410^a 400^a		*Charge transfer complex; most intense peak at 450 nm*	*766652*
145.	**Benzo[*b*]triphenylene**					
	2-MTHF (77 K)	PS/ESR	454	31000	‡ESR; only most intense visible peak reported; "1,2,3,4-dibenzanthracene"; oscillator strength = 0.20	696115
	Benzene	MOD	450		$\tau_T = 90$ μs	71E361
	Cyclohexane	LP	440		‡*Rise time of transient was the same as the decay time of the singlet*	*68B006*
	Epoxy plastic (296 K)	LP	425 412			686058

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	PMMA	LP	445		70E288
	PMMA (293 K)	CWL/KM	752, 1300 680 613 568 446, 28800 422 400	Two transitions were assigned with the 0-0 bands identified by their extinction coefficients; both transitions are assigned as $^3B_2^- \leftarrow {}^3B_2^+$; oscillator strength = 0.10, 0.27	707230
	PMMA	PS	612^a 596^a 578^a 540^a 498^a 455^a 425^a 412^a 396^a	Most intense peak at 455 nm	766652
146.	**1-Benzoylacetone**				
	EtOH/MeOH (118 K)	FP	438	Solvent was 3:1 EtOH to MeOH	68B005
147.	**Benzoylamino-2-Δ^2-thiazoline**				
	Cyclohexane (293 K)	FP/RA	551, 7200	‡Triplet ET to biacetyl, oxygen quenching; ϵ relative to naphthalene in cyclohexane (ϵ_{414} = 24500 L mol^{-1} cm^{-1}); τ_T = 1000 μs	82E373
148.	**9-Benzoylanthracene**				
	Benzene	LP	434 408		84B110
	EPA (77 K)	FP	430 406^a	430 nm peak was the more intense; $\tau_T = 3.31 \times 10^4$ μs	82E338
	Toluene	LP	420	‡Oxygen quenching; rise time of 0.02 ± 0.004 ns	777635
149.	**9-Benzoyl-10-bromoanthracene**				
	EPA (77 K)	FP	430	τ_T = 170 μs	82E338
150.	**9-Benzoyl-10-chloroanthracene**				
	EPA (77 K)	FP	432	τ_T = 3800 μs	82E338
	Toluene	LP	415	‡Oxygen quenching; rise time of 0.052 ± 0.002 ns	777635
151.	**9-Benzoyl-10-cyanoanthracene**				
	Toluene	LP	430	‡Oxygen quenching	777635
152.	**2-Benzoyl-*N*-methyl-β-naphthiazoline**				
	EtOH	FP	630	‡Oxygen quenching (6.6×10^{10} L mol^{-1} s^{-1}); 50 μs delay; τ_T = 480 μs	78E534
	THF	FP/SD	640, 16000 620^b, 15000 440, 8000^a	‡Oxygen quenching; 50 μs delay; τ_T = 380 μs	78E534
	THF	FP/SD	640, 16000 440, 13000	‡Oxygen quenching (6.6×10^{10} L mol^{-1} s^{-1}); 50 μs delay; τ_T = 390 μs	79E304
153.	**8-Benzoylnaphtho[*de*-2.3.4]bicyclo[3.2.2]nona-2,6,8-triene**				
	EPA (103 K)	LP	430 380	‡Phosphorescence decay, oxygen quenching	81F390
	MCH (173 K)	LP	430 380	‡Phosphorescence decay, oxygen quenching; τ_T = 1.0 μs	81F390
154.	**9-Benzoyl-10-nitroanthracene**				
	Benzene	LP	431^a	Delay 400 ns	80E884
	Benzene (293 K)	LP	~450	170 ps delay; growth followed at 452 nm; rise time of $(82 \pm 6) \times 10^{-3}$ ns	80B084
	EPA (77 K)	FP	~450	$\tau_T = 1.6 \times 10^4$ μs	80B084
	EPA (77 K)	FP	436^a	$\tau_T = 1.6 \times 10^4$ μs	80E884
	EPA (77 K)	LP	435^a		84F385

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
155.	**2-Benzoylpyridine**					
	PFMCH	FP	526^a 331^a		Shoulder at 539^a nm; 331 nm peak was the more intense; τ_T = 480 μs	747390
156.	**3-Benzoylpyridine**					
	PFMCH	FP	523^a 305^a		‡Phosphorescence decay; 305 nm peak was the more intense; τ_T = 110 μs	747390
157.	**4-Benzoylpyridine**					
	PFMCH	FP	510^a 490^a 319^a		‡Phosphorescence decay; most intense peak at 319 nm; "phenyl-4-pyridyl ketone"; τ_T = 240 μs	747390
158.	**1-Benzoyl-3,3,3-trifluoroacetone**					
	EtOH/MeOH (118 K)	FP	633		Solvent was 3:1 EtOH to MeOH	68B005
159.	**Benzyl 9-anthroate**					
	Acetonitrile	FP	425		Radical anion (λ_{max} = 550 nm) also observed; τ_T = 1100 μs	80A030
	Benzene	FP/?	430 410	63000 28000^a	ε method unspecified; τ_T = 6100 μs	80A030
160.	**1-Benzylisoquinoline-*N*-oxide**					
	EtOH	FP	392		τ_T = 2.9 μs	727105
161.	**Benzyl phenyl ketone, conjugate acid**					
	Sulfuric acid	LP	359^a		5 mol L^{-1} H_2SO_4; solvent was 4:1 water to acetonitrile; pK_a 0.35 ± 0.05	84E456
162.	**3-Benzyl-3-phenylphenanthro[9,10-*b*]furan-2(3*H*)-one**					
	Benzene	LP	490^a		‡Oxygen quenching and triplet ET to 1-methylnaphthalene	84E520
163.	**3-Benzyl-3,4,5-triphenyl-2(3*H*)-furanone**					
	Benzene	LP/ET	375 ± 5	14000 ± 2800	‡Oxygen quenching; ε relative to benzophenone in benzene (ϵ_{532} = 7600 L mol^{-1} cm^{-1}); τ_T = 8.2 ± 1.2 μs; k_{et} = 2.7 × 10^9 L mol^{-1} s^{-1}	84E520
164.	**Biacetyl**					
	2-PrOH	FP	1060 910 800 725 330 304 210		‡Oxygen quenching; delay 0 μs	697092
	Benzene	PR	317		‡Phosphorescence half-life; half-life = 120 μs	680386
	Benzene	PR/ET	315	6200	‡Phosphorescence decay; ε relative to benz[*a*]anthracene in cyclohexane (ϵ_{480} = 25100 L mol^{-1} cm^{-1}); author reported the mean of 2 measurements with this and another ref. cmpd. as 6400 ± 1600 L mol^{-1} cm^{-1}	680727
	Benzene	PR/ET	315	6600	‡Phosphorescence decay; ε relative to anthracene in cyclohexane (ϵ_{420} = 57200 L mol^{-1} cm^{-1}); author reported the mean of 2 measurements with this and another ref. cmpd. as 6400 ± 1600 L mol^{-1} cm^{-1}	680727
	Benzene	PR/ET	315	5160	ε relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ε obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	CCl_4	FP	1056 916 796 720 330 310 220		‡Oxygen quenching	697092
	EtOH	LP/RF	740	1760	ϵ relative to biacetyl in 2-PrOH (ϵ_{725} = 1710 L mol^{-1} cm^{-1}); τ_T = 3.4 ± 1.0 μs	84E162
	Liquid paraffin	FP	317		Solvent viscosity was 0.03 N·s/m^2	58E001
165.	**9,9′-Bianthryl**					
	MeOH	LP	425			776431
166.	**9,9′-Bicarbazole**					
	Cyclohexane	FP	410^a 370^a		‡Triplet ET to anthracene; carbazyl radicals (λ_{max} = 600 nm) also observed; τ_T = 120 μs	78A368
	Hexane	FP	420		‡Oxygen and piperylene quenching; "dicarbazyl"	757573
167.	**Bifluorenylidene**					
	Liquid paraffin	FP/TD	440	≥110000	‡Phosphorescence decay in MCH/Isopentane glass at 77K; solvent was "viscous paraffin", viscosity 1.75 P; τ_T = (2.2 ± 0.2) × 10^3 μs	767488
	MCH/Isopentane (77 K)	FP	440		‡Phosphorescence decay; glass was 1:1 MCH to isopentane by volume; τ_T = (0.94 ± 0.03) × 10^6 μs	767488
168.	**Bilirubin**					
	Benzene	PR/ET	500	8800	‡Triplet ET from biphenyl and to β-carotene, oxygen quenching (8.2 × 10^8 L mol^{-1} s^{-1}); ϵ relative to biphenyl in benzene (ϵ_{305} = 27100 L mol^{-1} cm^{-1}); half-life = 9 μs; E_T = ~150 kJ mol^{-1}; k_{et} = 4.4 × 10^9 L mol^{-1} s^{-1}	761168
169.	**Biliverdin**					
	Acetone	PR-ET/ET	700^a	16000^a	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene (ϵ_{360} = 27100 L mol^{-1} cm^{-1}), assuming ϵ_{ref} independent of solvent; more intense maximum below 400 nm not observed; half-life = 11.7 μs; E_T = ~90 kJ mol^{-1}; k_{et} = 7.4 × 10^9 L mol^{-1} s^{-1}	79E136
170.	**Biliverdin, dimethyl ester**					
	Benzene	PR-ET/ET	800^a 400^a	14000^a 55000^a	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene (ϵ_{360} = 27100 L mol^{-1} cm^{-1}); half-life = 6.7 μs; E_T = ~90 kJ mol^{-1}; k_{et} = 1.05 × 10^{10} L mol^{-1} s^{-1}	79E136
171.	**1,1′-Binaphthyl**					
	2-MTHF	LP-ET	610^a		‡Triplet ET from benzoquinone, oxygen quenching, triplet quenching; 2 μs delay; shoulder at 550 nm	777241
	2-MTHF (123 K)	LP-ET	610^a 530^a 415^a 395^a		‡Oxygen quenching, triplet quenching; 10 μs delay	777241
	2-MTHF (83 K)	LP-ET	530^a 415^a 395^a		‡Oxygen quenching, triplet quenching; 14 ms delay	777241
	Benzene (299 K)	PR/ET	615^b 608^a	12000	Shoulder at 407^a nm; ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 7630 L mol^{-1} cm^{-1})	741006
	Toluene	PR	605		‡Triplet ET to fluorenone, oxygen quenching; 2 μs delay; τ_T = 14 μs	771048
172.	**2,2′-Binaphthyl**					
	Benzene (299 K)	PR/ET	637^a 601^a 450^b 440^a	 24000	Shoulder at 554^a nm; ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 7630 L mol^{-1} cm^{-1}); 440 nm was the most intense peak	741006

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
173.	**Biphenyl**				
	2-PrOH/Isooctane/Et$_2$O (81 K)	FP	371^{a}	‡Phosphorescence decay; glass was 1:3:3 2-PrOH to isooctane to Et$_2$O	81B119
	3-MH (77 K)	PR	375	‡Phosphorescence decay; $\tau_T = 3.7 \times 10^6$ µs	771059
	3-MP	PR	360	$G\epsilon_{360}$ = 16600 L mol^{-1} cm^{-1} / (100 eV absorbed); half-life = 3.4 µs	64B006
	3-MP (77 K)	PS/ESR	375, 28200	‡ESR; oscillator strength = ~0.27	69B002
	Acetone	PR	360		710186
	Alcohol/Ether (77 K)	MOD	370	Glass was 2:1 alcohol to ether	76E682
	Benzene	PR/ET	359, 27100	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a *simultaneous least squares fit of data from* several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene; corrected λ_{max} quoted from reference [78Z194]	71E360
	Benzene	PR	370		761024
	Boric acid	PS	360	Glass	777388
	BuOH (~80 K)	FP/COM	$363, 300^{d}$	ϵ estimated from numerical simulation of triplet state kinetics; $\tau_T = (3.93 \pm 0.1) \times 10^6$ µs	67B010
	BuOH (~80 K)	FP/IV	$363, 250^{d}$	ϵ estimated by extrapolation to infinite excitation rate	67B010
	Cyclohexane	PR/ET	361.3, 33000	ϵ relative to anthracene in cyclohexane (ϵ_{420} = 57200 L mol^{-1} cm^{-1}); *author reported mean of 2 measurements* (this one and another with a different ref. cmpd.) as 35400 ± 8850 L mol^{-1} cm^{-1}	680727
	Cyclohexane	PR/ET	361.3, 37700	ϵ relative to benz[*a*]anthracene in cyclohexane (ϵ_{480} = 25100 L mol^{-1} cm^{-1}); author reported mean of 2 measurements (this one and another with a different ref. cmpd.) as 35400 ± 8850 L mol^{-1} cm^{-1}	680727
	Cyclohexane	PR/ET	361.3, 42800	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); reference ϵ obtained by starting from ϵ_{max} = 3220 L mol^{-1} cm^{-1} for this ketyl radical in water and assuming the *f* of the *ketyl radical is independent of solvent; final* ϵ obtained from a simultaneous least squares fit to data from several compounds	71E360
	EPA (77 K)	PS/KM	$630^{a}, 1600^{a}$ $577^{a}, 2000^{a}$ $529^{a}, 1800^{a}$ $488^{a}, 2100^{a}$ $458^{a}, 1900^{a}$ $428^{a}, 1500^{a}$ 370, 35800 $357^{a}, 27000^{a}$	Two electronic bands, the 2nd starting at 370 nm; ϵ-method assumed on basis of earlier work by authors; oscillator strength = 0.07, 0.42	747347
	EtOH/Et$_2$O (77 K)	MOD/KM	$365, 7000^{c} \pm 2100$	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	EtOH/MeOH (113 K)	FP/SD	$625^{a}, 500^{a}$ $571^{a}, 800^{a}$ $526^{a}, 750^{a}$ $484, 1200^{a}$ $452^{a}, 900^{a}$ $424^{a}, 600^{a}$ 370, 50000 ± 10000 $352^{a}, 30000^{a}$	‡Phosphorescence decays; shoulders at 685 and 334^{a} nm; glass was 3:1 EtOH to MeOH; three electronic states were tentatively assigned as $^3A_g^+$, $^3B_{3g}^-$, and $^3A_g^-$ for the 0-0 bands of 685, 484, and 370 nm, respectively; T^1 was $^3B_{1u}^+$	70E290
	Ethyl acetate	PR	360	0.8 µs delay; *G*(triplets) estimated assuming ϵ independent of solvent	761080
	Hexane (300 K)	MOD/SD	360, 38500	$\tau_T = 130 \pm 5$ µs	69E208
	Liquid paraffin	FP	368.5 352	Solvent viscosity was 0.03 N·s/m^2; relative intensities (100:69)	58E001
	Liquid paraffin (290 K)	PR	363	Delay 20 µs; τ_T = 85 µs	700277
	PMMA	PR	370		692001
	PVA	FP	365	Stretched polymer film; polarized spectrum obtained with some structure	776279

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	PVA (81 K)	FP	373^a		‡Phosphorescence decay	81B119
	Polystyrene	PR	375		$G\epsilon$ = 11000 L mol^{-1} cm^{-1} / (100 eV absorbed); τ_T = 2 × 10^4 μs	672086
	Polystyrene (77 K)	COM	370		Method was "photolysis"	692001
	Polystyrene	PR	385^a		$G\epsilon_{385}$ = 6000^a L mol^{-1} cm^{-1} / (100 eV absorbed)	701073
	Toluene/EtOH (77 K)	MOD	366^a		Glass was 19:1 toluene to EtOH	719059
174.	**Biphenyl-d_{10}**					
	EtOH/Et_2O (77 K)	MOD/KM	365	7000 ± 2100	Glass was 2:1 EtOH to Et_2O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
175.	**4-Biphenylcarboxaldehyde**					
	Alcohol/Ether (77 K)	MOD	440		Glass was 2:1 alcohol to ether	76E682
176.	**Biphenylene**					
	Benzene	PR/ET	350	10000	‡Triplet ET from naphthalene and triplet ET to anthracene; ϵ relative to naphthalene in benzene (ϵ_{max} = 13200 L mol^{-1} cm^{-1}); half-life = 80 μs	720464
	Cyclohexane	FP-ET/SD	339	10000	‡Triplet ET from naphthalene and triplet ET to anthracene; τ_1 = 100 μs; oscillator strength = 0.13	720464
177.	**2-Biphenylphenylbenzoxazole**					
	Benzene	LP/SD	560	45000	‡Oxygen quenching (1.5 × 10^9 L mol^{-1} s^{-1}); 100 ns delay; "PBBO"; τ_T = 0.325 μs	777265
178.	**2-(4-Biphenylyl)benzoxazole**					
	Pentane	LP/TD	460	2500 ± 250	Shoulders at 536^a, 495^a, and 405^a nm; τ_T = 0.70 ± 0.07 μs	82E632
179.	**1-(4-Biphenylyl)-3-chloro-1-propanone**					
	Benzene	FP	425		‡Physical quenching by free radical; τ_T = 140 μs	83P212
	CCl_4	FP	425		‡Physical quenching by free radical; τ_T = 90 μs	83P212
180.	**1-(2-Biphenylyl)-1-phenylethylene**					
	Cyclohexane	LP/?	370	17000 ± 3000	‡Oxygen quenching; τ_T = 1.75 μs	78E448
181.	**2-(4-Biphenylyl)-5-phenyl-1,3,4-oxadiazole**					
	Benzene	LP	510		‡Oxygen quenching (1.0 × 10^9 L mol^{-1} s^{-1}); 100 ns delay; τ_T = 0.460 μs	777265
182.	**2-(4-Biphenylyl)-5-phenyloxazole**					
	Dioxane	LP/TD	530 498^a 455^a 426^a	61000 ± 250	τ_T = 0.62 ± 0.06 μs	82E632
	Pentane	LP/TD	540 499^a 417^a	71500 ± 250	τ_T = 0.35 ± 0.04 μs	82E632
183.	**5''-[1,1'-Biphenyl]-4-yl-1,1':4',1'':3'',1''':4''',1''''-quinquephenyl**					
	2-PrOH/Isooctane/Et_2O (81 K)	FP	576^a 533^a 498^a 455^a 349^a		‡Phosphorescence decay; glass was 1:3:3 2-PrOH to isooctane to ether; most intense peak at 455 nm; "1,3,5-tris(biphenyl-4-yl)benzene"; τ_T = 2.2 × 10^6 μs	81B119
	Alcohol/Ether (77 K)	MOD	572 446		Glass was 2:1 alcohol to ether	76E682
184.	**2,2'-Biquinoline**					
	Water/EtOH	FP	600^a 460^a 420^a		Solvent was 3:2 water to EtOH by volume; 20 μs delay; pH 7.5	79E799

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
185.	**6,6′-Biquinoline, conjugate diacid**					
	Water/EtOH	FP	590^a 450^a		Relative intensities (1:2) ; solvent was 2:1 water to EtOH by volume; 20 μs delay; pK_a = 3.8 ± 0.5; pH 1.2	79E799
186.	**2,2′-Biquinoline, conjugate monoacid**					
	Water/EtOH	FP	610^a 415^a		Solvent was 3:2 water to EtOH by volume; 20 μs delay; pK_a = 5.8 ± 0.5; pH 0.4	79E799
187.	**6,6′-Biquinoline, conjugate monoacid**					
	Water/EtOH	FP	580^a 410^a		Relative intensities (1:2); solvent was 3:2 water to EtOH; 20 μs delay; pK_a = 5.6 ± 0.5; pH 5.0	79E799
188.	**Bis(2,2′-bipyridine)dichloroiridium(III) ion**					
	DMF/Water	LP	577^a 554^a 490^a 470^a 458^a 442^a 431^a		Shoulders at 528^a and 509^a nm; solvent was 9:11 dimethylformamide to water	79B098
	DMF/Water	LP	600^a 565^a 505^a 469^a 454^a		Shoulders at 534^a, 439^a, and 419^a nm; solvent was 19:1 dimethylformamide to water	79B098
	Water	LP	488^a 468^a 459^a 439^a		Shoulder at 419^a nm	79B098
189.	**2,5-Bis(5-*tert*-butyl-2-benzoxazolyl)thiophene**					
	Benzene	LP/SD	520	160000	‡Oxygen quenching (2.1 × 10^9 L mol^{-1} s^{-1}); 100 ns delay; "BBOT"; τ_T = 0.240 μs	777265
190.	**4,4′-Bis(dimethylamino)benzophenone**					
	EtOH	FP	500^a 405^a		‡Triplet ET to naphthalene, oxygen quenching; decay measured at 500 nm, lifetime = 25 μs in cyclohexane; "Michler's ketone"; τ_T = 20 μs; k_{et} = (9.9 ± 0.1) × 10^9 L mol^{-1} s^{-1}	777603
191.	**6,6′-Bis(dimethylamino)-3,3′-diethyl-2,2′-thiacarbocyanine iodide**					
	BuOH	FP	700^a			777036
192.	**1,7-Bis(dimethylamino)-1,4,6-heptatrien-3-one**					
	PrOH	FP	800		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
193.	**2,5-Bis[7-(dimethylamino)-2,4,6-heptatrienylidene]cyclopentanone**					
	Toluene	FP	850 730		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
194.	**1,9-Bis(dimethylamino)-1,3,6,8-nonatetraen-5-one**					
	PrOH	FP	750		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
	Toluene	FP	820 610		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
195.	**1,9-Bis(dimethylamino)-1,4,6,8-nonatetraen-3-one**					
	PrOH	FP	550		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
196.	***all-trans*-1,15-Bis(dimethylamino)-1,3,6,8,10,12,14-pentadecaheptaen-5-one**					
	Toluene	FP	630		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
197.	**2,6-Bis[5-(dimethylamino)-2,4-pentadienylidene]cyclohexanone**					
	Heptane	FP	886^a 782^a 619^a		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
	PrOH	FP	950 680		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
	Toluene	FP	910 640		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
198.	**2,5-Bis[5-(dimethylamino)-2,4-pentadienylidene]cyclopentanone**					
	Toluene	FP	900 635		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
199.	**2,6-Bis[3-(dimethylamino)-2-propenylidene]cyclohexanone**					
	PrOH	FP	800		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
	Toluene	FP	750 600		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
200.	**4,4′-Bis(dimethylamino)thiobenzophenone**					
	Benzene	LP/RA	490 ± 5 335 ± 5	7200 ± 1400 14400 ± 2900	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 7630 L mol^{-1} cm^{-1}), taking $\Phi_T = 0.4$ at 337 nm excitation and taking $\Phi_T = 1$ for benzophenone; $\tau_T = 1.3 \pm 0.1$ μs	84A221
201.	***all-trans*-1,13-Bis(dimethylamino)-1,3,5,8,10,12-tridecahexaen-7-one**					
	Toluene	FP	900 670		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
202.	***all-trans*-1,13-Bis(dimethylamino)-1,3,6,8,10,12-tridecahexaen-5-one**					
	PrOH	FP	740		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
	Toluene	FP	600		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
203.	***all-trans*-1,11-Bis(dimethylamino)-1,3,6,8,10-undecapentaen-5-one**					
	PrOH	FP	870		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
	Toluene	FP	680		‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
204.	**Bis(dimethylformamide)phthalocyaninatoruthenium(II)**					
	Acetonitrile	LP	527^a		Another maximum at 359^a was near a SD region; τ_T = 0.165 μs	83E262
205.	**Bis(dimethylsulfoxide)phthalocyaninatoruthenium(II)**					
	Acetonitrile	LP	485^a		Another maximum at 352^a nm was near a SD region	83E262

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
206.	**Bis(dimethylsulfoxide)phthalocyaninatoruthenium(II)/1,4-Dinitrobenzene**				
	Acetonitrile	LP	525^a	Triplet exciplex; another maximum at 409^a nm was near a SD region	83E262
207.	**1,4-Bis(methylamino)anthraquinone**				
	Benzene	PR-ET/ET	550, 20000	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene assuming ground state dimerization; τ_T = 5.9 μs; E_T = 97 - 151 kJ mol^{-1}; k_{et} = 8.1 × 10^9 L mol^{-1} s^{-1}	761122
208.	**1,1-Bis(1-naphthyl)ethylene**				
	Benzene	LP-ET	444^a	‡Triplet ET from xanthone and oxygen quenching; τ_T = 0.22 μs	84B007
209.	***trans*-1,2-Bis(1-naphthyl)ethylene**				
	Benzene	LP/ET	530 ± 3, 30000 ± 4500	‡Quenching by oxygen, a nitroxide free radical, and azulene; ϵ relative to fluorenone in benzene (ϵ_{435} = 6000 L mol^{-1} cm^{-1}); τ_T = 0.91 ± 0.14 μs; k_{et} = (7.4 ± 1.1) × 10^9 L mol^{-1} s^{-1}	84E237
	Bromobenzene	LP	535 ± 3	τ_T = 0.67 ± 0.10 μs	84E237
210.	***trans*-1,2-Bis(2-naphthyl)ethylene**				
	Benzene	LP/ET	430 ± 3, 20000 ± 3000	‡Quenching by oxygen, a nitroxide free radical, and azulene; ϵ relative to fluorenone in benzene (ϵ_{435} = 6000 L mol^{-1} cm^{-1}); τ_T = 0.21 ± 0.03 μs; k_{et} = (7.7 ± 1.2) × 10^9 L mol^{-1} s^{-1}	84E237
	Bromobenzene	LP	435 ± 3	τ_T = 0.17 ± 0.03 μs	84E237
211.	**9,10-Bis(phenylethynyl)anthracene**				
	Acetonitrile	LP-ET	~480^a	‡Triplet ET from benzophenone; delay 5 μs	82E509
212.	***rac*-Bis[1-(1-pyrenyl)ethyl]ether**				
	Hexane	LP	513^a 479^a 415 390	Most intense peak at 415 nm	83B137
213.	**Bonellin**				
	EtOH (298 K)	LP/TD	625^a, 40000^a 443^b, 9500 ± 500 390^a, 10000^a	‡Triplet ET from anthracene, oxygen quenching (1.7 × 10^8 L mol^{-1} s^{-1}); τ_T = 430 ± 50 μs; E_T = 180 ± 20 kJ mol^{-1}; k_{et} = (2.0 ± 1.0) × 10^8 L mol^{-1} s^{-1}	80E593
214.	**Brilliant Sulfaflavine anion**				
	EPA	CWL/SD	575, 1800	Glass was 1:1 mixture of standard EPA and EtOH	73E346
215.	**9-Bromoanthracene**				
	Acetonitrile	LP	424^a 400^a	‡Oxygen quenching; 424 nm peak was the more intense; τ_T = 19.5 μs	84B110
	Benzene	PR/ET	430, 48000	ϵ relative to naphthalene in benzene (ϵ_{max} = 17500 L mol^{-1} cm^{-1})	690087
	Benzene	PR/ET	430, 47700	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 10300 L mol^{-1} cm^{-1})	690087
	Cyclohexane	FP	425	τ_T = 43 μs	62E009
	Cyclohexane	PR	425		690087
	Cyclohexane	FP/SD	423.5, 66500 ± 3250	ϵ method assumes linear variation of triplet spectrum in SD region	767147
	Dioxane	PR	425		690087
	EPA (77 K)	LP	430 405	τ_T = 200 μs	84B110
	Liquid paraffin	FP	419	Viscosity of solvent was 0.167 N·s/m^2; τ_T = 110 μs	62E009
216.	**4-Bromobiphenyl**				
	Toluene	PR	390	‡Oxygen quenching; τ_T = ~4 μs	80A235

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
217.	**4-Bromo-1-cyanoisoquinoline-*N*-oxide**					
	Cyclohexane	FP	427		$\tau_T = 1.7$ μs	727105
	EtOH	FP	420		$\tau_T = 4.0$ μs	727105
218.	***N*-[2-[(2-Bromo-6-cyano-4-nitrophenyl)azo]-5-[(2-cyanoethyl)(2-hydroxyethyl)amino]-4-methoxyphenyl]acetamide**					
	2-MTHF (103 K)	LP	680 410		Shoulder at 780 nm; triplet not observable above 211 K; below 116 K lifetime constant; $\tau_T = 130$ μs	80B101
	Dibutyl terephthalate	LP	685 400		‡Possibilities other than triplet character excluded; $\tau_T = 0.023$ μs	80B101
	Glycerol triacetate	LP	685 400		Shoulder at 780 nm; $\tau_T = 0.014$ μs	80B101
	Glycerol triacetate (203 K)	LP	685 400		Shoulder at 790 nm; below 221 K lifetime constant; $\tau_T = 83$ μs	80B101
219.	***N*-[2-[(2-Bromo-4,6-dinitrophenyl)azo]-5-[(2-cyanoethyl)(2-hydroxyethyl)amino]-4-methoxyphenyl]acetamide**					
	1,3-Dibromobenzene	LP	700 390		Shoulder at 780 nm; $\tau_T = 0.010$ μs	80B101
	1-Phenylethanol	LP	700 400		Shoulder at 780 nm; $\tau_T = 0.012$ μs	80B101
	2-MTHF (103 K)	LP	700 400		‡Oxygen quenching; triplet virtually not observable above ~273 K; below 111 K lifetime constant; $\tau_T = 100$ μs	80B101
	2-MTHF	LP	800-700		$\tau_T = \leqslant 0.008$ μs	80B101
	2-PrOH	LP	800-700		$\tau_T = 0.012$ μs	80B101
	Biphenyl/Diphenyl ether	LP	700 420		Shoulder at 800 nm; solvent was 1:3 biphenyl to diphenyl ether; $\tau_T = 0.008$ μs	80B101
	Dibutyl terephthalate	LP	700 400		‡Possibilities other than triplet character of the transient excluded; shoulder at 750 nm; $\tau_T = 0.026$ μs	80B101
	Glycerol triacetate	LP	695 400		Shoulder at 770 nm; $\tau_T = 0.012$ μs	80B101
	Glycerol triacetate (203 K)	LP	720		Below 220 K lifetime constant; $\tau_T = 100$ μs	80B101
	PMMA	LP	680		Shoulder at 740 nm	80B101
	o-Terphenyl/Diphenyl ether	LP	695 400		Shoulder at 780 nm; solvent was 1:1 *o*-terphenyl to diphenyl ether; $\tau_T = 0.010$ μs	80B101
220.	**4-[(2-Bromo-4,6-dinitrophenyl)azo]-*N*,*N*-dimethylbenzenamine**					
	2-MTHF (103 K)	LP	700 410		Lifetime measured at 138 K; triplet not observable above 138 K; below 100 K lifetime (500 μs) constant; $\tau_T = 0.014$ μs	80B101
	Glycerol triacetate (203 K)	LP	700		Lifetime measured at 247 K; triplet not observable above 247 K; $\tau_T = 0.020$ μs	80B101
221.	**4-Bromoisoquinoline-*N*-oxide**					
	Water	FP	382		$\tau_T = 0.96$ μs	727105
222.	**Bromo(methanol)(phthalocyaninato)rhodium(III)**					
	Acetonitrile/2-PrOH	LP/SD	640^b 590^b	900 22000	Solvent was 2.6 mol L^{-1} 2-PrOH	83F405
223.	**1-(Bromomethyl)naphthalene**					
	?	LP	426		Solvent was either MeOH or cyclohexane	84A222
224.	**1-Bromonaphthalene**					
	CTAB	LP/TD	425 400^a	11500 7000^a	Aqueous micelle; ϵ method corrects for TT-annihilation in micellar environment and gives upper limit; shoulder at 370 nm; $\tau_T = 50$ μs	81N070
	Cyclohexane	FP	424		$\tau_T = 270$ μs	62E009
	Cyclohexane (77 K)	PS	414.5 392.0		Relative intensities (2:1)	69E211
	Et_2O/Pentane (77 K)	PS	415.5 393		Relative intensities (2:1)	69E211
	Ethylene glycol	FP	420 398 378		Relative intensities (100:60:25); $\tau_T = 830 \pm 140$ μs	61E005

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Hexane	FP	419 398 375		Relative intensities (100:55:20); $\tau_T = 83 \pm 14$ μs	61E005
	Hexane	LP	425		Delay 500 ps	82E303
	Toluene	PR	420		‡Oxygen quenching; $\tau_T = \sim 9$ μs	80A235
225.	**2-Bromonaphthalene**					
	Cyclohexane	FP	425		$\tau_T = 150$ μs	62E009
	Cyclohexane (77 K)	PS	417 390 370		Relative intensities (100:55:10)	69E211
	EPA (77 K)	PS	421.8		‡Phosphorescence decay	51E001
	EPA (77 K)	FP	423 398			55E002
	Hexane	FP	417.5 392.9			54E001
	Hexane	FP	417.5 394 372		Relative intensities (100:61:29)	58E001
	Liquid paraffin	FP	423		Viscosity of solvent was 0.167 N·s/m^2; $\tau_T = 2300$ μs	62E009
226.	**4-[(2-Bromo-4-nitrophenyl)azo]-*N*,*N*-dimethylbenzenamine**					
	2-MTHF (77 K)	LP	700 400		Triplet not observable above 125 K; below 106 K lifetime constant; $\tau_T = 100$ μs	80B101
	EPA (89 K)	LP	710 390			80B101
	EtOH/MeOH (113 K)	LP	700 390		Solvent was 4:1 EtOH to MeOH	80B101
	Glycerol triacetate (203 K)	LP	680 400		Lifetime measured at 247 K; triplet not observable above 247 K; $\tau_T = 0.014$ μs	80B101
	MCH/Toluene (113 K)	LP	700 390		Solvent was 1:1 MCH to toluene	80B101
	PMMA	LP	690			80B101
227.	**9-Bromophenanthrene**					
	Cyclohexane	FP	482.5		$\tau_T = 115$ μs	62E009
	Liquid paraffin	FP	482.5		Viscosity of solvent was 0.167 N·s/m^2; $\tau_T = 710$ μs	62E009
228.	**1-Bromopyrene**					
	EtOH (293 K)	LP	505^a 476^a		More intense absorption below 425 nm	697226
229.	***trans*-4-Bromostilbene**					
	2-MTHF (135 K)	LP	392 373 352		First peak most intense; $\tau_T = 0.02$ μs	79E378
	2-MTHF (135 K)	LP	392 373 352		Triplet absorption not observable above 135 K; reported lifetime constant below 104 K; $\tau_T = 480$ μs	79E640
	3-MP (88 K)	LP	393 376 355			79E640
	EPA (130 K)	LP	393 372 355		First peak most intense; $\tau_T = 0.02$ μs	79E378
	EPA (108 K)	LP	393 372 355		Triplet absorption not observable above 130 K; reported lifetime constant below 97 K; $\tau_T = 500$ μs	79E640
	EtOH (138 K)	LP	391 372 352		Relative intensities (4:3:1); triplet absorption not observable above 143 K; reported lifetime constant below 115 K; $\tau_T = 480$ μs	79E640
	EtOH (143 K)	LP	391 372 352		First peak most intense; $\tau_T = 0.1$ μs	79E378

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	EtOH/MeOH (103 K)	LP	392 372 352		Solvent was 4:1 EtOH to MeOH	79E640
	Glycerol (286 K)	LP	395 375 354		First peak most intense; $\tau_T = 0.03$ μs	79E378
	Glycerol (193 K)	LP	395 375 354		Relative intensities (4:3:1); triplet absorption not observable above 286 K; reported lifetime constant below 209 K; $\tau_T = 450$ μs	79E640
	Glycerol triacetate (233 K)	LP	390 370 352		Triplet absorption not observable above 243 K; reported lifetime constant below 207 K; $\tau_T = 440$ μs	79E640
	Glycerol triacetate (243 K)	LP	390 370 352		First peak most intense; $\tau_T = 0.03$ μs	79E378
	MCH/Isohexane (114 K)	LP	392 372 352		First peak most intense; $\tau_T = 0.3$ μs	79E378
	MCH/Isohexane (77 K)	LP	392 372 352		Solvent was 1:1 MCH to isohexane by volume; triplet absorption not observable above 114 K; reported lifetime constant below 100 K; $\tau_T = 450$ μs	79E640
230.	**2-Bromotriphenylene**					
	EtOH/MeOH (113 K)	FP/TD	430,	>8000	Solvent was 3:1 EtOH to MeOH; lower limit assumes total ground state depletion	67B004
231.	**2-Butanone**					
	Methylene chloride	LP	245		‡Phosphorescence decay and oxygen quenching; $\tau_T =$ 1.4 μs	84B051
232.	**Butyl benzoylformate**					
	Benzene (298 K)	LP	451^{a} 430^{a} 400^{a}		$\tau_T = 0.5$ μs	84A030
233.	**4-*tert*-Butyl-3,5-dinitroanisole**					
	CF_3CH_2OH	LP	441^{a}		‡Quenching by oxygen and tetramethyldiazetine dioxide; $\tau_T = 3.5$ μs	84E033
234.	**2-[1-(Butylimino)ethyl]-5-methylphenol**					
	Benzene (295 K)	LP	430^{a}		‡Oxygen quenching and triplet ET to compound by triplet donors	727374
235.	**2-*tert*-Butyl-4-methylindazole**					
	EtOH (103 K)	MOD/SD	409^{a},	8400^{a}	Shoulders at 388^{a} and 294^{a} nm; another maximum < 250 nm; $\tau_T = (9.1 \pm 0.8) \times 10^5$ μs	716244
	EtOH (178 K)	MOD/SD	409^{a},	7600^{a}	Shoulders at 393^{a} and 280^{a} nm; another maximum < 250 nm; $\tau_T = (1.9 \pm 0.3) \times 10^4$ μs	716244
236.	***N*-Butyl-5-nitro-2-furamide**					
	2-PrOH (298 K)	LP	505 ± 5		$\tau_T = 0.037$ μs	84A263
	Acetonitrile (298 K)	LP	498 ± 5		‡Quenching by oxygen and azulene; $\tau_T = 0.26$ μs	84A263
	CCl_4 (298 K)	LP	500 ± 5		$\tau_T = 0.052$ μs	84A263
	MeOH (298 K)	LP	515 ± 5		$\tau_T = 0.022$ μs	84A263
	Water (298 K)	LP	515 ± 5		$\tau_T = 0.019$ μs	84A263
237.	**1-Butynylbenzene**					
	Isopentane/2-PrOH (77 K)	PS	255^{a}		‡ESR; glass was 7:3 isopentane to 2-propanol by volume; "1-ethyl-2-phenylacetylene"; by assuming that radical formation occurs only from T* and that it is wavelength-independent, the author devise an ESR method that determines the shape of TTA even in the SD region	68B007

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
238.	**Butyraldehyde**					
	Pentane	LP	355 320		‡Triplet ET to 2,5-dimethyl-2,4-hexadiene; both peaks have the same decay and quenching behavior and are attributed to a single species; $\tau_T = 0.210$ μs; $k_{et} = (1.5 \pm 0.2) \times 10^{10}$ L mol^{-1} s^{-1}	81E442
239.	**9-Butyrylanthracene**					
	EPA (77 K)	FP	430		$\tau_T = 3.42 \times 10^4$ μs	82E338
240.	**Cadmium(II) tetrabenzoporphyrin**					
	Pyridine	FP	500 415			73E345
241.	**Cadmium(II) tetraphenylporphyrin**					
	MCH	FP/TD	490, 415,	57000 22000	‡Oxygen quenching; $\tau_T = 265$ μs	81E271
242.	**Caffeine**					
	Water	LP-ET	351		‡Triplet ET from acetone; $\tau_T = 4.5$ μs; pH 7.1; $k_{et} = 5.6 \times 10^9$ L mol^{-1} s^{-1}	82B045
243.	**Camphoroquinone**					
	2-PrOH	FP	1060 908 790 702 630 ~500 320 276		‡Triplet ET from benzophenone, triplet ET to anthracene, and oxygen quenching; another maximum <200 nm; delay 0 μs	697092
	Benzene	FP	1070 916 796 706 638 404 314		‡Triplet ET from benzophenone, triplet ET to anthracene, and oxygen quenching	697092
	CCl_4	FP	1068 916 796 705 638 590 500 316 280		‡Triplet ET from benzophenone, triplet ET to anthracene, and oxygen quenching; another maximum <220 nm	697092
244.	**Canthaxanthin**					
	?	FP-ET	541^a		‡Triplet ET from anthracene; it was not reported whether the solvent was hexane or benzene; lifetime was measured in hexane; $\tau_T = 7.1$ μs	733001
	Benzene	PR-ET	555		‡Triplet ET from naphthalene; $\tau_T = 3.8$ μs	80A143
245.	**Carbazole**					
	2-MTHF (77 K)	PS/ESR	433,	12200	‡ESR; only most intense visible peak reported; oscillator strength encompasses two electronic transitions; oscillator strength = 0.18	696115
	Benzene	FP	418^a			84F248
	Cyclohexane	FP/?	435^a, 400^a,	14000^a 12500^a	ϵ determination unspecified; $\tau_T = 167$ μs	77A178
	Cyclohexane	FP/ET	420,	14500	ϵ relative to naphthalene in cyclohexane ($\epsilon_{415} = 24500$ L mol^{-1} cm^{-1}); carbazyl radicals ($\epsilon_{600} = 7000$ L mol^{-1} cm^{-1}) also observed; $\tau_T = 170$ μs	78A368

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	Cyclohexane	LP	~620^a 420	‡Rises with fluorescence decay; relative intensities (1:8); shoulder at 400 nm; $S_n \leftarrow S_1$ absorption also recorded (λ_{620} = 20000 L mol^{-1} cm^{-1})	80E023
	EPA (77 K)	PS	428 406	‡Phosphorescence decay; $\tau_T = (8.0 \pm 0.2) \times 10^6$ μs	67E106
	EPA (77 K)	PS/KM	431^a, 14300 407^a, 11200^a	Shoulders at 506^a and 375^a nm; two electronic bands were assigned: the 1st was the shoulder at 506 nm with f = 0.06, and the 2nd started at 431 nm; ϵ-method assumed on basis of earlier work by authors; oscillator strength = 0.24	747347
	EtOH (77 K)	MOD/KM	425, 19000 ± 4700 406, 14000 ± 3500 318, 7000 ± 1700 305, 5700 ± 1400		737055
	EtOH	FP	639 ~480 425^a 405^a	Most intense peak at 425 nm	766421
	EtOH/Et$_2$O (77 K)	MOD/KM	425, 10100 ± 4000	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Hexane	FP	420	‡Oxygen and piperylene quenching	757573
	PMMA (77 K)	CWL	510^a 430^a 415^a 378^a	Most intense peak 430 nm	83Z042
246.	**3-Carbethoxypsoralen**				
	Benzene	PR/ET	450^b, 7500 400^a	‡Triplet ET from biphenyl, oxygen quenching (1.9 × 10^9 L mol^{-1} s^{-1}); ϵ relative to biphenyl in benzene (ϵ_{367} = 27100 L mol^{-1} cm^{-1}); τ_T = 20 μs	82E133
	Benzene	LP	407^a	‡Oxygen quenching and triplet ET from biphenyl	84B025
	EtOH	LP/ET	590^a 500^a 450^b, 6800 370^a	‡Triplet ET to retinol, oxygen quenching (2.7 × 10^9 L mol^{-1} s^{-1}); ϵ relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}) assuming ϵ independent of solvent; τ_T = 5.5 μs; $k_{et} = 9.6 \times 10^8$ L mol^{-1} s^{-1}	82E133
	EtOH	LP/ET	450^b, 5457	ϵ relative to retinol, but actual reference ϵ used was not specified; τ_T = 5.6 μs	83E324
	Water	LP/ELT	605^a 590^a 450^b, 3700 ± 900 400^a	‡Oxygen quenching (3.0 × 10^9 L mol^{-1} s^{-1}); ϵ relative to radical anion (ϵ_{600} = 2500 L mol^{-1} cm^{-1}) assuming electron transfer from tyrosine 100% efficient; τ_T = 17 μs	82E133
	Water	PR/ELT	605^a 590^a 450^b, 3150 400^a	‡Oxygen quenching (3.0 × 10^9 L mol^{-1} s^{-1}); ϵ relative to radical anion (ϵ_{600} = 2500 L mol^{-1} cm^{-1}); τ_T = 17 μs	82E133
	Water	LP/ELT	605^a 590^a 450^b, 3700 ± 900 400^a	‡Oxygen quenching (3.0 × 10^9 L mol^{-1} s^{-1}); ϵ relative to radical anion (ϵ_{400} = 2000 L mol^{-1} cm^{-1}) assuming electron transfer from tryptophan 100% efficient; τ_T = 17 μs	82E133
	Water	LP/TD	450^b, 2000	τ_T = 5 μs	83E324
	Water	LP	612^a 578^a 397^a	‡Oxygen quenching	84B025
247.	**Carbostyril**				
	EPA (77 K)	PS	427^a	Phosphorescence decay; shoulder at 465^a nm; $\tau_T = 9.6 \times 10^5$ μs	717171
	EtOH/Water	FP	451^a 430^a	Solvent was 7:3 EtOH to water; peaks were of almost equal intensity	737046
	Glycerol	FP	444^a	Shoulder at 488^a nm	717171
	Liquid paraffin (268 K)	FP	488^a 446^a	446 nm was the more intense peak	717171

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Water	FP	451ᵃ 431ᵃ	Shoulder at 476ᵃ nm; 451 nm was the more intense peak; τ_T = 17 μs	737046
248.	**Carbostyril, negative ion**				
	Water	FP	460ᵃ	Shoulders at 478ᵃ and 440ᵃ nm; τ_T = 30 μs; pH 14	737046
249.	**4-Carboxybenzophenone**				
	Water	LP/RA	535, 6600 525ᵇ, 6150	‡Phosphorescence decay; carboxylate anion form; ε relative to benzophenone in benzene (ϵ_{525} = 7630 L mol^{-1} cm^{-1}) assuming triplet yields of unity for both species; corresponding ketyl radical (ϵ_{570} = 5500 L mol^{-1} cm^{-1}) and radical anion (ϵ_{660} = 8000 L mol^{-1} cm^{-1}) also measured; lifetime limited by ground state quenching; τ_T = 5.0-6.7 μs; pH 7	81A314
250.	**11-*cis*-β-*apo*-14′-Carotenal**				
	Hexane (298 K)	LP/SD	470 ± 5, 90000 ± 10000	"11-*cis*-C_{22} aldehyde"	84B026
	MeOH	LP-ET	490	‡Triplet ET from anthracene	84B026
251.	**β-*apo*-14′-Carotenal**				
	Acetonitrile	PR/RF	490, 112000	"*all-trans*-C_{22} aldehyde"; ε relative to compound in cyclohexane (ϵ_{470} = 121000 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; τ_T = 11.9 μs	79E546
	Benzene	PR/RF	490, 119000	ε relative to compound in cyclohexane (ϵ_{470} = 121000 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; τ_T = 8.3 μs	79E546
	Benzene	LP	485		82F477
	CF_3CH_2OH	LP-ET	510	*‡Triplet ET from anthracene; τ_T = ~17 μs*	83E026
	Cyclohexane	PR/ET	470, 121000	ε relative to biphenyl in cyclohexane ($\epsilon_{361.3}$ = 42800 L mol^{-1} cm^{-1}); τ_T = 7.1 μs	79E546
	Cyclohexane	LP	473		82F477
	Cyclohexane	LP-ET	475	‡Triplet ET from anthracene; solution 0.08 mol L^{-1} in $(CF_3)_2CHOH$; H-bonded species shows as a shoulder around 510 nm; τ_T = 8 μs	83E026
	DFMeOH	LP-ET	560	‡Triplet ET from anthracene; τ_T = >40 μs	83E026
	Hexane	LP/SD	470, 127000 ± 19100	ε assumes triplet does not absorb where singlet depletion is followed; τ_T = 5 μs; E_T = ~148 kJ mol^{-1}	78E721
	MeOH	PR/RF	475, 149000ᶜ	ε relative to compound in cyclohexane (ϵ_{470} = 121000 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; τ_T = 10.3 μs	79E546
252.	**β-*apo*-8′-Carotenal**				
	?	FP-ET	517ᵃ	‡Triplet ET from anthracene; it was not reported whether the solvent was hexane or benzene; lifetime was measured in hexane; τ_T = 10 μs	733001
	Hexane	LP-ET/SD	520, 223000 ± 33500	‡Triplet ET from biphenyl; ε assumes triplet does not absorb where singlet depletion is followed; τ_T = 2.5 μs; E_T = ~122 kJ mol^{-1}	78E721
253.	**15,15′-*cis*-β-Carotene**				
	?	FP-ET	507ᵃ	‡Triplet ET from anthracene; it was not reported whether the solvent was hexane or benzene; lifetime was measured in hexane; shoulder at 499ᵃ nm; τ_T = 7.1 μs	733001
	Hexane	PR/ET	515, 250000 ± 37500	‡Triplet ET from biphenyl, ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; τ_T = 5.9 ± 0.6 μs; k_{et} = (2.0 ± 0.20) × 10^{10} L mol^{-1} s^{-1}	776412
254.	**β-Carotene**				
	Acetic acid	LP-ET	512	*‡Triplet ET from hematoporphyrin; τ_T = 9 μs*	81B115
	Benzene (296 K)	LP-ET	526	Triplet ET from chlorophyll *a*; oxygen quenching (3.6 × 10^9 L mol^{-1} s^{-1}); τ_T = 5.9 μs; k_{et} = 1.2 × 10^9 L mol^{-1} s^{-1}	73E347

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Benzene	LP-ET	520		‡Triplet ET from anthracene; $\tau_T = 8.0 \pm 0.5$ μs	767094
	Benzene	PR	540			761024
	CTAB/Triton X-100	LP	525 475		Surfactant ratio 1:2 CTAB to Triton X-100; mixed aqueous micelle; $\tau_T = 4$ μs	80N033
	Carbon disulfide (293 K)	LP	550		‡Triplet ET from chlorophyll *a*; $\tau_T = 15$ μs; $k_{et} = 4 \times 10^9$ L mol^{-1} s^{-1}	69N001
	Hexane (188 K)	FP-ET	522		‡Triplet ET from benz[*a*]anthracene; $\tau_T = 300$ μs	66E089
	Hexane (298 K)	FP-ET	514		‡Triplet ET from chlorophyll *a*, tetracene, benz[*a*]anthracene, and anthracene; the data presented is for anthracene; $\tau_T = 70$ μs; $k_{et} = 1.1 \times 10^{10}$ L mol^{-1} s^{-1}	66E089
	Hexane (293 K)	LP	515		‡Triplet ET from chlorophyll *a*	69N001
	Hexane	PR/ET	515	170000 ± 40000	ϵ relative to naphthalene in cyclohexane ($\epsilon_{412.5} = 22600$ L mol^{-1} cm^{-1}), exact ref. used by author not stated but surmised; $\tau_T = 9$ μs	703001
	Hexane	PR/SD	515	230000	$\tau_T = 9$ μs	703001
	Hexane	PR/ET	515 482^a	130000 ± 10000	‡Triplet ET from naphthalene and oxygen quenching; shoulder at 453^a nm; ϵ relative to naphthalene in cyclohexane ($\epsilon_{415} = 24500$ L mol^{-1} cm^{-1}), except authors used 412.5 nm as reference λ; $\tau_T = 9$ μs; $k_{et} = 1.5 \times 10^{10}$ L mol^{-1} s^{-1}	713035
	Hexane	PR/ET	515	242000 ± 36300	‡Triplet ET from biphenyl; ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; $\tau_T = 5.9 \pm 0.6$ μs; $k_{et} = (1.8 \pm 0.18) \times 10^{10}$ L mol^{-1} s^{-1}	776412
255.	**ζ-Carotene**					
	Cyclohexane	PR/ET	445	81000	‡Triplet energy transfer from biphenyl; ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}); $\tau_T = 23$ μs; $E_T = <123$ kJ mol^{-1}; $k_{et} = 1.4 \times 10^{10}$ L mol^{-1} s^{-1}	761035
256.	**β-*apo*-8′-Carotenoic acid, methyl ester**					
	?	FP-ET	507^a		‡Triplet ET from anthracene; it was not reported whether the solvent was hexane or benzene; lifetime was measured in hexane; shoulder at 497^a nm; $\tau_T = 8.3$ μs	733001
257.	**4-(β-*apo*-7′-Carotenyl)benzyl pyropheophorbide**					
	Toluene	LP	~540		$\tau_T = 4.63$ μs	82B094
258.	**Chalcone**					
	Heptane	LP	430 ± 15		"1,3-Diphenyl-2-propen-1-one"; $\tau_T = 0.013$ μs	83E347
259.	**Chloranil**					
	1,2-Dichloroethane	LP/RA	510 370	7200 ± 1300 4700^a	‡Oxygen quenching; lifetime measured for the 510 nm band; ϵ relative to benzophenone in benzene ($\epsilon_{532.5} = 7630$ L mol^{-1} cm^{-1}) and assuming Φ_T for chloranil is unity; $\tau_T = 5.6$ μs	776335
	1,4-Dioxane	LP/RA	515	5800 ± 100	ϵ relative to benzophenone in benzene ($\epsilon_{532.5} = 7600$ L mol^{-1} cm^{-1}) assuming $\Phi_T = 1.0$ for chloranil in 1,4-dioxane; subsidiary peak at 740 nm due to complexation with solvent; $\tau_T = 3.4$ μs	79A178
	Acetone	FP	520 503 471			727069
	Acetonitrile	FP	510 487 479 372			727069
	Acetonitrile	LP/RA	510	7700 ± 300	ϵ relative to benzophenone in benzene ($\epsilon_{532.5} = 7630$ L mol^{-1} cm^{-1}) assuming $\Phi_T = 1$ for chloranil in acetonitrile; ϵ_{ref} assumed from earlier work	78A195
	Benzene	FP	516			727069

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Butyronitrile	LP/RA	510 480 380	7570	‡Oxygen quenching; ϵ relative to the chloranil radical anion in acetonitrile (ϵ_{max} = 9700 L mol^{-1} cm^{-1}); other peaks of roughly equal intensity at 480 and 380 nm; τ_T = 6.3 μs	79B061
	Cyclohexane	LP	500		τ_T = 2.0 ± 0.3 μs	697272
	Cyclohexane	FP	539 507 495 474			727069
	Dioxane	LP/RA	515	5800 ± 300	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 7630 L mol^{-1} cm^{-1}) assuming Φ_T = 1 for chloranil in dioxane; ϵ_{ref} assumed from earlier work	78A195
	EtOH	LP	500		‡Oxygen and anthracene quenching; τ_T = 1.2 μs	697272
	MeOH	FP	~500			727069
	THF	FP	~500			727069
	Trichlorotrifluoroethane	FP	522 507 497 473 410 379		‡Oxygen quenching; τ_T = 30 μs	727069
260.	**Chloranil/Triphenylamine**					
	Benzene/MeOH (293 K)	LP	650 550		650 nm band was the more intense; solvent was 19:1 benzene to MeOH; τ_T = 0.04 μs	81E715
	Benzene (293 K)	LP	650 550		650 nm band was the more intense; τ_T = 0.067 μs	81E715
261.	**Chloroaluminum phthalocyanine**					
	Dimethylacetamide-/Water	LP/SD	490^b	26600	Solvent was 7:3 dimethylacetamide to water	83E088
	Dimethylsulfoxide/Water	LP/SD	490^b	26600	Solvent was 8:2 dimethylsulfoxide to water	83E088
262.	**1-Chloroanthracene**					
	Benzene	PR/ET	437.5	60900	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 10300 L mol^{-1} cm^{-1})	690087
	Benzene	PR/ET	437.5	66500	ϵ relative to naphthalene in benzene (ϵ_{max} = 17500 L mol^{-1} cm^{-1})	690087
	Cyclohexane	FP	425		τ_T = 670 μs	62E009
	Cyclohexane	PR	430			690087
	Dioxane	PR	432.5			690087
	Hexane	FP	430.7 407.5			54E001
	Hexane	FP	431 407.5		Relative intensities (100:25)	58E001
	Liquid paraffin	FP	419		Viscosity of solvent was 0.167 N·s/m^2; τ_T = 4200 μs	62E009
263.	**1-Chloroanthraquinone**					
	EPA (77 K)	LP	480^a 375^a		‡Phosphorescence decay; delay 500 ns; 375 nm was the more intense peak; τ_T = 170 ± 10 μs	83E016
	EtOH	LP	380^a		Delay 50 ns	84A253
	Toluene	LP	495^a 385^a		‡Phosphorescence decay in EPA at 77 K; delay 300 ns; 385 nm was more intense peak	83E016
264.	**2-Chloroanthraquinone**					
	EPA (77 K)	FP	376^a		‡Phosphorescence decay; τ_T = 3400 μs	83E016
	Toluene	LP	381^a		‡Phosphorescence decay in EPA at 77 K; delay 300 ns	83E016
265.	**Chlorobenzene**					
	Cyclohexane	LP	295^a		‡Triplet ET to piperylene, oxygen quenching (4.5 × 10^9 L mol^{-1} s^{-1}); 400 ns delay; τ_T = 0.48 μs	707561
	Cyclohexane	LP/RA	300	6250 ± 300	ϵ relative to naphthalene in cyclohexane (ϵ_{414} = 24500 L mol^{-1} cm^{-1}), taking 0.64 for Φ_T of chlorobenzene and 0.75 for naphthalene; τ_T = 1.6 ± 0.1 μs	84E529

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
266.	**4-Chlorobenzophenone**				
	Acetonitrile/Water	LP/ET	535, 7000 320, 12800	Solvent was 9:1 acetonitrile to water; ϵ relative to 1-methylnaphthalene in acetonitrile/water (ϵ_{415} = 11200 L mol^{-1} cm^{-1})	84B033
267.	**(2′-Chlorobenzoyl)amino-2-Δ^2-thiazoline**				
	Cyclohexane (293 K)	FP/RA	557, 11600	‡Triplet ET to biacetyl, oxygen quenching; ϵ relative to naphthalene in cyclohexane (ϵ_{414} = 24500 L mol^{-1} cm^{-1}); τ_T = 2000 μs	82E373
268.	**(4′-Chlorobenzoyl)amino-2-Δ^2-thiazoline**				
	Cyclohexane (293 K)	FP/RA	563, 16900	‡Triplet ET to biacetyl, oxygen quenching; ϵ relative to naphthalene in cyclohexane (ϵ_{414} = 24500 L mol^{-1} cm^{-1}); τ_T = 2000 μs	82E373
269.	**4-Chloro-6-[4-(diethylamino)phenyl]-*N*,*N*-dimethyl-1,3,5-triazin-2-amine**				
	EPA (77 K)	PS	485	‡Phosphorescence decay; τ_T = 4.2 × 10^6 μs	83E427
	PMMA (293 K)	PS	490		83E427
270.	***N*-[2-[(2-Chloro-4,6-dinitrophenyl)azo]-5-[(2-cyanoethyl)(2-hydroxyethyl)amino]-4-methoxyphenyl]acetamide**				
	2-MTHF (108 K)	LP	690 410	Shoulder at 780 nm; lifetime measured at 189 K; triplet not observable above 189 K; below 100 K lifetime (1000 μs) constant; τ_T = 0.091 μs	80B101
	Dibutyl terephthalate	LP	690 400	Shoulder at 770 nm; τ_T = 0.028 μs	80B101
	Glycerol triacetate (203 K)	LP	690	Shoulder at 780 nm; below 216 K lifetime constant; τ_T = 500 μs	80B101
	Glycerol triacetate	LP	695 400	Shoulder at 780 nm; τ_T = 0.020 μs	80B101
271.	**3-Chloro-2,6-diphenyl-1,4-benzoquinone/4-Methoxy-*N*,*N*-dimethylaniline**				
	Benzene (293 K)	LP	560 460	560 nm peak was the more intense; τ_T = 0.083 μs	81E715
	Benzene/MeOH (293 K)	LP	460	Solvent was 19:1 benzene to MeOH; τ_T = 0.056 μs	81E715
272.	**3-Chloro-2,6-diphenyl-1,4-benzoquinone/Naphthalene**				
	Benzene (293 K)	LP	600	τ_T = 0.11 μs	81E715
	Benzene/MeOH (293 K)	LP	600	Solvent was 19:1 benzene to MeOH; τ_T = 0.091 μs	81E715
273.	**3-Chloro-2,6-diphenyl-1,4-benzoquinone/*N*,*N*,*N*′,*N*′-Tetramethyl-*p*-phenylenediamine**				
	Benzene (293 K)	LP	620 550	550 nm peak was the more intense	81E715
	Benzene/MeOH (293 K)	LP	620 570	570 nm peak was the more intense; solvent was 19:1 benzene to MeOH	81E715
274.	**3-Chloro-2,6-diphenyl-1,4-benzoquinone/1,2,3-Trimethoxybenzene**				
	Benzene/MeOH (293 K)	LP	460	Solvent was 19:1 benzene to MeOH; τ_T = 0.37 μs	81E715
	Benzene (293 K)	LP	560 460	560 nm peak was the more intense; τ_T = 0.63 μs	81E715
275.	**3-Chloro-2,6-diphenyl-1,4-benzoquinone/Triphenylamine**				
	Benzene (293 K)	LP	650 550	550 nm band was the more intense; τ_T = 0.16 μs	81E715
	Benzene/MeOH (293 K)	LP	650 550	650 nm band was the more intense; solvent was 19:1 benzene to MeOH; τ_T = 0.077 μs	81E715
276.	**Chloroindium(III) phthalocyanine**				
	Dimethylacetamide-/Water	LP/SD	490, 23000	Solvent was 7:3 dimethylacetamide to water	84A122
277.	**Chloro(methanol)(phthalocyaninato)rhodium(III)**				
	Acetonitrile/2-PrOH	LP/SD	640^b, 900 590^b, 22000	Solvent was 2.6 mol L^{-1} 2-PrOH	83F405

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
278.	**1-(Chloromethyl)naphthalene**					
	Cyclohexane	LP	422		‡Oxygen quenching	84A222
	MeOH	LP	422		‡Triplet ET from benzophenone and thioxanthane	84A222
279.	**1-Chloronaphthalene**					
	1-Chloronaphthalene	FP-ET	427 403		‡Triplet ET from benzophenone; 30 μs delay; evidence for triplet excimer at long wavelengths presented; relative intensities (3:2); τ_T = 20 μs	767159
	Cyclohexane	FP	420		τ_T = 280 μs	62E009
	Cyclohexane (77 K)	PS	413.5 319		Relative intensities (10:6)	69E211
	Cyclohexane	LP/ET	420	20700 ± 3000	‡Triplet ET from TMPD; ε relative to TMPD in cyclohexane (ϵ_{570} – 11900 L mol^{-1} cm^{-1})	757282
	Durene (77 K)	PS	424.5 400		Single crystal	67B008
	Et$_2$O/Pentane (77 K)	PS	419 395.5 374.5		Relative intensities (10:6:1)	69E211
	Hexane	FP-ET	424 397 380		‡Triplet ET from benzophenone; 30 μs delay; relative intensities (6:3:1)	767159
	Hexane (293 K)	LP	423^a		Delay 500 ps	82E303
	PMMA (294 K)	FP	524^a		Shoulder at 552 nm^a; τ_T = (1.4 ± 0.1) × 10^5 μs	69B004
280.	**2-Chloronaphthalene**					
	Cyclohexane	FP	420		τ_T = 180 μs	62E009
	Cyclohexane (77 K)	PS	414 411 392.5 390 370		Relative intensities (10:-:6:-:2)	69E211
	EPA (77 K)	PS	420.7 397		‡Phosphorescence decay	51E001
	PMMA (294 K)	FP	578^a 532^a		Shoulder at 637^a nm; τ_T = (2.5 ± 0.2) × 10^5 μs	69B004
281.	**3-Chloro-1-(2-naphthyl)-1-propanone**					
	Benzene	FP	425		τ_T = 220 μs	83P212
	CCl$_4$	FP	400		τ_T = 251 μs	83P212
282.	**1-(2-Chlorophenyl)naphthalene**					
	3-MP (77 K)	PS/ESR	495 465^a 433^a	9500 7100^a 3900^a	‡ESR; oscillator strength = 0.12	69B002
283.	**1-(4-Chlorophenyl)naphthalene**					
	3-MP (77 K)	PS/ESR	505 472^a 435^a	32500 15800^a 7400^a	‡ESR; oscillator strength = 0.29	69B002
284.	**Chlorophyll *a***					
	Acetone	LP/SD	460	56000		84R057
	Benzene	FP	460		Half-life = 150 ± 40 μs	55E003
	Cyclohexanol	FP	465 360		Half-life = 600 ± 180 μs	55E003
	Cyclohexanol (294 K)	LP	1150 750		Half-life = 500 μs	81B111
	Digitonin (293 K)	LP	670^a 510^a		‡Oxygen quenching (2.4 × 10^8 L mol^{-1} s^{-1}); aqueous micellar suspension; τ_T = 830 μs	69N001
	Et$_2$O	FP/SD	430^b	40000		67E027
	Heptane	FP/TD	480^b 470^b 460^b	17700 ± 3000 23000 ± 3000 24000 ± 4000	Solution contains pyridine; ε method assumed	77C001
	Heptane	FP/TD	480^b	17100 ± 3000	Solution contains ether; ε method assumed	77C001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	MeOH	FP	462 425(?) 390(?)	Half-life = 200 ± 50 μs	55E003
	MeOH	FP	550 450	550 nm maximum was judged to be of "doubtful significance" by the experimenters	58R002
	Polyvinylbutyral (77 K)	LP	472^a		80E867
	Polyvinylbutyral (77 K)	FP	460^a 425^a	Polymer film; $\tau_T = 2 \times 10^3$ μs	82E129
	Pyridine (298 K)	FP/SD	530, 17800 462, 32000	τ_T = 1500 μs	58R001
	Pyridine	LP/COM	540, 35000 460, 48000	Triplet concentration calculated by kinetic simulation; $S_n \leftarrow S_1$ spectrum also resolved (ϵ_{440} = 68000 L mol^{-1} cm^{-1}); ϵ_{460} corrected from text	79B037
	Pyridine	LP	450^a	τ_T = 70 μs	81F121
	SHS	LP	740^a 465	Aqueous microemulsion, droplet radius ~ 100 Å; difference spectrum only; τ_T = 800 μs	80N057
285.	**Chlorophyll *b***				
	3-MP	FP/SD	450^b, 26000		67E027
	Benzene	FP	482 440 420(?)	Half-life = 1300 ± 300 μs	55E003
	Benzene	FP	580 475 440	440 and 580 nm maxima were judged to be of "doubtful significance" by the experimenters	58R002
	Benzene	FP	480 430	430 nm maximum was judged to be of "doubtful significance" by the experimenters; benzene was wet	58R002
	Benzene	FP/SD	316^a, 36500^a	τ_T = 2500 μs	59B002
	Et$_2$O	FP/SD	450^b, 21000		67E027
	MeOH	FP	496 454 420(?) 390	Half-life = 100 ± 40 μs	55E003
	MeOH/Water	FP	~700 ~525 ~405	Solvent was 19:1 MeOH to water	55R001
	Pyridine (298 K)	FP/SD	605, 12100 550, 21500 485, 34700 445, 26000 380, 19700	τ_T = 3200 μs	58R001
286.	**Chlorophyll *a* dimer**				
	Heptane	FP/TD	480^b, 13500 ± 4000	Solution contains ether; ε method assumed	77C001
	Heptane	FP/TD	480^b, 17700 ± 3000 470^b, 21500 ± 4000 460^b, 25000 ± 4000	Solution contains pyridine; ε method assumed	77C001
287.	**Chlorophylline**				
	Water	FP	520 470	Sodium salt	65R023
288.	***cis*-4-Chlorostilbene**				
	EtOH (123 K)	LP	390 370 347	Triplet state absorption observed only after repetitive (~30) flashes	79E640
289.	***trans*-4-Chlorostilbene**				
	EPA (108 K)	LP	391 370 346	Triplet absorption not observable above 122 K; reported lifetime constant below 93 K; $\tau_T = 10^4$ μs	79E640
	EtOH (103 K)	LP	390 369 348	Triplet absorption not observable above 135 K; reported lifetime constant below 111 K; $\tau_T = 10^4$ μs	79E640

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Glycerol (197 K)	LP	395 376 355		Relative intensities (3:2:1); triplet absorption not observable above 275 K; reported lifetime constant below 202 K; τ_T = 5000 μs	79E640
290.	**2-Chlorothioxanthen-9-one**					
	Benzene	FP	650-670		‡Oxygen quenching (5.5 × 10^9 L mol^{-1} s^{-1}); τ_T = 61 μs	81A294
291.	**6-Chloro-1,3,3-trimethyl-6′-nitrospiro-(2,2′-indolin[2*H*-1]benzopyran)**					
	Toluene (298 K)	FP	450		‡Oxygen quenching, activationless decay; assigned to $\pi \rightarrow \pi^*$ transition in uncolored form	67B003
292.	**Chlorpromazine**					
	2-PrOH	LP	460		‡Triplet ET to β-carotene, oxygen quenching; peak at 510 nm assigned to dechlorinated radical; τ_T = 3.2 μs	767023
293.	**4-Chromanone**					
	Benzene	LP	~450^{a}		110 ps delay; τ_T = 0.3 μs; rise time of (50 ± 10) × 10^{-3} ns	81E222
	EPA (77 K)	FP	427^{a}		‡Phosphorescence decay	80E884
	EPA (77 K)	FP	430^{a}		‡Phosphorescence decay: τ_T = 93 × 10^3 μs	81E222
	EtOH	LP	557^{a} 442^{a}		‡Oxygen quenching; shoulder at 511^{a} nm; 442 nm peak more intense; delay 150 ns; τ_T = 0.406 μs	80E884
	EtOH	LP	560^{a} 510^{a} 450^{a}		150 ns delay; relative intensities (1:2:3); τ_T = 0.4 μs; rise time of (50 ± 10) × 10^{-3} ns	81E222
294.	**Chromone**					
	EPA (77 K)	FP	650^{a}		‡Phosphorescence decay; lifetime lengthens in polar glasses; τ_T = (35 ± 10) × 10^3 μs	81E222
295.	**Chrysene**					
	1-BuOH/Isopentane (77 K)	PS	583.0 540.5 406.0		A distinction between a 1:7 and a 3:7 glass was not made	63B001
	2-MTHF (77 K)	PS/ESR	585 461^{a} 418^{a}	48600 3900^{a} 6600^{a}	‡ESR; shoulders at 571^{a}, 543^{a}, and 495^{a} nm; the band was assigned as $^3A_g \leftarrow {}^3B_u$; oscillator strength = 0.40	68D211
	2-MTHF (77 K)	PS	586^{a} 460^{a} 419^{a}		Shoulders at 574^{a}, 545^{a}, and 496^{a} nm	69E210
	Benzene	PR	575			761024
	Cyclohexane	LP/ET	565	21600 ± 2000	‡Triplet ET to anthracene; ε relative to anthracene in cyclohexane ($\epsilon_{422.5}$ = 64700 L mol^{-1} cm^{-1})	757282
	EPA (77 K)	PS	584.1		‡Phosphorescence decay; 1st transition assigned as $^3L_a \rightarrow {}^3C_b$	51E001
	EPA (77 K)	PS	629 583.1 406 385		‡Phosphorescence decay; relative intensities (11:100:18:15); unresolved shoulders at 563 nm and 541 nm; τ_T = (2.6 ± 0.2) × 10^6 μs	54B001
	EPA (77 K)	PS	730 625		Weak bands in the red only studied	67B005
	EPA (77 K)	PS/SD	585	48000 ± 4800		68E105
	EPA (77 K)	PS/IV	585	36200	λ_{max} assumed from previous work; ε estimated by extrapolation to infinite excitation rate	69E212
	EPA (77 K)	PS	729.9 625.0 580.0 559.9 535.0 400.0 379.9		Relative intensities (6:3:100:60:30:12:10)	69E211
	EtOH (293 K)	FP	562.5			68E098
	EtOH	LP	560^{a}		1.8 μs delay; solution contains Ag ions	78E554

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm, ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	EtOH/Et$_2$O (77 K)	MOD/KM	580, 23100 ± 6900	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Hexane	FP	554.9		54E001
	Hexane	FP/SD	570, 8800 401, 1800 378, 1500	Bands were assigned to 2 electronic transitions; 570 nm band was assigned to the 1st electronic transition; oscillator strength = 0.15, 0.025	58E001
	Hexane (77 K)	PS	580.0 534.8 400.0	Relative intensities (100:30:12)	69E211
	Hexane (300 K)	MOD/SD	564^a, 23500^a 400^a, 1700^a 285, 26200^a 254, 25800^a	Shoulder at 517^a nm; in their later compilation [73E284], the authors normalize to ϵ_{585} = 48000 L mol^{-1} cm^{-1} which means all of their values reported here should be multiplied by a factor of about 2; τ_T = 710 ± 25 μs	69E208
	Polystyrene	PR	569^a	$G\epsilon_{569}$ = 6500^a L mol^{-1} cm^{-1} / (100 eV absorbed)	701073
	Water/*tert*-BuOH	FP	560^a	Solvent mixture contains "46%" *tert*-BuOH for solubility; pH ~6	767189
296.	**9-Cinnamoylanthracene**				
	EPA (77 K)	FP	430	"9-Anthryl styryl ketone"; $\tau_T = 3.43 \times 10^4$ μs	82E338
297.	**Copper(II) phthalocyanine**				
	1-Chloronaphthalene	LP/TD	480 470^b, 3600	‡Triplet ET to β-carotene; τ_T = 0.035 ± 0.005 μs; E_T = 150 ± 10 kJ mol^{-1}	78A378
298.	**Coproporphyrin III**				
	MeOH/Water	LP/TD	401^a, 144000^a	Solvent 9:1 MeOH to 7.4 phosphate buffer; shoulders at 373^a and 326^a nm	83E667
	Water	LP/TD	401^a, 86100^a 372^a, 95800^a	Phosphate buffer; pH 7.4	83E667
299.	**Coproporphyrin III, tetramethyl ester**				
	Benzene	LP/TD	440^b, 26000 401^a	‡Oxygen quenching (1.6 × 10^9 L mol^{-1} s^{-1}); τ_T = 240 μs	80E200
	Benzene	PR/ET	440^b, 27000 401^a	‡Oxygen quenching (1.6 × 10^9 L mol^{-1} s^{-1}); ϵ relative to biphenyl in benzene (ϵ_{360} = 27100 L mol^{-1} cm^{-1}); τ_T = 240 μs	80E200
300.	**Coproporphyrin I, tetramethyl ester**				
	Benzene	PR/ET	440^b, 26500 398^a 330^a	‡Oxygen quenching (1.8 × 10^9 L mol^{-1} s^{-1}); ϵ relative to biphenyl in benzene (ϵ_{360} = 27100 L mol^{-1} cm^{-1}); τ_T = 250 μs	80E200
	Benzene	LP/TD	440^b, 32000 398^a 330^a	‡Oxygen quenching (1.8 × 10^9 L mol^{-1} s^{-1}); τ_T = 250 μs	80E200
301.	**Coronene**				
	2-MTHF (77 K)	PS/ESR	484, 15800	‡ESR; only most intense visible peak reported; assignment $^3A_1 \leftarrow {}^3B_2$; oscillator strength = 0.23	696115
	?	FP/?	700^b, 900 460, 15000	Method and solvent unspecified	78A163
	Benzene	PR	480		761024
	Dioxane	LP	490	‡Rise time of transient was the same as the decay time of the singlet	68B006
	Dioxane	LP	525 480		70E288
	EtOH (293 K)	FP	478		68E098
	EtOH	LP	480^a	1.8 μs delay; solution contains Ag ions	78E554
	EtOH/Et$_2$O (77 K)	MOD/KM	460, 14300 ± 4300	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Hexane	FP	630.1 490.2 461.9	Band at 461.9 was later assigned as $S_n \leftarrow S_1$ by authors in [737463]	54E001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Hexane	FP/SD	524.5 480 461	330^{d} 680^{d} 1000^{d}	Band at 461 nm was assigned to a second electronic transition; band at 461 nm was later reassigned as $S_n \leftarrow S_1$ by authors in [737463]; oscillator strength = —, 0.02	58E001
	PMMA (296 K)	LP	480 390		‡Decay of singlet was roughly the same as the rise of the transient	686058
	PMMA	LP	525 480			70E288
	Polystyrene	PR	459^{a}		$G\epsilon_{459} = 7900^{a}$ L mol^{-1} cm^{-1} / (100 eV absorbed)	701073
	Toluene	LP	595 565 530 495		Delay 880 ns	737463
	Water/2-PrOH	FP	465^{a}		Solvent mixture contains "40%" 2-propanol for solubility; pH ~6	767189
302.	**Coronene-d_{12}**					
	PMMA (77 K)	PS/SD	637^{a} 588^{a} 549^{a} 483^{a} 398^{a}	10300^{a} 5100^{a} 5400^{a} 17500^{a} 13400^{a}	$\tau_T = 3.5 \times 10^5$ μs	69E216
	PMMA (296 K)	PS/SD	633^{a} 588^{a} 549^{a} 483^{a} 398^{a}	8600^{a} 5200^{a} 5400^{a} 16800^{a} 14600^{a}	$\tau_T = 2.0 \times 10^5$ μs	69E216
303.	**Coumarin**					
	Benzene	PR/ET	400	11000	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene ($\epsilon_{367} = 27100$ L mol^{-1} cm^{-1}); 20 ns delay; $\tau_T = 3.8$ μs; $k_{et} = 3.4 \times 10^9$ L mol^{-1} s^{-1}	79E282
	EPA (77 K)	PS	460.8 451 432.1 423 406.5 389^{a}		‡Phosphorescence decay; shoulders at 441^{a} and 413^{a} nm; most intense peaks were at 460.8, 432.1, and 406.5 nm; $\tau_T = (7 \pm 2) \times 10^5$ μs	71B001
	EPA	CWL	460^{a} 433^{a} 417^{a} 392^{a}		Shoulder at 449^{a} nm; glass, temperature unspecified	73E344
	Water	LP	400		0.1 μs delay; $\tau_T = 1.3$ μs	79E282
304.	***p*-Cresol**					
	Water	LP	255^{a}		‡Triplet ET to tryptophan; lifetime was measured at pH 7.5; there was a broad maximum between ~350 and ~420 nm; spectrum is the difference between spectra at 20 ns and 15 μs; $\tau_T = 3.4 \pm 0.2$ μs; pH 7.7	757161
305.	**α-Crocetin**					
	Water	LP/ET	470^{b} 445^{a}	73000 94800^{a}	‡Oxygen quenching; ϵ relative to psoralen in water ($\epsilon_{460} = 10000$ L mol^{-1} cm^{-1}); $\tau_T = 8$ μs; pH 8	83B068
306.	**Croconate Blue dianion**					
	EtOH	LP-ET/SD	590^{b}	25000	‡Triplet ET from 9,10-dibromoanthracene and oxygen quenching; $\tau_T = 69$ μs; $k_{et} = 4.5 \times 10^9$ L mol^{-1} s^{-1}	84N017
	Water	LP-ET/SD	585^{b}	20000	‡Triplet ET from 9,10-dibromoanthracene and oxygen quenching; $\tau_T = 32$ μs	84N017
307.	**Crystal Violet**					
	PMMA (193 K)	PS	640		Shoulder at 620 nm	59B001
	PMMA (77 K)	PS	1280 1210 1100 750 640 620			65B004

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	PMMA (77 K)	PS	1241^{a} 613^{a}		Relative intensities (3:20); shoulder at 532^{a} nm; solvent contains 2-chloroethanol	69B003
308.	**9-Cyanoanthracene**					
	Acetonitrile	FP	433		$\tau_T = 560\ \mu s$	737140
	Acetonitrile	LP	425		‡Oxygen quenching; intersystem crossing promoted by thioanisole	83E025
	Benzene	PR/ET	435,	10300	ϵ relative to naphthalene in benzene ($\epsilon_{max} = 17500$ L mol^{-1} cm^{-1})	690087
	Benzene	FP	440		$\tau_T = 530\ \mu s$	737140
	Cyclohexane	PR	425			690087
	Cyclohexane	FP	433		$\tau_T = 1700\ \mu s$	737140
	Dioxane	PR	432.5			690087
309.	**4-Cyanobiphenyl**					
	Toluene/EtOH (77 K)	MOD	404^{a}		Glass was 19:1 toluene to EtOH	719059
310.	**4′-Cyanochalcone**					
	Heptane	LP	360 ± 15		"4-(1-Oxo-3-phenyl-2-propenyl)benzonitrile"; $\tau_T = 0.020\ \mu s$	83E347
311.	***trans*-4-Cyano-4′-dimethylaminostilbene**					
	2-MTHF (133 K)	LP	~700 460			80F299
	Glycerol triacetate (198 K)	LP	~700 460			80F299
312.	***N*-[5-[(2-Cyanoethyl)(2-hydroxyethyl)amino]-2-[(2,4-dinitrophenyl)azo]-4-methoxyphenyl]acetamide**					
	2-MTHF (77 K)	LP	700 410		‡Oxygen quenching; triplet not observable above 153 K; below 117 K lifetime constant; $\tau_T = 1000\ \mu s$	80B101
	Dibutyl terephthalate	LP	~700		$\tau_T = \leqslant 0.012\ \mu s$	80B101
	Glycerol triacetate	LP	~700			80B101
	Glycerol triacetate (198 K)	LP	680 420		Lifetime measured at 268 K; triplet virtually not observable above 268 K; below 213 K lifetime constant; $\tau_T = 0.025\ \mu s$	80B101
	PMMA	LP	660			80B101
313.	***trans*-4-Cyano-4′-methoxystilbene**					
	2-MTHF (143 K)	LP	490 410		Triplet absorption not observable above 143 K; below 106 K lifetime (1 × 10^{4} μs) constant; $\tau_T = 3.3\ \mu s$	80F299
	EtOH (132 K)	LP	480 420		Triplet absorption not observable above 132 K; below 113 K lifetime (1.3 × 10^{4} μs) constant; lifetime measured at 132 K; $\tau_T = 5.0\ \mu s$	80F299
	Glycerol triacetate (198 K)	LP	450		No triplet observed at room temperature; $\tau_T = \sim 7000\ \mu s$	78B088
	Glycerol (198 K)	LP	490 420			80F299
	Glycerol triacetate (223 K)	LP	450		Triplet absorption not observable above 238 K; below 206 K lifetime (1 × 10^{4} μs) constant; lifetime measured at 238 K; $\tau_T = 2.0\ \mu s$	80F299
	PMMA (298 K)	LP	430			80F299
314.	**1-Cyanonaphthalene**					
	Cyclohexane (77 K)	PS	413 390			69E211
	Et$_2$O/Pentane (77 K)	PS	445 423.5 412 387			69E211
	MeOH	FP	440^{a}			736218
315.	**9-Cyano-10-nitroanthracene**					
	Benzene	LP	~460^{a}		Delay 3.0 μs	80E884
	EPA (77 K)	LP	430^{a}			84F385

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
316.	***trans*-4-Cyanostilbene**					
	2-MTHF (98 K)	LP	405		Triplet absorption not observable above 127 K; below 104 K lifetime constant; $\tau_T = 1 \times 10^4$ μs	80F299
	EtOH (118 K)	LP	400		Triplet absorption not observable above 138 K; below 110 K lifetime ($1.7 \times 10^4 \mu$s) constant; lifetime measured at 138 K; $\tau_T = 1.7$ μs	80F299
	Glycerol triacetate (198 K)	LP	405		Triplet absorption not observable above 239 K; below 210 K lifetime constant; $\tau_T = 1 \times 10^4$ μs	80F299
	PMMA (298 K)	LP	395			80F299
317.	**1,3-Cycloheptadiene**					
	Benzene	PR	310		$\tau_T = 0.39$ μs	82B057
318.	**2-Cyclohepten-1-one**					
	Cyclohexane	LP	270^a		‡Oxygen quenching; solvent uncertain; $\tau_T = 0.011$ μs	80B055
319.	**1-(1-Cyclohepten-1-yl)naphthalene**					
	Benzene	LP-ET	443^a 381^a		‡Triplet ET from xanthone and oxygen quenching; $\tau_T = 0.053$ μs	84B007
320.	**2-(1-Cyclohepten-1-yl)naphthalene**					
	Benzene	LP-ET	390^a		‡Triplet ET from xanthone and oxygen quenching (7.0×10^9 L mol^{-1} s^{-1}); $\tau_T = 0.04$ μs	84B090
321.	**1,3-Cyclohexadiene**					
	Benzene	LP-ET/TD	302.5,	2300 ± 300	‡Triplet ET from 2-fluorenyl phenyl ketone and other triplet sensitizers; ϵ assumes ET proceeds with unit efficiency; $\tau_T = 30$ μs; $E_T = \sim 220$ kJ mol^{-1}	80B021
	Benzene	PR	310		$\tau_T = 5.2$ μs	82B057
322.	**2-Cyclohexen-1-one**					
	Cyclohexane	LP/RA	270^b, 265^a	$\geqslant 2100$	‡Oxygen quenching (5×10^9 L mol^{-1} s^{-1}); solvent uncertain; ϵ relative to benzophenone in benzene ($\epsilon_{535} = 7600$ L mol^{-1} cm^{-1}, $\Phi_T = 1$); ϵ is lower limit since $\Phi_T \leqslant 1$; $\tau_T = 0.023$ μs	80B055
323.	**1-(1-Cyclohexen-1-yl)naphthalene**					
	Benzene	LP-ET	442^a		‡Triplet ET from xanthone and oxygen quenching; $\tau_T = 2$ μs	84B007
324.	**1,3-Cyclooctadiene**					
	Benzene	PR	315		$\tau_T = 0.14$ μs	82B057
325.	**1-(1-Cycloocten-1-yl)naphthalene**					
	Benzene	LP-ET	446^a 381^a		‡Triplet ET from xanthone and oxygen quenching; $\tau_T = 0.12$ μs	84B007
326.	**Cyclopentadiene**					
	Benzene	PR	300		$\tau_T = 1.6$ μs	82B057
327.	**2-Cyclopentenone**					
	Cyclohexane	LP/RA	270^b, 260^a	$\geqslant 1900$	‡Oxygen quenching (5×10^9 L mol^{-1} s^{-1}); solvent uncertain; ϵ relative to benzophenone in benzene ($\epsilon_{535} = 7600$ L mol^{-1} cm^{-1}, $\Phi_T = 1$); ϵ is lower limit since $\Phi_T \leqslant 1$; $\tau_T = 0.030$ μs	80B055
328.	**1-(1-Cyclopenten-1-yl)naphthalene**					
	Benzene	LP-ET	441^a		‡Triplet ET from xanthone and oxygen quenching; $\tau_T = 3.6$ μs	84B007
329.	**2-(1-Cyclopenten-1-yl)naphthalene**					
	Benzene	LP-ET	581^a 394^a		‡Triplet ET from xanthone and oxygen quenching (3.3×10^9 L mol^{-1} s^{-1}); 394 nm peak was the more intense	84B090

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
330.	**1,2,3,4,5,6,7,8,9,10-Decahydro-1,1,5,5,6,6,10,10-octamethylcyclobuta[1,2:3,4]dicycloheptene**					
	Benzene	LP-ET	< 300		‡Triplet ET from 2,3-dimethyl-1,4-naphthoquinone; τ_T = 0.24 μs; E_T = > 120 kJ mol^{-1}; $k_{et} = 7 \times 10^9$ L mol^{-1} s^{-1}	81E098
331.	**Decapreno-β-carotene**					
	Benzene (296 K)	LP-ET	595		Triplet ET from chlorophyll *a*; oxygen quenching (7.0 × 10^9 L mol^{-1} s^{-1}); τ_T = 3.2 μs; $k_{et} = 1.8 \times 10^9$ L mol^{-1} s^{-1}	73E347
	Benzene	PR-ET	590		‡Triplet ET from naphthalene; τ_T = 6.5 μs	80A143
332.	**Deoxybenzoin**					
	Benzene	LP	500 $<390^a$		‡Oxygen quenching (~2 × 10^9 L mol^{-1} s^{-1}); τ_T = >0.24 μs	79A289
	Benzene	LP	450 315		‡Oxygen quenching (> 10^9 L mol^{-1} s^{-1}); relative intensities (1:4); τ_T = 0.77 μs	79A028
	MeOH	LP	495^a		Oxygen quenching (2.4 × 10^9 L mol^{-1} s^{-1}); τ_T = 0.14 μs	77E797
333.	**Deuteroporphyrin, dimethyl ester**					
	Benzene	LP/TD	440^b 410^a	22000	‡Oxygen quenching (2.3 × 10^9 L mol^{-1} s^{-1}); τ_T = 220 μs	80E200
	Benzene	PR/ET	440^b 410^a	28000	‡Oxygen quenching (2.3 × 10^9 L mol^{-1} s^{-1}); ε relative to biphenyl in benzene (ϵ_{360} = 27100 L mol^{-1} cm^{-1}); τ_T = 210 μs	80E200
334.	***trans-N,N′*-Diacetylindigo**					
	EPA (83 K)	LP	575^a 365^a		Relative intensities (2:1); data corrected from paper (H. Goerner, private communication, 1985); τ_T = 80 μs	79E543
	EPA (283 K)	LP	580^a 375^a		Relative intensities (2:1); no transient spectrum observed at RT; data corrected from paper (H. Goerner, private communication, 1985); τ_T = 0.4 μs	79E543
	Glycerol triacetate (203 K)	LP	580^a 390^a		Data corrected from paper (H. Goerner, private communication, 1985)	79E543
335.	**1,4-Diaminoanthraquinone**					
	Benzene	PR-ET/ET	575	22000	‡Triplet ET from biphenyl; ε relative to biphenyl in benzene assuming ground state dimerization; τ_T = 4.5 μs; E_T = 123 - 151 kJ mol^{-1}; $k_{et} = 2.2 \times 10^9$ L mol^{-1} s^{-1}	761122
336.	**3,6-Diaminophthalimide**					
	EtOH	FP	545		Lifetime limited by aeration; τ_T = 0.560 μs	757522
337.	**5,5′-Di-*tert*-amylthioindigo**					
	2-MTHF (93 K)	LP	595 390		τ_T = 120 μs	79E543
	2-MTHF	LP	590 385		τ_T = 0.25 μs	79E543
	EPA (77 K)	FP	590		τ_T = 154 μs	767582
	EPA (93 K)	LP	580 370		τ_T = 53 μs	79E543
	EPA (283 K)	LP	590 370		Φ_T strongly temperature dependent in this solvent; τ_T = 0.40 μs	79E543
	Glycerol triacetate (203 K)	LP	605 390		Relative intensities (5:4); τ_T = 33 μs	79E543
	Glycerol triacetate	LP	600 385		Relative intensities (5:4); τ_T = 0.36 μs	79E543
	MCH	LP	595 380		τ_T = 0.25 μs	79E543
	PMMA	LP	590 390			79E543

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
338.	**Dibenz[*a*,*j*]acridine/PrOH**					
	3-MP/PrOH (77 K)	PS	550		Glass was 99:1 3-MP to PrOH; which isomer of PrOH was not specified; no T-T absorption in 3-MP; "1,2,7,8-dibenzacridine"	706135
339.	**Dibenz[*a*,*h*]acridine**					
	3-MP (77 K)	PS	585		"1,2,5,6-Dibenzacridine"	706135
			545			
			520			
340.	**Dibenz[*a*,*h*]anthracene/Chloranil**					
	PMMA	PS	668^{a}		Most intense peak at 580 nm	766652
			626^{a}			
			580^{a}			
			540^{a}			
			508^{a}			
			495^{a}			
			470^{a}			
			455^{a}			
			440^{a}			
			424^{a}			
341.	**Dibenz[*a*,*h*]anthracene**					
	2-MTHF (77 K)	PS/ESR	587	25000	‡ESR; only most intense visible peak reported; assignment ${}^3A_g \leftarrow {}^3B_u$; oscillator strength encompasses two electronic transitions; "1,2,5,6-dibenzanthracene"; oscillator strength = 0.25	696115
	Benzonitrile	LP/RF	583^{a}	10500 ± 700	ϵ relative to compound in toluene (ϵ_{584} = 13000 L mol^{-1} cm^{-1})	83F075
			548^{a}	9400^{a}		
			509^{a}	7900^{a}		
			476^{a}	6000^{a}		
			445^{a}	5000^{a}		
	EPA (77 K)	PS	585		‡Phosphorescence decay	51E001
			546			
			506			
			495			
	EPA (77 K)	PS	584.8		‡Phosphorescence decay; relative intensities (100:67:39:40:30:24); τ_T = (1.4 ± 0.1) × 10^6 μs	54B001
			547.1			
			508			
			500			
			472			
			428			
	EPA (77 K)	PS/SD	585	35000 ± 3500		68E105
	EPA (77 K)	PS/IV	585	28700	λ_{max} assumed from previous work; ϵ estimated by extrapolation to infinite excitation rate	69E212
	EtOH/Et$_2$O (77 K)	MOD/KM	560	17600 ± 5300	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Hexane	FP	535.1			54E001
			498.0			
			452.9			
			421.1			
	Hexane	FP/SD	532.5	67000	The bands between 532.5 and 469.5 nm were assigned to the 1st electronic transition, the next three bands to the 2nd electronic transition, and the last band to the 3rd electronic transition; oscillator strength = 2.2, 0.4, —	58E001
			499	57600		
			469.5	46900		
			424	33400		
			398	18100		
			376.5	9400		
			327			
	Liquid paraffin	FP/TD	535^{b}	22000 ± 3000		67E031
	Liquid paraffin	MOD	573		Mull; relative intensities (100:91:59); τ_T = 90.3 μs	71E361
			538			
			510			

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	PMMA	LP	532 480		70E288
	Toluene	LP/ET	584^{a}, 13000 ± 1000 544^{a}, 12100^{a} 509^{a}, 8300^{a} 478^{a}, 7000^{a} 444^{a}, 3300^{a}	ϵ relative to anthracene in toluene ($\epsilon_{428.5}$ = 42000 L mol^{-1} cm^{-1})	83F075
342.	**7*H*-Dibenzo[*c*,*g*]carbazole**				
	Cyclohexane	LP	~600		82E497
343.	**Dibenzo[*b*,*def*]chrysene**				
	Hexane	MOD	511^{a} 480^{a}	"3,4,8,9-Dibenzpyrene"; 511 nm was the more intense peak; $\tau_T = 130$ μs	70E295
	Hexane	MOD	510 470	Relative intensities (100:28); $\tau_T = 130$ μs	71E361
	Liquid paraffin	MOD	520 490	Mull; relative intensities (100:37); $\tau_T = 110$ μs	71E361
344.	**Dibenzo[*def*,*mno*]chrysene**				
	Heptane	LP	662 633 581 535 524 508	"Anthanthrene"; delay 370 ns	737463
	Liquid paraffin	MOD	585 420 395	Mull; relative intensities (__:100:19); shoulder at 560 nm with relative intensity 34; $\tau_T = 103$ μs	71E361
345.	**Dibenzo[*def*,*p*]chrysene**				
	Hexane	MOD	573 477	Relative intensities (23:100); "1,2,3,4-dibenzpyrene"; $\tau_T = 120$ μs	71E361
346.	**Dibenzo[*def*,*mno*]chrysene-6,12-dione**				
	Benzene	FP	688^{a} 520^{a}	"Anthanthrone"; 688 nm peak was the more intense	84F379
347.	**Dibenzo[*g*,*p*]chrysene**				
	Heptane	LP	633 613 575 532 503 483 442	"1,2,3,4,5,6,7,8-Tetrabenznaphthalene"; delay 380 ns	737463
348.	**5*H*-Dibenzo[*a*,*d*]cycloheptene**				
	Cyclohexane	FP	425	Decay followed in acetonitrile and mixed hydrocarbons as a function of temperature	80E375
	Isopentane/3-MP (77 K)	FP/IV	426, 20000 402^{a}	Glass was 6:1 isopentane to 3-MP; shoulder at 373^{a} nm; $\tau_T = 7100$ μs	687111
349.	**Dibenzophenazine**				
	Toluene (293 K)	FP	530^{a} 510^{a} 480^{a}	‡Phosphorescence decay in EPA at 77 K, oxygen quenching; isomer unspecified	80E778
350.	**6*H*-Dibenzo[*b*,*d*]pyran-6-one**				
	EtOH (300 K)	FP	500 390		81E650
351.	**Dibenzo[*f*,*h*]quinoxaline**				
	PMMA (77 K)	PS	460 429 387	‡Phosphorescence decay (?); "5,6,7,8-dibenzoquinoxaline"; $\tau_T = 9.4 \times 10^{5}$ μs	70E291

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
352.	**Dibenzo[*c*,*g*]triphenylene**					
	MCH	LP	605 420		‡Oxygen quenching; relative intensities (2:1); τ_T = 120 μs	79A237
353.	**2,3-Dibenzoylbicyclo[2.2.1]hepta-2,5-diene**					
	MeOH	LP	445[a]		Assignment uncertain; shoulder around 400 nm; τ_T = 0.054 μs	80F372
354.	**2,3-Dibenzoylbicyclo[2.2.2]octa-2,5-diene**					
	MeOH	LP	450[a]		Assignment uncertain; shoulder around 520 nm; τ_T = 0.040 μs	80F372
355.	**Dibenzoylmethane**					
	EtOH/MeOH (118 K)	FP	630		Solvent was 3:1 EtOH to MeOH	68B005
356.	***N*-[(Dibenzylamino)methyl]phthalimide**					
	EtOH	FP	590 350		‡Oxygen quenching, diene quenching; maxima assumed from text; τ_T = 12 μs	79A147
357.	**2,5-Di(4-biphenylyl)oxazole**					
	2-MTHF (77 K)	CWL	590		"BBO"	74B003
	Benzene	LP/SD	560	110000	‡Oxygen quenching (1.7 × 10^9 L mol^{-1} s^{-1}); 100 ns delay; τ_T = 0.285 μs	777265
358.	**9,10-Dibromoanthracene**					
	Acetonitrile	LP	421[a]		‡Oxygen quenching; τ_T = 19.5 μs	84B110
	Cyclohexane	FP	419		τ_T = 36 μs	62E009
	EPA (77 K)	LP	427		τ_T = 22 μs	84B110
	EtOH	LP/ET	420	82000	ϵ relative to Methylene Blue cation (ϵ_{860} = 27000 L mol^{-1} cm^{-1}); solvent and temperature assumed; τ_T = 11 μs	78E394
	Liquid paraffin	FP	424		Viscosity of solvent was 0.167 N·s/m^2; τ_T = 44 μs	62E009
	Toluene	LP/ET	427.5	48000 ± 4000	ϵ relative to rubrene in toluene (ϵ_{500} = 26000 L mol^{-1} cm^{-1})	84E393
359.	**4,4′-Dibromobiphenyl**					
	Hexane (293 K)	LP	~400		Delay 500 ps	82E303
	Toluene	PR	390		‡Oxygen quenching; τ_T = ~3 μs	80A235
360.	**Dibromofluorescein dianion**					
	Water	FP/SD	506[b]	18000 ± 6000	pH 9	67E031
361.	**1,4-Dibromonaphthalene**					
	Cyclohexane	FP	425		τ_T = 150 μs	62E009
	Liquid paraffin	FP	423		Viscosity of solvent was 0.167 N·s/m^2; τ_T = 2000 μs	62E009
362.	**(*E*)-*N*,*N*-Dibutyl-2,3-dihydro-3-oxo-2-(3-oxonaphtho[1,2-*b*]thien-2(3*H*)-ylidene)naphtho[1,8-*bc*]thiopyran-6-sulfonamide**					
	Chloroform	LP	730		A substituted "*trans*-perinaphthioindigo"	83A355
363.	**(*Z*)-*N*,*N*-Dibutyl-2,3-dihydro-3-oxo-2-(3-oxonaphtho[1,2-*b*]thien-2(3*H*)-ylidene)naphtho[1,8-*bc*]thiopyran-6-sulfonamide**					
	Chloroform	LP	670		A substituted "*cis*-perinaphthioindigo"	83A355
364.	**5,5′-Dibutylthioindigo**					
	EPA (77 K)	FP	585		τ_T = 152 μs	767582
365.	**5,5′-Di-*tert*-butylthioindigo**					
	EPA (77 K)	FP	595		τ_T = 133 μs	767582
366.	***trans*-1,2-Di(*N*-carbazolyl)cyclobutane**					
	DMF	LP	420		‡Oxygen quenching; 500 ns delay	81P245
	THF	LP	424[a]		Delay 800 ns; shoulders at 504[a] and 404[a] nm	83E662
367.	***meso*(DL)-2,4-Di(*N*-carbazolyl)pentane**					
	THF	LP	424[a]		Delay 700 ns; shoulders at 501[a] and 399[a] nm	83E662

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
368.	**rac(DD,LL)-2,4-Di(N-carbazolyl)pentane**					
	THF	LP	425^a		Delay 1 μs; shoulders at 498^a and 402^a nm	83E662
369.	**1,5-Dichloroanthracene**					
	Benzene	PR/ET	445	63400	ϵ relative to naphthalene in benzene (ϵ_{max} = 17500 L mol^{-1} cm^{-1})	690087
	Benzene	PR/ET	445	64300	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 10300 L mol^{-1} cm^{-1})	690087
	Cyclohexane	FP	425		τ_T = 60 μs	62E009
	Cyclohexane	PR	440			690087
	Cyclohexane	FP/RA	955	1000	‡Oxygen quenching; ϵ relative to 1,5-dichloroanthracene in benzene (ϵ_{445} = 64300 L mol^{-1} cm^{-1})	71B005
			850			
			760			
			442.5			
			420			
	Dioxane	PR	442.5			690087
	Liquid paraffin	FP	419		Viscosity of solvent was 0.167 N·s/m^2; τ_T = 2000 μs	62E009
	PFMCH	FP	951^a		‡Oxygen quenching	71B005
			840^a			
			755^a			
			430^a			
			410^a			
	PMMA	FP	855			66E086
370.	**9,10-Dichloroanthracene**					
	Acetonitrile	FP	418^a			82F494
	Benzene	PR/ET	422.5	41700	ϵ relative to naphthalene in benzene (ϵ_{max} = 17500 L mol^{-1} cm^{-1})	690087
	Benzene	PR/ET	422.5	51100	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 10300 L mol^{-1} cm^{-1})	690087
	Cyclohexane	FP	419		τ_T = 100 μs	62E009
	Cyclohexane	PR	417.5			690087
	Dioxane	PR	420			690087
	EtOH (298 K)	FP	419^a			66E086
	EtOH (201 K)	FP	421^a			66E086
	EtOH	FP/ET	694^b	64	Triplet ET from eosin; ϵ relative to eosin in EtOH (ϵ_{580} = 9400 L mol^{-1} cm^{-1})	78E019
			417	46000		
	Liquid paraffin	FP	423		Solvent viscosity was 0.03 N·s/m^2	58E001
	Liquid paraffin	FP	419		Viscosity of solvent was 0.167 N·s/m^2; τ_T = 500 μs	62E009
	Toluene	LP/ET	426	46000 ± 4000	ϵ relative to rubrene in toluene (ϵ_{500} = 26000 L mol^{-1} cm^{-1})	84E393
371.	**1,8-Dichloroanthraquinone**					
	EPA (77 K)	LP	500^a		‡Phosphorescence decay; delay 100 ns; 370 nm was the more intense peak; τ_T = 40 ± 10 μs	83E016
			370^a			
	EPA (77 K)	LP	375^a		Delay 100 ns	84A253
	EtOH	LP	380^a		Delay 50 ns	84A253
	Toluene	LP	500^a		‡Phosphorescence decay in EPA at 77 K; delay 300 ns; 379 nm was more intense peak	83E016
			379^a			
372.	**4,4′-Dichlorobenzophenone**					
	Acetonitrile/Water	LP/ET	545	9600	Solvent was 9:1 acetonitrile to water; ϵ relative to 1-methylnaphthalene in acetonitrile/water (ϵ_{415} = 11200 L mol^{-1} cm^{-1})	84B033
			320	12900		
373.	**Dichlorobis(4,7-dimethyl-1,10-phenanthroline)iridium(III) ion**					
	DMF/Water	LP	608^a		Shoulders at 530^a and 511^a nm; solvent was 9:11 dimethylformamide to water	79B098
			573^a			
			543^a			
			489^a			
			464^a			
			447^a			
			425^a			

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	DMF/Water	LP	626^a 566^a 547^a 535^a 516^a 497^a 468^a		Shoulders at 588^a, 458^a, and 439^a nm; solvent was 19:1 dimethylformamide to water	79B098
	Water	LP	588^a 552^a 531^a 490^a 461^a 444^a 424^a		Shoulders at 509^a and 469^a nm	79B098
374.	**Dichlorobis(5,6-dimethyl-1,10-phenanthroline)iridium(III) ion**					
	DMF/Water	LP	650^a 566^a 512^a 440^a		Solvent was 19:1 dimethylformamide to water	81E786
	DMF/Water	LP	572^a 510^a 438^a		Solvent was 9:11 dimethylformamide to water; shoulder at 479^a nm	81E786
	EtOH/MeOH	LP	435^a		Solvent was 4:1 EtOH to MeOH; shoulders at 559^a, 487^a, and 410^a nm	81E786
	Water	LP	606^a 568^a 530^a			81E786
375.	**Dichlorobis(1,10-phenanthroline)iridium(III) ion**					
	DMF/Water	LP	566^a 502^a 474^a		Solvent was 9:11 dimethylformamide to water; shoulders at 590^a, 538^a, 460^a, 445^a and 423^a nm	79B098
	DMF/Water	LP	516^a 570^a 531^a 499^a		Solvent was 19:1 dimethylformamide to water; shoulders at 473^a and 450^a nm	79B098
	DMF/Water	LP	613^a 477^a		Solvent was 19:1 dimethylformamide to water; shoulders at 559^a and 507^a nm	81E786
	DMF/Water	LP	483^a 434^a		Solvent was 9:11 dimethylformamide to water; shoulder at 537^a nm	81E786
	EtOH/MeOH	LP	451^a		Solvent was 4:1 EtOH/MeOH; shoulders at 522^a and 482^a nm	81E786
	EtOH/MeOH (77 K)	LP	508^a 481^a 450^a		Glass was 4:1 EtOH to MeOH	81E786
	Water	LP	598^a 561^a 530^a 509^a 476^a 451^a 418^a			79B098
	Water	LP	532^a 440^a			81E786
376.	**3,5-Dichloro-2,6-diphenyl-1,4-benzoquinone/Triphenylamine**					
	Benzene (293 K)	LP	650 550		550 nm band was the more intense; $\tau_T = 0.1$ μs	81E715
	Benzene/MeOH (293 K)	LP	650 550		650 nm band was the more intense; solvent was 19:1 benzene to MeOH; $\tau_T = 0.048$ μs	81E715
377.	**1,4-Dichloronaphthalene**					
	Cyclohexane	FP	422.5		$\tau_T = 360$ μs	62E009

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
378.	**4,4′-Dichlorostilbene**					
	Isopentane/3-MP (77 K)	FP/IV	380^a		*Glass was 6:1 isopentane to 3-MP; the ϵ at 359 was* listed as 280000 in the paper, but we assume that this was a misprint; shoulder at 344^a nm and some unresolved feature centered at 394^a nm; τ_T = 4800 μs	*687111*
			359	28000		
379.	**4-(4,6-Dichloro-1,3,5-triazin-2-yl)-*N*,*N*-diethylaniline**					
	EPA (77 K)	PS/KM	490	31000 ± 5000	‡Phosphorescence decay; τ_T = (4.3 ± 0.4) × 10^6 μs	83E427
	PMMA (293 K)	PS/KM	490	31000 ± 5000	τ_T = (1.7 ± 0.1) × 10^6 μs	83E427
380.	**Dicumarol**					
	EPA (77 K)	PS	499.5		‡Phosphorescence decay; most intense peaks were at 499.5, 465, and 437 nm; τ_T = (1.3 ± 0.2) × 10^6 μs	71B001
			465			
			437			
			413^a			
			380^a			
381.	**9,10-Dicyanoanthracene**					
	Acetonitrile	LP	440		‡Oxygen quenching; intersystem crossing promoted by dimethyliodobenzene; shoulder at 425 nm	83E025
	Heptane	FP	426		‡Oxygen quenching and enhanced triplet yield in presence of dibromoethane; τ_T = ~100 μs	78E414
	Toluene	LP/ET	440	9000 ± 2000	ϵ relative to rubrene in toluene (ϵ_{500} = 26000 L mol^{-1} cm^{-1})	84E393
382.	**1,2-Dicyanobenzene**					
	EPA (77 K)	FP	510		‡Phosphorescence decay, molecular orbital calculations; ϵ roughly 200 L mol^{-1} cm^{-1} (method unspecified); τ_T = 2.5 μs	776213
			459			
383.	**1,3-Dicyanobenzene**					
	EPA (77 K)	FP	530		‡Phosphorescence decay, molecular orbital calculations; ϵ roughly 200 L mol^{-1} cm^{-1} (method unspecified); τ_T = 5.0 μs	776213
			440			
			290^a			
	Et$_2$O/Isopentane (77 K)	PS	300		Glass was 1:1 Et$_2$O to isopentane	75B004
384.	**1,4-Dicyanobenzene**					
	EPA (77 K)	FP	500		‡Phosphorescence decay, molecular orbital calculations; ϵ roughly 200 L mol^{-1} cm^{-1} (method unspecified); shoulder at 450 nm; τ_T = 1.9 μs	776213
	Et$_2$O/Isopentane (77 K)	PS	297		Glass was 1:1 Et$_2$O to isopentane	75B004
385.	**1,4-Dicyanonaphthalene**					
	Acetonitrile	LP	455			*84B017*
			275			
	Acetonitrile	LP/ET	455	7000 ± 1000	‡Oxygen quenching (2.1 × 10^9 L mol^{-1} s^{-1}); ϵ relative to benzophenone in acetonitrile (ϵ_{520} = 6500 L mol^{-1} cm^{-1}); τ_T = 40 μs	84B066
			275			
	Heptane	LP	455			84E236
			275			
386.	***trans*-4,4′-Dicyanostilbene**					
	2-MTHF (133 K)	LP	415		Triplet absorption not observable above 134 K; below 99 K lifetime (1.3 × 10^4 μs) constant; lifetime measured at 134 K; τ_T = 1.0 μs	80F299
	EtOH (135 K)	LP	410		Triplet absorption not observable above 138 K; below 110 K lifetime (1.3 × 10^4 μs) constant; lifetime measured at 138 K; τ_T = 2.5 μs	80F299
	Glycerol triacetate (198 K)	LP	410		Triplet absorption not observable above 243 K; below 214 K lifetime constant; τ_T = 6700 μs	80F299
	PMMA (298 K)	LP	405			80F299

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
387.	***all-trans*-3′,4′-Didehydro-β,ψ-16′-carotenal**				
	Hexane	LP-ET/SD	580, 363000 ± 54500	‡Triplet ET from biphenyl; ϵ assumes triplet does not absorb where singlet depletion is followed; "torularhodinaldehyde"; $\tau_T = 2.5$ μs; $E_T = \sim 94$ kJ mol^{-1}	78E721
388.	**6,6′-Diethoxythioindigo**				
	Benzene	LP	560^a 420^a	‡Oxygen quenching (2.9×10^9 L mol^{-1} s^{-1}); spectrum independent of amount of *cis* or *trans* isomers used; $\tau_T = 0.143$ μs	78F030
	Dichloromethane	LP	560^a 420^a	‡Oxygen quenching; spectrum independent of amount of *cis* or *trans* isomers used; $\tau_T = 0.065$ μs	78F030
389.	***N*-[2-(Diethylamino)ethyl]phthalimide**				
	EtOH	FP	590 350	‡Oxygen quenching, diene quenching; maxima assumed from text; $\tau_T = 42$ μs	79A147
390.	**7-Diethylamino-4-methylcoumarin**				
	EPA	CWL	596^a	Glass, temperature unspecified	73E344
	EtOH	FP/ET	620, 21600 ± 2200	ϵ relative to anthracene in EtOH ($\epsilon_{420} = 75000$ L mol^{-1} cm^{-1}); there was another maximum at wavelength shorter than 400 nm; $\tau_T = 3000 \pm 1000$ μs; $k_{et} = (6.9 \pm 1.0) \times 10^9$ L mol^{-1} s^{-1}	747049
391.	**1,1′-Diethyl-6-bromo-2,2′-cyanine iodide**				
	PVA	FP/SD	651^a, 33800^a		67F505
392.	**1,1′-Diethyl-2,2′-carbocyanine chloride**				
	Ethylene glycol	FP	635	"Pinacyanol chloride"; $\tau_T = 256 \pm 20$ μs	79E243
	Glycerol	FP	635	$\tau_T = 417 \pm 50$ μs	79E243
	MeOH	FP-ET/SD	635, 58000 ± 3000 625^b, 52000	‡Triplet ET from naphthalene, oxygen quenching; $\tau_T = 190 \pm 18$ μs; $k_{et} = (1.0 \pm 0.1) \times 10^{10}$ L mol^{-1} s^{-1}	79E243
	PVA	FP	741^a 673^a	$\tau_T = 2.0 \times 10^4$ μs	69B005
393.	**1,1′-Diethyl-4,4′-carbocyanine iodide**				
	EtOH	FP-ET/ ET&SD	778^a, 59000^a 728^b, 32000 593^b, 6000 504^a, 25100^a 425^a, 36400^a	ϵ relative to naphthalene in EtOH ($\epsilon_{415} = 40000$ L mol^{-1} cm^{-1}); in ET measurement, compensation was made for the simultaneous decay and buildup of triplet; shoulder at 580^a nm; $\tau_T = 1100$ μs; $k_{et} = 1.0 \times 10^{10}$ L mol^{-1} s^{-1}	736051
394.	**1,1′-Diethyl-2,2′-cyanine iodide**				
	MeOH	LP	600	‡Triplet ET from naphthalene; "pseudoisocyanine"; $\tau_T = 49 \pm 1$ μs; $k_{et} = (1.2 \pm 0.1) \times 10^{10}$ L mol^{-1} s^{-1}	79E828
	PVA	FP/SD	635^a, 31000^a		67F505
	PVA	FP	642^a	$\tau_T = 1.2 \times 10^4$ μs	69B005
395.	**1,1′-Diethyl-2,2′-dicarbocyanine iodide**				
	EtOH	FP-ET/ ET&SD	791^a, 111000^a 780^b, 115000 ± 11000 760^b, 96800 ± 9700 740^b, 40000 627.5^b, 40000 611^a, 48000^a	ϵ relative to naphthalene in EtOH ($\epsilon_{415} = 40000$ L mol^{-1} cm^{-1}); in ET measurement, compensation was made for the simultaneous decay and buildup of triplet; shoulder at 504^a nm; $\tau_T = 480$ μs; $k_{et} = 8.9 \times 10^9$ L mol^{-1} s^{-1}	736051
396.	**1,1′-Diethyl-6-iodo-2,2′-cyanine iodide**				
	PVA	FP/SD	660^a, 28500^a	Shoulder at 501^a nm	67F505
397.	**3,3′-Diethyl-9-methoxy-2,2′-thiacarbocyanine iodide**				
	2-PrOH	FP	640^a		777036
	BuOH	FP	650		777036
	PrOH	FP	648^a	Isomer of PrOH unspecified	757441

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
398.	**3,3′-Diethyl-2,2′-oxacarbocyanine iodide**					
	BuOH	FP-ET	605		‡Triplet ET from naphthalene	777036
399.	**3,3′-Diethyl-2,2′-oxadicarbocyanine iodide**					
	EtOH	FP-ET/ET	670^b	95500 ± 9500	‡Triplet ET from naphthalene; ϵ relative to naphthalene in EtOH (ϵ_{415} = 40000 L mol^{-1} cm^{-1}); τ_T = ~5000 μs; k_{et} = 6.7 × 10^9 L mol^{-1} s^{-1}	726156
			660^b	110000 ± 10000		
			650	135000^a		
400.	***N,N*′-Diethylrhodamine**					
	1-PrOH	FP/SD	920		‡Triplet ET to anthracene sulfonic acid and from naphthalene, oxygen quenching; 250 μs delay	78A304
			615	12000		
			410			
	Water	FP/SD	920		250 μs delay; blue band decays with same lifetime as others	777041
			625			
			590^b	8000		
			410			
	Water	FP	920		‡Triplet ET to anthracene sulfonic acid and from naphthalene, oxygen quenching; 250 μs delay; pH 7.0	78A304
			615			
			410			
401.	**5,5′-Diethylselenoindigo**					
	EPA (77 K)	FP	630		τ_T = 303 μs	767582
402.	**9,9-Diethyl-9*H*-9-stannafluorene**					
	MCH/Isopentane (77 K)	FP	382^a		‡Phosphorescene lifetime; glass was 3:1 MCH to isopentane; shoulder at 366^a nm; τ_T = 4.3 × 10^4 μs	81E648
403.	**3,3′-Diethyl-2,2′-thiacarbocyanine iodide**					
	BuOH	FP-ET	605^a		‡Triplet ET from naphthalene	777036
	PVA	FP	930^a		Shoulder at 869^a nm; τ_T = 6500 μs	69B005
			911^a			
404.	**3,3′-Diethyl-2,2′-thiacyanine iodide**					
	2-PrOH	FP-ET	660		‡Triplet ET from naphthalene	777036
	PVA	FP	711^a		Shoulder at 566^a nm; τ_T = 1.6 × 10^4 μs	69B005
			629^a			
405.	**3,3′-Diethyl-2,2′-thiadicarbocyanine iodide**					
	2-PrOH	FP-ET	705		‡Triplet ET from naphthalene	777036
	EtOH	FP-ET/ET	770^b	130000 ± 9000	‡Triplet ET from naphthalene; ϵ relative to naphthalene in EtOH (ϵ_{415} = 40000 L mol^{-1} cm^{-1}); shoulder at ~780^a nm; τ_T = 1100 μs; k_{et} = (5.6 ± 0.4) × 10^9 L mol^{-1} s^{-1}	726156
			760^b	156000 ± 10000		
			~690^a	267000^a		
	PVA	FP	1020^a		Shoulder at 982^a nm; τ_T = 4000 μs	69B005
406.	**3,3′-Diethyl-2,2′-thiatricarbocyanine iodide**					
	Propane	FP/ET	900	145000	‡Triplet ET from anthracene, oxygen quenching; ϵ relative to anthracene in propane ($e_{422.5}$ = 52000 L mol^{-1} cm^{-1}) assuming unit transfer probability; radical cations and anions also observed (λ_{max} = 520 nm); τ_T = 67 μs	79A346
407.	**6,6′-Dihexyloxythioindigo**					
	EPA (77 K)	FP	560		τ_T = 323 μs	767582
408.	**12*a*,12*b*-Dihydrobenzo[*ghi*]perylene**					
	MCH/Isohexane	LP	428		‡First order production from well characterized triplet state, oxygen quenching (1.1 × 10^9 L mol^{-1} s^{-1}); relative intensities (1:1); solvent was 2:1 MCH to isohexane; τ_T = 0.81 ± 0.03 μs	79A237
			360			
409.	**3,4-Dihydro-1,1′-binaphthyl**					
	Benzene	LP-ET	567^a		‡Triplet ET from xanthone and oxygen quenching; τ_T = 1.8 μs	84B007
			401^a			

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
410.	**4*a*,5*a*-Dihydrocarbazole**					
	MCH	LP-ET	430		‡Triplet ET from triphenylamine and oxygen quenching; τ_T = 0.5 μs	72B002
	MCH	LP	435		‡Kinetic precurser of ground state (λ_{max} = 610 nm); τ_T = 0.67 μs	78B072
411.	**4′,5′-Dihydro-3-carbethoxypsoralen**					
	EtOH	LP	535^a		‡Oxygen quenching (1.8 × 10^9 L mol^{-1} s^{-1}); τ_T = 26 μs	82E133
	Water	LP/ELT	550^a,	10000 ± 1500	‡Oxygen quenching (3 × 10^9 L mol^{-1} s^{-1}); ε relative to radical anion (ϵ_{600} = 1500 L mol^{-1} cm^{-1}) assuming electron transfer from tyrosine 100% efficient; τ_T = 25 μs	82E133
412.	**7,7′-Dihydro-β-carotene**					
	?	FP-ET	478^a 445^a		‡Triplet ET from anthracene; it was not reported whether the solvent was hexane or benzene; lifetime was measured in hexane; 478 nm peak was the more intense; τ_T = 14 μs	733001
	Hexane	PR/ET	447.5,	420000 ± 63000	‡Triplet ET from biphenyl; ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; τ_T = 14 ± 1.4 μs; k_{et} = (2.1 ± 0.21) × 10^{10} L mol^{-1} s^{-1}	776412
413.	**8*b*,9*a*-Dihydro-9*H*-cyclopropa[*e*]pyrene**					
	Hexane	LP	521^a 485^a		τ_T = 4 ± 1 μs	84F068
414.	**10,11-Dihydro-5,7:14,16-dietheno-8*H*,13*H*-diindeno[2,1-*h*:1′,2′-*i*][1,4]dioxacyclotridecin**					
	2-MTHF (77 K)	PS/KM	385^a,	21200^a	Compound "XI" in paper	83E383
415.	**12*a*,12*b*-Dihydro-5,8-dimethyl(indolino[2,3-*c*]carbazole)**					
	MCH (278 K)	LP	500		Delay 0.5 μs	83A225
416.	**5,10-Dihydro-5,10-dimethylphenazine**					
	3-MP	LP/RA	450, 337^b,	62000 ± 20000 16000	ε relative to anthracene in cyclohexane (ϵ_{422} = 61000 L mol^{-1} cm^{-1}); τ_T = 8 μs	777088
417.	**(*R*)-4,5-Dihydrodinaphtho[2,1-*e*:1′,2′-*g*][1,4]dioxocin**					
	2-MTHF (96 K)	PS	417^a		Compound "VI" in paper; shoulder at 407^a nm	83E383
418.	**(*R*)-5,6-Dihydro-4*H*-dinaphtho[2,1-*f*:1′,2′-*h*][1,5]dioxonin**					
	2-MTHF (96 K)	PS	427^a 408^a		Compound "VII" in paper	83E383
419.	**5,10-Dihydro-5,10-diphenylphenazine**					
	3-MP	LP/RA	444, 400^a, 337^b, 280^a,	98000 ± 30000 88000^a 10000 91000^a	ε relative to anthracene in cyclohexane (ϵ_{422} = 61000 L mol^{-1} cm^{-1}); τ_T = 1 μs	777088
420.	**5,10-Dihydroindeno[2,1-*a*]indene**					
	Benzene (298 K)	LP-ET	392 ~375		‡Triplet ET from benzophenone, oxygen quenching (3.4 × 10^9 L mol^{-1} s^{-1}); τ_T = > 3 μs; k_{et} = 5 × 10^9 L mol^{-1} s^{-1}	81E214
	Benzene (298 K)	LP-ET	392 ~375		‡Triplet ET from xanthone, oxygen quenching; τ_T = > 5 μs	81E214
	EPA (77 K)	FP	395 375 355		Most intense peak at 395 nm; τ_T = 88 μs	737069
	EPA (298 K)	LP	384 365			81E214

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
421.	**3,4-Dihydro-2′-methyl-1,1′-binaphthyl**					
	Benzene	LP-ET	481^a		‡Triplet ET from xanthone	84B007
422.	**5,10-Dihydro-5-methyl-10-phenylphenazine**					
	3-MP	LP/RA	444 337^b	94000 ± 30000 12000	ϵ relative to anthracene in cyclohexane (ϵ_{422} = 61000 L mol^{-1} cm^{-1}); τ_T = 6 μs	777088
423.	**5,12-Dihydro-5-methylquino[2,3-*b*]acridine-7,14-dione**					
	EtOH (300 K)	FP	710 350		‡Triplet ET to anthracene and oxygen quenching; τ_T = 70 μs	79E965
	EtOH (300 K)	FP/SD	710	15300 ± 1500	"*N*-Methylquinacridinone"	81E649
424.	**9,10-Dihydro-9-oxo-2-acridinesulfonate ion**					
	EtOH	FP	580		‡Oxygen quenching; τ_T = 140 μs	81A390
425.	**9,10-Dihydro-9-oxo-2-acridinesulfonic acid**					
	PVA	FP	585		Lifetime quoted from [79E964]; τ_T = 2 × 10^5 μs	81A390
426.	**2,3-Dihydrophenalene**					
	EPA	FP	430 400		‡Oxygen quenching (2 × 10^9 L mol^{-1} s^{-1}) at 260 K; τ_T = 2 μs	81F390
427.	**3,4-Dihydrophenanthrene**					
	Benzene	LP-ET	580 430		‡Oxygen and azulene quenching and triplet ET from benzophenone; τ_T = 1.2 μs	83E278
428.	**9,10-Dihydrophenanthrene**					
	Hexane (300 K)	MOD/SD	480 365	7800 26000	τ_T = 120 ± 9 μs	69E208
429.	**1,2-Dihydro-3-phenylnaphthalene**					
	Isopentane/3-MP (77 K)	FP/IV	384 364^a	40000	Glass was 6:1 isopentane : 3-MP; τ_T = 3400 μs	687111
430.	**4′,5′-Dihydropsoralen**					
	Benzene	PR/ET	500	15700	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene (ϵ_{367} = 27100 L mol^{-1} cm^{-1}); 5 μs delay; k_{et} = 5.6 × 10^9 L mol^{-1} s^{-1}	79E282
	Water	LP	510		4 μs delay	79E282
431.	**5,12-Dihydroquino[2,3-*b*]acridine-7,14-dione**					
	EtOH (300 K)	FP	710 350		"Linear quinacridinone"; [79E965] quotes a λ_{max} = 690 nm for the same system	81E649
432.	**1,2-Dihydro-2,2,4,6-tetramethylquinoline**					
	Benzene	FP	647^a			84F248
433.	**1,4-Dihydro-5,6,11,12-tetraphenyl-1,4-epidioxytetracene**					
	Cyclohexane	LP	432^a		A rubreneperoxide, called "II" in paper	84E056
434.	**5,12-Dihydro-5,6,11,12-tetraphenyl-5,12-epidioxytetracene**					
	Cyclohexane	LP	455^a		A rubreneperoxide, called "I" in paper	84E056
435.	**(*E*)-5[(3,4-Dihydro[1,4]thiazino[3,4-*b*]benzothiazol-1-yl)methylene]-3-ethyl-2-thioxo-4-thiazolidinone**					
	Toluene	FP-ET	650^a		‡Triplet ET from fluorenone; "merocyanine dye photoisomer"	767764
436.	**10*H*,10′*H*-10,10′-Dihydroxybianthrylidene**					
	1-PrOH/2-PrOH (83 K)	FP	465^a 405^a		Solvent was 2:3 1-PrOH to 2-PrOH	777238
437.	**4,4′-Dihydroxybiphenyl**					
	PVA (77 K)	FP	550 400 390		Stretched polymer film; most intense peak at 400 nm polarization also measured	78B129

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Toluene/EtOH (77 K)	MOD	411^a		Glass was 19:1 toluene to EtOH	719059
438.	**Dihydroxylycopene**					
	Benzene	PR-ET	540		‡Triplet ET from naphthalene; τ_T = 7.9 μs	80A143
439.	**1,5-Dihydroxynaphthalene**					
	3-MP/Et$_2$O (77 K)	PS	447		‡Phosphorescence decay; glass 19:1 3-MP to Et$_2$O; 447 nm peak was the most intense; τ_T = 1.03 × 10^6 μs	74B004
			420			
			394.5			
440.	**1,8-Dihydroxynaphthalene**					
	3-MP/Et$_2$O (77 K)	PS	448		‡Phosphorescence decay; glass 19:1 3-MP to Et$_2$O; 448 nm peak was the more intense; τ_T = 1.11 × 10^6 μs	74B004
			423			
441.	**2,3-Dihydroxynaphthalene**					
	3-MP/Et$_2$O (77 K)	PS	443		‡Phosphorescence decay; glass 19:1 3-MP to Et$_2$O; 443 nm peak was the most intense; τ_T = 1.95 × 10^6 μs	74B004
			418			
			394			
	Toluene/EtOH (77 K)	MOD	445^a		Glass was 19:1 toluene to EtOH	719059
	Water	FP	430		‡Oxygen quenching; pK_a = 10.0 ± 0.2; 5 μs delay; pH 1.8	77A196
442.	**2,7-Dihydroxynaphthalene**					
	3-MP/Et$_2$O (77 K)	PS	444		‡Phosphorescence decay; glass 19:1 3-MP to Et$_2$O; 444 nm peak was the more intense; τ_T = 1.01 × 10^6 μs	74B004
			419			
443.	**2,3-Dihydroxynaphthalene, conjugate base**					
	Water	FP	545^a		‡Oxygen quenching; 5 μs delay; pH 13.5	77A196
			500^a			
			480^a			
			455^a			
			440^a			
444.	**3,6-Dihydroxyphthalimide**					
	Dioxane	FP/TD	440	2900	Lifetime limited by aeration; τ_T = 0.250 μs	7575
445.	**4,4′-Dimethoxybenzophenone**					
	Acetonitrile/Water	LP/ET	675	3600	Solvent was 9:1 acetonitrile to water; ε relative to 1-methylnaphthalene in acetonitrile/water (ϵ_{415} = 11200 L mol^{-1} cm^{-1})	84D[illegible]
			545	5200		
			440	7100		
			350	7800		
446.	**2,3-Dimethoxy-1,4-benzoquinone**					
	Benzene	PR	434^a		τ_T = 0.37 ± 0.05 μs	743062
	Cyclohexane	PR/ET	430 ± 5	5300 ± 1200	ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1})	743062
	Cyclohexane	LP/ET	430 ± 5	5700 ± 1200	‡Triplet ET to β-carotene; ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}); τ_T = 0.59 ± 0.10 μs	743062
447.	**2,5-Dimethoxy-1,4-benzoquinone**					
	Benzene	PR	452^a		Shoulder at 487^a nm; τ_T = 5.0 ± 0.7 μs	743062
	Cyclohexane	PR/ET	489^a		ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1})	743062
			440 ± 5	5400 ± 1100		
	Cyclohexane	LP/ET	489^a		‡Triplet ET to β-carotene; ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}); τ_T = 5.9 ± 1.0 μs	743062
			440 ± 5	5300 ± 1100		
448.	**4,4′-Dimethoxybiphenyl**					
	Boric acid	PS	415		Glass	777388
449.	**5,7-Dimethoxycoumarin**					
	Benzene	PR/ET	450	11400	‡Triplet ET from biphenyl; ε relative to biphenyl in benzene (ϵ_{367} = 27100 L mol^{-1} cm^{-1}); 20 ns delay; τ_T = 10 μs; k_{et} = 5.6 × 10^9 L mol^{-1} s^{-1}	79E282

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
450.	**2,3-Dimethoxy-5-methyl-1,4-benzoquinone**				
	Benzene	PR	423^a	$\tau_T = 0.59 \pm 0.10$ μs	743062
	Cyclohexane	PR/ET	430 ± 5, 6300 ± 1400	ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1})	743062
	Cyclohexane	LP/ET	430 ± 5, 6800 ± 1400	‡Triplet ET to β-carotene; ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}); $\tau_T = 0.55 \pm 0.09$ μs	743062
	Trichlorotrifluoroethane	LP	413^a	$\tau_T = 0.43 \pm 0.08$ μs	743062
451.	**1,4-Dimethoxynaphthalene**				
	3-MP (77 K)	PS	469 445	‡Phosphorescence decay; 469 nm peak was the more intense; $\tau_T = 1.08 \times 10^6$ μs	74B004
452.	**1,2-Dimethoxy-4-nitrobenzene**				
	Acetonitrile	LP	490^a		82B014
453.	***trans*-2,5-Dimethoxy-4′-nitrostilbene**				
	Glycerol triacetate (198 K)	LP	~780 540 467	Most intense peak at 467 nm	78B088
	Glycerol triacetate	LP	~830 554 465	Most intense peak at 465 nm	78B088
454.	**4,4′-Dimethoxythiobenzophenone**				
	Benzene	LP/RA	520 ± 5, 3500 ± 700 400 ± 5, 5500 ± 1100 295 ± 5, 19900 ± 4000	ϵ relative to benzophenone in benzene ($\epsilon_{532.5} = 7630$ L mol^{-1} cm^{-1}), taking $\Phi_T = 0.5$ at 337 nm excitation and taking $\Phi_T = 1$ for benzophenone; SD method gave similar ϵ; $\tau_T = 1.4 \pm 0.1$ μs	84A221
455.	**4-(Dimethylamino)chalcone**				
	Heptane	LP	550 ± 15	"3-[4-(Dimethylamino)phenyl]-1-phenyl-2-propen-1-one"; $\tau_T = 0.5$ μs	83E347
456.	**10-(Dimethylamino)-3,5,7,9-decatetraen-2-one**				
	Toluene	FP-ET	520	‡Triplet ET from anthracene	83E737
457.	**2-(Dimethylamino)ethyl benzoate**				
	Cyclohexane (290 K)	FP	352^a 321^a	10 μs delay	767556
458.	**2-[7-(Dimethylamino)-2,4,6-heptatrienylidene]-6-[5-(dimethylamino)-2,4-pentadienylidene]cyclohexanone**				
	Toluene	FP	680	‡Oxygen quenching and triplet ET from anthracene and benzo[*rst*]pentaphene and to azulene, perylene, and tetracene	83E737
459.	***N*-[(Dimethylamino)methyl]phthalimide**				
	EtOH	FP	590 350	‡Oxygen quenching, diene quenching; maxima assumed from text; $\tau_T = 10$ μs	79A147
460.	**1-Dimethylamino-4-nitronaphthalene**				
	2-PrOH	LP	505	Lifetime extrapolated from low temperature; $\tau_T = 0.002$ μs	77A216
	Acetone	LP	505	‡Oxygen quenching (0.7×10^9 L mol^{-1} s^{-1}); $\tau_T = 1.0$ μs	77A216
	Acetonitrile	LP	510	$\tau_T = 0.2$ μs	77A216
	Benzene	LP	510	‡Oxygen quenching (1.6×10^9 L mol^{-1} s^{-1}); $\tau_T = 4.5$ μs	77A216
	Cyclohexane	LP	500	‡Phosphorescence decay in PMMA at 77 K; $\tau_T = 9.1$ μs	77A216
	Hexane	LP	500	$\tau_T = 8.4$ μs	77A216

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
461.	***trans*-4-Dimethylamino-4′-nitrostilbene**					
	2,2-Dimethylbutane-/Pentane (77 K)	FP	845^a		Glass 3:8 pentane to 2,2-dimethylbutane; shoulder at 750^a nm	747022
	2-PrOH	LP	680			78B088
	Benzene	LP	800		‡Oxygen quenching and triplet ET from triphenylene; shoulder at 745 nm; $\tau_T = 2.1$ μs	747022
	Benzene	LP	790			78B088
	Cyclohexane	LP	735		Shoulder at 650 nm; $\tau_T = 0.43$ μs	747022
	DMF	LP-ET	910 820		‡Triplet ET from triphenylene; $\tau_T = 21$ μs; $k_{et} = 8 \times 10^9$ L mol^{-1} s^{-1}	747022
	DMF	LP	805			78B088
	EtOH	LP	630			78B088
	Glycerol triacetate (198 K)	LP	830			78B088
	Glycerol triacetate	LP	835			78B088
	MeOH	LP	600			78B088
	Toluene	LP	800		$\tau_T = 1.8$ μs	82F498
	tert-BuOH	LP	760			78B088
462.	**8-(Dimethylamino)-3,5,7-octatrien-2-one**					
	Toluene	FP-ET	480		‡Triplet ET from anthracene	83E737
463.	**9-[4-(Dimethylamino)phenyl]anthracene**					
	Acetonitrile	LP	442^a		‡Oxygen quenching	776464
	Acetone	LP	440^a		‡Oxygen quenching	776464
	Et_2O	LP	444^a		‡Oxygen quenching	776464
464.	**4-[2-[4-(Dimethylamino)phenyl]ethyl]benzophenone**					
	Acetonitrile	LP	490^a		Possible triplet exciplex, structure unspecified; "benzophenone-$(CH_2)_2$-(*N*,*N*-dimethylaniline)"	78B112
465.	***trans*-1-(4-Dimethylaminophenyl)-2-nitroethylene**					
	Benzene/Acetonitrile	LP	660^a		Solvent was 8:2 benzene to acetonitrile by volume	78E057
	Benzene	LP	650^a		$\tau_T = 0.56$ μs	78E057
	Cyclohexane	LP	570^a		$\tau_T = 0.379$ μs	78E057
	EPA (77 K)	PS/SD	600 440	19100 ± 3820 35000 ± 7000	‡Phosphorescence decay; $\tau_T = (7.9 \pm 1.5) \times 10^4$ μs	78E057
466.	**2-(Dimethylamino)purine**					
	Acetonitrile (300 K)	FP	485		‡Oxygen quenching and quenching by 2,4-hexadienol; $\tau_T = 59 \pm 4$ μs	756270
467.	**2-(Dimethylamino)pyridine**					
	2-PrOH (179 K)	FP	~470		‡Phosphorescence decay in EPA; $\tau_T = (1.4 \pm 0.3) \times 10^3$ μs	767526
	3-MP (179 K)	FP	$\sim 465^a$		‡Phosphorescence decay in EPA	767526
	EPA (100 K)	FP	~470		‡Phosphorescence decay in EPA; $\tau_T = (4.73 \pm 0.46) \times 10^3$ μs	767526
	EPA (103 K)	FP	470^a		Lifetime measured at 93 K; $\tau_T = 0.4 \times 10^6$ μs	80E318
468.	**4-(Dimethylamino)pyridine**					
	2-PrOH (188 K)	FP	500		$\tau_T = 200 \pm 12$ μs	737127
	EPA (93 K)	FP	500		‡Phosphorescence decay	72B004
	EPA (77 K)	FP	500		‡Phosphorescence decay	737127
	Et_2O (183 K)	FP	500			737127
469.	**2-(Dimethylamino)pyridine/4-Nitroaniline**					
	EPA (100 K)	FP	590 460		At 93 K lifetimes are 4.5 ms (590 nm) and 0.4 s (460 nm); relative intensities (2:1)	80E318
470.	***N*,*N*-Dimethylaniline**					
	3-MP (77 K)	FP	465^a 456^a 440^a 341^a		‡Phosphorescence decay; another maximum was estimated to be at ~392 nm which was in the SD region of 390-430 nm; most intense peak at 341 nm	69E215

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Cyclohexane	PR	460 ± 10	‡Oxygen quenching (10^{10} L mol^{-1} s^{-1}); further peak at 370 nm attributed to the cyclohexadienyl radical; half-life = 0.95 μs	761069
	Liquid paraffin	FP	480 340	‡Phosphorescence decay in low temperature glass; delay 5 μs; half-life = 100 μs	68B002
	N,N-Dimethylaniline	LP/ET	465, 5000	‡Triplet ET to anthracene and to naphthalene; ε relative to naphthalene in dimethylaniline ($\epsilon_{427.5}$ = 14400 L mol^{-1} cm^{-1}); half-life = 0.25 μs; k_{et} = 4.8 × 10^9 L mol^{-1} s^{-1}	720440
471.	***N,N'*-Dimethyl-3-anilinocarbazole**				
	MCH (278 K)	LP	610	‡Oxygen quenching and rise time same as fluorescence decay; delay 30 ns; rise time of 13 ns	83A225
472.	**1,3-Dimethylanthracene**				
	EtOH (93 K)	PS	442 417		66B001
473.	**9,10-Dimethylanthracene**				
	Benzene	PR/ET	435, 47000	ε relative to benzophenone in benzene ($\epsilon_{532.5}$ = 10300 L mol^{-1} cm^{-1})	690087
	Benzene	PR/ET	435, 42200	ε relative to naphthalene in benzene (ϵ_{max} = 17500 L mol^{-1} cm^{-1})	690087
	Cyclohexane	PR	427.5		690087
	Dioxane	PR	430		690087
474.	**2,5-Dimethyl-1,4-benzoquinone**				
	SDS	LP	470	Aqueous micelles; τ_T = 0.035 μs	83N133
	Water	LP	480 440	τ_T = 0.83 μs	80B112
475.	**2,6-Dimethyl-1,4-benzoquinone**				
	SDS	LP	455	Aqueous micelles; τ_T = 0.020 μs	83N133
	Water	LP	445	τ_T = 0.060 μs	83N133
476.	**3,3'-Dimethylbiphenyl**				
	3-MH (77 K)	PR	390	1 μs delay; radical ions also contribute to observed peak at 390 nm; τ_T = 3 × 10^6 μs	771059
477.	**(*all-E*)-3,8-Dimethyl-1,10-bis(2,6,6-trimethyl-1-cyclohexen-1-yl)-1,3,5,7,9-decapentaene**				
	Benzene (296 K)	LP-ET	457	Triplet ET from chlorophyll *a*; oxygen quenching (2.8 × 10^9 L mol^{-1} s^{-1}); τ_T = 20 μs; k_{et} = 0.9 × 10^9 L mol^{-1} s^{-1}	73E347
478.	**1-(3,3-Dimethyl-1-buten-2-yl)naphthalene**				
	Benzene	LP-ET	426^a	‡Triplet ET from xanthone and oxygen quenching; τ_T = 0.44 μs	84B007
479.	***N,N'*-Dimethyl-5,11-dihydroindolo[3,2-*b*]carbazole**				
	SDS	LP	658^a 395^a	Aqueous micelle	79N005
480.	***cis*-2,3-Dimethyl-2,3-di-(2-naphthyl)oxirane**				
	Benzene	LP/ET	425, 10000 ± 2000	‡Oxygen and azulene quenching; ε relative to benzophenone in benzene ($\epsilon_{533.5}$ = 7630 L mol^{-1} cm^{-1}); τ_T = 1.2 ± 0.2 μs	84A344
481.	***trans*-2,3-Dimethyl-2,3-di-(2-naphthyl)oxirane**				
	Benzene	LP/ET	425, 12000 ± 2400	‡Oxygen and azulene quenching; ε relative to benzophenone in benzene ($\epsilon_{533.5}$ = 7630 L mol^{-1} cm^{-1}); τ_T = 1.4 ± 0.2 μs	84A344

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
482.	**2,4-Dimethyl-1,5-diphenyl-1,5-pentanedione**					
	?	LP	455^a		Solvent benzene (?); conformation such that carbonyl groups are in the plane formed by the three central carbons of the pentane chain; more intense maximum below 350 nm; τ_T = 0.060 μs	81A404
483.	***N,N'*-Dimethyl-*N,N'*-diphenyl-1,4-phenylenediamine**					
	MCH (278 K)	LP	635		‡Oxygen quenching and risetime same as fluorescence decay; delay 50 ns; τ_T = 3 μs; rise time of 5 ns	83A225
484.	**3,9-Dimethyl-*trans*-fluorenacene**					
	3-MP (77 K)	MOD/ SD&KM	481 457	93500 ± 4300 55600 ± 3500		757141
485.	**2,5-Dimethyl-2,4-hexadiene**					
	Benzene	PR	310		τ_T = 0.08 μs	82B057
486.	**1,3-Dimethylindazole**					
	EtOH (178 K)	MOD/SD	420^a	8100^a	Shoulders at 439^a and 286^a nm; another maximum < 250 nm; τ_T = (1.5 ± 0.2) × 10^4 μs	716244
	EtOH (103 K)	MOD/SD	420^a 287^a	8600^a 4700^a	Shoulder at 448^a nm; another maximum < 250 nm; τ_T = (3.6 ± 0.4) × 10^6 μs	716244
487.	***N,N'*-Dimethylindigo**					
	EPA (98 K)	LP	740 470		No triplet spectrum observed at RT; data corrected from paper (H. Goerner, private communication, 1985)	79E543
488.	**1,4-Dimethyl-7-isopropylazulene**					
	Benzene	LP-ET	380-420		‡Triplet ET from benzophenone, oxygen quenching; τ_T = 3 μs; k_{et} = 7 × 10^9 L mol^{-1} s^{-1}	81F275
489.	**1,2-Dimethylnaphthalene**					
	Cyclohexane (77 K)	PS	420 400			67B007
490.	**2,3-Dimethylnaphthalene**					
	Cyclohexane (77 K)	PS	426.5 420.5 404 398 392.5			67B007
	EtOH (77 K)	MOD	422		Halfwidth 540 cm^{-1}	777538
	Toluene (77 K)	MOD	433		Halfwidth 920 cm^{-1}	777538
491.	**2,7-Dimethylnaphthalene**					
	EtOH (77 K)	MOD	419		Halfwidth 460 cm^{-1}	777538
	Toluene (77 K)	MOD	431		Halfwidth 880 cm^{-1}	777538
492.	***N,N*-Dimethyl-2-naphthylamine**					
	Cyclohexane	FP	476^a		Delay 30 μs	686045
493.	***N,N*-Dimethyl-2-naphthylamine, conjugate acid**					
	Water	FP	409 388		pK_a = 2.7; pH Acidic	61E008
494.	***cis*-3,3-Dimethyl-1-(2-naphthyl)-1-butene**					
	Benzene	LP-ET	430 400		‡Oxygen and azulene quenching and triplet ET from benzophenone and xanthone; τ_T = 0.14 μs	83E278
495.	***trans*-3,3-Dimethyl-1-(2-naphthyl)-1-butene**					
	Benzene	LP-ET	430 400		‡Oxygen and azulene quenching and triplet ET from benzophenone and xanthone; τ_T = 0.13 μs	83E278

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
496.	**2,2-Dimethyl-1-(1-naphthyl)-1-phenylethylene**					
	Benzene	LP-ET	410[a]		‡Triplet ET from xanthone and oxygen quenching; $\tau_T = 0.10$ μs	84B007
497.	***N,N*-Dimethyl-4-nitroaniline**					
	EPA (77 K)	PS/KM	900 760 550 390	3370 ± 170 2780 ± 140 2700 ± 135 20600 ± 1030	‡Phosphorescence decay; $\tau_T = (4.37 \pm 0.10) \times 10^5$ μs	78E057
	EPA (77 K)	PS	550 450		‡Phosphorescence decay; $\tau_T = 8.3 \times 10^5$ μs	83E427
498.	***N,N*-Dimethyl-4-[(4-nitrophenyl)azo]benzenamine**					
	2-MTHF (103 K)	LP	700 390		Triplet not observable above 125 K; below 103 K lifetime constant; $\tau_T = 500$ μs	80B101
	Glycerol triacetate (203 K)	LP	690		Lifetime measured at 233 K; triplet not observable above 233 K; $\tau_T = 0.050$ μs	80B101
499.	**3,8-Dimethyl-4,7-phenanthroline**					
	EtOH/Et$_2$O (77 K)	PS	495 465 435		Solvent was 3:2 EtOH to Et$_2$O; relative intensities (100:60:25); $E_T = 264$ kJ mol^{-1}	80B130
500.	***N,N*-Dimethyl-*p*-phenylenediamine**					
	EtOH (77 K)	MOD/KM	530	23000 ± 5700		737055
501.	**(*E,E,E,E,E,E*)-7,11-Dimethyl-7-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2,4,6,8,10,12-tridecahexaenal**					
	Cyclohexane	COM	500	201000	"*all-trans*-C$_{24}$ aldehyde"; ε average of that obtained by PR/ET, LP/ET and LP/SD; ε relative to C$_{17}$ aldehyde in cyclohexane ($\epsilon_{410} = 63000$ L mol^{-1} cm^{-1}) in LP/ET; ε relative to biphenyl in cyclohexane ($\epsilon_{361.3} =$ 42800 L mol^{-1} cm^{-1}) in PR/ET; $\tau_T = 7.1$ μs	79E546
	MeOH	LP/SD	510	136000	ε is upper limit; $\tau_T = 8.3$ μs	79E546
502.	**1,3-Dimethyluracil**					
	Acetonitrile	LP/?	380[a]	8000[a]	ε method unspecified	81E042
503.	**(*S*)-Dinaphtho[2,1-*d*:1′,2′-*f*][1,3]dioxepin**					
	2-MTHF (96 K)	PS	420[a] 400[a]		Compound "V" in paper	83E383
504.	**Di-2-naphthylamine**					
	Toluene/EtOH (77 K)	MOD	508[a] 439[a]		Glass was 19:1 toluene to EtOH; 508 nm peak was the more intense	719059
505.	**1,4-Di-1-naphthylbutane**					
	Isooctane	FP	430[a] 400[a] 380[a] 362[a]		Isomer assumed; additional absorption in the red assigned to intramolecular triplet eximer	78B089
	Isooctane	LP	405[a] 390[a]		Shoulder at 370 nm; rise time of ~100 ns	81E015
506.	***t*-3,*t*-4-Di-(1-naphthyl)-*r*-1,*c*-2-dimethoxycarbonylcyclobutane**					
	Acetonitrile	LP-ET	430		‡Triplet ET from benzophenone, oxygen quenching (1.5×10^{10} L mol^{-1} s^{-1}); 100 ns delay; $\tau_T = 0.13$ μs; $k_{et} = (7 \pm 1) \times 10^9$ L mol^{-1} s^{-1}	80B010
	Acetonitrile	LP-ET	470		‡Triplet ET from benzophenone; 400 ns delay; intramolecular triplet exciplex; $\tau_T = 4.0$ μs; $k_{et} = (7 \pm 1) \times 10^9$ L mol^{-1} s^{-1}	80B010
507.	**1,2-Di-1-naphthylethane**					
	Isooctane	FP	430[a] 396[a] 355[a]		Isomer assumed; shoulder ~380 nm; additional absorption in the red assigned to intramolecular triplet eximer	78B089

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Isooctane	LP	410^a 390^a		Shoulder at 370 nm; additional absorption around 470 nm (rise time < 17 ns) ascribed to triplet excimer; rise time of ~100 ns	81E015
508.	**Di-1-naphthylmethane**					
	Isooctane	FP	430^a 396^a 350^a		Shoulder ~370 nm; additional absorption in the red assigned to intramolecular triplet eximer; τ_T = ~50 μs	78B089
	Isooctane	LP	410^a 390^a		Shoulder at 370 nm; rise time of ~100 ns	81E015
509.	**2,5-Di(1-naphthyl)-1,3,4-oxadiazole**					
	Cyclohexane	FP/TD	602 569 454	7150^a 5200^a 5500^a	Only peaks reported by authors given - extensive vibronic structure observed; oscillator strength = 0.04, 0.04, 0.06	78B081
	Cyclohexane	FP/TD	600^a 570^a 460^a	7100^a 5200^a 5700^a	0-0 bands only reported here though vibrational structure seen; oscillator strength = 0.04, 0.04, 0.06	79E297
510.	***cis*-2,3-Di-(2-naphthyl)oxirane**					
	Benzene	LP/ET	430	10000 ± 2000	‡Oxygen and azulene quenching; ε relative to benzophenone in benzene ($\epsilon_{533.5}$ = 7630 L mol^{-1} cm^{-1}); τ_T = 0.36 ± 0.05 μs	84A344
511.	***trans*-2,3-Di-(2-naphthyl)oxirane**					
	Benzene	LP/ET	430	>8000	‡Oxygen and azulene quenching; ε relative to benzophenone in benzene ($\epsilon_{533.5}$ = 7630 L mol^{-1} cm^{-1}); τ_T = 0.16 ± 0.02 μs	84A344
512.	**1,3-Di-1-naphthylpropane**					
	Isooctane	FP	430^a 400^a 375^a		Isomer assumed; additional absorption in the red assigned to intramolecular triplet eximer	78B089
	Isooctane	LP	415^a 390^a		Shoulder at 370 nm; rise time of ~100 ns	81E015
513.	**1,3-Di-2-naphthylpropane**					
	Methylene chloride	LP	430^a		Shoulder at 405^a	84P257
514.	**5,5′-Dineopentylthioindigo**					
	EPA (77 K)	FP	592		τ_T = 130 μs	767582
	EPA (93 K)	LP	580 375		τ_T = 53 μs	79E543
	EPA (283 K)	LP	590 370		Φ_T strongly temperature dependent in this solvent; τ_T = 0.46 μs	79E543
	Glycerol triacetate (203 K)	LP	600 390		τ_T = 50 μs	79E543
	Glycerol triacetate	LP	595 385		τ_T = 0.40 μs	79E543
515.	**3,5-Dinitroanisole**					
	Acetonitrile/Water	LP	475		Solvent 1:1 acetonitrile to water; τ_T = 0.055 μs	737466
	Water	LP	~435			82F150
516.	**3,5-Dinitroanisole/Water**					
	Water	LP	435		‡Oxygen quenching and triplet ET to 3,3′,4,4′-tetramethyldiazetine dioxide; transient was assigned to an H-bonding exciplex with water; τ_T = 1.4 μs	777345
517.	**1,2-Dinitronaphthalene**					
	EtOH	LP	550		‡Phosphorescence decay in EPA glass at 77 K, triplet ET to tetracene, oxygen quenching (3.3 × 10^9 L mol^{-1} s^{-1}); τ_T = 4.3 μs	776194

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Hexane	LP	490		‡Phosphorescence decay in EPA glass at 77 K, triplet ET to tetracene, oxygen quenching (1.9×10^9 L mol^{-1} s^{-1}); $\tau_T = 1.0\ \mu s$	776194
518.	**1,4-Dinitronaphthalene**					
	EtOH	LP	550		Lifetime measured in neutral EtOH; spectrum shifts to the red (30 nm) with increasing sulfuric acid concentration ($\{10$ mol L$^{-1}\}$); $\tau_T = 4.76\ \mu s$	767270
	Formamide	LP	570			767270
	Hexane	LP	545		‡Phosphorescence decay in EPA at 77K, triplet ET to tetracene; $\tau_T = 4.55\ \mu s$; $k_{et} = 1.0 \times 10^{10}$ L mol^{-1} s^{-1}	767270
519.	**1,8-Dinitronaphthalene**					
	EtOH	LP	590		‡Phosphorescence decay in EPA glass at 77 K, triplet ET to tetracene, oxygen quenching (2.1×10^9 L mol^{-1} s^{-1}); $\tau_T = 5.3\ \mu s$	776194
	Hexane	LP	550		‡Phosphorescence decay in EPA glass at 77 K, triplet ET to tetracene, oxygen quenching (8.1×10^8 L mol^{-1} s^{-1}); $\tau_T = 2.5\ \mu s$	776194
520.	**4-[(2,4-Dinitrophenyl)azo]-*N*,*N*-dimethylbenzenamine**					
	2-MTHF (103 K)	LP	700 420		Triplet not observable above 126 K; below 103 K lifetime constant; $\tau_T = 1300\ \mu s$	80B101
	Glycerol triacetate (198 K)	LP	690		Lifetime measured at 233 K; triplet not observable above 233 K; $\tau_T = 0.033\ \mu s$	80B101
521.	**3-[[4-[(2,4-Dinitrophenyl)azo]phenyl](2-hydroxyethyl)amino]-4-propanenitrile**					
	2-MTHF (103 K)	LP	700 400		Triplet not observable above 123 K; below 103 K lifetime constant; $\tau_T = 670\ \mu s$	80B101
	Glycerol triacetate (203 K)	LP	680		Lifetime measured at 248 K; triplet not observable above 248 K; $\tau_T = 0.025\ \mu s$	80B101
522.	***trans*-2,4-Dinitrostilbene**					
	Glycerol triacetate	LP	542 428		542 nm peak was the more intense	78B088
	Glycerol triacetate (198 K)	LP	560 434		560 nm peak was the more intense	78B088
523.	***cis*-4,4′-Dinitrostilbene**					
	Cyclohexane	LP	500		$\tau_T = 0.083\ \mu s$	747022
	MeOH	LP	500			747022
524.	***trans*-4,4′-Dinitrostilbene**					
	Cyclohexane	LP	500		‡Oxygen quenching in benzene; $\tau_T = 0.080\ \mu s$	747022
	EPA (77 K)	FP	550^a			747022
	EPA	LP	472			78B088
	EPA (88 K)	LP	486			78B088
	Glycerol triacetate (198 K)	LP	~735 496		496 nm peak was the more intense	78B088
	Glycerol triacetate	LP	500			78B088
	MeOH	LP	500		‡Oxygen quenching in benzene	747022
525.	***N*,*N*′-Dipentylpyromellitic diimide**					
	Acetonitrile	LP	555 510 420		Triplet detected in the presence of *N*-benzyl-1,4-dihydronicotinamide	83B041
526.	**1,3-Di(9-phenanthryl)propane**					
	Decane (293 K)	LP	481^a 447^a 427^a		Shoulder at 402^a nm; The shortest wavelength band and shoulder are mainly due to intramolecular triplet excimers	82E287
	THF	LP	480^a 450^a		Delay 1 μs; shoulder at 423^a nm	83E554

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
527.	**Diphenylacetylene**				
	Glycerol	FP	418 380	418 nm was the stronger band; τ_T = 267 μs	747417
528.	**Diphenylamine**				
	3-MP (77 K)	PS	545	τ_T = (2.0 × 0.1) × 10^6 μs	67E106
	Cyclohexane	PR/ET	530, 10400	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); reference ϵ obtained by starting from ϵ_{max} = 3220 L mol^{-1} cm^{-1} for this ketyl radical in water and assuming the f of the ketyl radical is independent of solvent; final ϵ obtained from a simultaneous least squares fit to data from several compounds	71E360
	EPA (~90 K)	PS	558^a		42B002
	EPA (77 K)	PS	549	‡Phosphorescence decay; τ_T = (1.9 ± 0.2) × 10^6 μs	67E106
	EtOH (77 K)	MOD/KM	550, 31000 ± 7700		737055
	EtOH/Et$_2$O (77 K)	MOD/KM	550, 28600 ± 11000	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Hexane	LP	520		84E043
	Toluene/EtOH (77 K)	MOD	555^a	Glass was 19:1 toluene to EtOH	719059
529.	**9,10-Diphenylanthracene**				
	Benzene	PR/ET	445, 17700	ϵ relative to naphthalene in benzene (ϵ_{max} = 17500 L mol^{-1} cm^{-1})	690087
	Benzene	PR/ET	445, 13800	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 10300 L mol^{-1} cm^{-1})	690087
	Benzene (298 K)	FP	~450	τ_T = 5000 ± 2500 μs	746270
	Benzene	PR/ET	450, 20000 ± 1000	ϵ relative to biphenyl in benzene (ϵ_{359} = 27100 L mol^{-1} cm^{-1})	83E281
	Bromobenzene	LP	452		83E281
	Cyclohexane	PR	445		690087
	Cyclohexane	PR/ET	440, 16000 ± 1000	ϵ relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1})	83E281
	Dioxane	PR	425		690087
	EtOH (298 K)	FP	~440	τ_T = 3000 ± 1500 μs	746270
	EtOH	FP/ET	421, 26000^c	Triplet ET from eosin; ϵ relative to eosin in EtOH (ϵ_{580} = 9400 L mol^{-1} cm^{-1})	78E019
	Heptane (298 K)	FP	~450	τ_T = 2500 ± 1300 μs	746270
	Liquid paraffin	FP	440		65F031
	MeOH	LP	440		83E281
	Toluene	LP/ET	452, 15500^a	Triplet ET from anthracene; ϵ relative to anthracene in benzene (Φ_T = 0.72, $\epsilon_{428.5}$ = 42000 L mol^{-1} cm^{-1}) assuming Φ_T = 0.72 for anthracene in toluene; oxygen quenching (3.4 × 10^9 L mol^{-1} s^{-1}); paper shows a spectrum with a peak at 428 nm with an ϵ of 18500 L mol^{-1} cm^{-1} which we take to be the spectrum of the sensitizer anthracene; τ_T = 10^3 μs	82E451
	Toluene	PR/ET	448, 16000 ± 1000	ϵ relative to biphenyl in benzene (ϵ_{359} = 27100 L mol^{-1} cm^{-1}), assuming no solvent effect	83E281
530.	**4,4′-Diphenylbenzophenone**				
	Alcohol/Ether (77 K)	MOD	415	Glass was 2:1 alcohol to ether	76E682
531.	**2,6-Diphenyl-1,4-benzoquinone**				
	Dibutyl phthalate	LP	600^a	τ_T = 0.56 μs; E_T = 218 - 238 kJ mol^{-1}	79B044
532.	**2,6-Diphenyl-1,4-benzoquinone/Diphenylamine**				
	Toluene (261 K)	LP	700^a	Claimed triplet exciplex; τ_T = 0.083 ± 0.012 μs	79B044
533.	**2,6-Diphenyl-1,4-benzoquinone/TMPD**				
	Dibutyl phthalate	LP	610^a 560^a	Claimed triplet exciplex; τ_T = 0.039 ± 0.003 μs; E_T = < 175 kJ mol^{-1}	79B044

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
534.	**2,6-Diphenyl-1,4-benzoquinone/Triphenylamine**					
	Benzene (293 K)	LP	650 550		550 nm band was the more intense; $\tau_T = 0.2\ \mu s$	81E715
	Benzene/MeOH (293 K)	LP	650 550		650 nm band was the more intense; solvent was 19:1 benzene to MeOH; $\tau_T = 0.083\ \mu s$	81E715
	Dibutyl phthalate	LP	670[a] 550[a]		Claimed triplet exciplex; $\tau_T = 0.14 \pm 0.01\ \mu s$; $E_T = < 175$ kJ mol^{-1}	79B044
535.	**1,4-Diphenyl-1,3-butadiene**					
	2-MTHF (123 K)	LP	~395			82E429
	Acetonitrile (298 K)	LP-ET	384		‡Triplet ET from benzophenone	82E429
	Benzene (295 K)	LP/SD	395 ± 2	45000 ± 6800	Triplet yields enhanced by presence of O_2; $\tau_T = 2.6 \pm 0.3\ \mu s$	82E365
	Benzene (298 K)	LP-ET	394 372		‡Triplet ET from biacetyl	82E429
	Benzene	LP	405		‡Oxygen and azulene quenching; $\tau_T = 2.6 \pm 0.2\ \mu s$	84E319
	Bromobenzene (295 K)	LP/SD	416 ± 2	45000 ± 6800	$\tau_T = 1.5 \pm 0.2\ \mu s$	82E365
	Cyclohexane (295 K)	LP/SD	390 ± 2	60000 ± 9000	Triplet yields enhanced by presence of O_2; shoulder at 372 nm; $\tau_T = 1.6 \pm 0.2\ \mu s$	82E365
	EPA (77 K)	FP	435 413 398 357		Main peak at 398 nm; $\tau_T = 2450\ \mu s$	707199
	Ethyl bromide (295 K)	LP/SD	392 ± 2	55000 ± 8300	$\tau_T = 2.5 \pm 0.3\ \mu s$	82E365
	Ethylene glycol	LP	393		‡Oxygen and azulene quenching; shoulders at 375 and 365 nm; $\tau_T = 5.0\ \mu s$	84E319
	Glycerol triacetate (298 K)	LP	~390		$\tau_T = 4\ \mu s$	82E429
	Glycerol triacetate (198 K)	LP	396		$\tau_T = 1500\ \mu s$	82E429
	MeOH (295 K)	LP/SD	385 ± 2	58000 ± 8700	Triplet yields enhanced by presence of O_2	82E365
536.	**1,4-Diphenylbutadiyne**					
	PMMA	PS	450		Polarization also measured; phase sensitive detection; $\tau_T = 8.0 \times 10^3\ \mu s$	78E152
537.	**1,2-Diphenylcyclobutene**					
	Benzene (298 K)	FP	~390		$\tau_T = \geqslant 200\ \mu s$	81E214
	Benzene (298 K)	LP-ET	~385		‡Triplet ET from benzophenone, oxygen quenching (4×10^9 L mol^{-1} s^{-1}); bandwidth ~3000 cm^{-1}; $\tau_T = > 3\ \mu s$; $k_{et} = 6.5 \times 10^9$ L mol^{-1} s^{-1}	81E214
	Benzene (298 K)	LP-ET	~385		‡Triplet ET from xanthone, oxygen quenching (3.4×10^9 L mol^{-1} s^{-1}); bandwidth ~3000 cm^{-1}; $\tau_T = > 3\ \mu s$; $k_{et} = 6 \times 10^9$ L mol^{-1} s^{-1}	81E214
	EPA (77 K)	LP	392 373			81E214
	EPA (298 K)	LP	~370			81E214
538.	**1,4-Diphenyl-2,3-dibenzoyl-1,4-epoxy-1,4-dihydronaphthalene**					
	Benzene	LP/RA	490 ±5	5270 ± 1300	‡Oxygen and azulene quenching; ϵ relative to benzophenone in benzene ($\epsilon_{532} = 7600$ L mol^{-1} cm^{-1}), assuming $\Phi_T = 1$ for benzophenone and taking $\Phi_T = 0.66$ for the compound in benzene; $\tau_T = 1.7 \pm 0.3\ \mu s$	84A355
	MeOH	LP	480 ± 5		‡Oxygen quenching; $\tau_T = 1.6 \pm 0.2\ \mu s$	84A355
539.	**1,1-Diphenylethylene**					
	tert-BuOH	LP-ET	~330		‡Triplet ET from acetone	82E204
540.	**9,9-Diphenyl-9*H*-9-germafluorene**					
	MCH/Isopentane (77 K)	FP	380[a]		‡Phosphorescene lifetime; glass was 3:1 MCH to isopentane; shoulder at 363[a] nm; $\tau_T = 4.5 \times 10^5\ \mu s$	81E648

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
541.	**1,6-Diphenyl-1,3,5-hexatriene**					
	1,2-Dichloroethane	LP	425 400		Radical cation (λ_{max} ~615 nm) also formed by a biphotonic process	80N033
	1,2-Dichloroethane	PR	425 400		Radical cation (λ_{max} ~615 nm) also formed	80N033
	2-MTHF (123 K)	LP	428		τ_T = 400 μs	82E429
	2-MTHF (298 K)	LP	420 396			82E429
	Acetonitrile (298 K)	FP	413 390		τ_T = 70 μs	82E429
	Benzene	PR/ET	422.5 397^{a}	113000 70500^{a}	ϵ relative to biphenyl in benzene (ϵ_{359} = 27100 L mol^{-1} cm^{-1}); ϵ_{ref} unstated, but assumed from authors' earlier work	761088
	Benzene (298 K)	LP-ET	425 400		‡Triplet ET from benzophenone and biacetyl	82E429
	Benzene (295 K)	LP/SD	426 ± 2	104000 ± 16000	Triplet yields enhanced by presence of O_2; τ_T = 10 ± 1 μs	82E365
	Bromobenzene (295 K)	LP/SD	430 ± 2	105000 ± 16000	τ_T = 13 ± 1 μs	82E365
	CTAB/Triton X-100	LP	415		Surfactant ratio 1:2 CTAB to Triton X-100; mixed aqueous micelle; τ_T = ~30 μs	80N033
	Cyclohexane	PR	425 400		Radical anion (λ_{max} ~660 nm) and cation (λ_{max} ~630 nm) also formed; half-life = 20 μs	80N033
	Cyclohexane (295 K)	LP/SD	416 ± 2	114000 ± 17000	Triplet yields enhanced by presence of O_2; τ_T = 20 ± 2 μs	82E365
	EPA (77 K)	FP	429 405		Main peak at 429 nm; τ_T = 400 μs	707199
	EtOH	PR/RF	415 388^{a}	113000 70300^{a}	ϵ relative to 1,6-diphenyl-1,3,5-hexatriene in benzene ($\epsilon_{422.5}$ = 113000 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; E_T = ~150 kJ mol^{-1}	761088
	EtOH	LP	420 390		Radical cation (λ_{max} ~600 nm) also formed by a biphotonic process	80N033
	Ethyl bromide (295 K)	LP/SD	420 ± 2	114000 ± 17000	τ_T = 12 ± 1 μs	82E365
	Glycerol triacetate (198 K)	LP	422		τ_T = 300 μs	82E429
	Glycerol triacetate (298 K)	LP	418		τ_T = 40 μs	82E429
	MeOH (295 K)	LP/SD	410 ± 2	121000 ± 18000	Triplet yields enhanced by presence of O_2; τ_T = 30 ± 3 μs	82E365
	SDS/Triton X-100	LP	425		Surfactant ratio 2:3 SDS to Triton X-100; mixed aqueous micelle; τ_T = ~30 μs	80N033
542.	**1,4-Diphenylnaphthalene**					
	3-MP (77 K)	PS/ESR	505 444	~10000 32500	‡ESR; oscillator strength = ~0.02, 0.52	69B002
543.	**1,5-Diphenylnaphthalene**					
	3-MP (77 K)	PS/ESR	538	22800	‡ESR; oscillator strength = 0.25	69B002
544.	**1,8-Diphenyl-1,3,5,7-octatetraene**					
	2-MTHF (298 K)	LP	435			82E429
	2-MTHF (123 K)	LP	440			82E429
	Acetonitrile (298 K)	FP	432 408		τ_T = 70 μs	82E429
	Benzene	PR/ET	440	162000	ϵ relative to biphenyl in benzene (ϵ_{359} = 27100 L mol^{-1} cm^{-1}); ϵ_{ref} unstated, but assumed from authors' earlier work	761088
	Benzene (298 K)	FP	444 419		‡Triplet ET from benzophenone and biphenyl; τ_T = 100 μs	82E429
	Benzene (295 K)	LP/SD	445 ± 2	188000 ± 28000	Triplet yields enhanced by presence of O_2; τ_T = 21 ± 2 μs	82E365
	Bromobenzene (295 K)	LP/SD	450 ± 2	179000 ± 27000	τ_T = 14 ± 1 μs	82E365

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Cyclohexane (295 K)	LP/SD	437 ± 2, 210000 ± 32000	Triplet yields enhanced by presence of O_2; τ_T = 40 ± 4 μs	82E365
	EtOH	PR/RF	427, 162000	ϵ relative to 1,8-diphenyl-1,3,5,7-octatetraene in benzene (ϵ_{440} = 162000 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; E_T = ~120 kJ mol^{-1}	761088
	Ethyl bromide (295 K)	LP/SD	440 ± 2, 230000 ± 35000	τ_T = 11 ± 1 μs	82E365
	Glycerol triacetate (298 K)	LP	440	τ_T = 60 μs	82E429
	Glycerol triacetate (198 K)	LP	444	τ_T = 100 μs	82E429
	MeOH (295 K)	LP/SD	430 ± 2, 191000 ± 29000	Triplet yields enhanced by presence of O_2; τ_T = 34 ± 3 μs	82E365
545.	**2,5-Diphenyl-1,3,4-oxadiazole**				
	Benzene	LP	550	‡Oxygen quenching (1.6 × 10^9 L mol^{-1} s^{-1}); 100 ns delay; "PPD"; τ_T = 0.300 μs	777265
	Cyclohexane	FP/TD	449, 670^a 440, 880^a 432, 900^a 425, 980^a	Authors claim that the spectrum reported in [777265] is erroneous; oscillator strength = 0.01	83E216
546.	**2,5-Diphenyloxazole**				
	Benzene	PR	500	‡Triplet ET from naphthalene and triplet ET to anthracene; "PPO"	720206
	Benzene	LP	570	‡Oxygen quenching (2.5 × 10^9 L mol^{-1} s^{-1}); 100 ns delay; τ_T = 0.200 μs	777265
	Cyclohexane	PR	500		720206
	Cyclohexane	FP/ET	500, 13000	‡Triplet ET to anthracene; ϵ relative to anthracene in cyclohexane (ϵ_{425} = 64700 L mol^{-1} cm^{-1}); τ_T = 1.7 × 10^3 μs	80E439
	EPA (77 K)	CWL	515		74B003
	EtOH	FP/ET	500, 28400 ± 1500	ϵ relative to naphthalene in EtOH (ϵ_{415} = 40000 L mol^{-1} cm^{-1}); τ_T = 2500 ± 1300 μs; k_{et} = (9.2 ± 1.0) × 10^9 L mol^{-1} s^{-1}	747049
547.	***N,N′*-Diphenyl-*p*-phenylenediamine**				
	Benzene	PR/ET	615, 26800	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
548.	***N,N′*-Diphenyl-*p*-phenylenediamine, conjugate acid**				
	EPA/Acetic acid (137.4 K)	FP/ELT	610 600^b, 67000 ± 15000	‡Phosphorescence decay; ϵ relative to the radical cation of compound (ϵ_{390} = 22000 L mol^{-1} cm^{-1}); solvent was 97:3 EPA to acetic acid; EPA was 8:3:5 Et_2O to isopentane to EtOH in this work	67A001
549.	**9,9-Diphenyl-9*H*-9-silafluorene**				
	MCH/Isopentane (77 K)	FP	373^a	‡Phosphorescene lifetime; glass was 3:1 MCH to isopentane; τ_T = 3.0 × 10^6 μs	81E648
550.	***N*-[(Dipropylamino)methyl]phthalimide**				
	EtOH	FP	590 350	‡Oxygen quenching, diene quenching; maxima assumed from text; τ_T = 10 μs	79A147
551.	**Durene/Tetracyanobenzene**				
	Et_2O/Isopentane (77 K)	MOD	541	Glass was 1:1 Et_2O to isopentane; another maximum >1430 nm	72E276

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
552.	**Duroquinone**					
	2-PrOH	LP	457^a		‡Triplet ET to anthracene; shoulder at 484^a	717520
	Acetonitrile	LP	485^a		50 ns delay; quenched by amines	777602
	Acetonitrile (293 K)	FP	480			82E614
	Benzene	PR/ET	490	9450	ϵ relative to biphenyl in cyclohexane ($\epsilon_{361.3}$ = 35400 L mol^{-1} cm^{-1}); author reports a mean of 9800 L mol^{-1} cm^{-1} from 3 separate standards	690520
	Benzene	PR/ET	490	8600	ϵ relative to anthracene in cyclohexane (ϵ_{420} = 57200 L mol^{-1} cm^{-1}); author reports a mean of 9800 L mol^{-1} cm^{-1} from 3 separate standards	690520
	Benzene	PR/ET	490	11400^c	ϵ relative to naphthalene in cyclohexane ($\epsilon_{412.5}$ = 22600 L mol^{-1} cm^{-1}); author reports a mean of 9800 L mol^{-1} cm^{-1} from 3 separate standards	690520
	Benzene	LP	490		τ_T = 3.1 μs	70E288
	Benzene	LP	477^a		‡Triplet ET to anthracene and dibenz[*a*,*h*]anthracene; τ_T = 10 μs	717520
	Benzene	PR/ET	490	6950	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Benzene (293 K)	FP	490			82E614
	Cyclohexane	PR/ET	490^b	4250	ϵ relative to biphenyl in cyclohexane ($\epsilon_{361.3}$ = 35400 L mol^{-1} cm^{-1}); author reports a mean of 4700 L mol^{-1} cm^{-1} from 3 separate standards	690520
	Cyclohexane	PR/ET	490^b	4950	ϵ relative to anthracene in cyclohexane (ϵ_{420} = 57200 L mol^{-1} cm^{-1}); author reports a mean of 4700 L mol^{-1} cm^{-1} from 3 separate standards	690520
	Cyclohexane	PR/ET	490^b	4900	ϵ relative to naphthalene in cyclohexane ($\epsilon_{412.5}$ = 22600 L mol^{-1} cm^{-1}), author reports a mean of 4700 L mol^{-1} cm^{-1} from 3 separate standards	690520
	Cyclohexane	PR/ET	490	5330	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); reference ϵ obtained by starting from ϵ_{max} = 3220 L mol^{-1} cm^{-1} for this ketyl radical in water and assuming the *f* of the ketyl radical is independent of solvent; final ϵ obtained from a simultaneous least squares fit to data from several compounds	71E360
	Cyclohexane	LP	490 450^a 310^a		Relative intensities (5:4:11); τ_T = 21 μs; oscillator strength = 0.121 ± 0.005	767144
	Dioxane	FP	485		Half-life = ~30 μs	587005
	Et$_2$O	FP	~485		Half-life = ~30 μs	587005
	EtOH	FP	~485		Half-life = ~30 μs	587005
	EtOH	LP/RF	490 455^a 310^a	5580 ± 550	ϵ relative to duroquinone in cyclohexane (ϵ_{490} = 5330 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; relative intensities (1:1:2); τ_T = 15 μs	767144
	EtOH/Sulfuric acid	FP	~490		Solvent was 50% 0.1 mol L^{-1} H$_2$SO$_4$ and 50% alcohol; half-life = 30 μs	587005
	EtOH/Water	FP	~485		Solvent was 1:1 EtOH to water; half-life = ~30 μs	587005
	Liquid paraffin	FP	490 460		Half-life = 100 μs	587005
	Liquid paraffin	LP	458^a		‡Quenching by anthracene; shoulder at 493^a nm; τ_T = 29 μs	717520
	MeOH (293 K)	FP	460			82E614
	PMMA	FP	470		τ_T = 180 ± 10 μs	707305
	SDS	LP	~450		Aqueous micelle	83N056
	Toluene	LP/ET	490	7600 ± 500	ϵ relative to anthracene in toluene ($\epsilon_{428.5}$ = 42000 L mol^{-1} cm^{-1})	83F075
	Water	LP/RF	500 440 420 395^a	4200 ± 450	ϵ relative to duroquinone in cyclohexane (ϵ_{490} = 5330 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; relative intensities (4:5:4:12); τ_T = 5.9 μs	767144

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm, ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Water/EtOH	LP/ELT	490^a 450^a 420^b, 6600 ± 800	ϵ relative to durosemiquinone (ϵ_{420} = 4700 L mol^{-1} cm^{-1}) assuming complete conversion in the presence of Fe^{2+} ions; solvent was 2:1 water to EtOH by volume; τ_T = 6.3 ± 0.8 μs	777045
	Water/MeOH	FP	510^a 440^a	Solvent was 4:1 water to MeOH by volume; lifetime measured at pH = 0.7; τ_T = 1.3 μs; pH >1	80C005
553.	**Duroquinone/Triphenylamine**				
	Benzene (293 K)	LP	490	τ_T = 2 μs	81E715
	Benzene/MeOH (293 K)	LP	650 550	650 nm band was the more intense; solvent was 19:1 benzene to MeOH; τ_T = 0.27 μs	81E715
554.	**Duroquinone, conjugate monoacid**				
	Water/MeOH	FP	470^a $\sim 380^a$	pK_a = −0.1; solvent was 4:1 water to MeOH by volume; lifetime measured at pH = −0.8; τ_T = ~0.3 μs; pH<1	80C005
555.	**Echinenone**				
	Benzene	PR-ET	550	‡Triplet ET from naphthalene; τ_T = 5.2 μs	80A143
556.	**Eosin**				
	Acetonitrile/Water	LP	580	Solvent was 3.5:1.5 acetonitrile to water; τ_T = 30 μs	84E216
	EtOH	FP/SD	580, 9400		716235
	Water	FP	550	Maximum was near the SD region; pH 9.1	746168
557.	**Eosin/Aniline**				
	Water	FP	555	Maximum was near SD region; pH 5.5	746168
558.	**Eosin/4-Bromophenol**				
	Water	FP	660	pH 9.2	746168
559.	**Eosin/2-Naphthol**				
	Water	FP	584	pH 9.0	746168
560.	**Eosin/Resorcinol**				
	Water	FP	580	pH 7.3	746168
561.	**Eosin/Sulfanilic acid**				
	Water	FP	597	pH 4.0	746168
562.	**Eosin dianion**				
	Water	FP/SD	540, 26000^a	Decay time was measured at pH 9; solution was oxygen free; pK_b > 10; paper reported a band at 459 nm that was later suggested to be due to semi-oxidized eosin [65A002]; τ_T = 2400 μs; pH 5.4	63A001
	Water	FP	565^a 325	565 nm maximum was near the SD region in an apparent difference spectrum and may not be the true maximum; paper reported 580 nm (instead of 565) as a maximum, but displayed spectrum and other reports were inconsistent with this; solution was a 0.1 mol L^{-1} phosphate buffer solution; pH 7.2	66A002
	Water	FP/SD	518^b, 28000 ± 4000	pH 9	67E031
	Water	FP/TD	630, 4800	pH Basic	727073
563.	**5-(1,4-Epidioxyphenyl)-6,11,12-triphenyltetracene**				
	Cyclohexane	LP	390^a	A rubreneperoxide, called "III" in paper	84E056
564.	**Ergosterol**				
	Benzene	LP-ET/TD	305, 2800 ± 500	‡Triplet ET from 2-fluorenyl phenyl ketone and other triplet sensitizers; ϵ assumes ET proceeds with unit efficiency; τ_T = > 150 μs; E_T = ~220 kJ mol^{-1}	80B021

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
565.	**Erythrosin**				
	?	FP	600 390	Solvent was not specified, probably water at an unknown pH	747229
	Acetonitrile/Water	LP	780	Solvent was 3.5:1.5 acetonitrile to water	84E216
566.	**Erythrosin dianion**				
	Gelatin	FP/SD	525^a, 12000^a	Extinction coefficient was calculated on the assumption that 44% of the ground state was converted to triplets in a 10 J flash; τ_T = 630 μs	64E016
	Water	FP/SD	526^b, 26000 ± 7000	pH 9	67E031
567.	**2-Ethoxynaphthalene**				
	Cyclohexane	FP	440^a 411^a	440 nm peak was the more intense; delay 30 μs	686045
	Liquid paraffin	FP	436 413 394	Solvent viscosity was 0.19 N·s/m^2; relative intensities (10:8:5)	58E001
568.	**Ethyl Violet**				
	PMMA (77 K)	PS	1232^a 625^a	Relative intensities (3:20); shoulder at 535^a nm; solvent contains 2-chloroethanol	69B003
569.	**10-Ethyl-9(10*H*)-acridinone**				
	EtOH (300 K)	FP/SD	580, 14600 ± 1500 310	"*N*-Ethylacridinone"; 310 nm quoted from [79E964]; τ_T = ~43 μs	81E649
570.	***N*-Ethylcarbazole**				
	2-MTHF	LP	420	Shoulder at 500 nm; τ_T = 5 μs	81E016
	Acetonitrile	LP/ET	420, 27000	ϵ relative to phenanthrene (ϵ_{480}= 27000 L mol^{-1} cm^{-1})	77B012
	Cyclohexane	FP	500^a 425^a	‡Triplet ET to anthracene; τ_T = 200 μs	78A368
	Cyclohexane	FP/ET	420, 13500	ϵ relative to naphthalene in cyclohexane (ϵ_{415} = 24500 L mol^{-1} cm^{-1})	84F039
	EtOH	LP/ET	420, 25000	ϵ relative to phenanthrene (ϵ_{480} = 27000 L mol^{-1} cm^{-1}); solvent and temperature assumed	78E394
	Hexane	FP	420	‡Oxygen and piperylene quenching; "ethylcarbazole"	757573
	MeOH	LP	420		77B012
	THF	LP	423^a	Delay 1 μs; shoulders at 498^a and 398^a nm	83E662
	Toluene	LP	425	‡Rises with flourescence decay; 100 ns delay	80E441
571.	**(*E*,*Z*)-3-Ethyl-5[(3-ethyl-2(3*H*)-benzothiazolylidene)ethylidine]-2-thioxo-4-thiazolidinone**				
	Toluene	FP-ET	600^a	‡Triplet ET from fluorenone; "merocyanine dye"	767764
572.	**1-Ethyl-2-[5-(1-ethyl-1,3-dihydro-3,3-dimethyl-2*H*-indol-2-ylidene)-3-fluoro-1,3-pentadienyl]-3,3-dimethyl-3*H*-indolium**				
	1-PrOH	LP-ET	710	‡Triplet ET from anthracene, oxygen quenching; τ_T = 109 μs	78A386
573.	**1-Ethyl-2-[5-(1-ethyl-1,3-dihydro-3,3-dimethyl-2*H*-indol-2-ylidene)-1,3-pentadienyl]-3,3-dimethyl-3*H*-indolium**				
	1-PrOH	LP-ET	690	‡Triplet ET from anthracene, oxygen quenching; τ_T = 455 μs	78A386
574.	**1-Ethylnaphthalene**				
	Isooctane	LP	415^a 390^a		81E015
575.	**2-Ethylnaphthalene**				
	Benzene	PR	430^a	‡Triplet ET to piperylene; τ_T = 7.1 μs; k_{et} = 1.29 × 10^9 L mol^{-1} s^{-1}	81E508
576.	**9-Ethylphenanthrene**				
	Liquid paraffin (293 K)	LP	482^a 452^a	Shoulder at 428^a nm	82E287
	THF	LP	480^a 453^a	‡Triplet ET to naphthalene; delay 500 ns; shoulder at 427^a nm	83E554

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
577.	***N*-Ethylphthalimide**				
	Acetonitrile	LP	335	‡Oxygen quenching; τ_T = 31 μs	80B066
578.	**β-Ethylstyrene**				
	Cyclohexane	LP/RA-ET	325^b, 3500	ϵ relative to naphthalene in cyclohexane (ϵ_{413} = 24000 L mol^{-1} cm^{-1}), but in ref. cited (ϵ_{415} = 24500 L mol^{-1} cm^{-1}); triplet ET from thioxanthone; τ_T = ~0.030 μs	82E181
579.	**Etiochlorin II**				
	Dimethyl phthalate	FP/SD	416^a	Shoulders at 466 nm and 424 nm	74B007
580.	**Euchrysine, conjugate monoacid**				
	Glycerol (293 K)	FP	620^a 560^a	Solvent has added glucose	776171
581.	**Flavine mononucleotide**				
	Water	LP	680	τ_T = 11 μs; pH 7.0	81A024
582.	**Flavine mononucleotide, conjugate monoacid**				
	Water	LP	680	pK_a = 5.2; τ_T = 10 μs; pH 4.1	81A024
583.	**Flavone**				
	Benzene	LP	661^a 366^a	‡Oxygen quenching; 661 nm peak was the more intense; delay 140 ns	80E884
	EPA (77 K)	FP	640^a 370^a	Lifetime measured at 370 nm; 370 nm peak was the more intense; τ_T = 4.1 × 10^5 μs	80E884
584.	**Fluoranthene**				
	PMMA (293 K)	FP	~450	τ_T = 4 × 10^5 μs	70E291
	Water/*tert*-BuOH	FP	405^a	Solvent mixture contains "1-5%" *tert*-BuOH for solubility; shoulder at 380 nm; pH ~6	767189
585.	**Fluorene**				
	2-MTHF (77 K)	PS/ESR	384, 20700	‡ESR; only most intense visible peak reported; oscillator strength = ~0.25	696115
	2-MTHF (77 K)	PS/KM	386^a, 18000^a		83E383
	EtOH (293 K)	FP	376		68E098
	EtOH/Et_2O (77 K)	MOD/KM	382, 12000 ± 3600	Glass was 2:1 EtOH to Et_2O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Heptane (77 K)	PS	421 386 366		67B007
	Heptane	FP	380^a 365^a	380 nm peak was the more intense	766421
	Hexane	FP	376		54E001
	Hexane (300 K)	MOD/SD	499^a, 3200^a 376, 40000	τ_T = 150 ± 2 μs	69E208
	Isopentane/MCH (77 K)	PS	421.1 388	Relative intensities (23:100); unresolved shoulder at 395 nm; τ_T = (5.7 ± 0.3) × 10^6 μs	54B001
	Liquid paraffin	FP	503 382.5	Solvent viscosity was 0.03 N·s/m^2; relative intensities (22:100); bands were assigned to 2 different electronic transitions	58E001
	PVA	FP	385	Stretched polymer film; polarized light indicates underlying band at 400 nm	776279
	Polystyrene	PR	394^a	$G\epsilon_{394}$ = 9900^a L mol^{-1} cm^{-1} / (100 eV absorbed)	701073
	Toluene/EtOH (77 K)	MOD	387^a	Glass was 19:1 toluene to EtOH; shoulder at 509^a nm	719059

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
586.	**Fluoren-9-one**					
	Acetonitrile	LP/?	420	6000	ϵ method unspecified; $\tau_T = 23$ μs	767201
	Acetonitrile	LP	630 600 425 387 317.5 285		‡Intensity of delayed fluorescence proportional to square of transient absorbance, decay kinetics; most intense peak at 285 nm; $\tau_T = 100$ μs	78E495
	Benzene	FP	600 430		‡Oxygen quenching; $\tau_T = 60$ μs	69E218
	Benzene	LP/ET	430	5900 ± 500	‡Triplet ET from benzophenone; ϵ relative to benzophenone in benzene ($\epsilon_{532.5} = 7630$ L mol^{-1} cm^{-1})	757282
	Benzene	LP	610 425		$\tau_T = 100$ μs	767201
	Benzene	LP	650 610 435 387 322.5 288		‡Intensity of delayed fluorescence proportional to square of transient absorbance, decay kinetics; most intense peak at 288 nm with approximate $\epsilon = 30000$ L mol^{-1} cm^{-1}; $\tau_T = 1000$ μs	78E495
	Cyclohexane	LP	590^a 425		‡Triplet ET, oxygen quenching; decay times limited in oxygen saturated solution; shoulder around 445 nm; relative intensities (1:10); $\tau_T = 0.220$ μs; rise time of 0.140 ± 0.030 ns	766464
	Cyclohexane	LP	620 460 420 360		‡Oxygen quenching; $\tau_T = 2.5$ μs; rise time of <50 ns	767201
	Hexane	LP	600 430		325 ps delay; relative intensities (1:3)	79B007
	MCH	LP	650 600 425 387 325 285		‡Intensity of delayed fluorescence proportional to square of transient absorbance, decay kinetics; most intense peak at 285 nm; $\tau_T = 500$ μs	78E495
	Water/*tert*-BuOH	FP	440^a 405^a 370^a		Solvent mixture contains "1-5%" *tert*-BuOH for solubility; pH ~6	767189
587.	**1-Fluorenyl diisopropyl borate**					
	Triisopropyl borate	FP	380			717266
588.	**2-Fluorenyl diisopropyl borate**					
	Triisopropyl borate	FP	380			717266
589.	**Fluoren-9-ylidene**					
	Acetonitrile	LP	500^a 400^a		Relative intensities (8:1); 200 ns delay	80A222
590.	**2-Fluorenyl phenyl ketone**					
	Benzene	LP/TD	525	18600 ± 900	$\tau_T = 360$ μs	80B021
591.	**Fluorescein**					
	Boric acid (178 K)	PS/SD	650 505	21000^a 17000^a	ϵ relative to ground state $\epsilon_{436} = 67000^a$ L mol^{-1} cm^{-1}.	41E001
	Boric acid (77 K)	PS/SD	1060 920 650	17000		65B004
	EtOH/Et$_2$O (90 K)	PS/SD	1140 640 470 370 320	13500^a 7000^a 9500^a 8500^a 4000^a	Solvent was 2:1 EtOH to Et$_2$O	57B001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	PMMA (193 K)	PS	500 465		Shoulders at 640 and 550 nm	59B001
	PMMA (77 K)	PS	1100 960 660			65B004
	PMMA (77 K)	PS	1660 1080 940 790 740 635 550 510			65B004
	PMMA (77 K)	PS	1056^a 641^a 552^a 498^a		Relative intensities (5:2:2:2); shoulders at 926^a and 461^a nm; solvent contains 2-chloroethanol; pH 4.0	69B007
592.	**Fluorescein, conjugate monoacid**					
	Sulfuric acid	FP/SD	640, 7700^a		Cation of fluorescein; pK_a = – 2.1; solution was 9 mol L^{-1} H_2SO_4; a spectrum was given also for the neutral triplet, at pH 0.7, which showed absorption between 450 and 850 nm, no distinct maximum was evident, but the extinction coefficient of the neutral triplet ranged between 1000 and 10,000 L mol^{-1} cm^{-1} in this region; τ_T = 4500 μs; pH Acidic	63F019
593.	**Fluorescein dianion**					
	EtOH	FP/TD	570, 6800		pH Basic	727073
	Water	FP/SD	535^a, 8700^a		Another maximum > 950 nm; pK_b 7.0; 535 nm peak was very broad, with 8700 L mol^{-1} cm^{-1} reading extending from ~532 to ~540 nm; τ_T = 2.0 × 10^4 μs; pH 12	60A001
	Water	FP/SD	489^b, 15000 ± 4000		pH 9	67E031
	Water	FP/TD	570, 8400		pH Basic	727073
594.	**Fluorobenzene**					
	Cyclohexane	LP	290^a		400 ns delay; τ_T = 0.67 μs	707561
595.	**4-Fluorobenzophenone**					
	Acetonitrile/Water	LP/ET	520, 5900 315, 12100		Solvent was 9:1 acetonitrile to water; ϵ relative to 1-methylnaphthalene in acetonitrile/water (ϵ_{415} = 11200 L mol^{-1} cm^{-1})	84B033
596.	***trans*-4-Fluorostilbene**					
	EPA (98 K)	LP	383 365 349		Triplet absorption not observable above 110 K; reported lifetime constant below 98 K; τ_T = 10^4 μs	79E640
	Glycerol (223 K)	LP	385 365 345		Relative intensities (3:2:1); triplet absorption not observable above 244 K; reported lifetime constant below 198 K; τ_T = 10^4 μs	79E640
597.	**γ-[2-(Formylamino)phenyl]-γ-oxo-α-aminobutyryl-L-lysine**					
	EtOH	LP	460		τ_T = 0.3 μs	78E308
	Water	LP	450		‡Oxygen quenching (1.3 × 10^9 L mol^{-1} s^{-1}); ionic strength 0.01 mol L^{-1}; τ_T = 0.85 μs; pH 7.5	78E308
598.	**3-Formylfurochromene**					
	EtOH	LP/ET	440, 28000		‡Triplet ET to retinol; ϵ relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}) assuming ϵ independent of solvent; τ_T = 50 μs; k_{et} = 4.2 × 10^9 L mol^{-1} s^{-1}	79E678

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm, ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
599.	***N*-Formylkynurenine**				
	EtOH	LP	450	‡Oxygen quenching (4.5×10^8 L mol^{-1} s^{-1}); $\tau_T = 10$ μs	78E308
	Water	FP	435	‡Oxygen and KI quenching; $\tau_T = 2$ μs; pH 7.6	757361
	Water	LP	440	‡Oxygen quenching (2×10^9 L mol^{-1} s^{-1}); ionic strength 0.01 mol L^{-1}; $\tau_T = 6.7$ μs; pH 7.5	78E308
600.	**2-Formyl-5′-methyldifurobenzene**				
	EtOH	LP/ET	540, 14000	‡Triplet ET to retinol; ϵ relative to retinol in hexane ($\epsilon_{405} = 80000$ L mol^{-1} cm^{-1}) assuming ϵ independent of solvent; $\tau_T = 13$ μs; $k_{et} = 4.7 \times 10^9$ L mol^{-1} s^{-1}	79E678
601.	**3-Formyl-2-methylfurochromene**				
	EtOH	LP/ET	450, 49500	‡Triplet ET to retinol; ϵ relative to retinol in hexane ($\epsilon_{405} = 80000$ L mol^{-1} cm^{-1}) assuming ϵ independent of solvent; $\tau_T = 29$ μs; $k_{et} = 3 \times 10^9$ L mol^{-1} s^{-1}	79E678
602.	**3-Formyl-8-methylfurochromene**				
	EtOH	LP/ET	450, 22000	‡Triplet ET to retinol; ϵ relative to retinol in hexane ($\epsilon_{405} = 80000$ L mol^{-1} cm^{-1}) assuming ϵ independent of solvent; $\tau_T = 18$ μs; $k_{et} = 6 \times 10^9$ L mol^{-1} s^{-1}	79E678
603.	**D-Glucose phenylosazone**				
	EtOH	LP/ET	460^b, 61200	N-chelate; no ref. cmpd. given for ϵ-measurement; $\tau_T = 0.46 \pm 0.01$ μs	83E018
	EtOH	LP/ET	530 460, 61000 ± 18000	N-chelate; ϵ relative to biacetyl in EtOH ($\epsilon_{740} = 1760$ L mol^{-1} cm^{-1}); $k_{et} = 2 \times 10^9$ L mol^{-1} s^{-1}	84E162
604.	**Hematoporphyrin IX**				
	Acetic acid	FP	450	‡Oxygen quenching	776190
	Acetic acid	LP	440	‡Triplet ET to β-carotene; $\tau_T = 42$ μs	81B115
	CTAB	LP	888 435 320	Aqueous micelles	82N210
	EtOH	FP	437	‡Oxygen quenching; $\tau_T = 910$ μs	82B118
	MeOH/Water	LP/TD	399^a, 117000^a	Solvent 9:1 MeOH to pH 7.4 phosphate buffer; shoulders at 370^a and 320^a nm	83E667
	SDS	LP	896 438 323	Aqueous micelles	82N210
	Triton X-100	LP	895 439 320	Aqueous micelles	82N210
	Water	FP	440	‡Oxygen quenching; $\tau_T = 710$ μs; pH 10.3	82B118
	Water	LP	890 440 320	pH Neutral	82N210
	Water	FP	440	‡Oxygen quenching; phosphate buffer; $\tau_T = 770$ μs; pH 7.1	82B118
	Water	LP/TD	390^a, 79400^a 371^a, 85800^a	Phosphate buffer; pH 7.4	83E667
605.	***all-trans*-1,3,5-Heptatriene**				
	Toluene	PR	315	‡Oxygen quenching; $G\Delta\epsilon_{max} = (1.8 \pm 0.2) \times 10^4$ L mol^{-1} cm^{-1} / (100 eV absorbed); $\tau_T = 0.29 \pm 0.03$ μs	84B139
606.	**Hexacene**				
	1,2,4-Trichlorobenzene	FP	550 513^a	‡Triplet ET from pentacene; shoulder at 481^a; 550 nm peak was the more intense; $\tau_T = 10$ μs	82E280
607.	**1,1,1,5,5,5-Hexafluoroacetylacetone**				
	EtOH/MeOH (118 K)	FP/SD	390, 1000 ± 200	Solvent was 3:1 EtOH to MeOH	68B005

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
608.	**Hexahelicene**					
	Et_2O/Isopentane (77 K)	PS	670		‡Phosphorescence decay; glass 1:1 Et_2O to isopentane; $\tau_T = 1.9 \times 10^6$ μs	62E008
609.	**10,11,13,14,16,17-Hexahydro-5,7:20,22-dietheno-8*H*,19*H*-diindeno[2,1-*n*:1′,2′-*o*][1,4,7,10]tetraoxacyclononadecin**					
	2-MTHF (77 K)	PS/KM	383^{a}	17100^{a}	Compound "XII" in paper	83E383
610.	**9,10,11,12,13,14-Hexahydro-5,7:15,17-dietheno-2,20-heptano-*H*-cyclotetradeca[1,2-*a*:1,14-*a*′]diindene**					
	2-MTHF (77 K)	PS/KM	465^{a}	35000^{a}	Compound "IX" in paper	83E383
611.	**Hexamethylbenzene/Tetracyanobenzene**					
	Et_2O/Isopentane (77 K)	MOD	1400 532		Glass was 1:1 Et_2O to isopentane	72E276
612.	**6-Hydroxy-7*H*-benz[*de*]anthracen-7-one**					
	2-PrOH	LP	530^{a}		Half-life = 2.4 ± 0.4 μs	757427
	Benzene	LP	535^{a}		‡Oxygen quenching (1.2 × 10^9 L mol^{-1} s^{-1}); half-life = 1.0 ± 0.2 μs	757427
613.	**2-Hydroxybenzophenone**					
	EtOH	LP	450		Possible tautomeric triplet state; 480 ps delay; $S_n \leftarrow S_1$ absorption (λ_{max} = 435 nm) also observed at 7 ps delay	80B001
	MeOH (175 K)	LP	~500		τ_T = 0.024 μs	82E475
614.	**4-Hydroxybenzophenone**					
	Isopentane (77 K)	FP	512^{a} 360^{a}		‡Phosphorescence decay	67E105
615.	**4-Hydroxybiphenyl**					
	PVA (77 K)	FP	520 390 348		Stretched polymer film; most intense peak at 390 nm; polarization also measured	78B129
616.	**3-Hydroxychromone**					
	Benzene	LP	397^{a}		Delay 200 ns; maximum uncertain due to absorption by a tautomer in the same spectral region	83B113
617.	**4-Hydroxycoumarin**					
	EPA (77 K)	PS	497.5 465.1 435 413^{a} 382^{a}		‡Phosphorescence decay; the 2 smallest wavelength maxima were somewhat in doubt because of photochem. in this region of the spectrum; most intense peaks were at 497.5, 465.1, and 435 nm; $\tau_T = (1.4 \pm 0.2) \times 10^6$ μs	71B001
618.	**1-(2-Hydroxyethyl)-3,3-dimethyl-6′-nitrospiro-(2,2′-indolin[2*H*-1]benzopyran)**					
	Benzene	PR	<430		‡Oxygen quenching; cis-cisoid isomer	78A411
619.	**3-Hydroxyflavone**					
	3-MP	LP	400		‡Oxygen quenching	83B030
620.	**7-Hydroxyflavone**					
	MeOH	LP	370		‡Oxygen quenching; τ_T = 5 μs	84A218
621.	**1-Hydroxyfluorene**					
	Isooctane	FP	385			717266
	PMMA	FP	385			717266
622.	**2-Hydroxyfluorene**					
	Isooctane	FP	385			717266
	PMMA	FP	385			717266
	Toluene/EtOH (77 K)	MOD	422^{a}		Glass was 19:1 toluene to EtOH; shoulders at 530^{a} and 387^{a} nm	719059

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
623.	**4-Hydroxy-6-methylcoumarin**					
	EPA	CWL	501^a 464^a 434^a 383^a		Glass, temperature unspecified	73E344
624.	**7-Hydroxy-4-methylcoumarin**					
	EPA	CWL/SD	505^a	$14500^a \pm 3600$	Glass, temperature unspecified	73E344
625.	**2-Hydroxy-2-methyl-1-phenylpropan-1-one**					
	Benzene	LP	310		‡Triplet ET to naphthalene; $\tau_T = 0.030$ μs; $k_{et} = 5 \times 10^9$ L mol^{-1} s^{-1}	80B030
626.	**2-Hydroxy-2-methyl-1-[4-(2-propyl)phenyl]propan-1-one**					
	Benzene	LP	310^a		‡Triplet ET to naphthalene; $\tau_T = 0.050$ μs	80B030
	Cyclohexane	LP	340			80B030
627.	**9-Hydroxyphenanthrene**					
	1,2-Dichloroethane	LP	455^a		‡Phosphorescence decay in MTHF at 77K; 400 ns delay	79A177
628.	**4′-Hydroxypropiophenone**					
	Acetonitrile/Water	LP	387^a		Solvent isotope insensitive quenching; solvent was 9:1 acetonitrile to water; lifetime limited by self-quenching; $\tau_T = 0.230$ μs	81A174
629.	**4-Hydroxypyrene**					
	1,2-Dichloroethane	LP	410		‡Oxygen quenching	79A177
630.	**1-(1*H*-Inden-3-yl)naphthalene**					
	Benzene	LP-ET	559^a 397^a		‡Triplet ET from xanthone and oxygen quenching; $\tau_T = 4.5$ μs	84B007
631.	**Indole**					
	Benzene (297 K)	PR	430		‡Triplet ET to naphthalene and anthracene, oxygen quenching	771021
	Cyclohexane	LP/RA	430	4000	‡Oxygen quenching, triplet quenching; ϵ relative to naphthalene in cyclohexane ($\epsilon_{414} = 24000$ L mol^{-1} cm^{-1}) and assuming $\Phi_T = 0.77$ for naphthalene and $\Phi_T = 0.51$ for indole; shoulder at 350 nm; $\tau_T = 16$ μs	777037
	Cyclohexane	LP/ET	430^b	4700 ± 500	‡Triplet ET to anthracene; ϵ relative to anthracene in cyclohexane ($\epsilon_{422.5} = 64700$ L mol^{-1} cm^{-1}); ϵ corrected for 4% radical absorption at maximum; and for energy transfer via excited singlet states; $\tau_T = 16$ μs; $k_{et} = 9 \times 10^9$ L mol^{-1} s^{-1}	81E082
	Water (298 K)	LP	~440		Spectrum is the difference between spectra at 50 ns and 4 μs; $\tau_T = 11.6 \pm 0.5$ μs; pH 7.5	757163
	Water	LP/RA	430	3640	ϵ relative to indole in cyclohexane ($\epsilon_{430} = 4700$ L mol^{-1} cm^{-1}) scaled by halfwidths; assumes oscillator strength is independent of solvent	81E082
632.	**2-Iodoanthracene**					
	Cyclohexane	LP	432		122 ps delay; rise time of $\sim 30 \times 10^{-3}$ ns	81E309
	Hexane (293 K)	LP	435 ~413		Delay 100 ps	82E303
633.	**9-Iodoanthracene**					
	Cyclohexane	LP	432		122 ps delay; rise time of $\sim 50 \times 10^{-3}$ ns	81E309
634.	**4-Iodobiphenyl**					
	Toluene	PR	400		‡Oxygen quenching	80A235
635.	**Iodo(methanol)(phthalocyaninato)rhodium(III)**					
	Acetonitrile/2-PrOH	LP/SD	640^b 590^b	900 22000	Solvent was 2.6 mol L^{-1} 2-PrOH	83F405

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
636.	**1-Iodonaphthalene**				
	Toluene	PR	430	‡Triplet ET to benz[*a*]anthracene, oxygen quenching; $\tau_T = \sim 0.010$ μs	80A235
637.	**2-Iodonaphthalene**				
	EPA (77 K)	FP	424		55E002
			400		
	Toluene	PR	430	‡Oxygen quenching	80A235
638.	**β-Ionone**				
	Hexane	LP/SD	330, 85300 ± 12800	ϵ assumes triplet does not absorb where singlet depletion is followed; $\tau_T = 0.16$ μs; $E_T = 207 \pm 12$ kJ mol^{-1}	78E721
639.	**2-Isopropylthioxanthen-9-one**				
	Benzene	FP	650-670	$\tau_T = 95$ μs	81A294
640.	**Isopsoralen**				
	Benzene	PR/ET	450^b, 4700	‡Triplet ET to β-carotene; ϵ relative to biphenyl in benzene ($\epsilon_{367} = 27100$ L mol^{-1} cm^{-1}); "angelicin"; $k_{et} = 5.2 \times 10^9$ L mol^{-1} s^{-1}	78E157
	Benzene	LP	405^a		78E157
	Water	LP	440^a	$\tau_T = 5.9$ μs	78E157
641.	**Isoquinoline**				
	1-BuOH/Isopentane (77 K)	FP/SD	419.0, 14900 ± 1000	Glass was 3:7 1-BuOH to isopentane; oscillator strength = 0.11	707240
			395^a, 7400^a		
	3-MP (77 K)	MOD/SD	417, 8800	Shoulder at 250 nm	73B001
			395^a		
			375^a		
			362^a		
			346^a		
			233, 14000		
	EPA (77 K)	PS	488	Relative intensities (3:9:100:66)	54B001
			459		
			421.6		
			400		
	Isopentane/MCH (77 K)	PS	414.1	Relative intensities (2:1)	54B001
			392		
642.	**Isoquinoline-*N*-oxide**				
	Cyclohexane	FP	418	$\tau_T = 3.6$ μs	727105
	EtOH	FP	396	$\tau_T = 7.7$ μs	727105
	Water	FP	389	$\tau_T = 2.0$ μs	727105
643.	**Kynurenic acid**				
	EtOH	LP/ET	570, 29000	‡Triplet ET to naphthalene, oxygen quenching (2×10^8 L mol^{-1} s^{-1}); ϵ relative to naphthalene in cyclohexane ($\epsilon_{415} = 24500$ L mol^{-1} cm^{-1}), assuming unit transfer efficiency and assuming ϵ independent of solvent (authors see naphthalene peak at 417.5 nm in EtOH); $k_{et} = 4 \times 10^8$ L mol^{-1} s^{-1}	79B086
	Water	LP	590	‡Triplet ET to naphthalene, oxygen quenching; $\tau_T = 10$ μs; pH 7; $E_T = 278$ kJ mol^{-1}	79B086
644.	**Lumichrome**				
	EtOH	LP/RA	560^a, 5200^a	ϵ relative to anthracene in cyclohexane ($\Phi_T = 0.71$, $\epsilon_{423} = 64700$ L mol^{-1} cm^{-1}) and using $\Phi_T = 0.61$ for lumichrome in ethanol; shoulder around 650 nm	777617
			450^a, 4000^a		
			370^a, 22600^a		
	Water	LP/RA	640, 5600^a	Lifetime measured at 640 nm; ϵ relative to anthracene in cyclohexane ($\Phi_T = 0.71$. $\epsilon_{423} = 64700$ L mol^{-1} cm^{-1}) and using $\Phi_T = 0.44$ for lumichrome in water; $\tau_T = 12$ μs; pH 2.2	777617
			570, 4800^a		
			400^a, 10300^a		
			350^a, 9000^a		
			300^a, 15400^a		

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
645.	**Lumiflavine**				
	Chloroform	FP/SD	396^a, 8130^a	τ_T = 30 μs	68E100
	EtOH	LP/RA	640^a, 10100^a 510^a, 5100^a 380^a, 12900^a	ϵ relative to anthracene in cyclohexane ($\Phi_T = 0.71$, $\epsilon_{423} = 64700$ L mol^{-1} cm^{-1}) and using $\Phi_T = 0.30$ for lumiflavine in ethanol; shoulder around 300 nm	777617
	Water	FP/TD	650, 5000	‡Transient sensitive to oxygen and iodide ions; TD assumed, value for ϵ is a lower limit, upper limit is double this value; pH 6.5	66E087
	Water	FP/SD	640, 5300^a 376^a, 13100^a	‡Triplet ET to acridine; τ_T = 90 μs	68E100
	Water	MOD	542^a	Another transition with a maximum at shorter wavelengths than 500 nm was also present; τ_T = 320 μs	70E295
	Water	FP/TD	690, 4400 370, 10700	Shoulder at ~440^a nm; pK_a 9.8; delay 8 μs; τ_T = 67 μs; pH 7	757078
646.	**Lumiflavine, conjugate monoacid**				
	Water	FP/TD	670, 4800 430, 7000 366^a, 6400^a	pK_a 4.4; delay 8 μs; τ_T = 29 μs; pH 2	757078
	Water	LP/RA	650, 6900 420^a, 7000^a 350^a, 6500^a	lifetime measured at 670 nm; ϵ relative to anthracene in cyclohexane ($\Phi_T = 0.71$, $\epsilon_{423} = 64700$ L mol^{-1} cm^{-1}) and using $\Phi_T = 0.42$ for lumiflavine in water; shoulder around 300 nm; τ_T = 20 μs; pH 2.2	777617
647.	**Lumiflavine, negative ion**				
	Water	FP/TD	650, ~2000 350, ~11000	Shoulder at ~440^a nm; delay 8 μs; τ_T = 63 μs; pH 13	757078
648.	***all-trans*-Lutein**				
	Digitonin (293 K)	LP/TD	518, 40000	‡Triplet ET from chlorophyll *a*, oxygen quenching (7 × 10^8 L mol^{-1} s^{-1}), temperature independent half-life; aqueous micellar suspension; half-life = 8.9 μs	69N001
649.	***all-trans*-Lycopene**				
	Hexane	FP-ET	534^a 527 520^a	‡Triplet ET from anthracene; 520 nm was the most intense peak; τ_T = 43 μs; $k_{et} = 1.7 \times 10^{10}$ L mol^{-1} s^{-1}	69E209
	Hexane	PR/ET	525, 390000 ± 20000 488^a ~460	‡Triplet ET from naphthalene; ϵ relative to naphthalene in cyclohexane ($\epsilon_{415} = 24500$ L mol^{-1} cm^{-1}), except authors used 412.5 nm as reference λ; τ_T = 8 μs; $k_{et} = 1.4 \times 10^{10}$ L mol^{-1} s^{-1}	713035
	Hexane	PR/ET	525, 495000 ± 74300	‡Triplet ET from biphenyl; ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; $\tau_T = 5.9 \pm 0.6$ μs; $k_{et} = (2.0 \pm 0.20) \times 10^{10}$ L mol^{-1} s^{-1}	776412
650.	**Lysyltryptophanyllysine**				
	Water (293 K)	LP	450	Buffered; τ_T = 20 μs; pH 7.0	81A232
651.	**Magnesium(II) mesoporphyrin**				
	EtOH (77 K)	FP	550^a 440^a	Relative intensities (1:7)	82E129
652.	**Magnesium(II) octaethylporphyrin**				
	MeOH	LP/ELT	440^b, 100000 430^a	‡Oxygen and ethyl iodide quenching; ϵ relative to methyl viologen radical cation in MeOH ($\epsilon_{440} = 580$ L mol^{-1} cm^{-1})	83A102
653.	**Magnesium(II) phthalocyanine**				
	Dimethylacetamide-/Water	LP/SD	490, 31000	Solvent was 7:3 dimethylacetamide to water	84A122
	Dioxane	FP	500 400		63B003
	Dioxane	FP	470	τ_T = 100 μs	65A001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Polyvinylbutyral (293 K)	LP	470 400			80E867
	Polyvinylbutyral (293 K)	LP	676 610		Relative intensities (5:1); polymer film; $\tau_T = 10$ μs	82E129
	PrOH	FP/SD	470	33600		73E345
	Pyridine	FP	470 400			58R002
	Pyridine	FP	500 400			63B003
654.	**Magnesium(II) tetraphenylporphyrin**					
	CTAC	LP	840 460		‡Oxygen quenching; aqueous micelles	83N073
	MCH	FP/TD	485 415	72000 27000	‡Oxygen quenching; $\tau_T = 1400$ μs	81E271
	SHS/2-Pentanol	LP	840 460		Aqueous microemulsion, hexadecane in water; shoulder at 720 nm	83N073
655.	**Malachite Green**					
	PMMA (77 K)	PS	780			65B004
656.	**Mercury(II) tetraphenylporphyrin**					
	MCH	FP/TD	495 420	86000 24000	‡Oxygen quenching; biexponential decay, reported value is shorter component; $\tau_T = 10$ μs	81E271
657.	**Mesoporphyrin**					
	Pyridine	FP	450		Isomer of mesoporphyrin unspecified	58R002
658.	**Mesoporphyrin, dimethyl ester**					
	Benzene	PR/ET	440^b 398^a	32000	‡Oxygen quenching (1.4×10^9 L mol^{-1} s^{-1}); ϵ relative to biphenyl in benzene ($\epsilon_{360} = 27100$ L mol^{-1} cm^{-1}); $\tau_T = 220$ μs	80E200
	Benzene	LP/TD	440^b 398^a	32000	‡Oxygen quenching (1.4×10^9 L mol^{-1} s^{-1}); $\tau_T = 220$ μs	80E200
659.	**1-(β-Methacryloxyethyl)-3,3-dimethyl-6′-nitrospiro(indoline-2,2′-[2*H*]benzopyran)**					
	Acetonitrile	LP	430^a			83B117
	Dioxane	LP	440		‡Oxygen quenching; $\tau_T = 1.0$ μs; rise time of <10 ns	82E041
	Toluene	LP	440			83B117
660.	**8,11*b*-Methanocyclodeca[*cde*]naphthalene**					
	Hexane	LP	490 390		‡Oxygen quenching; $\tau_T = 0.20 \pm 0.05$ μs	84F068
661.	**3-Methoxyacetophenone**					
	Water/Acetonitrile	LP	390^a		Solvent was 4:1 water to acetonitrile; 200 ns delay; $\tau_T = 3.2$ μs; $E_T = 303$ kJ mol^{-1}	82A082
662.	**4-Methoxyacetophenone**					
	Cyclohexane	LP/RA	360^a	10800^a	ϵ relative to benzophenone in cyclohexane ($\epsilon_{533} = 7630$ L mol^{-1} cm^{-1}, assuming no solvent effect from benzene), and taking all the triplet yields to be unity	737198
	Toluene	LP	390			84E144
663.	**3-Methoxy-7*H*-benz[*de*]anthracen-7-one**					
	Benzene	LP	~505^a		‡Oxygen quenching (1.3×10^9 L mol^{-1} s^{-1}); half-life $= 2.4 \pm 0.2$ μs	757427
664.	**4-Methoxybenzophenone**					
	Acetonitrile/Water	LP/ET	680 520 450 335	3400 5400 4700 5600	Solvent was 9:1 acetonitrile to water; ϵ relative to 1-methylnaphthalene in acetonitrile/water ($\epsilon_{415} = 11200$ L mol^{-1} cm^{-1})	84B033
	Water/Acetonitrile	LP	465^a 450^a		Solvent was 4:1 water to acetonitrile; 200 ns delay; $\tau_T = 7.2$ μs; $E_T = 288$ kJ mol^{-1}	82A082

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
665.	**9-[2-(4-Methoxycarbonylbenzoxy)ethyl]carbazole**				
	2-MTHF	LP	500^a 420	Relative intensities (1:2); $\tau_T = 5$ μs; rise time of 10 ns	81E016
666.	**9-[3-(4-Methoxycarbonylbenzoxy)propyl]carbazole**				
	2-MTHF	LP	490^a 420	Relative intensities (1:2); $\tau_T = 5$ μs	81E016
667.	**4-Methoxychalcone**				
	Heptane	LP	480 ± 15	"3-(4-Methoxyphenyl)-1-phenyl-2-propen-1-one"; $\tau_T = 0.023$ μs	83E347
	MeOH	LP	525 ± 15	$\tau_T = 0.029$ μs	83E347
668.	**(*R*)-4-Methoxydinaphtho[2,1-*d*:1′,2′-*f*][1,3,2]dioxaphosphepin 4-oxide**				
	2-MTHF (96 K)	PS/KM	420^a, 11100^a 400^a, 9100^a	Compound "IV" in paper	83E383
669.	**4-Methoxydinaphtho[2,1-*d*:1′,2′-*f*][1,3,2]dioxaphosphepin 4-oxide**				
	MTHF (102 K)	PS	418^a 400^a	Relative intensities (5:4); solvent and temperature assumed; $\tau_T = 10^6$ μs	80E361
670.	**8′-Methoxy-5-methyl-6′-nitrospiro[(5,6-dihydrophenanthridine-6,2)-(2*H*)chromene]**				
	Toluene	FP	640^a 510^a	‡Triplet ET from fluorene; E_T = 217-288 kJ mol^{-1}	767647
671.	**2-Methoxy-2-methyl-1-phenyl-1-propanone**				
	Cyclohexane	LP	475 430 400	‡Phosphorescence decay, oxygen quenching (1.1×10^9 L mol^{-1} s^{-1}); relative intensities (2:3:6); lifetime limited by reaction with solvent; $\tau_T = 0.12$ μs	80E642
672.	**1-Methoxynaphthalene**				
	3-MP (77 K)	PS	49. 462 441 417	441 nm peak was the most intense	74B004
	Cyclohexane	LP/ET	440, 7000 ± 500	‡Triplet ET from TMPD; ε relative to TMPD in cyclohexane (ϵ_{570} = 11900 L mol^{-1} cm^{-1})	757282
	EPA (77 K)	FP	490 465 440 420 395 370	440 nm was the most intense peak; $\tau_T = 2.3 \times 10^6$ μs	677485
	EtOH (293 K)	FP	436		68E098
	Isopentane/MCH/Et$_2$O (77 K)	PS	488^a 459^a 435^a 417^a	Glass was 6:1:0.7 isopentane to MCH to Et$_2$O; shoulder at 397^a nm; 435 nm was the most intense peak	71B003
	MeOH	FP	445^a		736218
673.	**2-Methoxynaphthalene**				
	3-MP (77 K)	PS	432 408 388 368 351.5	432 nm peak was the most intense	74B004
	Cyclohexane	LP/ET	435, 15000 ± 800	‡Triplet ET from TMPD; ε relative to TMPD in cyclohexane (ϵ_{570} = 11900 L mol^{-1} cm^{-1})	757282
	Heptane	FP	440^a	Lifetimes suggest solution not fully deaerated; $\tau_T = 50 \pm 5$ μs	77E663
	Isopentane/MCH/Et$_2$O (77 K)	PS	435^a 412^a	Glass was 6:1:0.7 isopentane to MCH to Et$_2$O; shoulders at 391^a and 375^a nm; 435 nm was the more intense peak	71B003

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
674.	**4-Methoxy-1-naphthonitrile**					
	EPA (77 K)	FP	522.5 495 469 450 425		495 was the most intense peak; $\tau_T = 2.2 \times 10^6$ μs	677485
675.	***cis,cis*-1-(3′-Methoxy-5′-nitro-2′-oxo-3′,5′-cyclohexadienyl)-3,4-dimethyl-1,3-pentadiene**					
	Toluene	LP/SD	520 330	~9000 ~12000	‡Oxygen quenching; ε's are uncertain because of spectral overlaps with another triplet and a photoproduct	83F081
676.	***trans*-3-Methoxy-4′-nitrostilbene**					
	Glycerol triacetate (198 K)	LP	755 552 420		Relative intensities (1:2:2)	78B088
	Glycerol triacetate	LP	755 554 412		Relative intensities (1:2:2)	78B088
677.	***cis*-4-Methoxy-4′-nitrostilbene**					
	Benzene	LP	600^a 420^a		Relative intensities (3:2); identical spectrum derived from *trans* isomer	78B088
	Cyclohexane	LP	545 416		Relative intensities (9:10); identical spectrum derived from *trans* isomer	78B088
	DMF	LP	652 466		Relative intensities (2:1); identical spectrum derived from *trans* isomer	78B088
	MeOH	LP	680^a 440^a		Relative intensities (2:1); identical spectrum derived from *trans* isomer	78B088
678.	***trans*-4-Methoxy-4′-nitrostilbene**					
	2,2-Dimethylbutane-/Pentane (77 K)	FP	650^a 600^a		Glass 3:8 pentane to 2,2-dimethylbutane	747022
	Benzene	LP	600^a 420^a		Relative intensities (3:2); identical spectrum derived from *cis* isomer	78B088
	Cyclohexane	LP	600		‡Oxygen quenching in benzene; $\tau_T = 0.090$ μs	747022
	Cyclohexane	LP	580		Identical spectrum obtained from *cis*-isomer; oxygen quenching (5.3×10^9 L mol^{-1} s^{-1}); $\tau_T = 0.077$ μs	777455
	Cyclohexane	LP	545 416		Relative intensities (9:10); identical spectrum derived from *cis* isomer	78B088
	DMF	LP	652 466		Relative intensities (2:1); identical spectrum derived from *cis* isomer	78B088
	EPA (77 K)	FP	645 612 450		Shoulders at 540 and 490 nm; 645 nm was the most intense peak; $\tau_T = 1.5 \times 10^4$ μs	677485
	EPA (88 K)	LP	610 526		610 nm peak was the more intense	78B088
	EPA	LP	600 526		600 nm peak was the more intense	78B088
	Glycerol triacetate	LP	~780 624 444		Most intense peak at 624 nm	78B088
	Glycerol triacetate (198 K)	LP	~780 625 460		Most intense peak at 625 nm	78B088
	MeOH	LP	~700 600		‡Oxygen quenching in benzene; $\tau_T = 0.33$ μs	747022
	MeOH	LP	680^a 440^a		Relative intensities (2:1); identical spectrum derived from *cis* isomer	78B088
679.	**4-Methoxyphenol**					
	EtOH (77 K)	MOD	444^a 392^a 337^a		‡Phosphorescence decay; $\tau_T = (2.9 \pm 0.2) \times 10^6$ μs	707152

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
680.	**2-[1-(4-Methoxyphenyl)-hydrazinyl-2-ylidene]-1-(4-nitrophenyl)-1,3-diketobutane**					
	Hexane	LP	510		‡Triplet ET to β-carotene and from biphenyl, oxygen quenching; half-life = 0.045 μs; E_T = 190 ± 10 kJ mol^{-1}	80A051
681.	***trans*-1-(4-Methoxyphenyl)-2-nitroethylene**					
	Benzene	LP	520^a		τ_T = 0.015 μs	78E057
	Benzene/Acetonitrile	LP	525^a		Solvent was 8:2 benzene to acetonitrile by volume; τ_T = 0.019 μs	78E057
	Cyclohexane	LP	450^a		τ_T = 0.0098 μs	78E057
	EPA (77 K)	PS/KM	740 530			78E057
682.	**4′-Methoxypropiophenone**					
	Benzene	LP/ET	390	12000	‡Triplet ET to naphthalene; ϵ relative to naphthalene in benzene (ϵ_{425} = 13000 L mol^{-1} cm^{-1})	81A174
	Benzene	LP	382^a			84E018
683.	**5-Methoxypsoralen**					
	Benzene	LP	455^a		"Bergapten"	78E157
	Benzene	PR/ET	450^b	10200	‡Triplet ET to β-carotene; ϵ relative to biphenyl in benzene (ϵ_{367} = 27100 L mol^{-1} cm^{-1}); k_{et} = 4.6 × 10^9 L mol^{-1} s^{-1}	78E157
	EtOH	LP/ET	461^a 450^b	11100^a 9500	ϵ relative to retinol, but actual reference ϵ used was not specified; τ_T = 4.2 μs	83E324
684.	**8-Methoxypsoralen**					
	Benzene	LP	470^a 390^a		"Xanthotoxin"; τ_T = 1.1 μs	78E157
	Benzene	FP-ET	600 480		‡Triplet ET from acetophenone; relative intensities (1:2)	79R026
	EtOH	LP/ET	370	24000	‡Triplet ET to retinol; ϵ relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}) assuming ϵ independent of solvent; τ_T = 10 μs; k_{et} = 5.3 × 10^9 L mol^{-1} s^{-1}	79E678
	EtOH	LP/ET	370^b	21000	ϵ relative to retinol, but actual reference ϵ used was not specified; τ_T = 2.3 μs	83E324
	Glycerol	FP	600 480		‡Oxygen quenching; there was a long-lived species that was attributed to a secondary product; there was another maximum <340 nm	757485
	Glycerol/Water	FP-ET	630 480 360		Solvent contains 57% (wt) glycerol; relative intensities (5:4:10)	79R026
	MeOH	LP	600 370			79B042
	Water	LP	>580^a 350^a			78E157
	Water	LP	360		‡Oxygen quenching (3.3 × 10^9 L mol^{-1} s^{-1}); radical contributions subtracted and no infrared peak observed; τ_T = 1.6 μs	79A114
	Water	LP/SD	370^b	16500	τ_T = 2.4 μs	83E324
685.	***trans*-4-Methoxystilbene**					
	EPA (77 K)	FP	400 382.5		Shoulder at 365 nm; 400 nm was the more intense peak; τ_T = 2.35 × 10^4 μs	677485
686.	**8-Methoxy-2,2,3-trimethyl-6-nitro-2*H*-chromene**					
	Toluene	LP/SD	520 330	~8000 ~10000	‡Oxygen quenching; ϵ's are uncertain because of spectral overlaps with another triplet and a photoproduct	83F081
687.	**6-Methoxy-1,3,3-trimethyl-6′-nitrospiro-(2,2′-indolin[2*H*-1]benzopyran)**					
	Toluene (298 K)	FP	470		‡Oxygen quenching, activationless decay; assigned to $\pi \rightarrow \pi^*$ transition in uncolored form	67B003

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
688.	**7′-Methoxy-1,3,3-trimethyl-6′-nitrospiro-(2,2′-indolin[2*H*-1]benzopyran)**					
	Toluene (298 K)	FP	445		‡Oxygen quenching, activationless decay; assigned to $\pi \rightarrow \pi^*$ transition in uncolored form	67B003
689.	**Methyl Violet**					
	PMMA (193 K)	PS	630			59B001
	PMMA (77 K)	PS	1290			65B004
			1200			
			1100			
			770			
			665			
			640			
			620			
	PMMA (77 K)	PS	1112^a		Relative intensities (1:5); shoulder at 524^a nm; solvent contains 2-chloroethanol	69B003
			613^a			
690.	**2-Methylaceanthren-1-one**					
	EPA (77 K)	FP	455		‡Phosphorescence decay; τ_T = 5900 μs	82E338
691.	**3-Methylacetophenone**					
	2-PrOH	LP	339^a		‡Quenching with oxygen, piperylene, and naphthalene	737473
	Cyclohexane	LP	332^a		‡Quenching with oxygen, piperylene, and naphthalene	737473
692.	**4-Methylacetophenone**					
	Cyclohexane	LP/RA	331^a	11400^a	ϵ relative to benzophenone in cyclohexane (ϵ_{533} = 7630 L mol^{-1} cm^{-1}, assuming no solvent effect from benzene), and taking all the triplet yields to be unity	737198
693.	**9-Methylacridine**					
	EtOH (298 K)	FP/?	521^a	3000^a		697225
			452^a	30000^a		
			408^a	10000^a		
			330^a	10000^a		
694.	**10-Methyl-9(10*H*)-acridinethione**					
	Acetonitrile (296 K)	LP/SD	520 ± 3	9000 ± 900	‡Oxygen (4.5 × 10^9 L mol^{-1} s^{-1}) and nitroxide radical quenching and triplet ET to anthracene; τ_T = 1.6 ± 0.3 μs	84E342
	Benzene (296 K)	LP/ET&SD	520 ± 3	9300 ± 900	‡Oxygen (5.2 × 10^9 L mol^{-1} s^{-1}) and nitroxide radical quenching and triplet ET to anthracene; ϵ relative to 1,6-diphenyl-1,3,5-hexatriene in benzene (ϵ_{426} = 104000 L mol^{-1} cm^{-1}); τ_T = 2.5 ± 0.5 μs	84E342
	Cyclohexane (296 K)	LP/ET&SD	520 ± 3	8800 ± 900	‡Oxygen (4.8 × 10^9 L mol^{-1} s^{-1}) and nitroxide radical quenching and triplet ET to anthracene; ϵ relative to 1,6-diphenyl-1,3,5-hexatriene in cyclohexane (ϵ_{416} = 114000 L mol^{-1} cm^{-1}); τ_T = 2.6 ± 0.5 μs	84E342
	MeOH (296 K)	LP/ET&SD	520 ± 3	8500 ± 900	‡Oxygen (4.5 × 10^9 L mol^{-1} s^{-1}) and nitroxide radical quenching and triplet ET to anthracene; ϵ relative to 1,6-diphenyl-1,3,5-hexatriene in MeOH (ϵ_{410} = 121000 L mol^{-1} cm^{-1}); τ_T = 2.3 ± 0.5 μs	84E342
695.	**4-(Methylamino)benzoic acid**					
	EtOH (93 K)	PS	435^a			66B001
			405^a			
			363^a			
696.	***N*-Methyl-1-anilinonaphthalene**					
	MCH (296 K)	LP	602^a		τ_T = 2000 μs	82E527
			420^a			
697.	***N*-Methyl-2-anilinonaphthalene**					
	MCH (153 K)	FP	500		‡Phosphorescence decay; lifetime = 120 μs at 294 K	82E527

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
698.	**N-Methyl-2-anilino-6-naphthalenesulfonate ion**					
	EtOH (293 K)	FP	500		$\tau_T = 200\ \mu s$	82E527
699.	**2-Methylanthracene**					
	EtOH	LP	427^a			706157
			405^a			
	EtOH/MeOH (113 K)	FP/TD	901^a	195^a	‡Phosphorescence decay; shoulders at 687^a, 672^a, 648^a, 634^a, 532^a, 328^a, and 272^a nm	72B001
			854^a	150^a		
			814^a	100^a		
			799^a	90^a		
			790^a	60^a		
			775^a	110^a		
			762^a	90^a		
			736^a	80^a		
			724^a	90^a		
			714^a	90^a		
			702^a	100^a		
			693^a	80^a		
			658^a	70^a		
			569^a	150^a		
			522^a	1200^a		
			481^a	1600^a		
			431^a	73000^a		
			407^a	22300^a		
			384^a	3900^a		
			366^a	1700^a		
			317^a	2300^a		
			305^a	2200^a		
			263^a	68300^a		
	PMMA	FP	901^a		‡Lifetime same as 430 nm triplet band; if $\epsilon_{430} \sim 50000$ L mol^{-1} cm^{-1}, then $\epsilon \sim 700$ L mol^{-1} cm^{-1} for near infrared band; $\tau_T = (2.1 \pm 1) \times 10^4\ \mu s$	66E086
			855^a			
			803^a			
			770^a			
			430			
700.	**9-Methylanthracene**					
	Benzene	PR/ET	430	64200	ϵ relative to benzophenone in benzene ($\epsilon_{532.5} = 10300$ L mol^{-1} cm^{-1})	690087
	Benzene	PR/ET	430	51300	ϵ relative to naphthalene in benzene ($\epsilon_{max} = 17500$ L mol^{-1} cm^{-1})	690087
	Cyclohexane	PR	425			690087
	Dioxane	PR	425			690087
	EtOH	LP	425^a			706157
			405^a			
	EtOH	FP/ET	440^b	2800	Triplet ET from eosin and proflavine; ϵ relative to eosin in EtOH ($\epsilon_{580} = 9400$ L mol^{-1} cm^{-1}) and proflavine in EtOH ($\epsilon_{550} = 11000$ L mol^{-1} cm^{-1})	716235
			426^b	37400		
			424	43000		
			420^b	24000		
	EtOH	FP-ET/RA	694^b	47	ϵ relative to 9-methylanthracene in EtOH ($\epsilon_{424} = 43000$ L mol^{-1} cm^{-1})	78E019
	Liquid paraffin	FP	428			65F031
701.	**9-Methylanthracene-d_{12}**					
	EtOH	LP	424^a			706157
702.	**Methyl benzoate**					
	Cyclohexane (290 K)	FP	333^a		10 μs delay	767556
703.	**2-Methylbenzoic acid**					
	Isopentane/MCH (77 K)	FP	325^a		‡Phosphorescence decay; solvent was 5:1 isopentane to MCH by volume; dimeric species; shoulder at 350^a nm; $\tau_T = 1.16 \times 10^6\ \mu s$	776222
			310^a			

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
704.	**3-Methylbenzoic acid**					
	Isopentane/MCH (77 K)	FP	325^a 310^a		‡Phosphorescence decay; solvent was 5:1 isopentane to MCH by volume; dimeric species; $\tau_T = 3.95 \times 10^6$ μs	776222
705.	**4-Methylbenzoic acid**					
	Isopentane/MCH (77 K)	FP	330^a 315^a		‡Phosphorescence decay; solvent was 5:1 isopentane to MCH by volume; dimeric species; $\tau_T = 3.45 \times 10^6$ μs	776222
706.	**2-Methylbenzophenone**					
	EtOH	LP	520		$\tau_T = 0.0028$ μs	84B003
707.	**4-Methylbenzophenone**					
	Acetonitrile/Water	LP/ET	525 315	6600 11700	Solvent was 9:1 acetonitrile to water; ε relative to 1-methylnaphthalene in acetonitrile/water (ϵ_{415} = 11200 L mol^{-1} cm^{-1})	84B033
708.	**Methyl-1,4-benzoquinone**					
	Water	LP	460 410		$\tau_T = 0.37$ μs	80B112
709.	**(2′-Methylbenzoyl)amino-2-Δ^2-thiazoline**					
	Cyclohexane (293 K)	FP/RA	550	7400	‡Triplet ET to biacetyl, oxygen quenching; ε relative to naphthalene in cyclohexane (ϵ_{414} = 24500 L mol^{-1} cm^{-1}); $\tau_T = 450$ μs	82E373
710.	**(4′-Methylbenzoyl)amino-2-Δ^2-thiazoline**					
	Cyclohexane (293 K)	FP/RA	550	9600	‡Triplet energy transfer to biacetyl, oxygen quenching; ε relative to naphthalene in cyclohexane (ϵ_{414} = 24500 L mol^{-1} cm^{-1}); $\tau_T = 2000$ μs	82E373
711.	**Methyl benzoylformate**					
	Benzene (298 K)	LP	446^a		Shoulders at 431^a and 400^a nm; $\tau_T = 1$ μs	84A030
712.	**Methylchlorophyllide *a***					
	Acetone	FP	520 470			65R023
	Benzene	FP	520 470			65R023
	EtOH	FP	520 470			65R023
713.	**1-Methyl-4-[4-cyanostyryl]pyridinium**					
	EtOH (103 K)	LP	415		Lifetime constant below 113 K; τ_T = ~500 μs	83E509
714.	**10-Methyl-5-deazaisoalloxazine-3-propanesulfonate ion**					
	Water	LP	660^a 516^a		Delay 200 ns; half-life = 7.5 μs	82B043
715.	**3-Methyl-5-deazalumiflavine**					
	Water	FP/TD	700^b 684^a 501^a	3600 ± 200 3700^a 8100^a	pH 9.2	81A434
716.	**1-Methyldeoxybenzoin**					
	Benzene	LP	325		‡Oxygen quenching (> 10^9 L mol^{-1} s^{-1}); $\tau_T = 0.09$ μs	79A028
717.	**Methyl 4-dimethylaminobenzoate**					
	EtOH (93 K)	PS	435^a 412^a 391^a 357^a		357 nm was the most intense peak	66B001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
718.	***N*-Methyldiphenylamine**				
	EPA (118 K)	FP/COM	540, 26000 ± 3000	‡Phosphorescence decay; ϵ based on quantitative decay of triplet to *N*-methyl-4a,4b-dihydrocarbazole whose room temperature $\epsilon_{610} = 21000 \pm 2000$ L mol^{-1} cm^{-1} in MCH	737125
719.	**Methylene Blue cation**				
	Acetonitrile	FP	870^a 750^a 520^a 422^a	$\tau_T = 150$ μs	77A203
	Acetonitrile	LP	870 420	1 μs delay; semioxidized cation radical ($\lambda_{max} = 520$ nm) also observed; half-life = 12.5 μs	81A347
	Acetonitrile	LP	860^a 780^a	‡Oxygen quenching (1.7 × 10^9 L mol^{-1} s^{-1}); relative intensities (7:4); 1 μs delay; $\tau_T = 14$ μs	84E216
	Acetonitrile/Water	LP	840^a 750^a	‡Oxygen quenching; relative intensities (13:6); 1 μs delay; solvent was 1:1 acetonitrile to water by volume	84E216
	CTAB	LP	420	Aqueous micelles	83N062
	EtOH	LP	847^a 775^a 418^a	847 nm was the most intense peak; $\tau_T = 450$ μs	756162
	EtOH	LP/SD	860 780 420 410^b, 20000		767803
	EtOH	LP/SD	860, 27000 420, 14000	ϵ assumes triplet does not absorb at 658 nm where SD was followed; solvent and temperature assumed	78E394
	EtOH/Water	LP/TD	840, 20000 420, 9000	Solvent was "30% EtOH"; no acid added; $\tau_T = 36$ μs; pH 8.2	79B104
	MeOH	LP/SD	420, 11000	‡Oxygen quenching; ϵ estimated assuming no triplet absorption at 650 nm; $\tau_T = 5.9$ μs	767574
	MeOH	LP/SD	410, 22000	‡Oxygen quenching (2.2 × 10^9 L mol^{-1} s^{-1}); ϵ assumes triplet does not absorb between 560 and 570 nm, where SD is monitored; decay followed at 420 nm; less intense peak at 525 nm assigned to triplet excimer; $\tau_T = 11 \pm 2$ μs	79A230
	Water	FP	420 280	pK_b = 7.2; pH Neutral; half-life = 130 μs	64B003
	Water	FP	800 415	pK_b = 7.3; delay 20 μs; $\tau_T = \sim 30$ μs; pH Neutral	64E013
	Water	LP/SD	820 420, 9000	‡Oxygen quenching; extinction coefficient was a lower limit; half-life = 30 μs	67E107
	Water	FP/SD	825, 18000	pK_a = 7.5 ± 0.1	67C001
	Water	LP	830 420	1 μs delay; semioxidized cation radical ($\lambda_{max} = 520$ nm) also observed; pH 8.2; half-life = 25 μs	81A347
720.	**Methylene Blue cation, conjugate monoacid**				
	Acetonitrile/Water	LP/TD	470^a, 4500^a 428^a, 6200^a 372^a, 14000^a	Solvent was 1:1 acetonitrile to water by volume; $\tau_T =$ 4.0 μs; pH Acidic	777062
	Acetonitrile/Water	LP/TD	710-670, ⩾16200 370, 15300	Solvent was 1:1 acetonitrile to water by volume; 0.01N HCl added; pH Acidic	79B104
	EtOH/Sulfuric acid	LP/RA	700^b, 55000	ϵ relative to unprotonated form ($\epsilon_{410} = 20000$ L mol^{-1} cm^{-1}); 500 ns delay; pH Acidic	767803
	EtOH/Water	LP/TD	703, 18700 680, 19000 370, 13200	Solvent was "30% EtOH"; 0.01N H_2SO_4 added; pK_a = 7.2; $\tau_T = 4.5$ μs; pH 2.0	79B104
	Hydrochloric acid	FP	375	pK_a = 6.7; delay 20 μs; pH 2	64E013
	Sulfuric acid	FP	375	pK_a = 6.8; pH 1	64B003
	Water	LP/TD	490^a, 3300^a 430^a, 3300^a 372^a, 7000^a	$\tau_T = 4.5$ μs; pH Acidic	777062
	Water	LP/TD	690, 14500 370, 12500	0.01N H_2SO_4 added; pH Acidic	79B104

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
721.	**Methylene Blue, dimer**					
	Water	LP	~550		‡Oxygen quenching; half-life = ~2 μs	67E107
722.	**Methylene Green cation**					
	Water	FP	794^a 761^a 518^a 412^a		SD region between 540 and 720 nm was not measured; pH 9	707364
723.	**4,4′-Methylenebis(1,1′-biphenyl)**					
	Alcohol/Ether (77 K)	MOD	380		Glass was 2:1 alcohol to ether	76E682
724.	**α-Methyl-β-ethylstyrene**					
	Cyclohexane	LP/RA-ET	325^b	4000	ε relative to naphthalene in cyclohexane (ϵ_{413} = 24000 L mol^{-1} cm^{-1}), but in ref. cited (ϵ_{415} = 24500 L mol^{-1} cm^{-1}); triplet ET from thioxanthone; τ_T = ~0.038 μs	82E181
725.	**5-Methyl-*endo-cis*-fluorenacene**					
	MCH/Isopentane (77 K)	PS	458^a		Glass was 4:1 MCH to isopentane; shoulder at 430 nm	74B006
726.	**7-Methylguanine**					
	Water	LP-ET	385		‡Triplet ET from acetone; pH 7.1; k_{et} = 7.5 × 10^9 L mol^{-1} s^{-1}	82B045
727.	**1-Methylindazole**					
	MeOH	FP	420		‡Oxygen quenching, piperylene quenching, and ESR; τ_T = 53 μs	757167
728.	**2-Methylindazole**					
	MeOH	FP	405		‡Oxygen quenching, piperylene quenching, and ESR; τ_T = 26 μs	757167
729.	**1-Methylindole**					
	Benzene (293 K)	LP-ET/ET	460	5000 ± 1500	‡Triplet ET from xanthone, from acetophenone and to naphthalene, oxygen quenching; ε relative to naphthalene in benzene (ϵ_{425} = 13200 L mol^{-1} cm^{-1}); τ_T = 2 μs	771021
	Benzene (297 K)	PR	460		‡Triplet ET to naphthalene and anthracene, oxygen quenching; τ_T = 1.8 μs	771021
	Water	FP	460		‡Oxygen quenching; τ_T = 29 μs; pH basic	83A213
730.	**2-Methylindole**					
	Water	LP-ET	435		‡Triplet ET from acetone; pH 7.1	82B045
731.	**3-Methylindole**					
	Benzene (297 K)	PR	450		‡Triplet ET to naphthalene and anthracene, oxygen quenching	771021
732.	**1-Methylisoquinoline-*N*-oxide**					
	Cyclohexane	FP	422		τ_T = 5.9 μs	727105
	EtOH	FP	418 395		‡Oxygen quenching and triplet ET to anthracene; τ_T = 7.7 μs	727105
	Water	FP	388		τ_T = 7.7 μs	727105
733.	**1-Methylnaphthalene**					
	1-Methylnaphthalene	PR/RF	420	6350	Liquid; ε relative to 1-methylnaphthalene in cyclohexane (ϵ_{420} = 14200 L mol^{-1} cm^{-1})	720243
	1-Methylnaphthalene	FP-ET	422^a 397^a		‡Triplet ET from benzophenone; 30 μs delay; evidence for triplet excimer at long wavelengths presented; relative intensities (3:2); 30 μs delay; τ_T = 25 μs	767159
	Acetonitrile/Water	LP/ET	415	11200	Solvent was 9:1 acetonitrile to water; ε relative to benzophenone in acetonitrile (ϵ_{520} = 6500 L mol^{-1} cm^{-1})	84B033

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Benzene	LP-ET	425	‡Triplet ET from benzophenone; k_{et} = 9.4 × 10^8 L mol^{-1} s^{-1}	84E092
	Cyclohexane (77 K)	PS	415.5 393 370	Relative intensities (10:6:1)	69E211
	Cyclohexane	PR/ET	420, 14200	ϵ relative to benzophenone ketyl radical in cyclohexane ($\epsilon_{542.5}$ = 3220 L mol^{-1} cm^{-1}), assuming ϵ is the same as $\epsilon_{537.5}$ for ketyl radical in water	720243
	Cyclohexane	LP/ET	420, 22400 ± 3000	‡Triplet ET from TMPD; ϵ relative to TMPD in cyclohexane (ϵ_{570} = 11900 L mol^{-1} cm^{-1})	757282
	EtOH/MeOH (113 K)	FP/TD	581^a, 100^a 562^a, 70^a 538^a, 150^a 503^a, 125^a 485^a, 230^a 457^a, 480^a	Glass was 3:1 EtOH to MeOH; shoulders at 629^a and 469^a nm	717460
	EtOH/MeOH (113 K)	FP/TD	628^a, 10^a 578^a, 100^a 535^a, 160^a 500^a, 120^a 484^a, 240^a 457^a, 480^a 419^a, 21900^a 396^a, 11300^a 375^a, 2500^a 356^a, 730^a 239^a, 49200^a	‡Phosphorescence decay; shoulders at 561^a, 469^a, 408^a, 367^a, 349^a, 285^a, and 236^a nm	72B001
	Hexane	FP-ET	418^a 395^a 383^a	‡Triplet ET from benzophenone; 30 μs delay; relative intensities (3:2:1)	767159
	Isooctane	FP	425^a 397^a 375^a	Shoulder at 360 nm	78B089
	Liquid paraffin	FP	422 399 380	Solvent viscosity was 0.03 N·s/m^2; relative intensities (100:60:31)	58E001
	PMMA (294 K)	FP	625^a	Shoulder at 568^a nm; τ_T = (1.10 ± 0.05) × 10^6 μs	69B004
734.	**2-Methylnaphthalene**				
	Cyclohexane	LP/ET	420, 25100 ± 3000	‡Triplet ET from TMPD; ϵ relative to TMPD in cyclohexane (ϵ_{570} = 11900 L mol^{-1} cm^{-1})	757282
	EtOH/MeOH (113 K)	FP/TD	575^a, 100^a 529^a, 170^a 490^a, 200^a 461^a, 280^a	Glass was 3:1 EtOH to MeOH; shoulder at 633^a nm	717460
	EtOH/MeOH (113 K)	FP/TD	631^a, 20^a 578^a, 100^a 532^a, 160^a 492^a, 200^a 462^a. 290^a 415^a, 25400^a 393^a, 12800^a 381^a, 1800^a 372^a, 3400^a 360^a, 600^a 353^a, 700^a 344^a, 350^a 238^a, 25500^a	‡Phosphorescence decay; shoulders at 402^a, 263^a, 234^a, and 231^a nm	72B001
	PMMA (294 K)	FP		Shoulder at 575^a nm; τ_T = (1.30 ± 0.05) × 10^6 μs	69B004
735.	**1-Methylnaphthalene/Pyromellitic dianhydride**				
	Et_2O/Isopentane (77 K)	FP	600^a 420^a	‡Phosphorescence decay; glass was 1:1 Et_2O to isopentane; shoulder at 645^a nm; τ_T = 9.8 × 10^4 μs	747587

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
736.	**Methyl 2-naphthoate**					
	Cyclohexane (290 K)	FP	412^a 401^a		35 μs delay; τ_T = 66 μs	767556
737.	**2-Methyl-1,4-naphthoquinone**					
	Water	LP/ELT	400^b	6600	‡Oxygen quenching and triplet ET to β-carotene; ε relative to 2-methylnaphthosemiquinone ion in water (ϵ_{390} = 11000 L mol^{-1} cm^{-1}); pH 7.0	83E311
738.	**1-Methyl-1-(1-naphthyl)ethylene**					
	Benzene	LP-ET	439^a		‡Triplet ET from xanthone and oxygen quenching; τ_T = 0.55 μs	84B007
739.	**1-Methyl-1-(2-naphthyl)ethylene**					
	Benzene	LP-ET	599^a 415^a 388^a		‡Triplet ET from xanthone and oxygen quenching (5 × 10^9 L mol^{-1} s^{-1}); 415 nm peak was the most intense; τ_T = 0.13 μs	84B090
740.	**Methyl-1-naphthylphenylgermane**					
	Cyclohexane	LP	430^a 410^a		430 nm peak was the more intense; delay 0.8 μs	83A218
741.	**5-Methyl-6′-nitrospiro[(5,6-dihydrophenanthridine-6,2)-(2*H*)chromene]**					
	Toluene	FP	670^a 470^a		‡Triplet ET from fluorene; τ_T = 300 μs; E_T = 217-288 kJ mol^{-1}	767647
742.	**1-Methyl-4-[4-nitrostyryl]pyridinium**					
	EtOH (298 K)	LP	450		‡Oxygen quenching and triplet ET from acetone and biacetyl; τ_T = 0.055 μs	83E509
	EtOH (103 K)	LP	450		Lifetime constant below 108 K; τ_T = 3000 μs	83E509
743.	**5-Methylphenazinium methyl sulfate**					
	Water	FP	525		‡Oxygen quenching; τ_T = 50 ± 5 μs; pH 3	80A196
744.	***N*-Methylphenothiazine**					
	Hexane	LP/ET	465	23000 ± 300	ε relative to naphthalene in cyclohexane (ϵ_{413} = 24500 L mol^{-1} cm^{-1}) assuming unit transfer efficiency and assuming ε independent of solvent	79N005
	SDS	LP/RA	465	23000	Aqueous micelle; ε relative to *N*-methylphenothiazine in hexane (ϵ_{465} = 23000 L mol^{-1} cm^{-1})	79N005
	Water/EtOH	LP	465		Solvent was 2:1 water to EtOH	82A297
745.	***N*-Methylphthalimide**					
	EtOH	FP	590 350		‡Oxygen quenching, diene quenching; maxima assumed from text; τ_T = 43 μs	79A147
746.	**4-(2-Methylpropionyloxy)benzophenone**					
	Benzene	LP	530		‡Triplet ET to naphthalene	84P005
747.	**Methyl pyropheophorbide *a***					
	Toluene	LP	~460			82B094
748.	***all-trans*-Methyl retinoate**					
	Benzene	PR/ET	435	89000	ε relative to biphenyl in benzene ($\epsilon_{367.5}$ = 27100 L mol^{-1} cm^{-1}); τ_T = 17 μs; k_{et} = 8.4 × 10^9 L mol^{-1} s^{-1}	80E137
749.	**2-Methylthioxanthen-9-one**					
	1,2-Dichloroethane	FP	650-670		τ_T = 20 μs	81A294
	Acetonitrile	FP	630		‡Oxygen quenching (5.5 × 10^9 L mol^{-1} s^{-1}); τ_T = 40 μs	81A294
	Benzene	FP	655^a		‡Oxygen quenching (5.5 × 10^9 L mol^{-1} s^{-1}); τ_T = 95 μs	81A294
	Cyclohexane	FP	650-670		τ_T = 10 μs	81A294
	EtOH	FP	605		τ_T = 60 μs	81A294
	MeOH	FP	605		τ_T = 68 μs	81A294

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
750.	**(*E*,*E*,*E*)-5-Methyl-7-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2,4,6-heptatrienal**				
	Acetonitrile	LP/SD	440, 51000	"*all-trans*-C_{17} aldehyde"; ϵ is upper limit; τ_T = 10.6 μs	79E546
	Acetonitrile	LP/RF	440, 61000	ϵ relative to compound in cyclohexane (ϵ_{410} = 63000 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; τ_T = 10.6 μs	79E546
	Benzene	PR/ET	430, 63000	ϵ relative to biphenyl in benzene ($\epsilon_{367.5}$ = 27100 L mol^{-1} cm^{-1}); τ_T = 9.1 μs	79E546
	Benzene	PR/RF	430, 71000	ϵ relative to compound in cyclohexane (ϵ_{410} = 63000 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; τ_T = 9.1 μs	79E546
	Cyclohexane	PR/ET	410, 63000	ϵ relative to biphenyl in cyclohexane ($\epsilon_{361.3}$ = 42800 L mol^{-1} cm^{-1}); τ_T = 6.2 μs	79E546
	MeOH	LP/SD	440, 51000	ϵ is upper limit; τ_T = 10.9 μs	79E546
	MeOH	LP/RF	440, 57000	ϵ relative to compound in cyclohexane (ϵ_{410} = 63000 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; τ_T = 10.9 μs	79E546
751.	**(*E*,*E*,*E*)-6-Methyl-8-(2,6,6-trimethyl-1-cyclohexen-1-yl)-3,5,7-octatrien-2-one**				
	Hexane	LP/SD	405-410, 52000	ϵ assumed to be at λ_{max}; "*all-trans*-C_{18} ketone"	84E036
752.	**(*E*,*E*,*Z*)-6-Methyl-8-(2,6,6-trimethyl-1-cyclohexen-1-yl)-3,5,7-octatrien-2-one**				
	Hexane	LP/SD	405-410, 66000	ϵ assumed to be at λ_{max}; "7-*cis*-C_{18} ketone"	84E036
	Hexane	PR/ET	405-410, 37000	ϵ relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; ϵ assumed to be at λ_{max}	84E036
753.	**(*E*,*Z*,*E*)-6-Methyl-8-(2,6,6-trimethyl-1-cyclohexen-1-yl)-3,5,7-octatrien-2-one**				
	Hexane	LP/SD	405-410, 54000	ϵ assumed to be at λ_{max}; "9-*cis*-C_{18} ketone"	84E036
	Hexane	PR/ET	405-410, 23000	ϵ relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; ϵ assumed to be at λ_{max}	84E036
754.	**(*E*,*Z*,*Z*)-6-Methyl-8-(2,6,6-trimethyl-1-cyclohexen-1-yl)-3,5,7-octatrien-2-one**				
	Hexane	LP/SD	405-410, 23000	ϵ assumed to be at λ_{max}; "7,9-*dicis*-C_{18} ketone"	84E036
	Hexane	PR/ET	405-410, 42000	ϵ relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; ϵ assumed to be at λ_{max}	84E036
755.	**(*E*,*E*)-3-Methyl-5-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2,4-pentadienal**				
	Hexane	LP/SD	385, 38500 ± 5800	ϵ assumes triplet does not absorb where singlet depletion is followed; "*all-trans*-C_{15} aldehyde"; τ_T = 0.1 μs; E_T = 188 ± 12 kJ mol^{-1}	78E721
	Hexane	PR/ET	380-390, 20000	ϵ relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; ϵ assumed to be at λ_{max}	84E036
	Hexane	LP/SD	380-390, 41000	ϵ assumed to be at λ_{max}	84E036
	MeOH	LP/RF	400, 34000	ϵ relative to compound in hexane (ϵ_{385} = 38500 L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; τ_T = 0.19 μs	79E546
756.	**(*E*,*Z*)-3-Methyl-5-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2,4-pentadienal**				
	Hexane	LP/SD	380-390, 17000	ϵ assumed to be at λ_{max}; "7-*cis*-C_{15} aldehyde"	84E036
	Hexane	PR/ET	380-390, 14000	ϵ relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; ϵ assumed to be at λ_{max}	84E036
757.	**(*Z*,*E*)-3-Methyl-5-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2,4-pentadienal**				
	Hexane	PR/ET	380-390, 28000	ϵ relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; ϵ assumed to be at λ_{max}	84E036
	Hexane	LP/SD	380-390, 14000	ϵ assumed to be at λ_{max}; "9-*cis*-C_{15} aldehyde"	84E036

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm, ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
758.	**(*Z*,*Z*)-3-Methyl-5-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2,4-pentadienal**				
	Hexane	PR/ET	380-390, 21000	ϵ relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; ϵ assumed to be at λ_{max}	84E036
	Hexane	LP/SD	380-390, 17000	ϵ assumed to be at λ_{max}; "7,9-*dicis*-C_{15} aldehyde"	84E036
759.	**3-Methyl-3,4,5-triphenyl-2(3*H*)-furanone**				
	Benzene	LP/ET	370 ± 5, 11000 ± 2200	‡Oxygen quenching; ϵ relative to benzophenone in benzene (ϵ_{532} = 7600 L mol^{-1} cm^{-1}); $\tau_T = 12 \pm 2$ μs; $k_{et} = 2.9 \times 10^9$ L mol^{-1} s^{-1}	84E520
760.	**1-Methyl-L-tryptophan**				
	EtOH	FP	460	‡Triplet ET from acetophenone	727041
	Water	FP	460	‡Air quenching; $\tau_T = <5$ μs; pH 5.4	727041
761.	**Methyl vinyl ketone**				
	Cyclohexane	LP	260^a	‡Oxygen quenching; solvent uncertain; $\tau_T = 0.008$ μs	80B055
762.	**1-Methyl-2-vinylnaphthalene**				
	Benzene	LP-ET	416^a 401^a	‡Triplet ET from xanthone and oxygen quenching (7.5 × 10^9 L mol^{-1} s^{-1}); 401 nm peak was the more intense; $\tau_T = 0.06$ μs	84B090
763.	**2-Methyl-3-vinylnaphthalene**				
	Benzene	LP-ET	571^a 412^a 391^a	‡Triplet ET from xanthone and oxygen quenching (4.9 × 10^9 L mol^{-1} s^{-1}); 412 nm peak was the most intense; $\tau_T = 0.255$ μs	84B090
764.	**1-Naphthaldehyde**				
	Benzene	FP	495	$\tau_T = 140$ μs	63E007
	Cyclohexane (77 K)	PS	412.5 405 387		69E211
	Cyclohexane	LP	494 475 450	Shoulders at 427 and 405 nm; delay 660 ps; rise time of 0.026 ± 0.003 ns	84B028
	Et_2O/Pentane (77 K)	PS	440 425 412 405 387		69E211
	MeOH	LP	478^a 456^a 410^a	Shoulders at 497^a, 437^a, and 425^a nm; delay 660 ps; 478 nm was the most intense peak; rise time of 0.020 ± 0.002 ns	84B028
	Toluene/MCH (50 K)	LP	479^a	Glass was 1:1 toluene to MCH; delay 42 ps; spectrum showed evidence of structure between 410 and 460 nm	84B028
	Water/*tert*-BuOH	FP	520^a	Solvent mixture contains "1-5%" *tert*-BuOH for solubility; shoulders at 540 and 470 nm; pH ~6	767189
765.	**2-Naphthaldehyde**				
	Cyclohexane	LP	434 408	Delay 600 ps; rise time of 0.055 ± 0.005 ns	84B028
	MeOH	LP	442^a	Delay 600 ps; rise time of 0.025 ± 0.003 ns	84B028
	Toluene/MCH (69 K)	LP	446^a	Glass was 1:1 toluene to MCH; delay 42 ps; shoulders at 431^a and 405^a nm	84B028
766.	**2-Naphthalenamine**				
	Liquid paraffin	FP	457 377		61E008

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
767.	**2-Naphthalenamine, conjugate acid**				
	MeOH/Water (290 K)	LP/ET	410, 7800 391^a, 4300^a 377^a, 2150^a	‡Oxygen quenching; ϵ relative to benzophenone ketyl radical in water (ϵ_{545} = 3220 L mol^{-1} cm^{-1}); solvent was 19:1 MeOH to water; τ_T = 1.8 μs; pH 1.8	83A249
	Water	FP	414 387	"2-Naphthylamine cation"; pK_a = 3.3; pH Acidic	61E008
768.	**Naphthalene**				
	1,2-Dichloroethane	FP	414	τ_T = 125 μs	80E720
	2-PrOH	FP	414^a 388^a 372^a	Relative intensities (5:3:1); 30 μs delay; τ_T = 58 μs	737158
	3-MP	PR	411^a 388^a	$G\epsilon$ values were 9870 and 27300 L mol^{-1} cm^{-1}/ (100 eV absorbed)	680553
	3-MP (77 K)	PR	413^a 390^a	$G\epsilon$ values were 17300 and 17900 L mol^{-1} cm^{-1}/ (100 eV absorbed)	680553
	3-MP (77 K)	PS/ESR	415, 31900	‡ESR; oscillator strength = 0.12	69B002
	3-MP (77 K)	PS	412.4 399.3 390.0 377.7 369.8 358.2 351.5 341.2	All 8 bands were assigned to the electronic transition ${}^3B_{3g}^- \leftarrow {}^3B_{2u}^+$	70B005
	3-MP (77 K)	MOD	415 400 391.5 380 371 360		73E342
	3-MP (85 K)	LP	415^a 400^a 391^a 379^a 372^a	415 nm peak was the most intense	747056
	3-MP (293 K)	LP	412 390 370	412 nm peak was the most intense; τ_T = 6 μs	747056
	Acetonitrile	FP	410^a 385^a 375^a	Relative intensities (5:3:1); 30 μs delay; τ_T = 38 μs	737158
	Benzene	FP	415 392 372	Relative intensities (100:60:15)	61E005
	Benzene	PR	420	$G\epsilon_{420}$ = 15100 L mol^{-1} cm^{-1} / (100 eV absorbed); half-life = 1.59 μs	64B006
	Benzene	PR/ET	415, 17500	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 10300 L mol^{-1} cm^{-1}); λ_{max} unspecified, assumed 415 nm	690087
	Benzene	PR/ET	425, 13200 402^a, 7300^a 382^a, 4200^a	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Benzene	PR	420 400		720206
	Benzene	LP/ET	425, 11300	‡Triplet ET from benzophenone; ϵ relative to benzophenone in benzene (ϵ_{533} = 7200 L mol^{-1} cm^{-1}); k_{et} = 0.74 × 10^9 L mol^{-1} s^{-1}	80B090
	Benzophenone (77 K)	PS-ET	425^a 403^a	Relative intensities (100:58^a); sample was a single crystal	64B005

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Benzophenone (77 K)	PS/COM	427^a, 3500^e 413^a, 1400^{a,e} 403^a, 1800^{a,e} 400^a, 1800^{a,e}	Mixed crystals; shoulder at 418^a; ϵ was measured using a technique involving reabsorption of phosphorescence	68E106
	Butane/Isopentane (77 K)	PS/IV	414, 14000 ± 3000 393^a, ~7800	Glass was 3:7 butane to isopentane; ϵ_T was computed from OD = $\epsilon_T \tau_p i_0(1 - \Phi_f)$ after the optical density, OD, was extrapolated to zero intensity of the monitoring beam (namely $i_0 \rightarrow 0$), here τ was lifetime of triplet, and Φ_f was fluorescence quantum yield; oscillator strength = 0.05	65E031
	Cyclohexane	FP	414	$\tau_T = 175\ \mu s$	62E009
	Cyclohexane (77 K)	PS	415^a 412^a 410^a	Other shoulders were present in the spectrum; the shoulders appeared in different places depending on whether the samples were frozen rapidly or slowly	63B004
	Cyclohexane	PR	415 390	$G\epsilon_{415} = 10200$ L mol^{-1} cm^{-1} / (100 eV absorbed); half-life = 5.85 μs	64B006
	Cyclohexane	PR	415 391 375	Relative intensities (100:55:22)	676011
	Cyclohexane (77 K)	PS	417.5 415 410.5 393.5 391 386 370 366 361 347.5		67B007
	Cyclohexane	PR/ET	412.5, 22600 ± 5650	ϵ relative to benzophenone ketyl radical in water ($\epsilon_{537.5}$ = 3220 L mol^{-1} cm^{-1}), assuming this value for $\epsilon_{542.5}$ in cyclohexane	680727
	Cyclohexane	LP	414		68E107
	Cyclohexane (77 K)	PS	415.0 411.5 409.0 393.0 389.5 387.5 373.0	Shoulder at 422 nm; peak positions depend on cooling rate	69E211
	Cyclohexane (77 K)	PS	412.0 409.0 406.8 390.0 386.5 385.5 370.0	Shoulder at 418.5 nm; peak positions depend on cooling rate	69E211
	Cyclohexane	PR/ET	415, 24500 393^a, 12000^a 373^a, 4600^a	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); reference ϵ obtained by starting from ϵ_{max} = 3220 L mol^{-1} cm^{-1} for this ketyl radical in water and assuming the f of the ketyl radical is independent of solvent; final ϵ obtained from a simultaneous least squares fit to data from several compounds	71E360
	Cyclohexane	PR	412.5 390 370		720206
	Cyclohexane	LP	414 391 370	$\tau_T = 10\ \mu s$	747056
	Cyclohexane	FP/SD	414, 24000 ± 3000		756293
	Dipropyl ether (118 K)	FP	417^a 405^a 394^a		696073

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Durene (77 K)	PS	419 395	Polarization of the bands was found to be along the long molecular axis; transition was assigned as $^3B_{2g} \leftarrow {}^3B_{1u}$; sample was a mixed crystal	64E014
	Durene (4.2 K)	PS	417.4 394.4 383 374	Single crystal; relative intensities (100:46:2:10)	67B008
	Durene (1.5 K)	PS	417.4 403 394 382 373	Mixed crystal; maxima were taken from a fit to the spectrum	75B003
	EPA (77 K)	PS/IV	417, $480^d \pm 50$ 392.8, $215^d \pm 40$	†Phosphorescence decay; ϵ's are too low; 1st transition assigned as $^3L_a \rightarrow {}^3C_b$	51E001
	EPA (77 K)	PS/SD	416.7, 10000 392.7, 4300 371, 1000	ϵ's are lower limits	54B001
	EPA (77 K)	FP	416 393 373	416 nm was the most intense peak; $\tau_T = 2.6 \times 10^6$ μs	677485
	EPA (77 K)	PS/KM	530^a, 900^a 499^a, 800^a 420^a, 20600^a 396^a, 11200^a	Solvent, temperature and extinction method assumed from earlier work; polarization also measured	69E213
	EPA (77 K)	PS/IV	417, 23600	λ_{max} assumed from previous work; ϵ estimated by extrapolation to infinite excitation rate	69E212
	EPA (77 K)	PS/KM	417, 23300	λ_{max} assumed from previous work; $\tau_T = 2.3 \times 10^6$ μs	69E212
	EPA (77 K)	FP/SD	414.0, 40000 ± 6000 393^a, 17000^a 374^a, 4000^a	$\tau_T = 2.3 \times 10^6$ μs; oscillator strength = 0.14	69F389
	EtOH (77 K)	PS	414 390 371		67B007
	EtOH (293 K)	FP	414		68E098
	EtOH	FP/ET	415, 40000 ± 2000 391^a	ϵ relative to anthracene in EtOH (ϵ_{420} = 75000 L mol^{-1} cm^{-1}); $\tau_T = 1800 \pm 700$ μs; $k_{et} = (1.26 \pm 0.1) \times 10^{10}$ L mol^{-1} s^{-1}	747049
	EtOH (77 K)	MOD	411 388^a 368^a	Relative intensities (6:3:1); halfwidth of principal maximum 480 cm^{-1}	777538
	EtOH/MeOH (113 K)	FP/TD	575^a, 140^a 559^a, 75^a 529^a, 250^a 515^a, 150^a 490^a, 330^a 476^a, 150^a 360^a, 459^a	Glass was 3:1 EtOH to MeOH; shoulders at 625^a, 588^a, 541^a, 500^a, and 467^a nm	717460
	EtOH/MeOH (113 K)	FP/TD	629.0, 10^a 574^a, 120^a 526^a, 250 488.6, 320^a 456^a, 350^a 414.0, 33000 400.2, 3200^a 390^a, 16700^a 376^a, 2100^a 369^a, 3500^a 359^a, 1000^a 351^a, 1000^a 341^a, 700^a 335^a, 700^a 323^a, 730^a 236.0, 55000	‡Phosphorescence decay; shoulders at 589^a, 556^a, 536^a, 511^a, 498^a, 467^a, and 266^a nm; 6 electronic transitions were assigned with 0-0's at 629, 488.6, 414, 400.2, 275, and 236 nm; oscillator strength = 0.002, 0.002, 0.12, ~0.01, 0.13, 0.5	72B001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Ethylene glycol	FP	415 392 378		Relative intensities (100:55:10); τ_T = 1000 ± 100 μs	61E005
	Hexamethylbenzene (77 K)	PS	418 395		Single crystal; relative intensities (2:1)	67B008
	Hexane	FP	413.1 390.0			54E001
	Hexane	FP	410 389 369		Relative intensities (107:55:15); τ_T = 91 ± 8 μs	61E005
	Hexane (77 K)	PS	416 391			67B007
	Isopentane/MCH (77 K)	PS	413.5 389.5 368		Relative intensities (100:41:9)	54B001
	Isopentane/MCH/Et$_2$O (77 K)	PS	414.5 392.0 372.5		‡Phosphorescence decay; glass was 6:1:0.7 isopentane to MCH to Et$_2$O; 414.5 nm was the most intense peak	71B003
	Liquid paraffin	FP/SD	415 391.5 372	10000 6800 2700	Solvent had viscosity of 0.03 N·s/m^2; all bands were assigned to same electronic transition; oscillator strength = 0.06	58E001
	Liquid paraffin	FP	415		Viscosity of solvent was 0.167 N·s/m^2; τ_T = 2850 μs	62E009
	MCH (77 K)	MOD	414^a 390^a 370^a		Relative intensities (6:3:1)	777538
	MCH (77 K)	MOD/KM	405^b 366^b	1600 740		82E648
	MCH/Isopentane (90 K)	MOD	417^a 400^a 391^a 382^a 372^a 360^a 351^a		Glass was 4:1 MCH to isopentane	72B003
	Naphthalene (373 K)	PR/RF	420	7100^c	Liquid; ε was found by assuming that the oscillator strength remained 0.12 in all solvents; τ_T = 1.2 μs	720243
	Naphthalene-d_8 (4.2 K)	MOD	415 402.5 392.5 380 372.5 360		Mixed crystals; the bands were embedded in a broad absorption band that was explained as due to mixing of guest triplet states with host conduction band or host charge-transfer states	73E342
	Naphthalene-d_8 (1.5 K)	PS	414.8 392 370		Mixed crystal; maxima were taken from a fit to the spectrum	75B003
	Naphthalene (78 K)	PR	600 565 535 416 392		Triplet exiton; most intense peak at 416 nm	761030
	Naphthalene	PR	415^a 390^a		Microcrystals; spectrum obtained by diffuse reflectance spectroscopy; 415 nm peak was the more intense; half-life = 20 μs	84B120
	PMMA (293 K)	PS	415.5 393.5		Relative intensities (100:45)	67B008
	PMMA (294 K)	FP/RF	571 526 415^a 391^a 373^a	~220 ~310	‡Phosphorescence decay; ε relative to naphthalene in cyclohexane ($\epsilon_{412.5}$ = 22600 L mol^{-1} cm^{-1}), assuming ϵ_{417} = 22000 L mol^{-1} cm^{-1} in PMMA; τ_T = (1.5 ± 0.05) × 10^6 μs; oscillator strength = ~0.002	69B004
	PMMA	PR	415 385		Relative intensity (10:6)	692001
	PMMA (86 K)	PR	415 390			710278

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	Pentane (77 K)	PS	413.6 401.6 390.6 370.1	Relative intensities (10:1:6:1)	69E211
	Polystyrene	PR	428 400 380	Relative intensities (100:53:33)	672086
	Polystyrene (77 K)	PR	425		692001
	Polystyrene	PR	424^a	$G\epsilon_{424} = 12000^a$ L mol^{-1} cm^{-1} / (100 eV absorbed)	701073
	Toluene (77 K)	MOD	422 402^a	Relative intensities (2:1); halfwidth of principal maximum 1180 cm^{-1}	777538
769.	**Naphthalene-d_8**				
	1-BuOH/Isopentane (77 K)	PS	413.2 389.7 371.0	A distinction between a 1:7 and a 3:7 glass was not made; the 3 bands were assigned to a single electronic transition $^3B_{3g}^- \leftarrow {}^3B_{1u}^+$	63B001
	3-MP (77 K)	PS/ESR	417, 31900 403^a, 5200^a 391^a, 14000^a	‡ESR; band was assigned as $^3B_{3g} \leftarrow {}^3B_{2u}$; oscillator strength = 0.12	68D211
	3-MP (77 K)	PS	575.0 547.0 531.2 509^a 491.6 473^a 456.0 412.2 400.5 390.0 379.3 369.3 359.4 351.3 342.2	Bands starting at 412.2 nm were assigned to the $^3B_{3g}^- \leftarrow {}^3B_{2u}^+$ transition; other bands may be a mixture of electronic transitions, but one of these was assigned as $^3A_{1g}^- \leftarrow {}^3B_{2u}^+$; the bands at <412 nm are about 20 times stronger than the bands >412 nm	70B005
	? (77 K)	PS	419^a 406^a 393^a	‡Phosphorescence decay and ESR lifetime; glass used was either 2-MTHF or 3-MP; $\tau_T = 2.30 \times 10^7$ μs	67E108
	Butane/Isopentane (77 K)	PS/IV	414, 14000 ± 3000 393^a, ~7800	Glass was 3:7 butane to isopentane; ϵ_T was computed from $OD = \epsilon_T \tau_p i_0 (1 - \Phi_f)$ after the optical density, OD, was extrapolated to zero intensity of the monitoring beam (namely $i_0 \rightarrow 0$), here τ was lifetime of triplet, and Φ_f was fluorescence quantum yield; oscillator strength = 0.05	65E031
	Cyclohexane (77 K)	PS	413.5 409.4 407.2 402.0 389.8 386.0 383.2 379.5 369.2 367.2	Shoulders at 418.2 nm and 397.4 nm; relative intensities (100:80:60:20:60:50:20:15:20:15)	69E211
	Dipropyl ether (100 K)	FP	415^a 394^a	Shoulders at 405^a and 373^a nm; $\tau_T = 1.9 \times 10^7$ μs	696073
	Dipropyl ether (110 K)	PS	417^a 395^a	Relative intensities (2:1); polarization also measured	70B002
	Durene (77 K)	PS	417^a 395^a 372^a	Single crystal; the points were taken from the spectum of the b-axis polarized absorption	67B008
	Durene (4.2 K)	PS	415.9 392.9 382 371 354	Single crystal; relative intensities (100:47:2:14:2)	67B008

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	EPA (82 K)	PS/KM	413, 23300 ± 650		68B003
	EPA (77 K)	PS/IV	417, 22000	λ_{max} assumed from previous work; ϵ estimated by extrapolation to infinite excitation rate; $\tau_T = 19 \times 10^6$ μs	69E212
	EPA (77 K)	PS	417	Transition assigned as $^3B_{1g}^- \leftarrow {}^3B_{2u}^+$	69B001
	EPA (77 K)	FP/SD	414.0, 40000 ± 6000	$\tau_T = 1.35 \times 10^7$ μs	69F389
	EtOH/Et$_2$O (77 K)	MOD/KM	417, 10000 ± 3000	Glass was 2:1 EtOH to Et$_2$O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	EtOH/MeOH (113 K)	FP/TD	575^a, 110^a 549^a, 70^a 529^a, 220^a 508^a, 130^a 493^a, 240^a 472^a, 140^a 457^a, 280^a 448^a, 170^a 439^a, 320^a	Glass was 3:1 EtOH to MeOH; shoulders at 595^a, 562^a, 515^a, 485^a, and 431^a nm	717460
	EtOH/MeOH (101 K)	PS	413^a 400^a 395^a 380^a 370^a	Glass was 3:1 EtOH to MeOH	75B002
	Hexamethylbenzene (77 K)	PS	415.3 393.2	Single crystal; relative intensities (100:48)	67B008
	PMMA (293 K)	PS	414.5 392.1 372	Relative intensities (100:44:4)	67B008
770.	**Naphthalene/Chloranil**				
	Liquid paraffin	MOD	405	Mull	71E361
771.	**Naphthalene/Pyromellitic dianhydride**				
	1,2-Dichloroethane (293 K)	LP	420	Charge-transfer complex only was excited; naphthalene-PMDA charge-transfer complex	757413
	Dipropyl ether (100 K)	FP	426^a	Shoulder at 403^a nm; $\tau_T = 1.8 \times 10^6$ μs	696073
772.	**Naphthalene/Tetrachlorophthalic anhydride**				
	Dipropyl ether (98 K)	FP	424^a	Shoulder at 407^a nm	696073
773.	**Naphthalene-d_8/Tetrachlorophthalic anhydride**				
	EPA (77 K)	PS	414.8 390.5		67B009
774.	**1-Naphthalenecarbothioic acid, *O*-ethyl ester**				
	Benzene	FP	490	‡Triplet ET to triplet acceptors; the solvent was not specified explicitly	757534
775.	**2-Naphthalenesulfonate ion**				
	Water	FP	413 390	‡Rises with fluorescence decay; 50 μs delay; pH 6; rise time of 23 ns	767189
776.	**1-Naphthalenesulfonic acid**				
	Liquid paraffin	FP	421 405 373.5	Solvent viscosity was 0.19 N·s/m^2; relative intensities (100:88:54)	58E001
777.	***anti*-[2.2](1,4)-Naphthalenophane**				
	2-MTHF (77 K)	LP	447.5		79B050
778.	***syn*-[2.2](1,4)-Naphthalenophane**				
	2-MTHF (77 K)	LP	612.5 465		79B050

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
779.	**2-(1-Naphthalenyl)-1,3-dioxane**					
	1,2-Dichloroethane	FP	420		$\tau_T = 108\ \mu s$	80E720
	Hexane	FP	415		$\tau_T = 63\ \mu s$	80E720
780.	**2-(2-Naphthalenyl)-1,3-dioxane**					
	1,2-Dichloroethane	FP	417		$\tau_T = 142\ \mu s$	80E720
	Hexane	FP	412		$\tau_T = 104\ \mu s$	80E720
781.	**1-Naphthoate ion**					
	Water	FP	439		pH 13	61E008
782.	**2-Naphthoate ion**					
	Water	FP	414		pH 13	61E008
783.	**Naphtho[1,2,3,4-*def*]chrysene**					
	Benzene	MOD	610 522 442		Relative intensities (100:64:41); "1,2,4,5-dibenzpyrene"; $\tau_T = 140\ \mu s$	71E361
784.	**1-Naphthoic acid**					
	Water	FP	446		pK_a = 3.8 ± 0.5; pH 1	61E008
785.	**2-Naphthoic acid**					
	Liquid paraffin	FP	430 412			61E008
	Water	FP	428		pK_a = 4.0; pH 1	61E008
786.	**1-Naphthol**					
	EPA (77 K)	PS	483 463 455		‡Phosphorescence decay	51E001
	Hexane	FP	520 389.5 374.5 347.5 335		All bands except 520 nm were assigned to the second electronic transition; relative intensities (16:100:67:49:24)	58E001
	Isooctane	FP	435 400		‡Similarity to 1-naphthyl diisopropyl borate spectrum	717266
	Isopentane/MCH/Et$_2$O (77 K)	PS	481.0 455.0 431.5 412.0		‡Phosphorescence decay; glass was 6:1:0.7 isopentane to MCH to Et$_2$O; 455.0 and 431.5 nm were the most intense peaks	71B003
	PMMA	FP	485 460 430 400		‡Similarity of spectrum to that of 1-naphthyl diisopropyl borate; there was a weak band extending from 540 - 510 nm	717266
787.	**2-Naphthol**					
	Cyclohexane	LP	433^a 413^a 385^a			737287
	Cyclohexane	FP	467^a 429^a 408^a 384^a 355^a		‡Oxygen quenching and triplet ET to perylene; most intense peak at 429 nm; $\tau_T = 67\ \mu s$	737113
	Cyclohexane	LP/ET	435	6500	Triplet ET from perylene; ϵ relative to perylene in cyclohexane (ϵ_{480} = 13000 L mol^{-1} cm^{-1}); $\tau_T = 67\ \mu s$	777391
	Gelatin	FP	443		‡Phosphorescence decay; $\tau_T = 4.7 \times 10^5\ \mu s$	64E016
	Heptane	FP	430^a		Lifetimes suggest solution not fully deaerated; $\tau_T = 36 \pm 3\ \mu s$	77E663
	Hexane	FP	429.0 404.0 381.0		Another band at 467 nm was identified as the 2-naphthoxyl radical; 429.0 nm was the most intense peak	71B003

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Isooctane	FP	433 405		‡Similarity to 2-naphthyl diisopropyl borate spectrum	717266
	Isopentane/MCH/Et$_2$O (77 K)	PS	443.0 419.0 395.5		‡Phosphorescence decay; glass was 6:1:0.7 isopentane to MCH to Et$_2$O; 443.0 nm was the most intense peak	71B003
	Liquid paraffin	FP	433 411 381.5			61E008
	PMMA	FP	525 438 405		‡Similarity to 2-naphthyl diisopropyl borate spectrum; 438 nm was the most intense peak	717266
	Water	FP	432		Another maximum near 350 nm and a shoulder near 390 nm; pK_a = 8.1; pH 4.6	61E008
	Water	LP	431^a		Solution saturated with N$_2$O; [HClO$_4$] = 0.2 mol L^{-1}; shoulder at ~410^a nm; delay 30 ns; pH Acidic	737287
788.	**1-Naphthol/Triethylamine**					
	Isopentane/MCH/Et$_2$O (77 K)	PS	488^a 461^a 435^a 417^a		H-bonded complex; glass was 6:1:0.7 isopentane to MCH to Et$_2$O; shoulder at 395^a nm; 461 nm was the most intense peak	71B003
789.	**2-Naphthol/Triethylamine**					
	Isopentane/MCH/Et$_2$O (77 K)	PS	446^a 424^a 388^a		H-bonded complex; glass was 6:1:0.7 isopentane to MCH to Et$_2$O; 446 nm was the most intense peak; shoulder at 405^a nm	71B003
790.	**9-Naphthoylanthracene**					
	EPA (77 K)	FP	427		‡Phosphorescence decay; τ_T = 3.07 × 10^4 μs	82E338
791.	**1-Naphthyl acetate**					
	MCH (77 K)	MOD/KM	436^b 405^b 366^b	960 1400 560		82E648
792.	**2-(1-Naphthyl)benzoxazole**					
	Pentane	LP/TD	530 489^a 422^a	24200 ± 250	Shoulder at 454^a nm; τ_T = 0.52 ± 0.05 μs	82E632
793.	**8-(1-Naphthyl)-6,7-dihydro-5*H*-benzocycloheptene**					
	Benzene	LP-ET	507^a 390^a		‡Triplet ET from xanthone	84B007
794.	**1-Naphthyl diisopropyl borate**					
	Triisopropyl borate	FP	900 535 502.5 476 450 420 397 377			717266
795.	**2-Naphthyl diisopropyl borate**					
	Triisopropyl borate	FP	525 425 401 380		425 nm was the most intense peak	717266
796.	***trans*-1-(1-Naphthyl)-2-(2-naphthyl)ethylene**					
	Benzene	LP/ET	500 ± 3	19000 ± 2900	‡Quenching by oxygen, a nitroxide free radical, and azulene; ϵ relative to fluorenone in benzene (ϵ_{435} = 6000 L mol^{-1} cm^{-1}); τ_T = 0.56 ± 0.08 μs; k_{et} = (6.9 ± 1.0) × 10^9 L mol^{-1} s^{-1}	84E237

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Bromobenzene	LP	505 ±3	$\tau_T = 0.43 \pm 0.06$ μs	84E237
797.	**1-Naphthyloxide ion**				
	EtOH/MeOH (77 K)	PS	505^a 476^a 452^a	Glass was 5:1 EtOH to MeOH; there was a shoulder at 422^a nm; the solution was 0.11 mol L^{-1} KOH; 505 nm was the most intense peak	71B003
798.	**2-Naphthyloxide ion**				
	Water	FP	460	Another maximum in the range 350 - 400 nm; pH 10.6	61E008
	Water	LP	455^a	Solution saturated with N_2O; delay 30 ns; pH 13	737287
799.	**2-(2-Naphthyloxy)-3,5,5-trimethyl-2-cyclohexen-1-one**				
	MCH	LP	430^a	‡Oxygen quenching (1.7×10^9 L mol^{-1} s^{-1}); decay measured at 410 nm and spectrum obtained by extrapolation to zero time; $\tau_T = 0.53$ μs	81F111
800.	**1-(1-Naphthyl)-1-phenylethylene**				
	Benzene	LP-ET	500^a 403^a	‡Triplet ET from xanthone; $\tau_T = 0.040$ μs	84B007
801.	***trans*-1-(1-Naphthyl)-2-phenylethylene**				
	Benzene	LP/ET	490 ± 3, 17000 ± 2600	‡Quenching by oxygen, a nitroxide free radical, and azulene; ε relative to fluorenone in benzene (ϵ_{435} = 6000 L mol^{-1} cm^{-1}); $\tau_T = 0.39 \pm 0.06$ μs; $k_{et} = (6.7 \pm 1.0) \times 10^9$ L mol^{-1} s^{-1}	84E237
	Bromobenzene	LP	495 ± 3	$\tau_T = 0.25 \pm 0.04$ μs	84E237
802.	***trans*-1-(2-Naphthyl)-2-phenylethylene**				
	Benzene	LP-ET	530^a 410^a	‡Triplet ET from xanthone and benzophenone, oxygen and azulene quenching; 50 ns delay; lifetimes are 0.08 μs (530 nm band) and 0.15 μs (410 nm band); possible triplet conformers; $E_T = 206$ kJ mol^{-1}	81E490
	Benzene	LP/ET	395 ± 3, 8000 ± 1200	ε relative to fluorenone in benzene (ϵ_{435} = 6000 L mol^{-1} cm^{-1}); $\tau_T = 0.14 \pm 0.02$ μs; $k_{et} = (9.0 \pm 1.3) \times 10^9$ L mol^{-1} s^{-1}	84E237
	Bromobenzene	LP	400 ± 3	$\tau_T = 0.09 \pm 0.01$ μs	84E237
	EPA (77 K)	LP	510 497 492 470		747376
803.	**2-(1-Naphthyl)-5-phenyl-1,3,4-oxadiazole**				
	Benzene	LP/SD	580, 67000	‡Oxygen quenching (1.6×10^9 L mol^{-1} s^{-1}); 100 ns delay; "α-NPD"; $\tau_T = 0.300$ μs	777265
	Cyclohexane	FP/TD	696, 6200^a 496, 5900^a 454, 4800^a	Only peaks reported by authors given - extensive vibronic structure observed; oscillator strength = 0.13, 0.02, 0.04	78B081
	Cyclohexane	FP/TD	550^a, 11000^a 495, 5000^a 455, 5000^a	Only principal maximum of the band(s) around 500 nm reported, extensive vibrational structure observed; ε method assumed from earlier work; oscillator strength = 0.13, 0.02, 0.04	79B119
804.	**2-(2-Naphthyl)-5-phenyl-1,3,4-oxadiazole**				
	Cyclohexane	FP/TD	611, 6200^a 508, 4000^a 413, 14000^a	Only peaks reported by authors given; oscillator strength = 0.04, 0.02, 0.09	78B081
	Cyclohexane	FP/TD	611, 6200^a 508, 4000^a 488, 3800^a 441, 4200^a 423, 14100^a	ε method assumed from earlier work; oscillator strength = 0.03, <0.01, <0.01, 0.01, 0.09	79B119

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
805.	**2-(1-Naphthyl)-5-phenyloxazole**				
	3-MP (77 K)	CWL	580	"α-NPO"	74B003
	Benzene	LP/SD	550, 100000	‡Oxygen quenching (2.3×10^9 L mol^{-1} s^{-1}); 100 ns delay; $\tau_T = 0.215$ μs	777265
806.	**Neo-alloocimene**				
	Toluene	PR/ET	340^a, 930^a 315, 1840^a	‡Triplet ET to perylene; ε relative to perylene in benzene ($\epsilon_{490} = 14300$ L mol^{-1} cm^{-1}); $\tau_T = 0.33$ μs; $k_{et} = 9.1 \times 10^9$ L mol^{-1} s^{-1}	83E258
807.	**Neomethylene Blue cation**				
	Water	FP/SD	840^b, 4000	‡Triplet ET from naphthalene, oxygen and I$^-$ quenching; pK_h = 6.5; structure of the spectrum could not be discerned because it was not corrected for SD; pH 9	70E293
808.	***all-trans*-Neurosporene**				
	Cyclohexane	PR/ET	489, 274000	ε relative to biphenyl in cyclohexane ($\epsilon_{360} = 42800$ L mol^{-1} cm^{-1}); $\tau_T = 6.6$ μs; $k_{et} = 1.22 \times 10^9$ L mol^{-1} s^{-1}	83B121
809.	**Neutral Red cation**				
	Water	FP/SD	580, 7300 380, 5800	‡Oxygen quenching; pK_b 4.5; $\tau_T = 63 \pm 12$ μs; pH 9.8	84B027
810.	**Neutral Red cation, conjugate diacid**				
	Water	FP/SD	680, 12000 390, 8000	‡Oxygen quenching; pK_a 4.8; $\tau_T = 63 \pm 12$ μs; pH 2.8	84B027
811.	**5-Nitroacenaphthene**				
	EPA (77 K)	PS/KM	850, 250 ± 30 600, 500 ± 60 370, 7100 ± 850	‡Phosphorescence decay; $\tau_T = (2.6 \pm 0.3) \times 10^5$ μs	78E057
812.	**4-Nitroaniline**				
	EPA (113 K)	FP	595	‡Phosphorescence decay; $\tau_T = 250$ μs	776104
	EPA (100 K)	FP	600^a	Lifetime measured at 93 K; $\tau_T = 4.5 \times 10^4$ μs	80E318
813.	**3-Nitroanisole**				
	CF_3CH_2OH	LP	400^a	$\tau_T = 3.5$ μs	84E033
814.	**4-Nitroanisole**				
	Glycerol triacetate (198 K)	LP	560 418	418 nm peak was the more intense	78B088
	Glycerol triacetate	LP	550 414	550 nm peak was the more intense	78B088
815.	**9-Nitroanthracene**				
	Benzene (293 K)	LP	435^a	170 ps delay; growth followed at 452 nm; authors later [84F385] quote $\lambda_{max} = 433$ nm, with a shoulder at 410 nm; rise time of $(76 \pm 6) \times 10^{-3}$ ns	80B084
	EPA (77 K)	FP	440^a	$\tau_T = 1.77 \times 10^4$ μs	80B084
	EtOH	LP	430^a	Rise time measured at 452 nm; 100 ps delay; rise time of 0.086 ± 0.006 ns	80E234
	EtOH (77 K)	FP	435^a	$\tau_T = 1.77 \times 10^4$ μs	80E234
816.	**4-Nitrobiphenyl**				
	Benzene	LP	540		747022
	EPA (77 K)	FP	550 520	‡Phosphorescence decay	747022
	Glycerol triacetate (198 K)	LP	530 ~375	530 nm peak was the more intense	78B088
	Glycerol triacetate	LP	526 ~370	526 nm peak was the more intense	78B088

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
817.	**2-[2-(5-Nitro-2-furanyl)]ethenylquinoline**				
	2-PrOH/Water	FP	590	‡Triplet energy transfer to 3,3′-diethylthiacarbocyanine iodide (in BuOH); solvent was 1:1 2-PrOH to water; 50 μs delay; τ_T = 670 ± 90 μs	79A403
818.	**5-Nitro-2-furoic acid**				
	Acetone (295 K)	LP/HAT	490, 19000	Hydrogen atom transfer from 2,4,6-tri-*tert*-butylphenol (1.71 × 10^9 L mol^{-1} s^{-1}); ϵ relative to 2,4,6-tri-*tert*-butylphenoxyl radical (ϵ_{620} = 400 L mol^{-1} cm^{-1}); τ_T = 0.2036 μs	81A140
	Acetone (295 K)	LP/ELT	490, 20900	‡Triplet ET to 1,4-benzoquinone, azulene and ferrocene, oxygen quenching (1.68 × 10^9 L mol^{-1} s^{-1}); electron transfer from triphenylamine (3.3 × 10^9 L mol^{-1} s^{-1}); ϵ relative to triphenylamine radical cation (ϵ_{660} = 28750 L mol^{-1} cm^{-1}); τ_T = 0.2036 μs; E_T = 240 ± 4 kJ mol^{-1}	81A140
	Acetone (295 K)	LP/ELT	490, 20500	Electron transfer from tris(4-bromophenyl)amine (8.94 × 10^9 L mol^{-1} s^{-1}); ϵ relative to tris(4-bromophenyl)amine radical cation (ϵ_{725} = 20800 L mol^{-1} cm^{-1}); τ_T = 0.290 μs	81A140
	Acetone (295 K)	LP/ELT	490, 20700	Electron transfer from TMPD (5.98 × 10^9 L mol^{-1} s^{-1}); ϵ relative to TMPD radical cation (ϵ_{565} = 12470 L mol^{-1} cm^{-1}); τ_T = 0.290 μs	81A140
	Acetonitrile (295 K)	LP/ELT	490, 22500	Electron transfer from iodide ion (6.65 × 10^9 L mol^{-1} s^{-1}); ϵ relative to iodine molecular anion (ϵ_{400} = 12900 L mol^{-1} cm^{-1}); τ_T = 0.290 μs	81A140
	DMF (295 K)	LP	490	τ_T = 0.0766 μs	81A140
	Ethyl acetate (295 K)	LP	490	τ_T = 0.070 μs	81A140
	Methylene chloride (295 K)	LP	495	τ_T = 0.070 μs	81A140
	Water (295 K)	LP	486	Lifetime increases to 34.2 ns in deuterated water; τ_T = 0.0272 μs	81A140
819.	**1-Nitronaphthalene**				
	EPA (77 K)	PS	580 420		78E057
	EtOH	LP	580	‡Phosphorescence decay at 77 K in PMMA and triplet ET to perylene and tetracene	747236
	EtOH	LP	580	‡Oxygen quenching (3.3 × 10^9 L mol^{-1} s^{-1}); τ_T = 4.9 μs	81B064
	Hexane	LP	525	‡Phosphorescence decay at 77 K in PMMA and triplet ET to perylene and tetracene	747236
	Hexane	LP	525	‡Oxygen quenching (1.3 × 10^9 L mol^{-1} s^{-1}); τ_T = 0.93 μs	81B064
	N-Methylformamide	LP	615	‡Phosphorescence decay at 77 K in PMMA and triplet ET to perylene and tetracene	747236
820.	**2-Nitronaphthalene**				
	Acetonitrile	LP	480	‡Phosphorescence decay in EPA at 77K, triplet ET to tetracene; τ_T = 2.90 μs; k_{et} = 7.1 × 10^9 L mol^{-1} s^{-1}	767269
	EPA	LP	470	Radical or radical anion seen at λ_{max} = 400 nm on exposure to a long (5 μs) flash	767269
	EPA (77 K)	PS/KM	760, 510 ± 25 475, 750 ± 40 360, 3600 ± 180	‡Phosphorescence decay; τ_T = (2.47 ± 0.02) × 10^5 μs	78E057
	EtOH	LP	470	‡Phosphorescence decay in EPA at 77K, triplet ET to tetracene; τ_T = 1.70 μs	767269
	EtOH	LP	470	‡Oxygen quenching (1.6 × 10^9 L mol^{-1} s^{-1}); τ_T = 1.7 μs	81B064
	Formamide	LP	520^a	‡Phosphorescence decay in EPA at 77K, triplet ET to tetracene	767269
	Hexane	LP	425	‡Phosphorescence decay in EPA at 77K, triplet ET to tetracene; τ_T = 0.530 μs	767269

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Hexane	LP	425		‡Oxygen quenching (1.7×10^9 L mol^{-1} s^{-1}); $\tau_T = 0.53$ μs	81B064
	Water	LP	485		‡Phosphorescence decay in EPA at 77K, triplet ET to tetracene; $\tau_T = 7.60$ μs	767269
821.	**4-Nitropyridine-*N*-oxide**					
	Water	FP	550 380		‡Oxygen quenching; $\tau_T = 30$ μs	737469
822.	**4-Nitroquinoline-*N*-oxide**					
	Benzene	LP	530		‡Triplet ET to tetracene; $k_{et} = 8 \times 10^9$ L mol^{-1} s^{-1}	84B128
	Water	LP	590 410		Phosphate buffer; $\tau_T = 50$ μs; pH 7	84B128
823.	***trans*-3-Nitrostilbene**					
	Glycerol triacetate	LP	365			78B088
	Glycerol triacetate (198 K)	LP	382			78B088
824.	***trans*-4-Nitrostilbene**					
	Cyclohexane	LP	540		‡Oxygen quenching in benzene; $\tau_T = 0.063$ μs	747022
	EPA (77 K)	FP	585^a		Shoulder at 555^a	747022
	EtOH/MeOH (103 K)	LP	590 450		Solvent was 4:1 EtOH to MeOH; 450 nm peak was the more intense	78B088
	EtOH/MeOH	LP	585 440		Solvent was 4:1 EtOH to MeOH; 440 nm peak was the more intense	78B088
	Glycerol triacetate	LP	540 425		540 nm peak was the more intense	78B088
	Glycerol triacetate (191 K)	LP	550 426		550 nm peak was the more intense	78B088
825.	**4-Nitro-*p*-terphenyl**					
	EPA (77 K)	PS/KM	800 600 340	14500 ± 725 25500 ± 1275 38500 ± 1925	‡Phosphorescence decay; $\tau_T = (3.14 \pm 0.16) \times 10^5$ μs	78E057
826.	**2-Nitrothiophene**					
	1-PrOH (273 K)	LP/ELT	545^b 544	8800	ϵ relative to $(C_6H_5)_2N\cdot$ in MTHF glass at 77 K (ϵ_{max} = 3900 L mol^{-1} cm^{-1}); protonation was thought to take place after ELT; $\tau_T = 0.118$ μs	82A153
	Acetone (273 K)	LP	549		$\tau_T = 0.227$ μs	82A153
	Acetonitrile (273 K)	LP/ELT	548 545^b	 10900	‡Oxygen quenching; ϵ relative to 3,3′,3″-tribromotriphenylamine radical cation in methylene chloride (ϵ_{max} = 20800 L mol^{-1} cm^{-1}), assuming no solvent effect; ϵ was to be an upper bound since assumptions included complete ELT, no back-reaction, and no reaction with solvent; $\tau_T = 0.30$ μs	82A153
	Acetonitrile (273 K)	LP/ELT	548 545^b	 8800	‡Oxygen quenching; ϵ relative to TMPD$^+$ in water (ϵ_{max} = 12470 L mol^{-1} cm^{-1}), assuming no solvent effect; ϵ was to be an upper bound since assumptions included complete ELT, no back-reaction, and no reaction with solvent; $\tau_T = 0.30$ μs	82A153
	Acetonitrile (273 K)	LP/ELT	548 545^b	 11200	‡Oxygen quenching; ϵ relative to triphenylamine radical cation in EtOH (ϵ_{max} = 28750 L mol^{-1} cm^{-1}), assuming no solvent effect; ϵ was to be an upper bound since assumptions included complete ELT, no back-reaction, and no reaction with solvent; $\tau_T = 0.30$ μs	82A153
	CCl_4 (273 K)	LP	549		$\tau_T = 0.022$ μs	82A153
	EtOH (273 K)	LP	545		$\tau_T = 0.129$ μs	82A153
	MeOH (273 K)	LP	545		$\tau_T = 0.282$ μs	82A153
	Methylene chloride (273 K)	LP	545		$\tau_T = 0.173$ μs	82A153
	Water (273 K)	LP	545			82A153
	Water	LP	545		Phosphate buffer used; pH 7.0 ± 0.1	82A154

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
827.	**Octaethylporphinatopalladium(II)**				
	Methyl methacrylate	LP	497^a 417^a	417 nm peak was the more intense	747346
828.	**Octaethylporphinatotin(IV) dichloride**				
	1,2-Dichloroethane	LP/SD	584^b, 2400 566^b, 3500 551^b, 5300 433^a 418^b, 18000		747346
829.	**8,9,10,11,12,13,14,15-Octahydro-5,7:16,18-dietheno-2,21-octanocyclopentadeca[1,2-*a*:1,15-*a*′]diindene**				
	2-MTHF (77 K)	PS/KM	397^a, 35900^a	Compound "X" in paper	83E383
830.	**(*all-E*)-3,7,11,15,20,24,28,32-Octamethyl-1,34-bis(2,6,6-trimethyl-1-cyclohexen-1-yl)-1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33-tritriacontaheptadecaene**				
	Benzene (296 K)	LP-ET	620	Triplet ET from chlorophyll *a*; oxygen quenching (5.6 $\times$ 10^9 L mol^{-1} s^{-1}); τ_T = 2.5 μs; k_{et} = 1.8 $\times$ 10^9 L mol^{-1} s^{-1}	73E347
831.	**Orotate ion**				
	Water	FP/SD	315, 22000	‡Oxygen quenching; pK_a 9.4; τ_T = 137 $\pm$ 10 μs; pH 7.0	71E367
832.	**Orotic acid**				
	Water	FP/SD	310, 11000 280, 14000	‡Oxygen quenching; pK_a 4.6; τ_T = 137 $\pm$ 10 μs; pH 3.0	71E367
833.	**7-Oxa-2,3-dibenzoylbicyclo[2.2.1]hepta-2,5-diene**				
	Benzene	LP/RA	410 $\pm$ 5, 5640 $\pm$ 1400	‡Oxygen and azulene quenching; ϵ relative to benzophenone in benzene (ϵ_{532} = 7600 L mol^{-1} cm^{-1}), assuming Φ_T = 1 for benzophenone and taking Φ_T = 0.70 for the compound in benzene; τ_T = 0.45 $\pm$ 0.07 μs	84A355
	MeOH	LP	405 $\pm$ 5	‡Oxygen quenching; τ_T = 0.41 $\pm$ 0.06 μs	84A355
834.	**7-Oxa-2,3-dibenzoylbicyclo[2.2.1]hept-2-ene**				
	Benzene	LP/RA	450 $\pm$ 5^b, 2700 $\pm$ 700 342^a	‡Oxygen and azulene quenching; ϵ relative to benzophenone in benzene (ϵ_{532} = 7600 L mol^{-1} cm^{-1}), assuming Φ_T = 1 for benzophenone and taking Φ_T = 0.74 for the compound in benzene; τ_T = 1.4 $\pm$ 0.2 μs	84A355
835.	**Oxonine cation**				
	MeOH	FP-ET/SD	750^a, 15000^a 675^a, 5000^a	‡Triplet ET from 9,10-dibromoanthracene, oxygen quenching; ϵ assumes triplet does not absorb where singlet depletion is followed; τ_T = 140 μs; pH Basic	767246
836.	**Oxonine cation, conjugate monoacid**				
	MeOH	FP-ET/SD	650^a, 16000^a 380^a, 13000^a	‡Triplet ET from 9,10-dibromoanthracene; ϵ assumes triplet does not absorb where singlet depletion is followed; τ_T = 55 μs; pH Acidic	767246
837.	**Oxotitanium(IV) tetraphenylporphyrin**				
	EtOH	LP	465	‡Oxygen quenching; delay 200 ns; triplet species likely to be in equilibrium with EtOH-coordinated triplet; τ_T = 35 $\pm$ 1 μs	84B008
838.	**Palladium(II) etioporphyrin I**				
	DMF	FP/SD	410, 70000 365, 51000	‡Phosphorescence decay; τ_T = 300 μs	73E345
839.	**Palladium(II) tetrabenzoporphyrin**				
	Pyridine	FP	480 385	‡Phosphorescence decay; τ_T = 190 μs	73E345

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
840.	**Palladium(II) tetrakis(carboxyphenyl)porphyrin**				
	Water	LP	850 720		82E622
841.	**Palladium(II) tetrakis(4-*N*-methylpyridyl)porphyrin**				
	Water	LP/TD	940, 6400 ± 600 470^b, 33400 ± 3300 450^b, 52000 ± 5200	Shoulder at 820 nm	82E622
842.	**Palladium(II) tetrakis(*p*-sulfonatophenyl)porphyrin**				
	Water	LP/TD	830, 7600 ± 800 460^b, 28000 ± 2800	Shoulder at 700 nm	82E622
843.	**Palladium(II) tetraphenylporphyrin**				
	MCH	FP/TD	450, 47000 385, 30000	‡Oxygen quenching; τ_T = 380 μs	81E271
	Pyridine	FP/SD	450, 47800 385, 35000		73E345
844.	**[2.2]Paracyclophane**				
	2-MTHF (77 K)	LP	550 380 340	Most intense peak at 380 nm; polarization also measured	79B050
	2-MTHF (77 K)	PS	380	Solvent uncertain; polarization also measured; τ_T = $>10^6$ μs	81F201
845.	**Pentacene**				
	1-Chloronaphthalene	FP/TD	505, 9900		727073
	Benzene (323 K)	FP/TD	505, 120000 472, 48000 392, 3000 374, 6500 340, 6900 305, 560000	Peak at 305 nm was the values measured in cyclohexane; shoulders at 440, 418, 355, and 292 nm, with the 292 nm figure for cyclohexane; 5 electronic transitions were assigned with 0-0 bands at 505 nm ($^3B_{1g}^-$), 392 nm ($^3A_{1g}^-$), 374 nm ($^3B_{1g}^-$), 340 nm ($^3B_{1g}^+$), and 305 nm ($^3B_{1g}^-$); T_1 was $^3B_{2u}^+$; τ_T = 69.9 ± 3.4 μs; oscillator strength = 0.7, <0.005, 0.03, <0.005, 2.1	727348
	Hexane	FP/SD	525, 30000 490, 205000 457, 107000 383. 60000 305, 630000	Bands were assigned to 4 separate electronic transitions; bands at 490 and 457 nm were assigned to the 2nd electronic transition; oscillator strength = 0.2, 2.4, 1.4, 2.0	58E001
	Hexane	FP	492 460 385 300	Relative intensities (3:2:1:10); τ_T = 110 ± 12 μs	61E005
846.	**Pentacyclo[18.2.2.2^{9,12}.0^{4,15}.0^{6,17}]hexacosa-4,6(17),9,11,15,20,22,23,25-nonane-10,25-dicarbonitrile**				
	Acetonitrile	LP	775^a 505^a	‡Triplet ET to piperylene, rises with fluorescence decay, oxygen quenching; 200 ns delay; "layered cyclophane"	776187
	Toluene	LP	760^a 525^a	‡Triplet ET to piperylene, rises with fluorescence decay, oxygen quenching; 200 ns delay	776187
847.	**Pentahelicene**				
	MCH/Isohexane	FP	630 420^a	‡Rise time identical to fluorescence decay, oxygen quenching (5.7 × 10^8 L mol^{-1} s^{-1}); relative intensities (3:1); solvent was 2:1 MCH to isohexane; τ_T = 0.31 ± 0.02 μs	79A237
	MCH/Isohexane (93 K)	FP	630 420^a	‡Phosphorescence decay, ODMR signal; relative intensities (3:1); solvent was 2:1 MCH to isohexane; τ_T = 2 × 10^6 μs	79A237
848.	**Pentaphene**				
	Cyclohexane	LP/SD	493, 45900^a 440, 37300^a	Delay 100 ns	84E390

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
849.	***cis*-Perinaphthothioindigo**					
	MCH/Toluene (93 K)	LP	661^a 590^a		Glass was 1:1 MCH to toluene; shoulder at 715^a; 661 nm peak was the more intense	82F295
	MCH/Toluene (93 K)	LP	641^a 591^a		Shoulder at 716^a nm; glass was 1:1 MCH to toluene; $\tau_T = \sim 10\,\mu s$	82A190
850.	***trans*-Perinaphthothioindigo**					
	MCH/Toluene (93 K)	LP	733^a		Glass was 1:1 MCH to toluene	82F295
	MCH/Toluene (93 K)	LP	733^a		‡Oxygen quenching at 295 K; glass was 1:1 MCH to toluene; $\tau_T = \sim 10\ \mu s$	82A190
851.	**1,4-Perinaphthyldiyl**					
	EPA (77 K)	PS	512^a 345^a 250^a		‡ESR, T^{-1} ESR signal intensity; triplet 0-0 bands only; apparent triplet ground state; spectrum probably contains singlet transitions	79E175
852.	**Perylene**					
	Benzene	PR/ET	490	14300	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Benzene	LP-ET	500 460		Triplet ET from 1-nitronaphthalene; $k_{et} = 4.2 \times 10^9$ L mol^{-1} s^{-1}	747236
	Cyclohexane	LP/ET	480	13000	Triplet ET from anthracene; ϵ relative to anthracene in cyclohexane (ϵ_{425} = 64700 L mol^{-1} cm^{-1})	777391
	Hexane	FP	485.9			54E001
	Hexane	FP	488 280		The two bands were assigned to different electronic transitions	58E001
	Polystyrene	PR	495		$G\epsilon$ = 6500 L mol^{-1} cm^{-1} / (100 eV absorbed); half-life = 6000 μs	672086
853.	**Perylene/Chloranil**					
	Liquid paraffin	MOD	475		Mull	71E361
	PMMA	PS	595 580 563 544 505 480 463		Charge transfer complex; most intense peak at 480 nm	766652
854.	**Phenanthrene**					
	1-BuOH/Isopentane (77 K)	PS	493.1 460.2 431.0		A distinction between a 1:7 and a 3:7 glass was not made; all 3 vibronic bands were assigned to the $^3B_2 \leftarrow {}^3A_1$ transition	63B001
	3-MP (77 K)	PS/ESR	490	41500	‡ESR; only most intense visible peak reported	696115
	Benzene	PR/ET	492.5	15700	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Benzophenone (77 K)	PS/COM	500^a 474^a 467^a 441^a 435^a	2100^c ± 1000 1200^{a,c} 1300^{a,c} 500^a 500^a	Mixed crystals; shoulders at 495^a, 488^a, 478^a, 469^a, and 455^a nm; ϵ measured by a technique involving re-absorption of phosphorescence	68E106
	Butane/Isopentane (77 K)	PS/IV	492.5 459^a	27000 ± 5000 $\sim$11000	Glass was 3:7 butane to isopentane; ϵ_T was computed from OD = $\epsilon_T \tau_p i_0(1 - \Phi_f)$ after the optical density, OD, was extrapolated to zero intensity of the monitoring beam (namely $i_0 \rightarrow 0$), here τ was lifetime of triplet, and Φ_f was fluorescence quantum yield; oscillator strength = 0.11	65E031

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Cyclohexane	FP	480	$\tau_T = 145\ \mu s$	62E009
	Cyclohexane	PR/ET	482.5, 21000 ± 5250	ϵ relative to benzophenone ketyl radical in water ($\epsilon_{537.5} = 3220$ L mol^{-1} cm^{-1}), assuming this value for $\epsilon_{542.5}$ in cyclohexane	680727
	Cyclohexane	LP	485 460 425	‡Rise time of transient was the same as the decay time of the singlet	68B006
	Cyclohexane	PR/ET	482.5, 25200	ϵ relative to benzophenone ketyl radical in cyclohexane ($\epsilon_{max} = 3700$ L mol^{-1} cm^{-1}); reference ϵ obtained by starting from $\epsilon_{max} = 3220$ L mol^{-1} cm^{-1} for this ketyl radical in water and assuming the f of the ketyl radical is independent of solvent; final ϵ obtained from a simultaneous least squares fit to data from several compounds	71E360
	Dipropyl ether (100 K)	FP	493^a 463^a 437^a	Shoulder at 474^a nm; $\tau_T = 3.8 \times 10^6\ \mu s$	696073
	Dipropyl ether (110 K)	PS	498^a 465^a 439^a	Relative intensities (4:2:1); polarization also measured	70B002
	EPA (77 K)	PS/IV	493.1, 1560^c ± 190 459.6, 880^c ± 80	‡Phosphorescence decay; ϵ's are too low; 1st transition assigned as $^3L_a \rightarrow {}^3C_b$	51E001
	EPA (77 K)	PS	493.1 460.2 431.0	‡Phosphorescence decay; relative intensities (100:45:14); $\tau_T = (3.3 \pm 0.2) \times 10^6\ \mu s$	54B001
	EPA (77 K)	PS	828 735 656 599 493	‡Phosphorescence decay; $\tau_T = (3.9 \pm 0.8) \times 10^6\ \mu s$	67E106
	EPA (77 K)	PS/KM	499^a, 18500^a 466^a, 9200^a 431^a, 2800^a	Solvent, temperature and extinction method assumed from earlier work; polarization also measured	69E213
	EPA (77 K)	FP/SD	492.5, 38000 ± 6000 461^a, 17000^a 431^a, 5700^a	$\tau_T = 3.4 \times 10^6\ \mu s$; oscillator strength = 0.15	69F389
	EPA (77 K)	PS/KM	493, 20400	λ_{max} assumed from previous work	69E212
	EtOH (293 K)	FP	482		68E098
	EtOH (77 K)	MOD/KM	489, 38000 ± 9500 457.5, 16000 ± 4000 428, 5400 ± 1300 293, 13000 ± 3300		737055
	EtOH (77 K)	MOD	490	Halfwidth 550 cm^{-1}	777538
	EtOH	LP	480^a 450^a	Relative intensities (3:2); solution contains Ag ions; 1.8 μs delay	78E554
	EtOH	LP	482^a 452^a 427^a	Solvent absolute EtOH	82B052
	EtOH/MeOH (104 K)	PS	489 459	Solvent was 3:1 EtOH to MeOH; polarization also measured	68E102
	EtOH/MeOH (101 K)	PS	490^a 459^a	Glass was 3:1 EtOH to MeOH	75B002
	Ethylene glycol	FP	485 453 428 400	Relative intensities (100:60:25:10); $\tau_T = 910 \pm 83\ \mu s$	61E005

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Heptane (77 K)	PS	829 723 650 496 492 485 474 465 455 443 435 428 405		69E211
	Hexamethylbenzene (130 K)	PS	496 465	Single crystal; relative intensities (100:61)	67B008
	Hexane	FP	481.0 452.9 425.0		54E001
	Hexane	FP	480 450 428 399	Relative intensities (100:60:25:10); $\tau_T = 93 \pm 7$ μs	61E005
	Hexane (77 K)	PS	497.5 485.9 471.9 460.0 435.9 430.1 410.0	Relative intensities (10:_:_:4:_:2:_)	69E211
	Liquid paraffin	FP	480	Viscosity of solvent was 0.167 N·s/m^2; $\tau_T = 2400$ μs	62E009
	Liquid paraffin	FP/TD	480^b, 24000 ± 2000		67E031
	PMMA (293 K)	PS	488.8 456 426	Relative intensities (100:55:10)	67B008
	PMMA	LP	520 510 481 454		70E288
	PMMA (15 K)	PS	816 720^a 489		81B094
	Polystyrene	PR	495^a 458^a	$G\epsilon_{495} = 11000^a$ L mol^{-1} cm^{-1} / (100 eV absorbed); $G\epsilon_{458} = 9200^a$ L mol^{-1} cm^{-1} / (100 eV absorbed)	701073
	Polyvinylbutyral (77 K)	LP	493 460 430^a		80E867
	Polyvinylbutyral (77 K)	FP	493 460 425^a	Relative intensities (5:2:1); polymer film; $\tau_T = 4.4 \times 10^6$ μs	82E129
	SDS	LP	490^a 460^a 420^a 400^a	Most intense peak at 490 nm; aqueous micelle	81N016
	Toluene (77 K)	MOD	500	Halfwidth 670 cm^{-1}	777538
855.	**Phenanthrene-d_{10}**				
	3-MP (77 K)	PS	825 727 650 594		67E106
	3-MP (77 K)	PS/ESR	489, 42900 457^a, 19100^a 429^a, 7900^a	‡ESR; band was assigned as $^3A_g \leftarrow {}^3B_2$; oscillator strength = 0.23	68D211

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
	3-MP (77 K)	PS	490^a 456^a 429^a		69E210
	3-MP (77 K)	PS	827^a 728^a 648^a 586^a 495 454^a	Band at 495 nm assigned as the 0-0 of the ${}^3A_1^- \leftarrow {}^3B_2^+$ and was the most intense band, ~ 4 times as strong as the bands to the red; 495 nm was the strongest vibronic band; shoulder at 426^a nm	74B002
	? (77 K)	PS	488 459 432^a	‡Phosphorescence decay and ESR lifetime; glass used was either 2-MTHF or 3-MP; $\tau_T = 1.36 \times 10^7$ μs	67E108
	Biphenyl (4 K)	PS	498^a	Maximum is taken from the *c′*-axis absorption spectrum	67B008
	Cyclohexane	LP	520 510 481 454		70E288
	EPA (77 K)	PS/RA	830, 675 734 658 598 493 459	‡Phosphorescence decay; ratio of intensity at 493 nm to that at 830 nm was 40; ε relative to phenanthrene-h_{10} in 3:7 butane/isopentane glass at 77 K ($\epsilon_{492.5} = 27000$ L mol^{-1} cm^{-1}); the 830 nm transition was assigned as ${}^3L_b \leftarrow {}^3L_a$; $\tau_T = (1.63 \pm 0.15) \times 10^7$ μs	67E106
	EPA (82 K)	PS/KM	487, 20400 ± 1100		68B003
	EPA (77 K)	PS	493	Transition assigned as ${}^3A_1^- \leftarrow {}^3B_2^+$	69B001
	EPA (77 K)	FP/SD	492.5, 31000 ± 5000	$\tau_T = 1.22 \times 10^7$ μs	69F389
	EPA (77 K)	PS/KM	823^a, 1000^a 723^a, 1400^a 651^a, 1100^a 597^a, 960^a 495, 20400 460^a, 9500^a 426^a, 2800^a	Two electronic transitions were assigned, the 2nd starting at 495 nm; shoulder at 926^a nm; ε-method assumed on basis of earlier work by authors, oscillator strength = 0.02, 0.15	747347
	Heptane (77 K)	PS	830 770 725 650 497 494 487 475 467.5 457 443 435 426 409 400	Relative intensities (14:13:19:12:100:88:59:35:43:30:19:24:20:11:10)	69E211
	Hexamethylbenzene (130 K)	PS	495 465	Single crystal; relative intensities (100:65)	67B008
	Hexane	PS	830 770 725 650	Weak bands in the red only studied	67B005
	PMMA (293 K)	PS	486.6 454 424	Relative intensities (100:65:10)	67B008
856.	**Phenanthrene/Pyromellitic dianhydride**				
	Dipropyl ether (100 K)	FP	493^a 437^a		696073

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
857.	**Phenanthrene/Tetrachlorophthalic anhydride**					
	Dipropyl ether (100 K)	FP	498[a] 469[a]		Shoulder at 435[a] nm; $\tau_T = 1.1 \times 10^6$ μs	696073
858.	**Phenanthrene-d_{10}/Tetrachlorophthalic anhydride**					
	EPA (77 K)	PS	492 458 431			67B009
859.	**Phenanthridine**					
	$EtOH/Et_2O$ (77 K)	PS	735 660 568 529 493 463 439		Solvent was 3:2 EtOH to Et_2O; relative intensities (17:25:70:82:84:100:65); E_T = 265 kJ mol^{-1}	80B130
	PMMA (293 K)	FP	440		$\tau_T = 2.5 \times 10^4$ μs	70E291
	PMMA (77 K)	PS	560 520 465			70E291
860.	**6(5*H*)-Phenanthridinone**					
	EtOH (300 K)	FP	425			81E649
861.	**1,10-Phenanthroline**					
	2-PrOH	FP	445 422		‡Oxygen quenching, pentadiene quenching; $\tau_T = 33 \pm 2$ μs	777201
	Benzene	PR	440 420		$\tau_T = 3.3 \pm 0.6$ μs	82A259
	Cyclohexane	FP	442 422		‡Oxygen quenching, pentadiene quenching; $\tau_T = 26 \pm 3$ μs	777201
	EtOH	FP	445 425		‡Oxygen quenching, pentadiene quenching; $\tau_T = 35 \pm 4$ μs	777201
	$EtOH/Et_2O$ (77 K)	PS	450 427		Solvent was 3:2 EtOH to Et_2O; relative intensities (100:93); E_T = 264 kJ mol^{-1}	80B130
	EtOH/MeOH	LP	434[a]		Solvent was 4:1 EtOH to MeOH; shoulders at 456[a] and 410[a] nm	81E786
	Heptane	FP	440 420		‡Oxygen quenching, pentadiene quenching; $\tau_T = 19 \pm 2$ μs	777201
	Isopentane	FP	440 420		‡Oxygen quenching, pentadiene quenching; $\tau_T = 17 \pm 2$ μs	777201
	PMMA (77 K)	PS	450 421		$\tau_T = 8.7 \times 10^5$ μs	70E291
	PMMA (293 K)	FP	~440		Decay was nonexponential, and lifetime was calculated from a terminal 1st-order rate constant; $\tau_T = 4.3 \times 10^5$ μs	70E291
	Water	FP	450 425		‡Oxygen quenching, pentadiene quenching; $\tau_T = 42 \pm 4$ μs	777201
862.	**1,7-Phenanthroline**					
	$EtOH/Et_2O$ (77 K)	PS	476 441		Solvent was 3:2 EtOH to Et_2O; relative intensities (92:100); E_T = 267 kJ mol^{-1}	80B130
863.	**1,8-Phenanthroline**					
	$EtOH/Et_2O$ (77 K)	PS	481 457 426		Solvent was 3:2 EtOH to Et_2O; relative intensities (87:100:52); E_T = 262 kJ mol^{-1}	80B130
864.	**1,9-Phenanthroline**					
	$EtOH/Et_2O$ (77 K)	PS	482 454 426		Solvent was 3:2 EtOH to Et_2O; relative intensities (100:65:43); E_T = 262 kJ mol^{-1}	80B130

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
865.	**4,7-Phenanthroline**					
	EtOH/Et$_2$O (77 K)	PS	488 458 435		Solvent was 3:2 EtOH to Et$_2$O; relative intensities (100:66:32); E_T = 267 kJ mol^{-1}	80B130
866.	**Phenazine**					
	Benzene	FP	440		τ_T = ~130 μs	717154
	CF$_3$CH$_2$OH	FP/SD	456^a 355^a	14100^a 36900^a	‡Oxygen quenching; no absorption could be seen in the 360 - 400 nm region, possibly due to SD masking it; lifetime was concentration dependent, and the value quoted was the longest measured and was measured at the lowest concentration; τ_T = 170 μs	716169
	Cyclohexane	FP	511^a 445^a		Shoulder at 434^a nm; 445 nm was the more intense peak; delay 30 μs	707337
	Isooctane	LP	500^a 440		Relative intensities (1:2); 50 ps delay; shoulders at 465, 455 and 425 nm; rise time of 140 ns	766469
	MCH	FP/SD	440^a 378^a 356^a	15100^a 36700^a 38400^a	‡Oxygen quenching; ε's at wavelengths shorter than 420 nm were more uncertain than the 440 nm band because of the SD region; τ_T = 42 ± 3 μs	716169
	MeOH	FP	508^a 447^a 391^a		Shoulder at 441^a nm; 447 nm was the most intense peak; delay 65 μs	707337
	MeOH	LP	500^a 440		Relative intensities (1:2); rise time of 200 ns	766469
	PMMA (293 K)	FP	460 440 426		τ_T = 9000 μs	70E291
	Toluene (293 K)	FP	515^a 430^a		‡Phosphorescence decay in EPA at 77 K, oxygen quenching	80E778
	Water	FP	506^a 445^a		Shoulder at 416^a nm; 445 nm was the more intense peak; pH ~6	707337
867.	**Phenazine, conjugate monoacid**					
	MeOH	FP	460		Solution was 0.1 mol L^{-1} acetic acid and 0.1 mol L^{-1} sodium acetate; delay 60 μs; pK_a 3.8; τ_T = 340 ± 40 μs	687213
868.	**Phenol**					
	Water (298 K)	LP	~250		Lifetime was measured at pH 7.5; spectrum is the difference between spectra at 20 ns and 15 μs; τ_T = 3.3 μs; pH 7.7	757161
869.	**Phenosafranin**					
	Water	FP	664^a		Any maxima in the range of 400 - 600 nm were masked by SD; pH 3-5	697061
870.	**Phenothiazine**					
	3-MP (77 K)	PS	465			67E106
	EPA (77 K)	PS	467			67E106
	MeOH	LP/ELT	460	27000	ε relative to phenothiazine radical cations in MeOH (ϵ_{520} = 9300 L mol^{-1} cm^{-1}); ELT measurement used Eu^{+3} ions as electron acceptors; 2nd-order rate constant in ELT = 4.7 × 10^9 L mol^{-1} s^{-1}	757353
871.	**Phenoxazine**					
	3-MP (77 K)	PS	460		τ_T = (2.7 ± 0.3) × 10^6 μs	67E106
	Benzene	FP	465		‡Phosphorescence decay in PMMA at 90 K; τ_T = 26 μs	707186
	EPA (77 K)	PS	458		‡Phosphorescence decay; τ_T = (2.7 ± 0.2) × 10^6 μs	67E106
	EtOH	FP	465		‡Phosphorescence decay in PMMA at 90 K; τ_T = 44 μs	707186
	Hexane	FP	465		‡Phosphorescence decay in PMMA at 90 K; τ_T = 26 μs	707186
	MCH	FP	465		‡Phosphorescence decay in PMMA at 90 K; τ_T = 32 μs	707186

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
872.	**3-Phenylacetylacetone**					
	EtOH/MeOH (118 K)	FP	490		Solvent was 3:1 EtOH to MeOH	68B005
873.	**Phenylacetylene**					
	Isopentane/2-PrOH (77 K)	PS	255^{a}		‡ESR; glass was 7:3 isopentane to 2-propanol by volume; by assuming that radical formation occurs only from T* and that it is wavelength-independent, the author devise an ESR method that determines the shape of TTA even in the SD region	68B007
874.	**9-Phenylacridan**					
	EtOH (97 K)	FP/?	520	10000^{a}	Shoulder at 625 nm	697225
875.	***N*-Phenylacridan**					
	EtOH (93 K)	PS	525^{a}			69E214
876.	**Phenylalanine**					
	Water (298 K)	LP	316^{a} 244^{a}		Spectrum is the difference between spectra at 10 μs and 20 ns; τ_T = 2.4 ± 0.2 μs; pH 0.3	757162
	Water (298 K)	LP	~310 ~240		‡Oxygen quenching; spectrum is the difference between spectra at 10 μs and 20 ns; τ_T = 3.1 ± 0.3 μs; pH 7.5	757162
877.	**4-(Phenylamino)-7*H*-benz[*de*]anthracen-7-one**					
	Benzene	LP	638^{a} 590^{a}		‡Oxygen quenching (1.7 × 10^{9} L mol^{-1} s^{-1}); half-life = ~0.28 μs	757427
878.	**9-Phenylanthracene**					
	2-PrOH	FP	428^{a}			65F031
	EtOH	FP	430		‡Quenching by heavy atom containing molecules	67E109
	EtOH	FP/ET	440^{b} 428 424^{b}	9100 13500 12500	Triplet ET from eosin and proflavine; ε relative to eosin in EtOH (ϵ_{580} = 9400 L mol^{-1} cm^{-1}) and proflavine in EtOH (ϵ_{550} = 11000 L mol^{-1} cm^{-1})	716235
	EtOH	FP-ET/RA	694^{b}	28	ε relative to 9-phenylanthracene in EtOH (ϵ_{430} = 14000 L mol^{-1} cm^{-1})	78E019
	Ethylene glycol	FP	432		‡Quenching by heavy atom containing molecules	67E109
	Liquid paraffin	FP	434			65F031
879.	**4-Phenylbenzophenone**					
	Alcohol/Ether (77 K)	MOD	540		Glass was 2:1 alcohol to ether	76E682
880.	**9-Phenyl-9*H*-9-bismafluorene**					
	MCH/Isopentane (77 K)	FP	387^{a}		‡Phosphorescene lifetime; glass was 3:1 MCH to isopentane; shoulder at 369^{a} nm; τ_T = 1000 μs	81E648
881.	**1-Phenylcyclohexene**					
	Cyclohexane	LP-ET/RA	325^{b}	4400	ε relative to naphthalene in cyclohexane (ϵ_{413} = 24000 L mol^{-1} cm^{-1}), but in ref. cited (ϵ_{415} = 24500 L mol^{-1} cm^{-1}); triplet ET from thioxanthone; τ_T = ~0.065 μs	82E181
882.	**1-Phenyldeoxybenzoin**					
	Benzene	LP	425 338		‡Oxygen quenching (> 10^{9} L mol^{-1} s^{-1}), piperylene quenching; relative intensities (1:3); τ_T = 0.27 μs	79A028
883.	**2,2′-(1,4-Phenylene)bisbenzoxazole**					
	Toluene	LP/TD	480 420	18600 ± 250	Shoulders at 562^{a}, 528^{a}, 451^{a}, and 405^{a} nm; τ_T = 0.48 ± 0.05 μs	82E632
884.	**2,2′-(1,4-Phenylene)bis[5-(4-butoxyphenyl)oxazole]**					
	2-MTHF (77 K)	CWL	590		"DibutoxyPOPOP"	74B003
885.	**2,2′-(1,4-Phenylene)bis[5-phenyloxazole]**					
	2-MTHF (77 K)	CWL	~500		"POPOP"	74B003
	Dioxane	LP	550^{a} 360^{a}		Weak very broad bands	80E438

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
886.	**O-(2-Phenylethyl) 4-(dimethylamino)benzenecarbothioate**					
	Cyclohexane	LP/SD	450,	20000 ± 10000	‡Oxygen quenching and triplet ET to tetracene; τ_T = 0.5 μs	737318
887.	**O-(2-Phenylethyl) 4-methoxybenzenecarbothioate**					
	Cyclohexane	LP	430		‡Oxygen quenching; τ_T = 0.3 μs	737318
888.	**O-(2-Phenylethyl) 1-naphthalenecarbothioate**					
	Cyclohexane	LP	480		‡Oxygen quenching and triplet ET to tetracene; τ_T = 1 μs	737318
889.	**O-(2-Phenylethyl) 2-naphthalenecarbothioate**					
	Cyclohexane	LP	440		‡Oxygen quenching	737318
890.	**2-Phenylindene**					
	Benzene (298 K)	LP-ET	~390		‡Triplet ET from benzophenone, oxygen quenching (4 × 10^9 L mol^{-1} s^{-1}); τ_T = > 3 μs; k_{et} = 6 × 10^9 L mol^{-1} s^{-1}	81E214
	Benzene (298 K)	FP	392		τ_T = ⩾ 100 μs	81E214
	Benzene (298 K)	LP-ET	392		‡Triplet ET from xanthone, oxygen quenching (3.8 × 10^9 L mol^{-1} s^{-1}); τ_T = > 5 μs; k_{et} = 6 × 10^9 L mol^{-1} s^{-1}	81E214
	EPA (77 K)	FP	390 368 352		Most intense peak at 390 nm; τ_T = 40 μs	737069
	EPA (298 K)	LP	380 360			81E214
891.	**β-Phenyl-4′-methoxypropiophenone**					
	Benzene	LP	381^a			84E018
892.	**1-[[(Phenylmethyl)sulfonyl]methyl]naphthalene**					
	Acetonitrile	LP	430^a			84B022
893.	**1-Phenylnaphthalene**					
	3-MP (77 K)	PS/ESR	495, 462^a, 441^a,	18400 10300^a 5700^a	‡ESR; shoulder at 418^a nm; oscillator strength = 0.16	69B002
	Cyclohexane	LP/ET	480,	17600 ± 1000	‡Triplet ET from TMPD; ϵ relative to TMPD in cyclohexane (ϵ_{570} = 11900 L mol^{-1} cm^{-1})	757282
894.	**2-Phenylnaphthalene**					
	3-MP (77 K)	PS/ESR	476, 433, 410^a, 382^a,	2400^a 34600 19300^a 12400^a	‡ESR; oscillator strength = 0.31	69B002
	Cyclohexane	LP/ET	425,	48300 ± 5000	‡Triplet ET from phenanthrene; ϵ relative to phenanthrene in cyclohexane ($\epsilon_{482.5}$ = 25200 L mol^{-1} cm^{-1})	757282
895.	**N-Phenyl-2-naphthylamine**					
	EtOH (77 K)	MOD/KM	520, 331, 292,	9000 ± 2300 7000 ± 1700 21500 ± 5400		737055
896.	**2-Phenyl-2-norbornene**					
	Cyclohexane	LP-ET/RA	325^b,	17900	ϵ relative to naphthalene in cyclohexane (ϵ_{413} = 24000 L mol^{-1} cm^{-1}), but in ref. cited (ϵ_{415} = 24500 L mol^{-1} cm^{-1}); triplet ET from thioxanthone; τ_T = ⩾2.0 μs	82E181
897.	**9-Phenyl-9H-9-phosphafluorene**					
	MCH/Isopentane (77 K)	FP	387^a		‡Phosphorescene lifetime; glass was 3:1 MCH to isopentane; shoulder at 378^a nm; τ_T = 1.2 × 10^6 μs	81E648

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
898.	**9-Phenylproflavine, conjugate monoacid**				
	EtOH/Et$_2$O (90 K)	PS/SD	1190, 41000^a 690, 8000^a 575, 15000^a 395, 12000^a 280, 47500^a 240, 18000^a	Solvent was 2:1 EtOH to Et$_2$O	57B001
899.	**9-Phenyl-9*H*-9-stibafluorene**				
	MCH/Isopentane (77 K)	FP	378^a	‡Phosphorescene lifetime; glass was 3:1 MCH to isopentane; $\tau_T = 1.2 \times 10^4$ μs	81E648
900.	**1-Phenylthio-3,4-dihydronaphthalene**				
	MCH	FP	550^a 430^a	‡Oxygen quenching; $\tau_T = 0.46$ μs	78A237
	MCH (110 K)	FP	560^a	‡Oxygen quenching; $\tau_T = 2.0 \times 10^3$ μs	78A237
901.	**Pheophytin *a***				
	Benzene	FP	480		55E003
	Benzene	FP	500 430	430 nm band was judged to be of "doubtful significance" by the experimenters; benzene was wet	58R002
	EtOH (298 K)	FP/SD	687^a, 4700^a 667^b, 4700 ± 500 528^a, 18100^a 407^a, 62800^a 332^a, 47100^a	$\tau_T = 750 \pm 100$ μs	70E296
	Pyridine	FP	430	Maximum was judged to be of "doubtful significance" by the experimenters	58R002
902.	**Pheophytin *b***				
	Benzene	FP	510 460 430	430 nm maximum was judged to be of "doubtful significance" by the experimenters; 460 nm was the most intense peak; benzene was wet	58R002
	EtOH (298 K)	FP/SD	667^b, 4700 ± 500 481^a, 31400^a 423^a, 71200^a	Shoulders at 508 nm and 662 nm; $\tau_T = 1050 \pm 100$ μs	70E296
	Pyridine	FP	520 460 410	Maxima at 410 and 520 nm were judged to be of "doubtful significance" by the experimenters	58R002
903.	**Photoprotoporphyrin isomer "A", dimethyl ester**				
	Benzene	LP/TD	475^b, 35500 471^a 420^a 349	‡Oxygen quenching (2.3×10^9 L mol^{-1} s^{-1}); relative intensities (8:4:5); $\tau_T = 83$ μs	80E200
	Benzene	PR/ET	475^b, 39200 471^a 420^a 349	‡Oxygen quenching (2.6×10^9 L mol^{-1} s^{-1}); ϵ relative to biphenyl in benzene ($\epsilon_{360} = 27100$ L mol^{-1} cm^{-1}); relative intensities (8:4:5); $\tau_T = 83$ μs	80E200
904.	**Photoprotoporphyrin isomer "B", dimethyl ester**				
	Benzene	PR/ET	477^a 475^b, 37000 411^a 349^a	‡Oxygen quenching (2.1×10^9 L mol^{-1} s^{-1}); ϵ relative to biphenyl in benzene ($\epsilon_{360} = 27100$ L mol^{-1} cm^{-1}); peaks roughly of equal intensity; $\tau_T = 89$ μs	80E200
905.	**Phthalazine**				
	1-BuOH/Isopentane (77 K)	FP/SD	420.5, 4450 ± 200	Glass was 3:7 1-BuOH to isopentane; oscillator strength = 0.11	726177
	Benzene	FP	396^a		747093
	EPA (77 K)	FP	403^a	‡Phosphorescence decay	747093
	Et$_2$O	FP	387^a	Shoulder at 423^a nm	747093
	EtOH	FP	385^a	Shoulder at 425^a nm	747093
	EtOH/Acetic acid	FP	387^a		747093
	Hexane	FP	389^a	Shoulder at 427^a nm	747093

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
906.	**Phthalocyaninatobis(pyridine)ruthenium(II)**				
	Methylene chloride	LP	~500		82C018
907.	**Phthalocyanine**				
	1-Chloronaphthalene	LP/TD	480, 28500 ± 2000	‡Triplet ET to β-carotene; authors prefer this value to those obtained by either SD or ET methods; $\tau_T = 130 \pm 10$ μs; $E_T = 120 \pm 10$ kJ mol^{-1}; $k_{et} = 1.25 \times 10^9$ L mol^{-1} s^{-1}	78A378
	1-Chloronaphthalene	PR/ET	480, 36000		78A378
	1-Chloronaphthalene	LP/SD	480, 38300	‡Authors reject this ϵ value since residual triplet and excited singlet absorptions are neglected	78A378
	1-Chloronaphthalene	LP/TD	480, 37000 ± 4000	ϵ method inferred from text	81E457
	1-Chloronaphthalene	LP/SM	480, 18000 ± 2000	‡Triplet ET to β-carotene; $\tau_T = 125$ μs	81E457
908.	**15-*cis*-Phytoene**				
	Cyclohexane	LP-ET/ET	320, ~20000	‡Triplet ET from fluorenone; ϵ relative to fluorenone ($\epsilon_{415} = 5500$ L mol^{-1} cm^{-1}), no solvent specified for this unpublished relative reference; $\tau_T = \sim 1$ μs; $E_T =$ 176-201 kJ mol^{-1}; $k_{et} = \sim 1 \times 10^{10}$ L mol^{-1} s^{-1}	761035
909.	***all-trans*-Phytoene**				
	Cyclohexane	LP-ET/ET	320, ~20000	‡Triplet ET from naphthalene; ϵ relative to naphthalene in cyclohexane ($\epsilon_{415} = 24500$ L mol^{-1} cm^{-1}); $\tau_T = \sim 1$ μs; $E_T =$ 176-201 kJ mol^{-1}; $k_{et} = \sim 1 \times 10^{10}$ L mol^{-1} s^{-1}	761035
910.	**Picene**				
	2-MTHF (77 K)	PS/ESR	636, 75500	‡ESR; the band was assigned as $^3A_1 \leftarrow {}^3B_2$; oscillator strength = 0.40	68D211
			575^a, 20100^a		
			535^a, 11000^a		
			467^a, 5300^a		
	Benzene	MOD	560	$\tau_T = 160$ μs	71E361
	Benzene	LP	685	Delay 370 ns	737463
			667		
			654		
			629		
			571		
			552		
			535		
			515		
			493		
			452		
	EPA (77 K)	PS/SD	630, 62000 ± 6200		68E105
	EPA (77 K)	PS/KM	623^a, 21300^a	Solvent, temperature and extinction method assumed from earlier work; polarization also measured	69E213
			575^a, 7200^a		
			533^a, 3700^a		
	EPA (77 K)	PS/IV	620, 23000	λ_{max} assumed from previous work; ϵ estimated by extrapolation to infinite excitation rate	69E212
	EtOH (77 K)	MOD	622	Halfwidth 570 cm^{-1}	777538
	Toluene (77 K)	MOD	631	Halfwidth 570 cm^{-1}	777538
911.	**2-Piperidinoanthraquinone**				
	Benzene	PR/ET	581^a, 14400^a	‡Triplet ET from triplet donors and triplet ET to triplet acceptors; ϵ relative to naphthalene in benzene (ϵ_{425} = 13200 L mol^{-1} cm^{-1}); $\tau_T = \sim 20$ μs	720392
912.	**Pivalophenone**				
	2-PrOH	LP	500^a	‡Triplet ET to naphthalene; relative intensities (1:2:3:5); maxima inferred from text; $\tau_T = 0.5$ μs	79P066
			450^a		
			400^a		
			360		
	Benzene	LP	500^a	‡Triplet ET to naphthalene; relative intensities (1:2:3:5); $\tau_T = 0.37 \pm 0.03$ μs; $k_{et} = (2.0 \pm 0.4) \times 10^9$ L mol^{-1} s^{-1}	79P066
			450^a		
			400^a		
			335		

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
913.	**Poly[oxy[2-(1-pyrenylmethyl)-1,3-propanediyl]oxy(1,4-dioxo-1,4-butanediyl)]**				
	DMF	LP	425^a	‡Rises with fluorescence decay, oxygen quenching	80B076
914.	**Poly[oxy[2-(1-pyrenylmethyl)-1,3-propanediyl]oxy(1,4-dioxo-1,4-butanediyl)]/1,4-Dicyanobenzene**				
	DMF	LP	425^a	‡Rises with fluorescence decay, oxygen quenching	80B076
915.	**Poly[oxy[2-(1-pyrenylmethyl)-1,3-propanediyl]oxy(1,4-dioxo-1,6-hexanediyl)]**				
	DMF	LP	430^a	‡Rises with fluorescence decay, oxygen quenching	80B076
916.	**Poly[oxy[2-(1-pyrenylmethyl)-1,3-propanediyl]oxy(1,4-dioxo-1,6-hexanediyl)]/1,4-Dicyanobenzene**				
	DMF	LP	435^a	‡Rises with fluorescence decay, oxygen quenching	80B076
917.	**Poly(phenylisopropenyl ketone)**				
	Benzene	LP	450	‡Triplet ET to naphthalene, oxygen quenching (6×10^8 L mol^{-1} s^{-1}); $\tau_T = 0.1$ μs; $k_{et} = (1.5 \pm 1) \times 10^9$ L mol^{-1} s^{-1}	79P066
918.	**Poly(4-vinylbenzophenone)**				
	Benzene	LP	535	$\tau_T = 2.27$ μs	79A171
919.	**Poly(2-vinylnaphthalene)**				
	Benzene	PR/ET	426^a, 12000	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene ($\epsilon_{367} = 27100$ L mol^{-1} cm^{-1}); degree of polymerization = 318 (monomer units); $\tau_T = 13.2$ μs; $k_{et} = 1.8 \times 10^8$ L mol^{-1} s^{-1}	79E666
	Benzene	PR/ET	426^a, 14000	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene ($\epsilon_{367} = 27100$ L mol^{-1} cm^{-1}); degree of polymerization = 2690 (monomer units); $\tau_T = 10.6$ μs; $k_{et} = 0.8 \times 10^8$ L mol^{-1} s^{-1}	79E666
	Benzene	PR/ET	426^a, 11000	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene ($\epsilon_{367} = 27100$ L mol^{-1} cm^{-1}); degree of polymerization = 688 (monomer units); $\tau_T = 12.2$ μs; $k_{et} = 1.4 \times 10^8$ L mol^{-1} s^{-1}	79E666
	Benzene	PR/ET	426^a, 11000	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene ($\epsilon_{367} = 27100$ L mol^{-1} cm^{-1}); degree of polymerization = 109 (monomer units); $\tau_T = 9.7$ μs; $k_{et} = 3.4 \times 10^8$ L mol^{-1} s^{-1}	79E666
920.	***21H,23H*-Porphine**				
	Dimethyl phthalate	FP/SD	752^a, 4890^a 419^a, 98600^a 384^a, 35400^a	Shoulders at 795 nm and 440 nm	74B007
921.	**Proflavine**				
	EtOH	FP/SD	550, 11000		716235
	Water (296 K)	FP/TD	549, 8000 ± 800	pH Basic	81E147
922.	**Proflavine, conjugate diacid**				
	SDS	LP	1160 560	‡Oxygen quenching; 1 μs delay; aqueous micelle; pK_a = 4.0; cation radical (λ_{max} 820 nm) also formed; τ_T = 7 μs; pH 3	80N112
923.	**Proflavine, conjugate monoacid**				
	EtOH	FP/TD	455, 6000	pH Acidic	727073
	EtOH/Et$_2$O (90 K)	PS/SD	1100, 63000^a 917^a, 12500^a 675, 10000^a 550, 12500^a 400, 4000^a 350, 6500^a 280, 47000^a 235, 11000^a 210, 10000^a	Solvent was 2:1 EtOH to Et$_2$O	57B001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Glycerol (293 K)	FP	650^a 600^a 540^a		Solvent has added glucose	776171
	SDS	LP	1080		1 μs delay; aqueous micelle; $\tau_T = \sim 35$ μs; pH 8.1	80N112
	Water	FP/SD	560 445^b 350	 <10000	‡Oxygen quenching; decay was second order with $2k \sim 10^9$ L mol^{-1} s^{-1}; pH 4	677029
	Water (296 K)	FP/TD	549	5700	Light saturation; pH 4.1	80B057
	Water	LP	1160 930 670 550		‡Oxygen quenching; radical dication (λ_{max} = 810 nm) also observed; τ_T = 20 μs; pH 3.0	80F373
924.	**Promazine**					
	2-PrOH	LP	465		‡Triplet ET to β-carotene, oxygen quenching; τ_T = 22.8 μs	767023
925.	**9-Propionylanthracene**					
	EPA (77 K)	FP	430		$\tau_T = 3.21 \times 10^4$ μs	82E338
926.	**Propiophenone**					
	2-PrOH	LP	325			84E018
	Acetonitrile/Water	LP	325		Solvent was 9:1 acetonitrile to water	84E018
	Benzene	LP	418^a		Much more intense peak below 300 nm; shoulder at 457^a nm	84E018
927.	***N*-Propylphthalimide**					
	EtOH	FP	590^a 350^a		‡Oxygen quenching (3.5×10^9 L mol^{-1} s^{-1}), diene quenching; 100 ns delay; relative intensities (1:5); τ_T = 40 μs	79A147
928.	**1-Propynylbenzene**					
	Isopentane/2-PrOH (77 K)	PS	255^a		‡ESR; glass was 7:3 isopentane to 2-propanol by volume; by assuming that radical formation occurs only from T* and that it is wavelength-independent, the author devises an ESR method that determines the shape of TTA even in the SD region	68B007
929.	**Protoporphyrin**					
	MeOH	FP	530 440		Maximum at 530 nm was judged to be of "doubtful significance" by the experimenters	58R002
	Pyridine	FP	420 350			58R002
930.	**Protoporphyrin IX**					
	Dioxane	LP	742^a		‡Triplet quenching by *cis*-piperylene; oxygen quenching (1.6×10^9 L mol^{-1} s^{-1}); TTA of globin complexes also studied	747630
	Water	LP	500^a 450^a		‡Oxygen quenching (1.6×10^9 L mol^{-1} s^{-1}); difference spectrum only reported; $\tau_T = \sim 150$ μs; pH 0	78E011
931.	**Protoporphyrin IX, dimethyl ester**					
	Benzene	PR/ET	710^a	9000^a	‡Triplet ET from biphenyl and to β-carotene, oxygen quenching (2.7×10^9 L mol^{-1} s^{-1}); ϵ relative to biphenyl in benzene (ϵ_{360} = 27100 L mol^{-1} cm^{-1}); more intense peak below 450 nm; E_T = 150 kJ mol^{-1}	771078
	Benzene	LP/TD	450^b 425 320	35000 ± 1500	‡First order decay, oxygen quenching (1.5×10^9 L mol^{-1} s^{-1}); τ_T = 550 μs	80B017
932.	**Protoporphyrin IX, dimethyl ester, conjugate diacid**					
	Benzene/Trifluoroacetic acid	LP/TD	560 470^b 415	 32000 ± 1500	‡Triplet ET to β-carotene, oxygen quenching (4×10^9 L mol^{-1} s^{-1}); τ_T = 71 μs; $k_{et} = 1.3 \times 10^{10}$ L mol^{-1} s^{-1}	80B017

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
933.	**Protoporphyrin IX, dimethyl ester, conjugate monoacid**					
	MeOH/Acetic acid	FP/TD	450[b]	27500 ± 1500	‡First order decay, oxygen quenching; solvent was 1:1 MeOH to acetic acid by volume; τ_T = 110 μs	80B017
934.	**Psoralen**					
	Benzene	PR/ET	450[b]	8100	‡Triplet ET to β-carotene; ε relative to biphenyl in benzene (ϵ_{367} = 27100 L mol^{-1} cm^{-1}); k_{et} = 5.0 × 10^9 L mol^{-1} s^{-1}	78E157
	Benzene	LP	450[a]			78E157
	EtOH	LP/ET	440	30100	‡Triplet ET to retinol; ε relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}) assuming ε independent of solvent; τ_T = 5 μs; k_{et} = 1.1 × 10^9 L mol^{-1} s^{-1}	79E678
	Water	LP	450[a]		τ_T = 7.1 μs	78E157
	Water	LP/TD	460	10000	‡Oxygen quenching; τ_T = 12 μs; pH 8	83B068
935.	**4′,5′-Psoralen-thymine photo adduct**					
	MeOH	LP/ET	500	8500	‡Triplet ET to *all-trans*-retinol; ε relative to *all-trans*-retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}), assumed unchanged in MeOH; 100 ns delay; τ_T = 10.6 μs; k_{et} = 2.2 × 10^9 L mol^{-1} s^{-1}	80A032
	Water	LP	500[a]		100 ns delay; τ_T = 2.5 μs	80A032
936.	**Purine**					
	Acetonitrile	FP	410[a] 380[a]		‡Oxygen quenching; 20 μs delay	80B077
	Water	FP	390 360 300		‡Oxygen quenching; 20 μs delay; pH 5.9	80B077
	Water (77 K)	PS/KM	455[a] 412[a] 390 380[a]	 4100 	‡Phosphorescence decay; τ_T = (3.6 ± 0.3) × 10^6 μs; pH Basic	80B077
937.	**Pyranthrene**					
	Benzonitrile	LP/RF	591[a] 502[a]	 8000 ± 500	ε relative to pyranthrene in toluene (ϵ_{500} = 14000 L mol^{-1} cm^{-1})	83F075
	Toluene	LP/ET	584[a] 500[a]	 14000 ± 1500	ε relative to anthracene in toluene ($\epsilon_{428.5}$ = 42000 L mol^{-1} cm^{-1})	83F075
938.	**Pyrazine**					
	MeOH/EtOH (~ 100 K)	FP/?	820[a] 260	5000[a] 1000[a]	‡Phosphorescence decay; glass was 1:1 MeOH to EtOH; shoulder at 300 nm assignment $^3B_{3u} \rightarrow {}^3B_{2g}$; τ_T = (11 ± 1) × 10^3 μs	80B011
	Water	LP/HAT	810 700 ~260 230	1000 ± 200 1100 ± 200 4900 ± 1500 3500 ± 1100	Shoulders at ~640 and ~295 nm; ε relative to the neutral pyrazyl radical in water (ϵ_{310} = 6700 L mol^{-1} cm^{-1}), assuming that the quenching of the triplet by 2-PrOH produced stoichiometric equivalents of the neutral pyrazyl radical and the dihydro radical cation of pyrazine; τ_T = 3.4 μs; pH 5.4	747233
	Water (298 K)	LP/HAT	810 700 ~260 230	1000 1100 4900 3500	‡Oxygen quenching; shoulders at ~640 and ~295 nm; ε relative to dihydropyrazyl radical cation in water (ϵ_{315} = 6900 L mol^{-1} cm^{-1}), assuming H-abstraction from 2-PrOH was complete; N_2O was used to scavenge hydrated electrons; lifetime was measured at pH 7.1 and was for infinite dilution; τ_T = 4.5 μs; pH 5.4	757309
939.	**Pyrene**					
	3-MP (77 K)	PS	518 487[a] 455[a] 411[a] 387[a]		The first band was assigned to one electronic transition, the 2nd two bands to a forbidden transition, and last 2 bands were assigned to a 3rd transition; this assignment was questioned in [70E294] where 518, 487, & 455 nm were all assigned to a single electronic transition; assumed 77 K	70B004
	Acetonitrile	FP	412		Pyrene radical cation (λ_{max} = 445 nm) also present	767071

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Benzene	PR/ET	420, 20900	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Cyclohexane	LP	510 490 415	‡Rise time of transient was the same as the decay time of the singlet	68B006
	Cyclohexane	LP	520 483 416		70E288
	Cyclohexane	LP	525 480 415	Delay 1 μs; 415 nm was the most intense peak	707346
	Cyclohexane	MOD	517 508 412 409	Relative intensities (26:18:100:75); τ_T = 180 μs	71E361
	Cyclohexane	PR/ET	412.5, 30400	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); reference ϵ obtained by starting from ϵ_{max} = 3220 L mol^{-1} cm^{-1} for this ketyl radical in water and assuming the f of the ketyl radical is independent of solvent; final ϵ obtained from a simultaneous least squares fit to data from several compounds	71E360
	Cyclohexane	PR	515 490 440 410 385 365		720206
	EPA (77 K)	PS	525 489 415.5 372	Relative intensities (20:15:100:10); unresolved shoulder at 515 nm; τ_T = (7 ± 2) × 10^5 μs	54B001
	EPA (77 K)	PS/IV	415, 48200	λ_{max} assumed from previous work; ϵ estimated by extrapolation to infinite excitation rate	69E212
	EPA (117 K)	FP	520^a 479^a 412^a 389^a	‡Oxygen quenching; 412 nm was the most intense peak	716243
	EtOH (293 K)	FP	408		68E098
	EtOH	LP	500^a 450^a 400^a	Relative intensities (1:1:5); 1.8 μs delay; solution contains Ag ions	78E554
	Hexane	FP	520.0 411.0 387.0 369.0		54E001
	Hexane (300 K)	MOD/SD	522^a, 6300^a 490^a, 2100^a 410^a, 34400^a 389^a, 14500^a 360^a, 2170^a 333^a, 3200^a 318^a, 3900^a 290, 12000 260, 14500		69E208
	Hexane	MOD	516^a 508^a 412^a 409^a	Shoulder at 484^a nm; 412 nm was the most intense peak; τ_T = 180 μs	70E295

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Liquid paraffin	FP	519.5 483 416 396.5 371.5		Solvent viscosity was 0.19 N·s/m^2; the bands at 519.5 and 483 nm belong to the 1st electronic transition, and the other 3 bands belong to the 2nd electronic transition; relative intensities (24:19:100:48:26)	58E001
	MeOH	LP	500^a 414^a 371^a		Delay 1 μs	707346
	PMMA	CWL/RF	971 901 870 781 741 613 562 521 485 455 413 392 370	~100 900 12500 48200 	ϵ relative to pyrene in EPA (ϵ_{max} = 48200 L mol^{-1} cm^{-1}); four electronic transitions were assigned, and the 0-0 bands of these transitions are identified by their ϵ; T_1 is $^3B_{2u}^+$, and the other states are $^3B_{3g}^+$, $^3A_g^+$, $^3B_{3g}^-$, and $^3A_g^-$ in increasing energy; $\tau_T = 5 \times 10^5$ μs; oscillator strength = $\sim 10^{\ 3}$, ~0.01, 0.14, 0.31	70E294
	PMMA	LP	520 483 416			70E288
	PMMA	PS	520^a 485^a 410^a 390^a		Relative intensities (7:5:21:10); polarization also measured; phase sensitive detection	78E152
	Pyrene (425 K)	LP	935 909 870 800 709 690 671 645 613 571 559 524 461		Liquid at 425 K; delay 350 ns; another maximum in 740 - 755 nm range	737101
	SDS	LP	414		Aqueous micelle	82N081
	Toluene	LP	529^a 421^a		Shoulder at 488^a nm; 421 nm was the more intense peak	717126
	Toluene	LP	520 410		50 ns delay	766528
	Water	LP	530^a 480^a 415^a		Solubilized by 1.5 × 10^{-5} mol L^{-1} bovine serum albumin; oxygen quenching (1.3 × 10^8 L mol^{-1} s^{-1}); 1 μs delay	773047
	Water	LP	414		Solubilized by caffeine; 2 μs delay	81E149
	Water/*tert*-BuOH	FP	410^a		Solvent mixture contains "1-5%" *tert*-BuOH for solubility; pH ~6	767189
940.	**Pyrene-d_{10}**					
	2-MTHF (77 K)	PS/ESR	416 394^a	43600 18100^a	‡ESR; shoulder at 408^a nm; the band was assigned as $^3B_{3g} \leftarrow {}^3B_{2u}$; oscillator strength = 0.21	68D211
	PMMA (77 K)	PS/SD	415^a 391^a	38600^a 20000^a	$\tau_T = 3.7 \times 10^6$ μs	696019
	PMMA (296 K)	PS/SD	415^a 391^a	39800^a 18700^a	$\tau_T = 2.4 \times 10^6$ μs	696019
941.	**Pyrene/Chloranil**					
	Liquid paraffin	MOD	405		Mull	71E361

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
942.	**Pyrene/Diethylaniline**					
	Toluene	LP	500		50 ns delay; possible triplet exciplex; τ_T = 0.107 μs	766528
943.	**Pyrene/Tetracyanobenzene, 1:1**					
	EPA (95 K)	FP	513^a 480^a 427^a 404^a 394^a 383^a		‡Oxygen quenching and an accompaning phosphorescence; 404 nm was the most intense peak	716243
944.	**Pyrene/Tetracyanobenzene, 2:1**					
	EPA (117 K)	FP	435^a 415^a 400^a		‡Oxygen quenching and an accompanying phosphorescence; 415 nm was the most intense peak	716243
945.	**1-Pyrenecarboxaldehyde**					
	2-PrOH (295 K)	LP/SD	440 ± 3,	18100 ± 1800	τ_T = 37 μs	83E387
	Acetonitrile (295 K)	LP/SD	438 ± 3,	18700 ± 1900	τ_T = 30 μs	83E387
	Acetone (295 K)	LP/SD	440 ± 3,	20100^c ± 2000	τ_T = 20 μs	83E387
	Benzene (295 K)	LP/SD&PR/ET	443 ± 3,	21000^c ± 2100	In ET method ε relative to biphenyl in benzene (ϵ_{361} = 42800 L mol^{-1} cm^{-1}); τ_T = 35 μs	83E387
	CCl_4 (295 K)	LP/SD	443 ± 3,	18800 ± 1900	τ_T = 49 μs	83E387
	CF_3CH_2OH (295 K)	LP/SD	438 ± 3,	16900^c ± 1700	τ_T = 58 μs	83E387
	Cyclohexane (295 K)	LP/SD&TD	440 ± 3,	18900 ± 1900	τ_T = 50 μs	83E387
	Cyclohexene (295 K)	LP/SD	440 ± 3,	17700 ± 1800	τ_T = 70 μs	83E387
	EtOH (295 K)	LP/SD	440 ± 3,	18200 ± 1800	τ_T = 38 μs	83E387
	Ethylene glycol (295 K)	LP/SD	440 ± 3,	18100 ± 1800	τ_T = 300 μs	83E387
	Hexane-d_{14} (295 K)	LP	428 ± 3		τ_T = 34 μs	83E387
	MeOH (295 K)	LP/SD	437 ± 3,	18300 ± 1800	τ_T = 26 μs	83E387
	MeOH/Water (295 K)	LP/SD	443 ± 3,	18500 ± 1900	Solvent was 1:1 MeOH to water; τ_T = 107 μs	83E387
	THF (295 K)	LP/SD	440 ± 3,	19100 ± 1900	τ_T = 59 μs	83E387
946.	**Pyrene-1-sulfonate**					
	Water	LP	520 420		Delay 1 μs	84E533
947.	**Pyrene-3-sulfonate**					
	Benzene/DDDAB	MOD	525 491 429		Inverse micelle; relative intensities (3:2:5); τ_T = 3000 μs	79N036
	Water	MOD	422		Principal maximum only reported	79N036
948.	**[2.2](2,7)-Pyrenophane**					
	2-MTHF (77 K)	LP	625 480 380			79B050
949.	**2-(1-Pyrenylmethyl)-1,3-propandiol diacetate**					
	DMF	LP	415^a		‡Rises with fluorescence decay, oxygen quenching	80B076
950.	**2-(1-Pyrenylmethyl)-1,3-propandiol diacetate/1,4-Dicyanobenzene**					
	DMF	LP	420		‡Rises with fluorescence decay, oxygen quenching; pyrene radical cation also observed (460 nm)	80B076
951.	**Pyrido[2,1,6-*de*]quinolizine**					
	Hexane	FP	380		‡Ground state recovery, molecular orbital calculations; solvent uncertain; "cycl[3.3.3]azine"; τ_T = ~0.1 μs; E_T = ~90 kJ mol^{-1}	80E405
952.	**Pyrimidine**					
	Water (298 K)	LP/HAT	600, 530 260^b,	 ~3000	‡Oxygen quenching; ε relative to dihydropyrazyl radical cation in water (ϵ_{315} = 6900 L mol^{-1} cm^{-1}), assuming H-abstraction from 2-PrOH was complete; N_2O and *tert*-BuOH were present as scavengers; lifetime was for infinite dilution; τ_T = 1.4 μs; pH 7.1	757309

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
953.	**Pyromellitic dianhydride**					
	CCl_4	FP	560^{a}		‡Oxygen and piperylene quenching; 335 nm peak more intense; shoulder at 530^{a} nm; delay 10 μs; "PMDA"	737098
			335^{a}			
	Et_2O/Isopentane (77 K)	FP	496^{a}		‡Phosphorescence decay; glass was 1:1 Et_2O to isopentane; shoulder or maximum at ~350 nm; τ_T = 6.7 × 10^5 μs	747587
954.	**Pyromellitic dianhydride/Et_2O**					
	Et_2O	FP	561^{a}		‡Oxygen and piperylene quenching; there was a maximum or shoulder near 340 nm; delay 10 μs; "PMDA"-Et_2O complex	737098
			529^{a}			
955.	**Pyronine**					
	Water	FP	482^{a}		pH 7	747229
956.	**4-Pyrrolidinopyridine**					
	EPA (77 K)	FP	510		‡Phosphorescence decay; τ_T = 1.1 × 10^6 μs	83B112
957.	**Pyruvic acid**					
	Acetonitrile	FP	695^{a}		‡Triplet ET to naphthalene, oxygen quenching; τ_T = 0.5 μs	81F070
958.	**Quantacure SKS anion**					
	Water	LP	631^{a}		‡Oxygen quenching; 447 nm peak was the more intense; anion of sodium (4-sulfomethylphenyl)-phenylethanedione salt; τ_T = 0.50 ± 0.02 μs; pH 6	82P060
			477^{a}			
959.	**[1,1′:4′,1″:4″,1‴-Quaterphenyl]-4,4‴-diamine**					
	2-MTHF (77 K)	CWL	650			74B003
960.	***p*-Quaterphenyl**					
	2-MTHF (77 K)	CWL	530		Shoulder at 498^{a} nm	74B003
	BuOH (~80 K)	FP	525^{a}		Relative intensities (5:2)	67B010
			495^{a}			
	Toluene/EtOH (77 K)	MOD	563^{a}		Glass was 19:1 toluene to EtOH; 563 nm peak was the more intense	719059
			395^{a}			
961.	**Quinoline**					
	1-BuOH/Isopentane (77 K)	FP/SD	458^{a}	2700^{a}	Glass was 3:7 1-BuOH to isopentane; shoulder at 384^{a} nm; oscillator strength = 0.13	707240
			425^{a}	7000^{a}		
			400.0	7100 ± 700		
	3-MP (77 K)	MOD/SD	485^{a}		Shoulder at 382^{a} nm	73B001
			455^{a}			
			422^{a}			
			398	6000		
			238	25000		
	EPA (77 K)	PS	487		Relative intensities (40:59:98:100); unresolved shoulders at 475 nm and 380 nm; τ_T = (5 ± 2) × 10^5 μs	54B001
			458			
			427			
			402			
	EtOH (77 K)	MOD/KM	425	6500 ± 1600		737055
	Isopentane/MCH (77 K)	PS	526		Relative intensities (4:22:42:97:100); unresolved shoulder at 373 nm	54B001
			485			
			450			
			420			
			395			
	Water	FP	418		pH Basic	61E008
962.	**Quinoline, conjugate acid**					
	Water	FP	465		pK_a = 6.0; pH Acidic	61E008
963.	**Quinoxaline**					
	1-BuOH/Isopentane (77 K)	FP/SD	425.0	8100 ± 800	Glass was 3:7 1-BuOH to isopentane; oscillator strength = 0.15	707240

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	3-MP (77 K)	PS	414		67E106
	EPA (77 K)	PS	417		67E106
	EtOH/MeOH (113 K)	FP/TD	410, >2500	Solvent was 3:1 EtOH to MeOH; lower limit assumes total ground state depletion	67B004
	Hexane	LP	430	100 ps delay; rise time of 0.04 ns	79B007
	Isooctane	LP	425	130 ps delay, at earlier times overlapping $S_n \leftarrow S_1$ absorption	79B076
	PMMA (293 K)	FP	~415	Decay was nonexponential, and lifetime was calculated from a terminal 1st-order rate constant; $\tau_T = \sim 5 \times 10^4$ μs	70E291
	Water (298 K)	LP	432 413 ~270	‡Oxygen quenching; shoulder at ~660 nm; a limit was set on ϵ_{413} as $\leqslant$ 7400 L mol^{-1} cm^{-1}, based on radical formation; τ_T = 29.4 μs; pH 7.1	757309
	Water	FP	426^a 410^a	pK_b = 9.0 ± 0.7; pH 12.6	766206
964.	**Quinoxaline-1,4-dioxide**				
	Water	FP	498^a 469^a	‡Triplet ET from 1,5-naphthalene disulfonate and to Methylene Blue; shoulder at 429^a nm; τ_T = 77 μs; pH Neutral	83F096
965.	**Retinal**				
	Toluene (299 K)	FP	450	Whether isomer was all-trans or 11-cis was not specified; τ_T = 13 μs	62E006
966.	**11-*cis*-Retinal**				
	Benzene	LP-ET	455	Triplet ET from anthracene; $k_{et} = 2.0 \times 10^{10}$ L mol^{-1} s^{-1}	777434
	Benzene	LP	455	τ_T = 8.70 μs	777434
	DMSO	LP/RF	480, 27000	‡Triplet ET to β-carotene; ε determined assuming oscillator strength independent of solvent, bands are symmetrical (in energy) and relative to measured value (unstated) in hexane	78E467
	EPA (77 K)	LP	445	τ_T = 41.3 ± 1.7 μs	79B077
	Hexane	PR/ET	450, 75000	ε relative to biphenyl in cyclohexane (ϵ_{365} = 42800 L mol^{-1} cm^{-1}, note literature value at 361.3 nm); τ_T = 8.3 ± 0.7 μs	741013
	Hexane	LP/ET	445, 57000 ± 14000	ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}); original reference quoted (440 ± 5) nm as λ_{max}, stated λ_{max} from [78Z194]; τ_T = 8.3 ± 0.7 μs	747633
	Hexane	PR/ET	445, 62000 ± 6000	ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}); original reference quoted (440 ± 5) nm as λ_{max}, stated λ_{max} from [78Z194]; τ_T = 8.3 ± 0.7 μs	747633
	Hexane	LP/SD	445, 50000^a	ε relative to anthracene in cyclohexane (ϵ_{423} = 64700 L mol^{-1} cm^{-1})	78E208
	MeOH	LP/RF	450, 27000	‡Triplet ET to β-carotene; ε determined assuming oscillator strength independent of solvent, bands are symmetrical (in energy) and relative to measured value (unstated) in hexane	78E467
967.	**13-*cis*-Retinal**				
	EPA (77 K)	LP	465	τ_T = 48.3 ± 2.8 μs	79B077
	Hexane	PR/ET	445 ± 5, 56000 ± 6000	ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}); τ_T = 8.3 ± 0.7 μs	747633
	Hexane	LP/ET	445 ± 5, 44000 ± 11000	ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}); τ_T = 8.3 ± 0.7 μs	747633
	Hexane	PR/ET	445, 68000 ± 10200	‡Triplet ET from biphenyl; ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; τ_T = 9.1 ± 0.9 μs; k_{et} = (2.0 ± 0.20) × 10^{10} L mol^{-1} s^{-1}	776412
	MeOH	LP/RF	450, 24300	‡Triplet ET to β-carotene; ε determined assuming oscillator strength independent of solvent, bands are symmetrical (in energy) and relative to measured value (unstated) in hexane	78E467

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
968.	**7,9-*cis*-Retinal**					
	Benzene	LP-ET	455		Triplet ET from anthracene; $k_{et} = 2.8 \times 10^{10}$ L mol^{-1} s^{-1}	777434
	Benzene	LP	455		$\tau_T = 8.47$ µs	777434
969.	**7-*cis*-Retinal**					
	Benzene	LP-ET	455		Triplet ET from anthracene; $k_{et} = 2.0 \times 10^{10}$ L mol^{-1} s^{-1}	777434
	Benzene	LP	455		$\tau_T = 8.70$ µs	777434
	EPA (77 K)	LP	455 425		Decay wavelength dependent; lifetime measured at 455 nm; $\tau_T = 44.2 \pm 0.6$ µs	79B077
970.	**9-*cis*-Retinal**					
	EPA (77 K)	LP	465		Concentration unspecified; $\tau_T = 58.8 \pm 2.4$ µs	79B077
	Hexane	LP/ET	445 ± 5,	63000 ± 15000	ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}); $\tau_T = 8.3 \pm 0.7$ µs	747633
	Hexane	PR/ET	445 ± 5,	56000 ± 6000	ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}); $\tau_T = 8.3 \pm 0.7$ µs	747633
	MeOH	LP/RF	460,	24300	‡Triplet ET to β-carotene; ϵ determined assuming oscillator strength independent of solvent, bands are symmetrical (in energy) and relative to measured value (unstated) in hexane; $\tau_T = \sim 0.17$ µs	78E467
971.	***all-trans*-Retinal/(CF$_3$)$_2$CHOH**					
	Cyclohexane	LP	475		$\tau_T = 11.1$ µs	82A288
972.	***all-trans*-Retinal**					
	Acetonitrile	LP/RF	470,	67000	ϵ relative to retinal in hexane ($\epsilon_{445} = 78000$ L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; $\tau_T = 12.0$ µs	79E546
	Acetonitrile	LP/SD	470,	59000	ϵ is upper limit; $\tau_T = 12.0$ µs	79E546
	Benzene	LP	455		$\tau_T = 9.09$ µs	777434
	Benzene	LP-ET	455		Triplet ET from anthracene; $k_{et} = 3.0 \times 10^{10}$ L mol^{-1} s^{-1}	777434
	Benzene	PR/RF	460,	62000	ϵ relative to retinal in hexane ($\epsilon_{445} = 78000$ L mol^{-1} cm^{-1}) assuming oscillator strength independent of solvent; $\tau_T = 9.1$ µs	79E546
	Benzene	PR/ET	460,	67000	ϵ relative to biphenyl in benzene ($\epsilon_{367.5} = 27100$ L mol^{-1} cm^{-1}); $\tau_T = 9.1$ µs	79E546
	Benzene	PR	460		‡Triplet ET from naphthalene; $\tau_T = 8.62$ µs; $k_{et} = 5.5 \times 10^9$ L mol^{-1} s^{-1}	81B008
	Cyclohexane	LP	445		$\tau_T = 9.3$ µs	82A288
	DFMeOH	LP-ET	550		‡Triplet ET from anthracene; $\tau_T = 24.2$ µs	82A288
	EPA (77 K)	LP	465		$\tau_T = 41.0 \pm 3.2$ µs	79B077
	Hexane	PR/ET	450,	74000	‡Triplet ET to β-carotene; ϵ relative to biphenyl in cyclohexane ($\epsilon_{361.3} = 42800$ L mol^{-1} cm^{-1}), assuming no solvent effect on biphenyl	733002
	Hexane	PR/ET	445 ± 5,	78000 ± 8000	ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}); $\tau_T = 8.3 \pm 0.7$ µs	747633
	Hexane	PR-ET/ET	450,	75000	ϵ relative to biphenyl in cyclohexane ($\epsilon_{365} = 42800$ L mol^{-1} cm^{-1}, note literature value at 361.3 nm); $\tau_T = 8.3 \pm 0.7$ µs; $k_{et} = (3 \pm 1) \times 10^{10}$ L mol^{-1} s^{-1}	741013
	Hexane	LP/ET	445 ± 5,	69000 ± 17000	ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}); $\tau_T = 8.3 \pm 0.7$ µs	747633
	Hexane	PR/ET	445,	114000^c ± 17100	‡Triplet ET from biphenyl; ϵ relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; $\tau_T = 9.1 \pm 0.9$ µs; $k_{et} = (2.0 \pm 0.20) \times 10^{10}$ L mol^{-1} s^{-1}	776412
	Hexane	LP/SD	445,	70000 ± 7000	ϵ relative to anthracene in cyclohexane ($\epsilon_{423} = 64700$ L mol^{-1} cm^{-1})	78E208
	MCH	FP	440		‡Oxygen quenching; half-life = 9.9 µs	59E006
	MCH	FP/?	450,	75800	Lifetime measurement was made at 293 K with retinal concentration 2.18×10^{-5} mol L^{-1}; $\tau_T = 11$ µs	62E007
	MCH (296 K)	LP/SD	448,	76000	‡Oxygen quenching and triplet ET to β-carotene; $\tau_T = 11$ µs	747334

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	MeOH	FP/?	465, 67000 450, 68900	Lifetime measurement was made at 293 K with retinal concentration 2.30×10^{-5} mol L^{-1}; $\tau_T = 17$ μs	62E007
	MeOH (296 K)	LP/SD	480, 64000 460, 74000	‡Oxygen quenching and triplet ET to β-carotene; $\tau_T = 16$ μs	747334
	MeOH	LP/RF	460, 38000^c	‡Triplet ET to β-carotene; ε determined assuming oscillator strength independent of solvent, bands are symmetrical (in energy) and relative to measured value (unstated) in hexane	78E467
	THF	FP/?	448, 78600	Lifetime measurement was made at 293 K with retinal concentration 2.28×10^{-5} mol L^{-1}; $\tau_T = 14$ μs	62E007
973.	***all-trans*-Retinoic acid**				
	Hexane	PR/ET	440, 73000	ε relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1})	82A205
	MeOH	LP	440	‡Oxygen quenching; $\tau_T = 1.6$ μs	82A205
974.	***all-trans*-Retinol**				
	Cyclohexane	LP	405	‡Triplet ET from biphenyl and oxygen enhancement of triplet yields	737185
	Hexane (298 K)	FP-ET	400^a 383^a	‡Triplet ET from benz[*a*]anthracene; delay 50 μs; $\tau_T = 17$ μs; $k_{et} = 5 \times 10^9$ L mol^{-1} s^{-1}	69E217
	Hexane	PR/ET	405, 57500 ± 500	‡Triplet ET from biphenyl; ε relative to biphenyl (ϵ_{ref} unstated); $k_{et} = 3 \times 10^9$ L mol^{-1} s^{-1}	746499
	Hexane	LP/ET	405, 57500 ± 500	‡Triplet ET from TMPD-biphenyl; ε relative to biphenyl (ϵ_{ref} unstated)	746499
	Hexane	PR/ET	405, 80000 ± 12000	‡Triplet ET from biphenyl; ε relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; $\tau_T = 15 \pm 1.5$ μs; $k_{et} = (2.3 \pm 0.23) \times 10^{10}$ L mol^{-1} s^{-1}	776412
975.	**Retinyl acetate**				
	Hexane	LP/ET	405, 64000 ± 1000	‡Triplet ET from TMPD-biphenyl; ε relative to biphenyl (ϵ_{ref} unstated)	746499
	Hexane	PR/ET	405, 64000 ± 1000	‡Triplet ET from biphenyl; ε relative to biphenyl (ϵ_{ref} unstated)	746499
	Hexane	PR/ET	395, 79000	ε relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1})	82A205
	MeOH	LP	395	‡Oxygen quenching (1.0×10^9 L mol^{-1} s^{-1}); $\tau_T = 8.3$ μs	82A205
976.	***N*-11-*cis*-Retinylidene-*n*-butylamine**				
	Hexane	LP-ET/ET	~435, 50000	ε relative to biphenyl in cyclohexane ($\epsilon_{361.3} = 42800$ L mol^{-1} cm^{-1}); ET was from an exciplex of TMPD and biphenyl which decayed to triplet biphenyl	747189
977.	***N*-13-*cis*-Retinylidene-*n*-butylamine**				
	Hexane	LP-ET	~440	ET was from an exciplex of TMPD and biphenyl which decayed to triplet biphenyl; the maximum was determined by smoothing the literature data	747189
978.	***N*-9-*cis*-Retinylidene-*n*-butylamine**				
	Hexane	LP-ET	~435	ET was from an exciplex of TMPD and biphenyl which decayed to triplet biphenyl	747189
979.	***N*-*all-trans*-Retinylidene-*n*-butylamine**				
	Hexane	LP-ET/ET	~435, 50000	ε relative to biphenyl in cyclohexane ($\epsilon_{361.3} = 42800$ L mol^{-1} cm^{-1}); ET was from an exciplex of TMPD and biphenyl which decayed to triplet biphenyl	747189
	Hexane	PR/ET	430, 158000 ± 23700	‡Triplet ET from biphenyl; ε relative to biphenyl in cyclohexane ($\epsilon_{361} = 42800$ L mol^{-1} cm^{-1}), assuming authors used standard for cyclohexane; $\tau_T = 20 \pm 2$ μs; $k_{et} = (1.5 \pm 0.15) \times 10^{10}$ L mol^{-1} s^{-1}	776412
	MCH (296 K)	LP/SD	435, 45000	‡Oxygen quenching and triplet ET from triplet donor, anthracene; $\tau_T = 17$ μs	747334

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
980.	***N*-11-*cis*-Retinylidene-*n*-butylamine, conjugate acid**				
	EtOH	LP-ET	~550	‡Triplet ET from phenanthrene; 550 nm was apparent maximum in difference spectrum; $\tau_T = 50 \mu s$; pH Acidic	757090
981.	***N*-*all-trans*-Retinylidene-*n*-butylamine, conjugate acid**				
	MCH/Trichloroacetic acid (296 K)	LP-ET/SD	570, 150000	‡Triplet ET from anthracene; $\tau_T = 20$ μs; $k_{et} = 1.2 \times 10^{10}$ L mol^{-1} s^{-1}	747334
982.	**Rhodamine 110**				
	EtOH	FP/SD	606^a, 11000^a 510, 15800 391^a, 8460^a	‡Triplet ET from naphthalene; shoulder at 460^a nm; long-lived photoproduct also observed; ϵ units uncertain	777316
983.	**Rhodamine B**				
	1-PrOH	FP/SD	1000 640, 13000 450	‡Triplet ET to anthracene sulfonic acid and from naphthalene, oxygen quenching; 250 μs delay	78A304
	EtOH	FP/SD	560, 23000 419^a, 12100^a	‡Triplet ET from naphthalene; shoulder at 640^a nm; long-lived photoproduct also observed; ϵ units uncertain	777316
	Water	FP	464^a	pH 7	747229
	Water	FP/SD	1000 640 625^b, 10000 450	250 μs delay; blue band decays with same lifetime as others	777041
	Water	FP	1000 640 450	‡Triplet ET to anthracene sulfonic acid and from naphthalene, oxygen quenching; 250 μs delay; pH 7.0	78A304
984.	**Rhodamine 6G**				
	1-PrOH	FP/SD	950 630, 13000 415	‡Triplet ET to anthracene sulfonic acid and from naphthalene, oxygen quenching; 250 μs delay	78A304
	Bromoform	FP	651^a	$\tau_T = 190$ μs	72E277
	DMSO	FP-ET	624^a	‡Triplet ET from anthracene; shoulder at ~705^a nm	72E277
	Deuterium oxide	FP/SD	1120, 42000 637, 20000 410, 28000 308, 28000	Shoulders at 578 and 308 nm	82B106
	EtOH	FP/ET	600, 18000 ± 3000 411^a, 18000^a	ϵ relative to naphthalene in EtOH ($\epsilon_{415} = 40000$ L mol^{-1} cm^{-1}); strong SD masked spectrum between 490 and 550 nm; spectrum corrected for a photoproduct absorbing in 350 - 490 nm region; $\tau_T = 3400 \pm 120$ μs	747050
	Glycerol (293 K)	FP	1120 610 415		82B106
	PMMA (200 K)	FP	1100 633 415	‡Phosphorescence decay	82B106
	Water	FP-ET	633^a	‡Triplet ET from naphthalene; shoulder at ~740^a nm; $\tau_T = 770$ μs	72E277
	Water	FP/SD	950 630 596^b, 8500 415	250 μs delay; blue band decays with same lifetime as others	777041
	Water	FP-ET	950	Triplet ET from naphthalene; no bands observed in the visible; pH 8.8	78A304
	Water	FP	950 635 410	Maximum at 635 nm has apparent contribution from triplet of conjugate acid (authors)	79F576

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Water	FP/SD	637, 20000 410, 24000 308, 28000 256, 42000 227, 44000	Shoulders at 578 and 308 nm; pH 7	82B106
985.	**Rhodamine 6G cation, conjugate monoacid**				
	Water	FP	950 630 415	‡Triplet ET to anthracene sulfonic acid and from naphthalene, oxygen quenching; 250 μs delay; pK_a = 7.3; pH 7.0	78A304
	Water	FP	1000 420 355 313 260	pH 1.5	82B106
986.	**Rhodamine 6G dimer**				
	$BuOH/CCl_4$	LP/ET	620^a, 16500^a	‡Triplet ET to anthracene; dimer species; solvent was 2:3 BuOH to carbon tetrachloride; ϵ relative to anthracene (ϵ_{ref} unstated) assuming unit transfer efficiency	75E530
	CCl_4	LP/ET	650^a, 10000^a	‡Triplet ET to anthracene; aggregate species; solvent contains 0.2% BuOH; ϵ relative to anthracene (ϵ_{ref} unstated) assuming unit transfer efficiency	75E530
987.	**Riboflavine, conjugate monoacid**				
	Water	LP/RA	670^a, 5000^a 415^a, 7900^a 350^a, 7000^a	lifetime measured at 660 nm; ϵ relative to anthracene in cyclohexane ($\Phi_T = 0.71$, $\epsilon_{423} = 64700$ L mol^{-1} cm^{-1}) and using $\Phi_T = 0.40$ for riboflavine in water; shoulder around 300 nm; $\tau_T = 19$ μs; pH 2.2	777617
988.	**Rose Bengal**				
	Acetonitrile/Water	LP	820	Solvent was 3.5:1.5 acetonitrile to water; $\tau_T = 30$ μs	84E216
	PrOH	FP	610^a 450^a	Relative intensities (1:1); $\tau_T = 500$ μs	79E848
989.	**Rubrene**				
	Acetonitrile	FP-ET	498^a 473^a 450^a	‡Triplet ET from biacetyl; delay 50 μs; $\tau_T = \sim 80$ μs	68E103
	Benzene	FP-ET	505 472	‡Triplet ET from benzophenone; $\tau_T = 100 \pm 20$ μs; E_T = 100 - 124 kJ mol^{-1}	776262
	Benzene	FP/ET	450^b, 3000	‡Triplet ET from benzophenone; ϵ_{ref} unstated; $\tau_T = 115 \pm 3$ μs; $E_T = 110 \pm 2$ kJ mol^{-1}	81E346
	Benzene	PR-ET	~475	‡Triplet ET from biphenyl; $\tau_T = 109$ μs	83E223
	Benzene	FP	496^a 467^a 438^a 413^a	496 nm was the most intense peak	84F248
	Hexane	FP	487.6		54E001
	Hexane	FP	536 519 418.5	Relative intensities (58:100:25)	58E001
	Toluene (295 K)	LP-ET/ET	495, 26000 ± 2000 468^a, 19000^a 440^a. 15000^a 414^a, 10000^a	‡Oxygen quenching, triplet ET from anthracene; ϵ relative to anthracene in benzene ($\epsilon_{431} = 42000$ L mol^{-1} cm^{-1}. assuming ϵ_{max} in toluene at 429 nm was the same); $\tau_T = 140$ μs; $k_{et} = (2.45 \pm 0.3) \times 10^9$ L mol^{-1} s^{-1}	81E716
990.	**Safranine cation**				
	Water	FP/SD	420, 10000	‡ Oxygen quenching; unprotonated species; spectrum between 500-600 nm uncharacterized; $\tau_T = 59$ μs; pH 10.4	81B032

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
991.	**Safranine cation, conjugate diacid**				
	Water	FP	698[a] 657[a] 384[a]	‡Oxygen quenching; pH 3-5	677322
	Water	FP/SD	660, 21500 390, 17500	‡ Oxygen quenching; pK_a = 7.5; spectrum between 500-600 nm uncharacterized; τ_T = 280 μs; pH 3.0	81B032
992.	**Safranine cation, conjugate monoacid**				
	Water	FP	377[a]	‡Oxygen quenching and KI quenching; another maximum > 800 nm with a shoulder at 743[a] nm; τ_T = 67 ± 13 μs; pH 7-9	677322
	Water	FP/SD	>800 800[b], 15500	‡Oxygen quenching; pK_a = 9.2; spectrum between 500-600 nm uncharacterized; τ_T = 44 μs; pH 8.3	81B032
993.	**Selenine cation**				
	Water	FP/SD	770[a], 17000[a] 690[a], 10500[a] 425[a], 12000[a]	ε assumes triplet does not absorb where singlet depletion is followed; lifetimes measured in MeOH; τ_T = 21 μs; pH 8.5	767246
994.	**Selenine cation, conjugate monoacid**				
	Water	FP/SD	650[a], 15500[a] 385[a], 13500[a]	ε assumes triplet does not absorb where singlet depletion is followed; lifetimes measured in MeOH; pK_a = 6.4 ± 0.2; τ_T = 0.39 μs; pH 4.6	767246
995.	**Selenopyronine**				
	Water	FP	690 480 400	‡Triplet ET to benzophenone; τ_T = 167 μs; pH 7.2	82E680
996.	***all-trans*-Spheroidene**				
	Cyclohexane	PR/ET	510, 309000	ε relative to biphenyl in cyclohexane (ϵ_{360} = 42800 L mol^{-1} cm^{-1}); τ_T = 5.5 μs; $k_{et} = 8.96 \times 10^9$ L mol^{-1} s^{-1}	83B121
997.	***all-trans*-Spheroidenone**				
	Cyclohexane	PR/ET	550, 60600	ε relative to biphenyl in cyclohexane (ϵ_{360} = 42800 L mol^{-1} cm^{-1}); τ_T = 3.8 μs; $k_{et} = 3.22 \times 10^{10}$ L mol^{-1} s^{-1}	83B121
998.	***all-trans*-Spirilloxanthin**				
	Cyclohexane	PR/ET	550, 92000	ε relative to biphenyl in cyclohexane (ϵ_{360} = 42800 L mol^{-1} cm^{-1}); τ_T = 3.7 μs; $k_{et} = 2.74 \times 10^{10}$ L mol^{-1} s^{-1}	83B121
999.	**Spiro[9,10-dihydro-9-oxoanthracene-10,2′-5′,6′-benzindan]**				
	Hexane	LP	423		84E077
1000.	**Stilbene**				
	Stilbene	PR	450[a]	Triplet exciton; shoulders at 500 nm and 630 nm	80E230
1001.	***trans*-Stilbene-2,2′-d_2**				
	EPA (77 K)	FP	380 360 342	Most intense peak at 380 nm; $\tau_T = 2.2 \times 10^4$ μs	707199
1002.	***trans*-Stilbene-2,3,4,5,6-d_5**				
	EPA (77 K)	FP	380 360 342	Most intense peak at 380 nm; $\tau_T = 2.4 \times 10^4$ μs	707199
1003.	***trans*-Stilbene-4,4′-d_2**				
	EPA (77 K)	FP	380 360 344	Most intense peak at 380 nm; $\tau_T = 2.2 \times 10^4$ μs	707199

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1004.	***trans*-Stilbene-7,7′-d_2**					
	EPA (77 K)	FP	380 360 344		Most intense peak at 380 nm; $\tau_T = 5.3 \times 10^4$ μs	707199
1005.	***cis*-Stilbene**					
	Benzene	PR	360		‡Oxygen quenching	680379
	Cyclohexane	PR	360		‡Oxygen quenching; $\tau_T = 17 \pm 6$ μs	680379
	EtOH (108 K)	LP	380 360 342		Triplet state absorption observed only after repetitive (~30) flashes	79E640
	MCH/Isohexane (93 K)	LP	380 360 341		Triplet state absorption observed only after repetitive (~30) flashes	79E640
1006.	***trans*-Stilbene**					
	Benzene	PR	360		‡Oxygen quenching	680379
	Benzene	PR	360		$G\epsilon_{360} = 2300 \pm 230$ L mol^{-1} cm^{-1} / (100 eV absorbed); $\tau_T = 0.11$ μs	720447
	Cyclohexane	FP	325		$\tau_T = 4 \times 10^4$ μs	600062
	Cyclohexane	PR	360		‡Oxygen quenching; $\tau_T = 14 \pm 6$ μs	680379
	EPA (77 K)	FP	379 360 343		379 nm was the most intense peak; $\tau_T = 2.2 \times 10^4$ μs	677485
	EPA (103 K)	LP	381 362 344		Triplet absorption not observable above 107 K; lifetime constant below 88 K; $\tau_T = 1.1 \times 10^4$ μs	79E640
	EtOH (98 K)	LP	381 361 343		Relative intensities (3:2:1); triplet absorption not observable above 128 K; lifetime constant below 105 K; $\tau_T = 1.2 \times 10^4$ μs	79E640
	Glycerol (235 K)	LP	385 366 350		Triplet absorption not observable above 244 K; lifetime constant below 200 K; $\tau_T = 10^4$ μs	79E640
	Glycerol triacetate (213 K)	LP	380 360 340		Triplet absorption not observable above 235 K; lifetime constant below 201 K; $\tau_T = 10^4$ μs	79E640
	Isopentane/3-MP (77 K)	FP/IV	378 358 341	34000	Glass was 6:1 isopentane : 3-MP; $\tau_T = 5300$ μs	687111
	MCH/Isohexane (98 K)	LP	380 360 342		Relative intensities (3:2:1); triplet absorption not observable above 109 K; reported lifetime constant below 95 K; $\tau_T = 1.4 \times 10^4$ μs	79E640
1007.	***trans*-Stilbene-d_{12}**					
	EPA (77 K)	FP	379 360 341		Main peak at 379 nm; $\tau_T = 9.2 \times 10^4$ μs	707199
	Isopentane/3-MP (77 K)	FP/IV	378 358 341	28000	Glass was 6:1 isopentane to 3-MP; $\tau_T = 1.1 \times 10^4$ μs	687111
1008.	**Styrene**					
	Cyclohexane	LP/RA-ET	325^b	2200	ϵ relative to naphthalene in cyclohexane ($\epsilon_{413} = 24000$ L mol^{-1} cm^{-1}), but in ref. cited ($\epsilon_{415} = 24500$ L mol^{-1} cm^{-1}); triplet ET from thioxanthone; $\tau_T = \sim 0.025$ μs	82E181
1009.	**Sulfacetamide**					
	Water	LP	450 330		‡Oxygen quenching and triplet ET to β-carotene in EtOH; spectrum obtained from composite spectra; $\tau_T = 0.5 \pm 0.05$ μs; pH 7.0	82A138
1010.	**4-Sulfomethylbenzophenone anion**					
	AOT/Decane/Water-/Cyclohexanol	LP	535		Microemulsion	84N125

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1011.	**[1,1′:4′,1′′-Terphenyl]-4,4′′-diamine**					
	2-MTHF (77 K)	CWL	560			74B003
1012.	***m*-Terphenyl**					
	2-PrOH/Isooctane/-Et_2O (81 K)	FP	404^a		‡Phosphorescence decay; glass was 1:3:3 2-PrOH to isooctane to Et_2O	81B119
	BuOH (~80 K)	FP/COM	401	72^d	ϵ estimated from numerical simulation of triplet state kinetics; $\tau_T = (4.65 \pm 0.2) \times 10^6$ μs	67B010
	BuOH (~80 K)	FP/IV	401	63^d	ϵ estimated by extrapolation to infinite excitation rate	67B010
	EtOH/Et_2O (77 K)	MOD/KM	436	3900 ± 1200	Glass was 2:1 EtOH to Et_2O; temp.temperature was not explicitly stated, but 77 K was inferred from the context	719059
	PVA (81 K)	FP	412^a 341^a		‡Phosphorescence decay	81B119
	Toluene/EtOH (77 K)	MOD	441^a 400^a 364^a		Glass was 19:1 toluene to EtOH; most intense peak was at 441 nm	719059
1013.	***o*-Terphenyl**					
	BuOH (~80 K)	FP/COM	488	80^d	ϵ estimated from numerical simulation of triplet state kinetics; $\tau_T = (3.45 \pm 0.1) \times 10^6$ μs	67B010
	BuOH (~80 K)	FP/IV	488	100^d	ϵ estimated by extrapolation to infinite excitation rate	67B010
	EtOH/Et_2O (77 K)	MOD/KM	390	<1000	Glass was 2:1 EtOH to Et_2O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Toluene/EtOH (77 K)	MOD	600^a 398^a 353^a		Glass was 19:1 toluene to EtOH; most intense peak was at 398 nm	719059
1014.	***p*-Terphenyl**					
	2-MTHF (77 K)	CWL	460		Shoulder at 413^a nm	74B003
	2-PrOH/Isooctane/-Et_2O (81 K)	FP	459		‡Phosphorescence decay; glass was 1:3:3 2-PrOH to isooctane to Et_2O; $\tau_T = 2.7 \times 10^6$ μs	81B119
	Alcohol/Ether (77 K)	MOD	459		Glass was 2:1 alcohol to ether	76E682
	Benzene	PR/ET	460	90000	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	BuOH (~80 K)	FP/COM	449	4880^d	ϵ estimated from numerical simulation of triplet state kinetics; $\tau_T = (1.93 \pm 0.06) \times 10^6$ μs	67B010
	BuOH (~80 K)	FP/IV	449	9920^d	ϵ estimated by extrapolation to infinite excitation rate	67B010
	EtOH/Et_2O (77 K)	MOD/KM	460	88000 ± 35000	Glass was 2:1 EtOH to Et_2O; temperature was not explicitly stated, but 77 K was inferred from the context	719059
	Hexane (300 K)	MOD/SD	444	40000	$\tau_T = 450 \pm 40$ μs	69E208
	MCH/Isopentane (77 K)	PS	455^a		Glass was 4:1 MCH to isopentane; shoulder at 425 nm	74B006
	Polystyrene	PR	470		$G\epsilon$ values increased with concentration; half-life = 2 × 10^4 μs	672086
	Toluene/EtOH (77 K)	MOD	467^a		Glass was 19:1 toluene to EtOH; shoulder at 394^a nm	719059
1015.	***p*-Terphenyl-d_{14}**					
	3-MP (77 K)	PS/ESR	461	12900	‡ESR; oscillator strength = 0.88	69B002
1016.	**4-(4-*p*-Terphenylylmethyl)benzophenone**					
	2-MTHF (77 K)	PS/ESR	480^a	110000 ± 20000		707036
1017.	**2-([1,1′:4′,1′′-Terphenyl]-4-ylmethyl)triphenylene**					
	2-MTHF (77 K)	PS/ESR	471^a	100000 ± 20000		707036
1018.	**Testosterone**					
	EtOH	LP	305^a		‡Triplet ET to piperylene, oxygen quenching (2.2 × 10^9 L mol^{-1} s^{-1}); solvent uncertain; $\tau_T = 0.044$ μs	80B055

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1019.	**Tetrabenzophenazine**				
	Toluene (293 K)	FP	495^{a}	‡Phosphorescence decay in EPA at 77 K, oxygen quenching; isomer unspecified	80E778
1020.	**Tetrabenzoporphine**				
	Pyridine	FP	440 400		73E345
1021.	**Tetracene**				
	2-MTHF (77 K)	CWL	485 468 440 412 385 360 320	The first 3 bands were assigned to $^3B_{3g}^{-} \leftarrow {}^3B_{2u}^{+}$, and the last 4 were assigned to $^3A_{1g}^{-} \leftarrow {}^3B_{2u}^{+}$	727000
	Acetonitrile	LP-ET	470^{a}	‡Triplet ET from 2-nitronaphthalene; $k_{et} = 7.1 \times 10^9$ L mol^{-1} s^{-1}	767269
	Acetonitrile	FP	460		78A163
	Benzene	PR/ET	465, 31200	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Benzene	LP-ET	470^{a}	‡Triplet ET from 2-nitronaphthalene; shoulder at 450 nm; $k_{et} = 7.4 \times 10^9$ L mol^{-1} s^{-1}	767269
	EtOH/MeOH/2-MTHF (113 K)	FP/SD	962, 1000 ± 300 935^{a}, 70^{a} 909^{a}, 80^{a} 893^{a}, 80^{a} 846.5, 790^{a} 806^{a}, 60^{a} 794^{a}, 70^{a} 769^{a}, 60^{a} 757, 300^{a} 694^{a}, 70^{a} 683, 90^{a} 671^{a}, 70^{a}	‡Lifetime same as TTA bands in the blue; glass was 3:1:4 EtOH to MeOH to 2-MTHF; shoulders at 862^{a}, 752^{a}, and 741^{a} nm; $\tau_T = 1000 \pm 50$ μs	69B006
	EtOH/MeOH (113 K)	FP/TD	962.0, 1000 931^{a}, 80^{a} 911^{a}, 90^{a} 888^{a}, 100^{a} 848^{a}, 750^{a} 807^{a}, 70^{a} 793^{a}, 80^{a} 774^{a}, 70^{a} 758^{a}, 290^{a} 699^{a}, 80^{a} 685^{a}, 100^{a} 497^{a}, 5600^{a} 481.5, 60000 463.3, 90000 438^{a}, 32900^{a} 413^{a}, 9150^{a} 368^{a}, 2300^{a} 339.1, 2000 318.0, 17000 305^{a}, 15600^{a} 285.8, 350000 244.0, 23000 235^{a}, 15800^{a}	‡Phosphorescence decay; shoulders at 864^{a}, 752^{a}, 745^{a}, 669^{a}, 534^{a}, 488^{a}, 458^{a}, 451^{a}, 330^{a}, 294^{a}, and 291^{a} nm; 7 electronic transitions were assigned with 0-0's at 962.0, 481.5, 463.3, 339.1, 318.0, 285.8, and 244.0 nm; oscillator strength = 0.002, 0.2, 0.45, 0.004, 0.15, 0.85, ~0.2	72B001

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Liquid paraffin	FP/SD	476 460 430.5 400 312 285.5	30000 52600 27300 8000 8000 195000	Solvent had viscosity of 0.03 N·s/m^2; 4 separate electronic transitions were assigned; bands between 460 and 400 nm were assigned to the second transition; oscillator strength = 0.1, 0.4, 0.05, 0.9	58E001
	MCH	LP	476^a 459^a 431^a		459 nm was the most intense peak	82F367
	THF	FP	480^a 460^a 435^a		460 nm was the most intense peak	757004
1022.	**1,5,9,10-Tetrachloroanthracene**					
	Liquid paraffin	FP	440		Viscosity of solvent was 0.167 N·s/m^2; τ_T = 310 μs	62E009
1023.	**1,2,4,5-Tetracyanobenzene**					
	Benzene	PR	1000		‡Triplet ET to anthracene; charge transfer complex with solvent	776146
	EPA (77 K)	FP	516 477		‡Phosphorescence decay, molecular orbital calculations; ε roughly 200 L mol^{-1} cm^{-1} (method unspecified); possible charge transfer complex with ether of solvent since radical anion detected on repeated flashing; τ_T = 3.1 μs	776213
1024.	***N,N,N',N'*-Tetraethyloxonine cation**					
	EtOH	LP-ET/SD	820 500^a	24000 8600^a	‡Triplet ET from 9,10-dibromoanthracene and oxygen quenching; solution 10^{-3} mol L^{-1} NH$_3$; τ_T = 285 μs	82E456
1025.	***N,N,N',N'*-Tetraethyloxonine cation, conjugate monoacid**					
	EtOH	LP-ET/SD	700 500^a	28000 9700^a	‡Triplet ET from 9,10-dibromoanthracene and oxygen quenching; solution 0.2 mol L^{-1} H$_3$PO$_4$; τ_T = 47 μs; k_{et} = 1.9 × 10^9 L mol^{-1} s^{-1}	82E456
1026.	**Tetraethylporphine**					
	Pyridine	FP	779^a 434^a		Shoulder at 451 nm	74B007
1027.	***N,N,N',N'*-Tetraethyl-[1,1':4',1'':4'',1'''-quaterphenyl]-4,4'''-diamine**					
	2-MTHF (77 K)	CWL	710			74B003
1028.	***N,N,N',N'*-Tetraethyl-[1,1':4',1''-terphenyl]-4,4''-diamine**					
	2-MTHF (77 K)	CWL	610			74B003
1029.	**(*R*)-4,5,6,7-Tetrahydrodinaphtho[2,1-*b*:1',2'-*d*][1,6]dioxecin**					
	2-MTHF (96 K)	PS	429^a 413^a		Compound "VIII" in paper	83E383
1030.	**6,7,8,9-Tetrahydro-4-hydroxythiazolo[4,5-*h*]isoquinoline-7-carboxylate ion**					
	Water	LP/ET	370	8000	‡Oxygen quenching and triplet ET to crocetin; ε relative to crocetin in water (ϵ_{470} = 75000 L mol^{-1} cm^{-1}); ε considered an upper limit; τ_T = 54 μs; pH 13; k_{et} = 1.8 × 10^{10} L mol^{-1} s^{-1}	84A024
1031.	**7,8,9,10-Tetrahydrotetrahydroxybenzo[*a*]pyrene**					
	Water	FP	415		Solution buffered; delay 50μs	82R150
1032.	**Tetrakis(2,6-dimethyl-4-sulfonatophenyl)porphine**					
	Water	LP/TD	780	3200	τ_T = 1800 μs	84E203
1033.	**Tetrakis(2-*N*-methylpyridyl)porphine**					
	Water	LP/TD	790	2600 ± 300	τ_T = 1160 ± 120 μs; pH 6.0	84E346

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1034.	**Tetrakis(3-*N*-methylpyridyl)porphine**				
	Water	LP/TD	840, 3200 ± 300 710	$\tau_T = 390 \pm 39$ μs; pH 6.0	84E346
1035.	**Tetrakis(4-*N*-methylpyridyl)porphine**				
	Water	LP/TD	450^b, 28600	‡Oxygen quenching; tetra-*p*-toluenesulfonate salt; pH 7.4; half-life = 120 μs	82A152
	Water	LP/TD	920, 7600 ± 800 470^b, 28000 ± 2800 450^b, 57600 ± 5800	Shoulder at 820 nm	82E622
	Water	LP/TD	920, 7600 ± 800 820	$\tau_T = 170 \pm 17$ μs; pH 6.0	84E346
1036.	**Tetrakis(2-pyridyl)porphine**				
	Methylene chloride	LP/TD	790, 2600 ± 300 695	$\tau_T = 150 \pm 15$ μs	84E346
1037.	**Tetrakis(3-pyridyl)porphine**				
	Methylene chloride	LP/TD	790, 3600 ± 400 700	$\tau_T = 170 \pm 17$ μs	84E346
1038.	**Tetrakis(4-pyridyl)porphine**				
	Methylene chloride	LP/TD	790, 3800 ± 400 695	$\tau_T = 170 \pm 17$ μs	84E346
1039.	**Tetrakis(2-pyridyl)porphine, conjugate diacid**				
	Water	LP	930 720	1 mol L^{-1} HCl; pH Acidic	84E346
1040.	**Tetrakis(3-pyridyl)porphine, conjugate diacid**				
	Water	LP	890 720	1 mol L^{-1} HCl; pH Acidic	84E346
1041.	**Tetrakis(4-pyridyl)porphine, conjugate diacid**				
	Water	LP	950 720	1 mol L^{-1} HCl; pH Acidic	84E346
1042.	**Tetrakis(*p*-sulfonatophenyl)porphinatorhodate(III) ion**				
	Water	LP/TD	830		84E045
1043.	**Tetrakis(*p*-sulfonatophenyl)porphine**				
	Water	LP/TD	460^b, 65000	‡Oxygen quenching (1.9×10^9 L mol^{-1} s^{-1}); $\tau_T = 400$ μs; pH 7	81E084
	Water	LP/TD	790, 3100 ± 300 680 460^b, 130000 ± 13000		82E622
	Water	LP/TD	440^b, 44250	‡Oxygen quenching; spectrum corrected for cation radical by monitoring e_{aq}^- absorption; pH 7.4	82A152
	Water	LP/TD	790, 3400	$\tau_T = 420$ μs	84E203
1044.	**Tetrakis(trimethylaminophenyl)porphine**				
	Water	LP/TD	800, 3200 690	$\tau_T = 540$ μs	83E462
1045.	***N,N,N′,N′*-Tetramethylbenzidine**				
	Acetonitrile	LP/SD	475, 36000 ± 4000	‡Oxygen quenching (2.2×10^{10} L mol^{-1} s^{-1}); $\tau_T = 10$ μs	84B066
	Acetonitrile	LP	475^a	‡Quenching by 2,5-dimethyl-2,4-hexadiene; spectrum obtained by subtracting radical cation spectrum from a composite spectrum; $\tau_T = 5$ μs	84F074
	Cyclohexane	LP	475	‡Triplet ET to naphthalene, oxygen quenching, intensity dependent lifetime; $E_T = 260 \pm 5$ kJ mol^{-1}; $k_{et} = 2 \times 10^9$ L mol^{-1} s^{-1}	767177

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	EtOH/Water	LP	475	‡Oxygen quenching; solvent was 1:1 EtOH to water; delay 250 ns	84E405
	MeOH	LP/ELT	475^{b}, 40000 ± 3000	‡Triplet ET to naphthalene, oxygen quenching, intensity dependent lifetime; ϵ relative to cation radical in MeOH (ϵ_{475} = 41000 L mol^{-1} cm^{-1}) obtained by electron transfer to Eu^{3+} ions and noting no change in absorbance at 475 nm; τ_T = ~10 μs; E_T = 260 ± 5 kJ mol^{-1}	767177
	SDS	LP/ELT	475^{b}, 40000 ± 2000	‡Triplet ET to naphthalene, oxygen quenching, intensity dependent lifetime; ϵ relative to cation radical in MeOH (ϵ_{475} = 41000 L mol^{-1} cm^{-1}) obtained by electron transfer to Eu^{3+} ions and noting no change in absorbance at 475 nm; aqueous micelle; E_T = 260 ± 5 kJ mol^{-1}	767177
1046.	**1,1′,3,3′-Tetramethyldianthrone**				
	MCH/Isohexane (93 K)	FP	490	‡ESR; shoulders at 450 nm and 530 nm; lifetime measured at 103 K; τ_T = 1200 μs	70B006
	PMMA	FP/SD	485, ≤26000		677223
	PMMA (140 K)	FP/SD	485, 26000	‡Phosphorescence decay; τ_T = 88000 μs	677223
1047.	**3,4,7,8-Tetramethyl-1,5-diazabicyclo[3,3,0]octa-3,7-diene-2,6-dione**				
	Acetonitrile	LP	420	‡Variation of decay with viscosity; ϵ > 10000 L mol^{-1} cm^{-1}; τ_T = 2.2 μs	79E443
1048.	**1,3,3,6-Tetramethyl-6′-nitrospiro-(2,2′-indolin[2*H*-1]benzopyran)**				
	Toluene (298 K)	FP	460	‡Oxygen quenching, activationless decay; assigned to $\pi \rightarrow \pi^*$ transition in uncolored form	67B003
1049.	***N,N,N′,N′*-Tetramethyl-*p*-phenylenediamine**				
	3-MP (77 K)	FP/SD	613^{a}, 15300^{a} 610^{b}, 15000 570^{a}, 13600^{a} 330^{a}, 5500^{a} 299^{a}, 17500^{a}	‡Phosphorescence decay and oxygen quenching; "TMPD"; shoulder at 532^{a} nm; spectrum was estimated in SD region, 340-360 nm; ϵ outside SD region was measured assuming integrated ϵ was equal to that of TMPD cation, and this was used in a modified SD method	69E215
	Acetonitrile	LP	560^{a}	Spectra extracted from composite spectra; τ_T = 0.5 μs	84B061
	Benzene	PR/ET	605, 12200	ϵ relative to benzophenone ketyl radical in cyclohexane (ϵ_{max} = 3700 L mol^{-1} cm^{-1}); ϵ obtained from a simultaneous least squares fit of data from several compounds making use of cyclohexane to benzene ϵ_{max} ratios of 1.83 for naphthalene and 1.45 for anthracene	71E360
	Cyclohexane	LP/ET	597^{a} 570^{b}, 11900 526^{a}	‡Oxygen quenching and delayed fluorescence; ϵ relative to naphthalene in cyclohexane (ϵ_{415} = 22400 L mol^{-1} cm^{-1})	707061
	Dipropyl ether (77 K)	MOD/KM	615, 24000 ± 6000 570, 24000 ± 6000 297, 28000 ± 7000		737055
	EtOH	FP	620^{a} 568^{a}		707061
	Heptane	LP	596^{a} 562^{a}	Delay 150 ns; 562 nm peak was the more intense; τ_T = 1.4 μs	82E474
	Hexane	LP	608^{a} 551^{a}	Delay 40 ns	84B061
	Liquid paraffin	FP	598^{a} 554^{a}	‡Negative comparisons with TMPD^{+} spectra and kinetics; shoulder at 524^{a} nm; another maximum ≤ 300 nm, and this maximum was the more intense than the 2 listed maxima; τ_T = 82 μs	66B003
	MCH/Isopentane (77 K)	PS	615^{a} 600^{a} 578^{a} 565^{a} 536^{a} 523^{a}	‡Phosphorescence decay; glass was 1:1 MCH to isopentane; the 6 peaks occurred in pairs, with the bands formed by each pair showing indications of additional structure	66B003

TABLE 1. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	PMMA	PR/ET	620 580	10000 11000	ϵ relative to naphthalene in cyclohexane (ϵ_{415} = 22000 L mol^{-1} cm^{-1}), assuming no solvent effects; reference ϵ was from a citation that actually reported $\epsilon_{412.5}$ = 22600 L mol^{-1} cm^{-1}	710278
	Polystyrene	PR/ET	630 580	15000 15000	ϵ relative to naphthalene in polystyrene (ϵ_{425} = 11000 L mol^{-1} cm^{-1})	710278
	Water	LP	630 570		Water	707061
1050.	**Tetramethylthiuram disulfide**					
	Hexane	FP	~400		‡Oxygen quenching; τ_T = 90 μs	78B108
1051.	**Tetramethylthiuram monosulfide**					
	Hexane	FP	~400		‡Oxygen quenching; τ_T = 90 μs	78B108
1052.	**1,1,4,4-Tetraphenyl-1,3-butadiene**					
	Toluene	PR	395^a		‡Triplet ET to β-carotene and oxygen quenching; τ_T = 0.665 μs	84E144
1053.	**Tetraphenylchlorin**					
	Benzene	FP	520 470		Maximum at 520 nm was judged to be of "doubtful signficance" by the experimenters; benzene was wet	58R002
	Dimethyl phthalate	FP/SD	441^a		Shoulder at 458 nm	74B007
1054.	**Tetraphenyl-*p*-dioxin**					
	Benzene	LP	550^a 350^a		‡Oxygen quenching (1.7 × 10^9 L mol^{-1} s^{-1}), triplet ET to Di-*tert*-butylselenoketone; maxima assumed solvent independent (text); τ_T = 0.630 μs; k_{et} = 1.8 × 10^8 L mol^{-1} s^{-1}	79A241
	MeOH	LP	550^a 350^a		‡Oxygen quenching, triplet quenching; relative intensities (1:3); τ_T = 0.535 μs	79A241
1055.	**3,3,4,5-Tetraphenyl-2(3*H*)-furanone**					
	Benzene	LP/ET	365 ± 5	13000 ± 2600	‡Oxygen quenching; ϵ relative to benzophenone in benzene (ϵ_{532} = 7600 L mol^{-1} cm^{-1}); τ_T = 12 ± 2 μs; k_{et} = 2.5 × 10^9 L mol^{-1} s^{-1}	84E520
1056.	**Tetraphenylporphinatorhodium(III) chloride**					
	MeOH	LP/TD	830			84E045
1057.	***meso*-Tetraphenylporphine**					
	Benzene	LP/TD	790	6000	τ_T = 1500 μs	84E203
	Toluene	FP/SD	780 690 430 390	6000 3500 83000 42000	τ_T = 1350 μs	60E006
	Toluene	LP	780			80B101
1058.	**Tetraphenylporphyrin dianion**					
	THF	FP	460		Electron photoejection ruled out by scavenging study; half-life = 1000 μs	79B114
1059.	**1,3,6,8-Tetraphenylpyrene**					
	Cyclohexane	FP/TD	525.5 510 499 488.5 478.5 460 434 429.5 426	14400 19700 18900 18100 16800 13900 16900 16700 16500	The 1st triplet level was assigned to $^3B_{2u}^+$; four electron transitions were assigned, with the 1st (band 1), 3rd (origin, band 6), and the 4th (origin, band 7) being $^3B_{2g}^-$, while the 2nd electronic transition (origin, band 2) being $^3A_g^-$	757439

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1060.	**Thiobenzophenone**					
	Benzene	LP/RA	515 ± 5, 400 ± 5,	4100 ± 800 4800 ± 1000	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 7630 L mol^{-1} cm^{-1}), taking $\Phi_T = 0.6$ at 337 nm excitation and taking $\Phi_T = 1$ for benzophenone; $\tau_T = 1.7 \pm 0.2$ μs	84A221
1061.	**Thioflavine**					
	PMMA (77 K)	PS	1650 1300 1200 1100 950 750			65B004
1062.	**Thioindigo**					
	2-MTHF	LP	588[a]		‡Oxygen quenching	79E325
	Benzene	LP	590[a] 530[a] 380[a]		‡Oxygen quenching (3.2 × 10^{9} L mol^{-1} s^{-1}); presumably twisted triplet since spectrum independent of amount of *cis* or *trans* isomers used; τ_T = 0.279 μs	78F030
	Butyronitrile	LP	580		‡Oxygen quenching	79E325
	Chloroform	LP	603			81E639
	Dichloromethane	LP	590[a] 530[a] 380[a]		‡Oxygen quenching; presumably twisted triplet since spectrum independent of amount of *cis* or *trans* isomers used; τ_T = 0.158 μs	78F030
	Glycerol triacetate (203 K)	LP	580 375		τ_T = 37 μs	79E543
	Glycerol triacetate	LP	575 370		τ_T = 0.20 μs	79E543
	MCH/Toluene (77 K)	LP	587[a]		Solvent was 1:1 MCH to toluene	79E325
	MCH/Toluene	LP	590		‡Oxygen quenching; solvent was 1:1 MCH to toluene	79E325
	Methylene chloride	LP	590 370		τ_T = 0.15 μs	79E543
	PMMA	LP	580 375			79E543
1063.	**Thionine cation**					
	Acetonitrile	FP	810[a] 740[a] 430[a]			78A447
	MeOH	FP	780 420			747038
	MeOH	FP/SD	780[a], 700[a], 430[a],	13200 7000[a] 12000[a]	Upper bound on ϵ; basic form of triplet; τ_T = 12 μs	777242
	Water	FP/SD	760[a], 690[a], 415[a],	9400[a] 6000[a] 12000[a]	τ_T = 1.7 μs; pH 8.	64E017
	Water	FP/SD	775,	10000	pK_a = 6.3 ± 0.1	67C001
	Water	FP	770		pK_a 8.95; pH 7.5-9.5	757148
	Water	FP	770[a]		Shoulder at 730 nm	777315
1064.	**Thionine cation, conjugate monoacid**					
	Sulfuric acid (295 K)	FP/SD	495[a],	5000[a]	Absorption spectra extends to 700 nm and has at least one additional maximum which was more intense than at 495 nm, but is masked by bleaching of ground state; temperature ± 1 K; pH ~0.7	61A001
	Water	FP/SD	655[a], 375[a],	15400[a] 14000[a]	pH 1.	64E017
	Water	FP	650			67C001
	Water	FP	645[a]		τ_T = 16 ± 2 μs; pH 2.5	777315
	Water	LP/SD	650, 380,	16000 14000	SD assuming no triplet absorption at 630 nm; solution 0.01 mol L^{-1} acid; pH 2	82E232
	Water/Acetonitrile	LP/SD	650, 380,	20000 15500	SD assuming no triplet absorption at 630 nm; solution 0.01 mol L^{-1} acid; solvent was 1:1 water to acetonitrile	82E232
	Water/EtOH	LP/SD	650, 380,	20500 16500	SD assuming no triplet absorption at 630 nm; solution 0.01 mol L^{-1} acid; solvent was 1:1 water to EtOH	82E232

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1065.	**Thiopyronine**					
	Water	FP	690 470-480 440 400 370 340		Solution was phosphate buffered; $\tau_T = 420\ \mu s$; pH 7.4	687142
1066.	**Thiopyronine cation**					
	Acetonitrile	FP/?	660^b	4560	ϵ method unspecified; $\tau_T = \sim 80\ \mu s$	80A369
	MeOH	FP/?	720^a 660^b 470^a 420^a	 4200	Radical ($\lambda_{max} = 425$ nm) and radical ion ($\lambda_{max} = 470$ nm) contributions in the blue unsubtracted; ϵ method unspecified; $\tau_T = \sim 80\ \mu s$	80A369
	Water	FP	704^a 344^a		$\tau_T = 420\ \mu s$; pH 7.4	697009
	Water	FP/?	660^b	4350	ϵ method unspecified; $\tau_T = \sim 80\ \mu s$	80A369
1067.	**4-Thiouridine**					
	Acetonitrile	LP/ET	520	50000	ϵ relative to retinol in hexane ($\epsilon_{405} = 80000$ L mol^{-1} cm^{-1})	83E625
	Water	LP/ET	520	50000	ϵ relative to retinol in hexane ($\epsilon_{405} = 80000$ L mol^{-1} cm^{-1})	83E625
1068.	**9*H*-Thioxanthene-9-thione**					
	Benzene	LP/RA	505 ± 5 350 ± 5	2500 ± 500 10600 ± 2100	ϵ relative to benzophenone in benzene ($\epsilon_{532.5} = 7630$ L mol^{-1} cm^{-1}), taking $\Phi_T = 0.8$ at 337 nm excitation and taking $\Phi_T = 1$ for benzophenone; SD method gave similar ϵ; $\tau_T = 0.83 \pm 0.08\ \mu s$	84A221
1069.	**Thioxanthen-9-one**					
	Acetonitrile	FP	625 ± 5		‡Triplet ET to triplet acceptors; $\tau_T = 73\ \mu s$	737190
	Acetonitrile	LP	620			84B116
	Benzene	LP/RA	650	30000 ± 5000	ϵ relative to anthracene in liquid paraffin ($\epsilon_{424} = 71000$ L mol^{-1} cm^{-1}), assuming $\Phi_T = 0.7$ for anthracene in benzene and $\Phi_T = 1.0$ for thioxanthen-9-one and assuming ϵ independent of solvent; wavelength assumed to be a maximum	79E099
	Benzene	LP/ET	650	30000 ± 5000	ϵ relative to anthracene in liquid paraffin ($\epsilon_{424} = 71000$ L mol^{-1} cm^{-1}) assuming ϵ independent of solvent; wavelength assumed to be a maximum	79E099
	Benzene	FP	650-670		$\tau_T = 95\ \mu s$	81A294
	tert-BuOH	FP	620 ± 5		‡Triplet ET to triplet acceptors	737190
1070.	**Thymidine**					
	Acetonitrile	LP/ET	370^b	3600	‡Triplet ET to retinol, oxygen quenching; ϵ relative to retinol in hexane ($\epsilon_{405} = 80000$ L mol^{-1} cm^{-1}), assuming no change in extinction coefficient of standard in acetonitrile, and making kinetic corrections; $k_{et} = 6 \times 10^9$ L mol^{-1} s^{-1}	79B087
	Water	LP/RF	370^b	3600	‡Oxygen quenching; ϵ relative to thymidine in acetonitrile ($\epsilon_{370} = 3600$ L mol^{-1} cm^{-1}), assuming oscillator strength independent of solvent; $\tau_T = 25\ \mu s$	79B087
1071.	**Thymidine 5′-monophosphate**					
	EtOH	LP/ET	370^b	4000	‡Triplet ET to retinol, oxygen quenching; ϵ relative to retinol in hexane ($\epsilon_{405} = 80000$ L mol^{-1} cm^{-1}), assuming no change in extinction coefficient of standard in EtOH, and making kinetic corrections; $\tau_T = 25\ \mu s$; $k_{et} = 2 \times 10^9$ L mol^{-1} s^{-1}	79B087
	Water	LP/RF	370^b	4000	‡Oxygen quenching; ϵ relative to thymidine 5′-monophosphate in EtOH ($\epsilon_{370} = 4000$ L mol^{-1} cm^{-1}), assuming oscillator strength independent of solvent	79B087

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1072.	**Thymine**				
	Acetonitrile	LP/ET	340^b, 4000	‡Triplet ET to β-carotene and retinol; ϵ relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}), assuming no solvent effect on reference *f*; no maximum was present, but 300 nm appeared to be a shoulder; τ_T = 2.5 μs; k_{et} = ~6 × 10^9 L mol^{-1} s^{-1}	757510
	Water	FP	340		717071
	Water	LP/ET	340^b, 4000	‡Triplet ET to β-carotene and retinol; ϵ relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}), assuming no solvent effects on reference *f* on going to acetonitrile and on thymine on going from acetonitrile to water; shoulder at ~340 nm; τ_T = 0.6 μs	757510
1073.	**Thymine, negative ion**				
	Water	FP	421^a	‡Oxygen quenching; shoulder at 490^a nm; another maximum <330 nm; pK_b ~3; pH 12	727036
1074.	**Toluene/Tetracyanobenzene**				
	Toluene/Et$_2$O (77 K)	MOD	1250 559	Glass was 1:1 toluene to Et$_2$O	72E276
1075.	***s*-Triazine**				
	Acetonitrile	LP/HAT	303 245, ~6000	Shoulders at ~450 and ~345 nm; ϵ relative to H adduct of *s*-triazine in acetonitrile (ϵ_{315} = 1900 L mol^{-1} cm^{-1}); τ_T = 0.91 μs	757066
1076.	**Tribenzo[*a*,*c*,*h*]phenazine**				
	PMMA (77 K)	PS	525	‡Phosphorescence decay (?); τ_T = 7.4 × 10^5 μs	70E291
	PMMA (293 K)	FP	525	Decay was nonexponential, and lifetime was calculated from a terminal 1st-order rate constant; τ_T = 3.2 × 10^5 μs	70E291
1077.	**2,9,10-Trichloroanthracene**				
	Liquid paraffin	FP	419	Viscosity of solvent was 0.167 N·s/m^2; τ_T = 400 μs	62E009
1078.	**1,3,5-Tricyanobenzene**				
	Et$_2$O/Isopentane (77 K)	PS	320	Glass was 1:1 Et$_2$O to isopentane	75B004
1079.	**Tricyclo[8.2.2.2^{4,7}]hexadeca-4,6,10,12,13,15-hexaene-5,15-dicarbonitrile**				
	Acetonitrile	LP	520^a	100 ns delay	776187
	Toluene	LP	520^a	100 ns delay	776187
1080.	**1,1,1-Trifluoroacetylacetone**				
	EtOH/MeOH (118 K)	FP	380	Solvent was 3:1 EtOH to MeOH	68B005
1081.	**4-(Trifluoromethyl)acetophenone**				
	Benzene	LP/RA	455^a, 2800^a 426^a, 2700^a	ϵ relative to benzophenone in cyclohexane (ϵ_{533} = 7630 L mol^{-1} cm^{-1}, assuming no solvent effect from benzene), and taking all the triplet yields to be unity	737198
1082.	**4-(Trifluoromethyl)benzophenone**				
	Acetonitrile/Water	LP/ET	530, 5800 320, 12400	Solvent was 9:1 acetonitrile to water; ϵ relative to 1-methylnaphthalene in acetonitrile/water (ϵ_{415} = 11200 L mol^{-1} cm^{-1})	84B033
1083.	**4,4,4-Trifluoro-1-phenyl-1,3-butanedionatosodium**				
	EPA	LP/SD	620^b, 11000	τ_T = 0.04 μs	84E232
	EPA	LP/ET	620^b, 12000	ϵ relative to naphthalene in cyclohexane (ϵ_{414} = 24500 L mol^{-1} cm^{-1}); τ_T = 0.03 μs; k_{et} = 4.1 × 10^9 L mol^{-1} s^{-1}	84E232
1084.	**2,4,6-Triisopropylbenzophenone**				
	Acetonitrile	LP	750 305	‡Triplet ET to *cis*-1,3-pentadiene; relative intensities (1:2); decays into biradical; τ_T = 0.255 ± 0.013 μs	80B088

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1085.	**2,3,5-Trimethyl-1,4-benzoquinone**					
	Water	LP	480 440		$\tau_T = 5.9\ \mu$s	80B112
1086.	**(*all-E*)-3,7,12-Trimethyl-1,14-bis(2,6,6-trimethyl-1-cyclohexen-1-yl)-1,3,5,7,9,11,13-tetradecaheptaene**					
	Benzene (296 K)	LP-ET	495		Triplet ET from chlorophyll *a*; oxygen quenching (3.2×10^9 L mol^{-1} s^{-1}); $\tau_T = 10\ \mu$s; $k_{et} = 0.8 \times 10^9$ L mol^{-1} s^{-1}	73E347
1087.	**1,1,2-Trimethyl-2-(2-naphthyl)ethylene**					
	Benzene	LP-ET	390^a		‡Triplet ET from xanthone and oxygen quenching (4.7×10^9 L mol^{-1} s^{-1}); $\tau_T = 0.07\ \mu$s	84B090
1088.	**1,3,3-Trimethyl-6′-nitrospiro-(2,2′-indolin[2*H*-1]benzopyran)**					
	MCH	LP	430		‡Oxygen quenching; ground state dimers form readily; $\tau_T = \sim 20\ \mu$s	80N064
	Toluene (298 K)	FP	443		‡Oxygen quenching, activationless decay; ϵ estimated > 10000 L mol^{-1} cm^{-1}; assigned to $\pi \rightarrow \pi^*$ transition in uncolored form	67B003
1089.	**3,5,5-Trimethyl-2-phenoxy-2-cyclohexene-1-one**					
	MCH	LP	380^a		‡Oxygen quenching; spectrum obtained by extrapolation to zero time	81F111
1090.	**4-[Tri(4-methylphenyl)porphinyl]-3-phenoxypropyl β-*apo*-6′-carotenate**					
	Benzene	LP	~540 ~440		The 80 ns lifetime associated with 440 nm triplet, assigned to porphyrin chromophore; 2.4 μs lifetime and 540 nm band assigned to carotenoid chromophore; 440 nm species is precursor of 540 nm species; $\tau_T = 2.4$; 0.080 μs	82E174
1091.	**4,5′,8-Trimethylpsoralen**					
	EtOH (180 K)	FP	481^a 461^a 376^a		‡Triplet ET from naphthalene; shoulder at 498^a nm	83B122
	MeOH	LP/ET	470, 370 ,	33000 ± 3000 27000^a	‡Triplet ET to β-carotene; ϵ relative to β-carotene in hexane ($\epsilon_{515} = 240000$ L mol^{-1} cm^{-1}) assuming ϵ independent of solvent; $\tau_T = 7.1\ \mu$s	79B042
1092.	**Triphenylamine**					
	3-MP (77 K)	PS	525		$\tau_T = (9 \pm 3) \times 10^5\ \mu$s	67E106
	EPA (77 K)	PS	531		‡Phosphorescence decay; $\tau_T = (9 \pm 2) \times 10^5\ \mu$s	67E106
	MCH	LP	520			72B002
	Toluene/EtOH (77 K)	MOD	583^a 410^a		Glass was 19:1 toluene to EtOH; 583 nm peak was the more intense	719059
1093.	**Triphenylamine, conjugate acid**					
	Acetic acid/MeOH/- Et$_2$O (77 K)	MOD/KM	579^b, 546^b, 436^b,	5900 9900 2300	Glass was 14:3:3 acetic acid to MeOH to Et$_2$O	82E648
1094.	**1,3,5-Triphenylbenzene**					
	2-PrOH/Isooctane/- Et$_2$O (81 K)	FP	500 346		‡Phosphorescence decay; glass was 1:3:3 2-PrOH to isooctane to Et$_2$O; $\tau_T = 3.9 \times 10^6\ \mu$s	81B119
	Alcohol/Ether (77 K)	MOD	494		Glass was 2:1 alcohol to ether	76E682

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
1095.	**Triphenylene**				
	2-MTHF (77 K)	PS/ESR	431, 16500 408^a, 9900^a	‡ESR; oscillator strength = 0.085	68D211
	3-MP (77 K)	PS	721 657		67E106
	? (77 K)	PS	434^a 410^a	‡Phosphorescence decay and ESR lifetime; glass used was either 2-MTHF or 3-MP; $\tau_T = 1.37 \times 10^7$ μs	67E108
	Benzene	FP	428 407	Relative intensities (10:9)	61E005
	Benzene	LP	428		70E288
	Benzene	LP/ET	435, 6000 ± 500	‡Triplet ET from benzophenone; ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 7630 L mol^{-1} cm^{-1})	757282
	Butane/Isopentane (77 K)	PS/IV	430, 7000 ± 2000 408^a, ~3800	Glass was 3:7 butane to isopentane; ϵ_T was computed from $OD = \epsilon_T \tau_p i_0(1 - \Phi_f)$ after the optical density, OD, was extrapolated to zero intensity of the monitoring beam (namely $i_0 \rightarrow 0$), here τ was lifetime of triplet, and Φ_f was fluorescence quantum yield; oscillator strength = 0.05	65E031
	Cyclohexane	LP	430	‡Rise time of transient was the same as the decay time of the singlet	68B006
	EPA (77 K)	PS	431	‡Phosphorescence decay	51E001
	EPA (77 K)	PS	727 661	‡Phosphorescence decay; $\tau_T = (1.34 \pm 0.3) \times 10^7$ μs	67E106
	EPA (82 K)	PS/KM	430, 16800 ± 300		68B003
	EPA (77 K)	FP/SD	430, 15600 ± 2300 409^a, 8200^a	$\tau_T = 1.38 \times 10^7$ μs; oscillator strength = 0.11	69F389
	EPA (77 K)	PS/KM	429^a, 17100^a 407^a, 11200^a 392^a, 7700^a	Solvent, temperature and extinction method assumed from earlier work; polarization also measured	69E213
	EPA (77 K)	PS/KM	430, 16800	λ_{max} assumed from previous work	69E212
	EtOH (77 K)	MOD/KM	340^b, 8500 310^b, 2500 295^b, 3200 274.3^b, 17500 270, 36500 262.5^b, 27500 250^b, 45000		757594
	EtOH (77 K)	MOD	727 650^a 431 408^a	Relative intensities (2:1:4:1); halfwidth of principal maximum 680 cm^{-1}	777538
	EtOH/MeOH (113 K)	FP/TD	350, >13000	Solvent was 3:1 EtOH to MeOH; lower limit assumes total ground state depletion	67B004
	Ethylene glycol	FP	428 407	Relative intensities (10:9); τ_T = 1000 ± 100 μs	61E005
	Hexane	FP	428.1		54E001
	Hexane	FP/SD	428, 4100 404, 3500 346, 7000	Band at 346 nm was assigned to the second electronic transition; oscillator strength = 0.025, 0.06	58E001
	Hexane	FP	428 405	Relative intensities (10:9); τ_T = 55 ± 9 μs	61E005
	Hexane (77 K)	PS	431 407 385 360 350	First 3 bands were of medium intensity and were assigned to one electronic transition; other 2 bands were of strong intensity and were assigned to another electronic transition	63B002
	Hexane (77 K)	PS	432.6 409.0 381.2 361.8	Sample was a Shpolskii matrix; first two bands were assigned to one electronic transition, and the last two were assigned to another one	65B003
	Hexane	PS	722 655	Weak bands in the red only studied	67B005

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
	Hexane (77 K)	PS	722.0 654.9 432.0 416.7 408.5 396.0 381.0 369.90 362.1 354.6	Relative intensities (15:10:100:42:62:33:_:40:_:35)	69E211
	MCH (77 K)	PS/KM	432, 14400 ± 1000	Photoreaction with solvent measured; $\tau_T = 14 \times 10^6$ μs	81F315
	MCH	LP	424^a 405^a	424 nm peak was the more intense	82F367
	PMMA	LP	428		70E288
	Toluene (77 K)	MOD	737 660^a 443	Relative intensities (4:2:3); halfwidth of principal maximum 2000 cm^{-1}	777538
1096.	**Triphenylene-*d*$_{12}$**				
	EPA (77 K)	FP/SD	431, 12000 ± 1800	$\tau_T = 1.73 \times 10^7$ μs	69F389
1097.	**Triphenylene/Chloranil**				
	Liquid paraffin	MOD	415	Mull	71E361
1098.	**Triphenylethylene**				
	Toluene	PR	366^a	‡Triplet ET to β-carotene; maximum uncertain because of low intensity of monitoring light (private communication, P.K. Das, 1984); $\tau_T = 0.130$ μs	84E144
1099.	**3,3,5-Triphenyl-2(3*H*)-furanone**				
	Benzene	LP/ET	330 ± 5, 13000 ± 2600	‡Oxygen quenching; ε relative to benzophenone in benzene ($\epsilon_{532} = 7600$ L mol^{-1} cm^{-1}); $\tau_T = 1.2 \pm 0.1$ μs; $k_{et} = 2.1 \times 10^9$ L mol^{-1} s^{-1}	84E520
1100.	**Triphenylmethane**				
	MCH (77 K)	PS	427^a		727440
1101.	**Triphenylmethyl cation**				
	Sulfuric acid/Acetic acid (77 K)	PS	340^a	‡Oxygen quenching; solvent was 1:1 sulfuric acid to acetic acid; pH Acidic	78A180
	Sulfuric acid/Acetic acid	FP	580^a 340	‡Oxygen quenching; solvent was 1:1 sulfuric acid to acetic acid; pH Acidic	78A180
1102.	**1,3,3-Triphenylprop-2-en-1-one**				
	MeOH	LP	440	‡Oxygen quenching; $\tau_T = 0.325$ μs	84E520
1103.	**Tris(2,2′-bipyridine)iridium(III) ion**				
	MeOH/Water	LP	567^a 519^a 500^a 463^a 451^a 438^a 424^a 404^a 379^a		79B098
1104.	**Tris(2,2′-bipyridine)osmium(II) ion**				
	Water	LP/SM	467^a, 5000^a 365^a, 17700^a	$\tau_T = 0.019$ μs	80E040

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1105.	**Tris(2,2′-bipyridine)ruthenium(II) ion**				
	Acetonitrile	LP/SD	360^b, 27300 ± 1500	‡Triplet ET to retinol; $\tau_T = 1.1 \pm 0.1$ μs	767180
	Water	LP/SD	360^b, 27300 ± 1500	‡Oxygen quenching (3.3×10^9 L mol^{-1} s^{-1}); $\tau_T = 0.67 \pm 0.02$ μs	767180
	Water	LP/TD	453^b, 7700^c 445^a, 8000^{a,c} 370^a, 13500^{a,c}	In estimation of ε, TD assumed from saturation of OD at intensities above 0.3×10^{18} photons/cm^2; shoulder at 350 nm	79B161
	Water	LP/SM	452^b, 2100 370^a, 28900^a 315^a, 36600^a 252^a, 41600^a		79B032
	Water	LP/SM	430^a, 6500^a 364^a, 25400^a		80E040
	Water	LP	368 310 255	pH 12.7	82A365
	Water	LP/TD	541, 3000 444, 5000 376, 29000 320, 37000 250^b, 40000		83B098
1106.	**Tris(1,10-phenanthroline)rhodium(III) ion**				
	Water (298 K)	LP/RA	490, 4300^a	ε relative to benzophenone in benzene ($\epsilon_{532} = 7630$ L mol^{-1} cm^{-1}, $\Phi_T = 1$), Φ_T for compound measured as 1; units for ε are assumed since they were not specified in the paper; $\tau_T = 0.25 \pm 0.02$ μs	84B055
	Water/Ethylene glycol (77 K)	LP	490	‡Phosphorescence decay; glass was 1:1 water to ethylene glycol; $\tau_T = (4.8 \pm 2) \times 10^4$ μs	84B055
1107.	**Tris(4,4,4-trifluoro-1-phenyl-1,3-butanedionato)lanthanum(III)**				
	EPA	LP/SD	620, 20000	$\tau_T = 2.6$ μs	84E232
	EPA	LP/ET	620, 27000	ε relative to naphthalene in cyclohexane ($\epsilon_{414} = 24500$ L mol^{-1} cm^{-1}); $\tau_T = 2.7$ μs; $k_{et} = 1.0 \times 10^9$ L mol^{-1} s^{-1}	84E232
1108.	**Tris(4,4,4-trifluoro-1-phenyl-1,3-butanedionato)lutetium(III)**				
	EPA	LP/SD	620^b. 28000	$\tau_T = 1.4$ μs	84E232
	EPA	LP/ET	620^b, 28000	ε relative to naphthalene in cyclohexane ($\epsilon_{414} = 24500$ L mol^{-1} cm^{-1}); $\tau_T = 1.5$ μs; $k_{et} = 1.0 \times 10^9$ L mol^{-1} s^{-1}	84E232
1109.	**Tryptophan**				
	PVA (293 K)	FP	480^a	‡Phosphorescence decay	757469
	Water (77 K)	PS	464^a	‡Phosphorescence decay; 4 mol L^{-1} $CaCl_2$ aqueous glass	700011
	Water (298 K)	LP	450	‡Triplet ET to anthracene in EtOH; lifetime was measured at pH 7.5; spectrum is the difference between spectra at 100 ns in O_2-free solution and 1 μs in O_2-containing solution; $\tau_T = 14.3 \pm 1.4$ μs; pH 5.4	757163
	Water	LP/COM	460, 5000	ε corrected for radical and hydrated electron absorption at 460 nm ε from quadratic fit to absorption decay curve assuming triplet-triplet annihilation with rate constant 10^{10} L mol^{-1} s^{-1}; pH 7	777432
1110.	**DL-Tryptophan**				
	PVA	FP/COM	485^a, 3700 ± 400	‡Phosphorescence decay; ε estimated based on $\Phi_f = 0.55$ and the assumption of no internal conversion	753103
1111.	**L-Tryptophan**				
	Ethylene glycol/Water (77 K)	PS/KM	450, 8000	‡Phosphorescence decay; glass was 1:1 ethylene glycol to water by volume; $\tau_T = 6.6 \times 10^6$ μs	716330
	Water	FP	460	pH 5.4	727041

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
1112.	**Tyrosine**				
	Water	LP	~575 295 250	Zwitterion; lifetime was measured at pH 6.0 and extrapolated to zero tyrosine concentration; pK_a's of triplet are 2.5 and 9.7; spectrum is the difference between spectra at 20 ns and 15 μs; τ_T = 5.5 ± 1.5 μs; pH 7.5	757161
1113.	**L-Tyrosylglycine**				
	Water	LP	~385^a	Another maxima below 250 nm that was at least 3 times as high as the maximum at 385^a nm; spectrum is the difference between spectra at 20 ns and 15 μs; τ_T = 3.4 ± 0.2 μs; pH 6.0	757161
1114.	**Ubiquinone 30**				
	Benzene	PR/ET	430^b, 13000	‡Triplet ET from anthracene; ε relative to biphenyl in benzene (ϵ_{367} = 27100 L mol^{-1} cm^{-1}); this ε may be too high, see comment under ubiquinone [743062]; half-life = 0.45 μs; k_{et} = 5.1 × 10^9 L mol^{-1} s^{-1}	723043
	Cyclohexane	LP/ET	440 ± 5, 8000 ± 1600	ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1}); listed value updates authors' earlier value, ε = 19000 L mol^{-1} cm^{-1}, from [723043] which was in error because of spectral overlap with the donor	743062
	Cyclohexane	PR/ET	440 ± 5, 7200 ± 1600	ε relative to biphenyl in cyclohexane (ϵ_{361} = 42800 L mol^{-1} cm^{-1})	743062
1115.	**Uracil**				
	Acetonitrile	LP/ET	340, 2750	‡Triplet ET to β-carotene and retinol; ε relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}), assuming no solvent effect on reference *f*; τ_T = 0.6 μs; k_{et} = ~8 × 10^9 L mol^{-1} s^{-1}	757510
	Water	FP	380	‡Oxygen quenching; τ_T = 6.1 ± 0.5 μs	697253
	Water	LP/ET	360, 2600^a	‡Triplet ET to β-carotene and retinol; ε relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}), assuming no solvent effects on reference *f* on going to acetonitrile and on uracil on going from acetonitrile to water; τ_T = 0.35 μs	757510
1116.	**Uridine**				
	Acetonitrile	LP/ET	370^b, 6400	‡Triplet ET to retinol, oxygen quenching; ε relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}), assuming no change in extinction coefficient of standard in acetonitrile, and making kinetic corrections; k_{et} = 6 × 10^9 L mol^{-1} s^{-1}	79B087
	Water	LP/RF	370^b, 6400	‡Oxygen quenching; ε relative to uridine in acetonitrile (ϵ_{370} = 6400 L mol^{-1} cm^{-1}), assuming oscillator strength independent of solvent; τ_T = 20 μs	79B087
1117.	**Uridine monophosphate**				
	EtOH	LP/ET	390, 9000	‡Triplet ET to retinol, oxygen quenching; ε relative to retinol in hexane (ϵ_{405} = 80000 L mol^{-1} cm^{-1}), assuming no change in extinction coefficient of standard in EtOH, and making kinetic corrections; k_{et} = 5 × 10^9 L mol^{-1} s^{-1}	79B087
	Water	LP/RF	390^b, 9000	‡Oxygen quenching (3 × 10^9 L mol^{-1} s^{-1}); ε relative to uridine monophosphate in EtOH (ϵ_{390} = 9000 L mol^{-1} cm^{-1}), assuming oscillator strength independent of solvent; τ_T = 33 μs	79B087
1118.	**Uroporphyrin I, octamethyl ester**				
	Benzene	PR/ET	440^b, 32000 405^a	‡Oxygen quenching (1.5 × 10^9 L mol^{-1} s^{-1}); ε relative to biphenyl in benzene (ϵ_{360} = 27100 L mol^{-1} cm^{-1}); τ_T = 270 μs	80E200
	Benzene	LP/TD	440^b, 26000 405^a	‡Oxygen quenching (1.5 × 10^9 L mol^{-1} s^{-1}); τ_T = 270 μs	80E200

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} , ϵ_{max} /nm /L mol^{-1} cm^{-1}	Comment	Ref.
1119.	**2-Vinylnaphthalene**				
	Benzene	PR/ET	426^a, 13200	‡Triplet ET from biphenyl; ϵ relative to biphenyl in benzene (ϵ_{367} = 27100 L mol^{-1} cm^{-1}); τ_T = 60 μs; k_{et} = 7.1 × 10^9 L mol^{-1} s^{-1}	79E666
	Benzene	LP-ET	417^a 396^a	‡Triplet ET from xanthone and oxygen quenching (3.9 × 10^9 L mol^{-1} s^{-1}); there was a weak, broad maximum in the region of 600 nm; τ_T = 0.25 μs	84B090
1120.	***9H*-Xanthene-9-thione**				
	Benzene	LP/RA	460 ± 5, 5500 ± 1100 345 ± 5, 15400 ± 3100	ϵ relative to benzophenone in benzene ($\epsilon_{532.5}$ = 7630 L mol^{-1} cm^{-1}), taking Φ_T = 0.8 at 337 nm excitation and taking Φ_T = 1 for benzophenone; SD method gave similar ϵ; τ_T = 1.8 ± 0.2 μs	84A221
1121.	**Xanthone**				
	1,1,2-Trichloro-trifluoroethane	LP	610	τ_T = 0.42 μs	767171
	2-PrOH (295 K)	LP	610^a	τ_T = 0.370 μs	80A338
	Benzene	LP/RA	610, 5300 ± 700	‡Triplet ET to naphthalene, oxygen quenching (5.6 × 10^9 L mol^{-1} s^{-1}); ϵ relative to benzophenone in benzene (ϵ_{525} = 7630 L mol^{-1} cm^{-1}) assuming Φ_T = 1 for both molecules; τ_T = 0.092 μs; k_{et} = (9.5 ± 1.0) × 10^9 L mol^{-1} s^{-1}	767171
	Benzene	LP/RA	600, 8600 ± 2000	ϵ relative to anthracene in liquid paraffin (ϵ_{424} = 71000 L mol^{-1} cm^{-1}), assuming Φ_T = 0.7 for anthracene in benzene and Φ_T — 1.0 for xanthone and assuming ϵ independent of solvent; wavelength assumed to be a maximum	79E099
	Benzene	LP	650	100 ps delay; rise time of 0.013 ns	79B007
	CCl_4 (295 K)	LP	655	τ_T = 0.70 μs	80A338
	Cyclohexane	LP	~610	τ_T = ~0.02 μs	767171
	EtOH/Water	LP	590	‡Oxygen quenching (2.4 × 10^9 L mol^{-1} s^{-1}); solvent was "10 wt% aqueous ethanol"; τ_T = 17.9 μs	767171
	EtOH/Water	LP	605	‡Triplet ET to naphthalene, oxygen quenching (2.8 × 10^9 L mol^{-1} s^{-1}); solvent was "95%" ethanol; τ_T = 1.41 μs; k_{et} = (5.6 ± 0.6) × 10^9 L mol^{-1} s^{-1}	767171
	Poly(styrenesulfonate)/DTB/Water	LP	600^a	Xanthone associated with aggregates in aqueous medium; spectrum averaged during first 40 ns; spectrum blue-shifts at longer times indicating a shift in position in the aggregate	84N163
	SDS	LP	607^a	Aqueous micelles	83N127
	SDS	LP	610	Aqueous micelles	84N197
1122.	***o*-Xylene**				
	Cyclohexane (289.5 K)	LP	~340^a	Delay 200 ns	83E483
1123.	**Zeaxanthin**				
	?	FP-ET	505^a	‡Triplet ET from anthracene; it was not reported whether the solvent was hexane or benzene	733001
	Benzene	PR-ET	520	‡Triplet ET from naphthalene; τ_T = 9.4 μs	80A143
1124.	**Zinc(II) chlorophyll *a***				
	Benzene	FP	450	Benzene was wet	58R002
1125.	**Zinc(II) cytochrome c**				
	Water (288.7 K)	LP	462	‡Phosphorescence decay, oxygen quenching; cytochrome c is from horse heart, type III; τ_T = 7000 μs	81E091
	Water/Glycerol (288.7 K)	LP	462	‡Phosphorescence decay, oxygen quenching; cytochrome c is from horse heart, type III; solvent contains 33% glycerol; τ_T = 14100 μs	81E091
1126.	**Zinc(II) etioporphyrin I**				
	Benzene	FP	510^a 430^a	Shoulder at 462^a nm; 430 nm was the more intense peak	747293
	DMF	FP/SD	440, 99000 411^b, 45300		73E345

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max}, /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1127.	**Zinc(II) etioporphyrin I/Hexachloroethane**					
	Benzene	FP	434[a]		Shoulder at 458[a] nm	747293
1128.	**Zinc(II) etioporphyrin I/*trans*-4-Nitrostilbene**					
	Benzene	FP	450		Triplet exciplex; assigned as a 1:2 complex of the porphyrin to the stilbene	717463
1129.	**Zinc(II) etioporphyrin I/4-Nitrotoluene**					
	Benzene	FP	440		Triplet exciplex; assigned as a 1:2 complex of the porphyrin to 4-nitrotoluene	717463
	Benzene	FP	532[a]		Shoulder at 462[a] nm; 439 nm was the more intense peak	747293
			439[a]			
1130.	**Zinc(II) phthalocyanine**					
	1-Chloronaphthalene	LP/TD	480	34000 ± 4000	λ_{max} and ϵ method inferred from text	81E457
	1-Chloronaphthalene	LP/SM	480	16000 ± 3000	‡Triplet ET to β-carotene; λ_{max} inferred from text	81E457
	Benzene	FP/?	545	44000	Method to be published	81E346
			450	51000		
	Dimethylacetamide-/Water	LP/SD	490	32500	Solvent was 7:3 dimethylacetamide to water	82A290
	PrOH	FP/SD	470	33000		73E345
1131.	**Zinc(II) porphyrin**					
	CTAC	LP/SM	840	7000[a]	50 ns delay; aqueous micelle; ϵ method uncertain; τ_T = 200 μs	80N087
			740[a]	5000[a]		
			460	10000		
	DODAC	LP/SM	840	7200[a]	Cationic vesicle; ϵ method uncertain; τ_T = ~500 μs	80N035
			740[a]	5000[a]		
			660[a]	3200[a]		
	Dimethyl phthalate	FP/SD	811[a]	11100[a]	Shoulder at 487 nm	74B007
			427[a]	167000[a]		
			389[a]	46300[a]		
1132.	**Zinc(II) protoporphyrin**					
	MeOH	FP	455			58R002
1133.	**Zinc(II) tetrabenzoporphyrin**					
	Pyridine	FP/SD	490	74000	‡Phosphorescence decay; τ_T = 525 μs	73E345
			410	37000		
1134.	**Zinc(II) tetraethylporphyrin**					
	Pyridine	FP/SD	845[a]			74B007
			790[a]			
1135.	**Zinc(II) tetrakis(carboxyphenyl)porphyrin**					
	Water	LP	820[a]		Most intense peaks at 710 nm and 680 nm; decay followed at 840 nm; pH 7	80A074
			710[a]			
			680[a]			
	Water	LP	830			82E622
			730			
1136.	**Zinc(II) tetrakis(2,6-dimethyl-4-sulfonatophenyl)porphyrin**					
	Water	LP/TD	830	6000	τ_T = 1300 μs	84E203
1137.	**Zinc(II) tetrakis(2-*N*-methylpyridyl)porphyrin**					
	Water	LP	850		Shoulder at 750 nm; τ_T = 1400 ± 140 μs; pH 6.0	84E346
1138.	**Zinc(II) tetrakis(3-*N*-methylpyridyl)porphyrin**					
	Water	LP	830		Shoulder at 750 nm; τ_T = 2000 ± 200 μs; pH 6.0	84E346
	Water	LP/SD	575[b]	3900	‡Oxygen quenching; τ_T = 1800 μs	84A264
			545[b]	8300		
			460			
			440[b]	57000		
			390[b]	18000		

TABLE 6. Spectral parameters for triplet-triplet absorption of organic molecules in condensed phases — Continued

No.	Solvent	Method	λ_{max} /nm	ϵ_{max} /L mol^{-1} cm^{-1}	Comment	Ref.
1139.	**Zinc(II) tetrakis(4-*N*-methylpyridyl)porphyrin**					
	Water	LP	1040[a] 1000[a] 950[a] 890[a] 830[a] 790[a] 730[a]		Most intense peaks at 1040 nm and 840 nm; decay followed at 840 nm; $\tau_T = 1.3 \times 10^3$ μs; pH 7	80A074
	Water	LP/TD	1020 470[b] 465[b]	7200 ± 700 60800 ± 6100 38400 ± 3800	Shoulders at 949 and 860 nm	82E622
	Water	LP/TD	1020	7200 ± 700	Shoulder at 950 nm; $\tau_T = 2000 \pm 200$ μs; pH 6.0	84E346
1140.	**Zinc(II) tetrakis(*p*-sulfonatophenyl)porphyrin**					
	MeOH	LP	840		$\tau_T = \sim 80$ μs	82N068
	Water	LP	840 780[a] 750[a] 660[a]		Most intense peak at 840 nm; decay followed at 840 nm; $\tau_T = 1.5 \times 10^3$ μs; pH 7	80A074
	Water	LP/TD	840 730 460[b]	6000 ± 600 55200 ± 5500		82E622
	Water (293 K)	LP/TD	470[b]	45000[a]	pH 7.0 ± 0.1	82A306
	Water	LP/TD	840	6000	$\tau_T = 1400$ μs	84E203
1141.	**Zinc(II) tetrakis(trimethylaminophenyl)porphyrin**					
	Water	LP/TD	840 730	5000	$\tau_T = 1200$ μs	83E462
1142.	**Zinc(II) tetraphenylchlorin**					
	Dimethyl phthalate	FP/SD	447[a]			74B007
1143.	**Zinc(II) tetraphenylporphyrin**					
	Benzene	LP/TD	845	8200		84E203
	CTAC	LP	840 720[a] 460		$\tau_T = >2500$ μs	80N044
	MCH	FP/TD	470 400	71000 38000	‡Oxygen quenching; $\tau_T = 1200$ μs	81E271
	SHS	LP	840 640		Aqueous microemulsion, droplet radius 17 nm; $\tau_T = 1700$ μs	80N143
	Toluene	FP/SD	845 745 470 400	8200 5300 74000 42000	$\tau_T = 1250$ μs	60E006
	Toluene	LP	750			80B101
	Triton X-100	LP	840 460		Relative intensities (1:10); aqueous micelle; $\tau_T = 2500$ μs	81N034

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[a] Data have been obtained by computer-assisted digitization from spectrum in cited reference

[b] (Wavelength, extinction coefficient) pair is not necessarily related to a spectral peak

[c] Measurement violates Chauvenet's criterion, see Section 4.2.2

[d] Measurement not included in averages because of systematic error

[e] Measurement not included in averages since performed in mixed crystals, neat liquids, or micelles

‡ Evidence supporting the assignment of the transient as a triplet state

9. References to Table 6

41E001 Reversible photochemical processes in rigid media. A study of the phosphorescent state. Lewis, G.N.; Lipkin, D.; Magel, T.T. J. Am. Chem. Soc. **63**: 3005–18 (1941).

42B002 Reversible photochemical processes in rigid media: The dissociation of organic molecules into radicals and ions. Lewis, G.N.; Lipkin, D. J. Am. Chem. Soc. **64**: 2801–8 (1942).

51E001 Excited triplet states of some polyatomic molecules. I. McClure, D.S. J. Chem. Phys. **19**: 670–5 (1951).

53E001 Triplet states in solution. Porter, G.; Windsor, M.W. J. Chem. Phys. **21**: 2088 (1953).

54B001 The triplet-triplet absorption spectra of some aromatic hydrocarbons and related substances. Craig, D.P.; Ross, I.G. J. Chem. Soc. : 1589–1606 (1954).

54E001 Studies of the triplet state in fluid solvents. Porter, G.; Windsor, M.W. Discuss. Faraday Soc. **17**: 178–86 (1954).

55E002 Excited triplet states of polyatomic molecules. II. Flash-lamp studies on aromatic ketones. McClure, D.S.; Hanst, P.L. J. Chem. Phys. **23**: 1772–7 (1955).

55E003 Preliminary study of a metastable form of chlorophyll in fluid solutions. Livingston, R. J. Am. Chem. Soc. **77**: 2179–82 (1955).

55R001 Reversible flash bleaching of chlorophyll. Abrahamson, E.W.; Linschitz, H. J. Chem. Phys. **23**: 2198–9 (1955).

57B001 Die spektroskopisch nachweisbaren Elektronenzustaende der stabilen und metastabilen Molekelform einiger Acridinfarbstoffe und des Fluoresceinkations. Zanker, V.; Miethke, E. Z. Naturforsch., Teil A **12A**: 385–95 (1957).

587005 Primary photoprocesses in quinones and dyes. I. Spectroscopic detection of intermediates. Bridge, N.K.; Porter, G. Proc. Roy. Soc. London, Ser. A **244**: 259–75 (1958).

58E001 The triplet state in fluid media. Porter, G.; Windsor, M.W. Proc. R. Soc. London, Ser. A **245**: 238–58 (1958).

58E002 The triplet state of anthracene in liquid solutions. Livingston, R.; Tanner, D.W. Trans. Faraday Soc. **54**: 765–71 (1958).

58R001 The absorption spectra and decay kinetics of the metastable states of chlorophyll A and B. Linschitz, H.; Sarkanen, K. J. Am. Chem. Soc. **80**: 4826–32 (1958).

58R002 Some properties of the ground triplet state of chlorophyll and related compounds. Livingston, R.; Fujimori, E. J. Am. Chem. Soc. **80**: 5610–3 (1958).

59B001 Contribution a l'etude de l'etat metastable des molecules de colorants: Bandes d'absorption dans le domaine visible. Laffitte, E.; Nouchi, G. C.R. Seances Acad. Sci. **248**: 2746–8 (1959).

59B002 Absorption spectrum and decay kinetics of the metastable state of chlorophyll b. Claesson, S.; Lindqvist, L.; Holmstroem, B. Nature **183**: 661–2 (1959).

59E006 Reversible spectral changes in retinene solutions following flash illumination. Abrahamson, E.W.; Adams, R.G.; Wulff, V.J. J. Phys. Chem. **63**: 441–3 (1959).

600062 Transient benzyl radical reactions produced by high-energy radiation. McCarthy, R.L.; MacLachlan, A. Trans. Faraday Soc. **56**: 1187–1200 (1960).

60A001 A flash photolysis study of fluorescein. Lindqvist, L. Ark. Kemi **16**: 79–138 (1960).

60E005 Experimental study of the triplet state of anthracene in fluid solutions. Jackson, G.; Livingston, R.; Pugh, A.C. Trans. Faraday Soc. **54**: 1635–9 (1960).

60E006 Studies on metastable states of porphyrins. II. Spectra and decay kinetics of tetraphenylporphine, zinc tetraphenylporphine and bacteriochlorophyll. Pekkarinen, L.; Linschitz, H. J. Am. Chem. Soc. **82**: 2407–11 (1960).

61A001 The photoreduction of thionine by ferrous sulphate. Hatchard, C.G.; Parker, C.A. Trans. Faraday Soc. **57**: 1093–106 (1961).

61E005 Energy transfer from the triplet state. Porter, G.; Wilkinson, F. Proc. R. Soc. London, Ser. A **264**: 1–18 (1961).

61E008 Acidity constants in the triplet state. Jackson, G.; Porter, G. Proc. R. Soc. London, Ser. A **260**: 13–30 (1961).

62E006 Some flash-photolytic and photochemical studies of retinene and related compounds. Grellmann, K.-H.; Memming, R.; Livingston, R. J. Am. Chem. Soc. **84**: 546–8 (1962).

62E007 Population and decay of the lowest triplet state in polyenes with conjugated heteroatoms: Retinene. Dawson, W.; Abrahamson, E.W. J. Phys. Chem. **66**: 2542–7 (1962).

62E008 Observed electronic transitions of hexahelicene. Rhodes, W.; El-Sayed, M.F.A. J. Mol. Spectrosc. **9**: 42–9 (1962).

62E009 Radiationless conversion from the triplet state. Hoffman, M.Z.; Porter, G. Proc. R. Soc. London, Ser. A **268**: 46–56 (1962).

62E010 Lifetime of the triplet state of anthracene in lucite. Melhuish, W.H.; Hardwick, R. Trans. Faraday Soc. **58**: 1908–11 (1962).

63A001 Transient measurements of photochemical processes in dyes. II. The mechanism of the photosensitized oxidation of aqueous phenol by eosin. Zwicker, E.F.; Grossweiner, L.I. J. Phys. Chem. **67**: 549–55 (1963).

63B001 Polarization of the triplet-triplet absorption spectrum of some polyacenes by the method of photoselection. El-Sayed, M.A.; Pavlopoulos, T. J. Chem. Phys. **39**: 834–8 (1963).

63B002 Absorption et luminescence du triphenylene en solution etendue dans l'hexane a 77°K: Mise en evidence d'une fluorescence par echelon (transition $T^* \rightarrow T$). Dupuy, F.; Nouchi, G.; Rousset, A. C. R. Seances Acad. Sci. **256**: 2976–9 (1963).

63B003 Intermolecular electron transfer in tetrapyrrol pigments under pulsed illumination. Shakhverdov, P.A.; Terenin, A.N. Dokl. Phys. Chem. **150**: 557–60 (1963) Translated from: Dokl. Akad. Nauk SSSR **150**: 1311–4 (1963).

63B004 Dispositif experimental pour la mesure des absorptions $T^* \leftarrow T$. Lochet, R.; Nouchi, G. J. Phys. (Paris) **24**: 765–7 (1963).

63E007 Decay kinetics of the 1-naphthaldehyde and benzophenone triplet states in benzene. Bell, J.A.; Linschitz, H. J. Am. Chem. Soc. **85**: 528–32 (1963).

63F019 The triplet state of fluorescein in sulfuric acid. Lindqvist, L. J. Phys. Chem. **67**: 1701–4 (1963).

63F021 One-electron photo-ionization of acridine dyes in rigid media: Evidence for the formation of transient radical ion. Lim, E.C.; Swenson, G.W. J. Chem. Phys. **39**: 2768–9 (1963).

64B003 Flash photolysis of methylene blue. I. Reversible photolysis in the absence of a reducing agent and in the presence of certain kinds of reducing agents. Matsumoto, S. Bull. Chem. Soc. Jpn. **37**: 491–8 (1964).

64B005 Polarized emission and triplet-triplet absorption spectra of aromatic hydrocarbons in benzophenone crystals. Hochstrasser, R.M.; Lower, S.K. J. Chem. Phys. **40**: 1041–6 (1964).

64B006 Formation of triplet states of solutes in the radiolysis of organic liquids. Dainton, F.S.; Kemp, T.J.; Salmon, G.A.; Keene, J.P. Nature **203**: 1050–2 (1964).

64E013 Studies of the transient intermediates in the photoreduction of methylene blue. Kato, S.; Morita, M.; Koizumi, M. Bull. Chem. Soc. Jpn. **37**: 117–24 (1964).

64E014 Triplet-triplet polarisation measurements in mixed crystals. Craig, D.P.; Fischer, G. Proc. Chem. Soc. 176 (1964).

64E015 Eine experimentelle Methode zur Ermittlung der Singulett-Triplett-Konversionswahrscheinlichkeit und der Triplett-Spektren von geloesten organischen Molekeln Messungen an 1,2-Benzanthracen. Labhart, H. Helv. Chim. Acta **47**: 2279–88 (1964).

64E016 Flash photolysis in thin films of gelatin and other polymers. Buettner, A.V. J. Phys. Chem. **68**: 3253–9 (1964).

64E017 Blitzlichtuntersuchungen ueber die Ausbleichreaktion von Thionin mit Allylthioharnstoff. Fischer, H. Z. Phys. Chem. (Frankfurt) **43**: 177–90 (1964).

650006 Pulse radiolysis of dioxane solutions. Baxendale, J.H.; Fielden, E.M.; Keene, J.P. Science **148**: 637–8 (1965).

65A001 Deactivation of the fluorescent and phosphorescent states of tetrapyrrole pigments in liquid solutions. Shakhverdov, P.A.; Terenin, A.N. Dokl. Phys. Chem. **160**: 163–5 (1965) Translated from: Dokl. Akad. Nauk SSSR **160**: 1141–3 (1965).

65A002 Transient species in the photochemistry of eosin. Kasche, V.; Lindqvist, L. Photochem. Photobiol. **4**: 923–33 (1965).

65B003 Quasilinear structure of luminescence spectra of triphenylene in frozen crystalline solutions. Ruziewicz, Z. Acta Phys. Pol. **28**: 389–406 (1965).

65B004 Contribution a l'etude de l'etat triplet des colorants: Spectres d'absorption dans le domaine des grandes longueurs d'onde, rouge et proche infrarouge. Lochet, R.; Nouchi, G. C.R. Seances Acad. Sci. **260**: 1897–1900 (1965).

65E031 Extinction coefficients of triplet-triplet transitions in aromatic compounds. Keller, R.A.; Hadley, S.G. J. Chem. Phys. **42**: 2382–7 (1965).

65E032 Untersuchung reversibler Photoprozesse durch Blitzlichtphotolyse. II. Triplett-Triplett-Annihilation von Anthracen. Wild, U.; Guenthard, Hs.H. Helv. Chim. Acta **48**: 1843–57 (1965).

65F031 Mechanism of fluorescence quenching in solution. Part 1. Quenching by bromobenzene. Medinger, T.; Wilkinson, F. Trans. Faraday Soc. **61**: 620–30 (1965).

65R023 Triplet-triplet absorption spectra of some tetrapyrrole pigments in liquid solution. Shakhverdov, P.A. Opt. Spectrosc. (USSR) **19**: 519–20 (1965) Translated **from**: Opt. Spektrosk.

66A002 Intermediates in the photoreduction of eosine as revealed by a flash-photolysis study. Ohno, T.; Kato, S.; Koizumi, M. Bull. Chem. Soc. Jpn. **39**: 232–9 (1966).

66A003 Studies of the photoreduction of acridine in ethanol by the flash technique. Kira, A.; Kato, S.; Koizumi, M. Bull. Chem. Soc. Jpn. **39**: 1221–7 (1966).

66B001 Triplet-triplet absorption spectra of solid solutions of certain organic compounds. Zhmyreva, I.A.; Kolobkov, V.P.; Volkov, S.V. Opt. Spectrosc. (USSR) **20**: 162–4 (1966) Translated **from**: Opt. Spektrosk.

66B003 The photo-ionization of molecules in solutions. III. Photoionization and recombination processes of N,N,N′,N′-tetramethyl-p-phenylenediamine in various organic solvent. Yamamoto, N.; Nakato, Y.; Tsubomura, H. Bull. Chem. Soc. Jpn. **39**: 2603–8 (1966).

66E085 Second triplet state of anthracene. Kellogg, R.E. J. Chem. Phys. **44**: 411–2 (1966).

66E086 Radiationless deactivation of the fluorescent state of substituted anthracenes. Bennett, R.G.; McCartin, P.J. J. Chem. Phys. **44**: 1969–72 (1966).

66E087 A fast reacting intermediate in flash excited flavin solution. Tegner, L.; Holmstroem, B. Photochem. Photobiol. **5**: 223–6 (1966).

66E089 Direct evidence for the sensitized formation of a metastable state of β-carotene. Chessin, M.; Livingston, R.; Truscott, T.G. Trans. Faraday Soc. **62**: 1519–24 (1966).

66E090 Stabilization of reactive species in polymethyl methacrylate. Melhuish, W.H. Trans. Faraday Soc. **62**: 3384–92 (1966).

672086 Pulse radiolysis of polystyrene. Ho, S.K.; Siegel, S.; Schwarz, H.A. J. Phys. Chem. **71**: 4527–33 (1967).

676011 Pulse-radiolysis studies of the formation of triplet excited states in cyclohexane solutions of naphthalene and anthracene. Hunt, J.W.; Thomas, J.K. J. Chem. Phys. **46**: 2954–8 (1967).

677029 Photoreduction of proflavine in the aqueous solution. I. A flash photolysis study. Kikuchi, K.; Koizumi, M. Bull. Chem. Soc. Jpn. **40**: 736–43 (1967).

677223 Untersuchung reversibler Photoprozesse durch Blitzlichtphotolyse. IV. Triplettzustaende des 1,3,6′,8′-Tetramethyldehydrodianthrons. Huber, J.R.; Wild, U.; Guenthard, Hs.H. Helv. Chim. Acta **50**: 841–8 (1967).

677259 Photochemical reaction between acridine and acridan in the presence and in the absence of oxygen. II. Studies by the flash technique. Kira, A.; Koizumi, M. Bull. Chem. Soc. Jpn. **40**: 2486–92 (1967).

677322 Transient measurements of photochemical processes in dyes. I. Primary processes in the flash-photolysis of safranine T. Chibisov, A.K.; Skvortsov, B.V.; Karyakin, A.V.; Shvindt, N.N. Khim. Vys. Energ. **1**: 529–35 (1967).

677485 Flashphotolysis of stilbenes at 77°K; in rigid EPA. Heinrich, G.; Blume, H.; Schulte-Frohlinde, D. Tetrahedron Lett. **47**: 4693–94 (1967).

677498 Flash-photolytic detection of triplet acridine formed by energy transfer from biacetyl. Kellmann, A.; Lindqvist, L. Proc. of Internat. Symposium on Triplet State, Beirut, Lebanon, 1967, p.439–45.

67A001 The one-electron oxidation of triplet diphenyl-p-phenylenediamine by the diimine. Linschitz, H.; Ottolenghi, M.; Bensasson, R. J. Am. Chem. Soc. **89**: 4592–9 (1967).

67B003 Spectrographie a resolution dans le temps appliquee a l'etude d'especes a tres courte duree de vie dans les spiropyrannes photochromiques. Mosse, M.; Metras, J.-C. J. Chim. Phys. Phys.-Chim. Biol. **64**: 691–4 (1967).

67B004 Existence de bandes d'absorption transitoire entre 5000 et 8800 Å dans les molecules aromatiques et heterocycliques. Astier, R.; Meyer, Y. J. Chim. Phys. Phys.-Chim. Biol. **64**: 919–21 (1967).

67B005 Absorption triplet-triplet de quelques hydrocarbures aromatiques: Mise en evidence de bandes de faible intensite dans le rouge. Nouchi, G. C.R. Seances Acad. Sci., Ser. B **264**: 152–5 (1967).

67B006 Transient absorption spectra of benzophenone studied by the flash excitation. Tsubomura, H.; Yamamoto, N.; Tanaka, S. Chem. Phys. Lett. **1**: 309–10 (1967).

67B007 Concentration dependence of the intensity of triplet-triplet absorption in some aromatic hydrocarbons. Bolotnikova, T.N.; Naumova, T.M. Opt. Spectrosc. (USSR) **23**: 206–8 (1967) Translated **from**: Opt. Spektrosk.

67B008 Triplet-triplet spectra of aromatic molecules in mixed crystals. Craig, D.P.; Fischer, G. Trans. Faraday Soc. **63**: 530–9 (1967).

67B009 Polarized triplet-triplet absorption in charge-transfer complexes. Eisenthal, K.B. J. Chem. Phys. **46**: 3268–9 (1967).

67B010 Triplet state studies of some polyphenyls in rigid glasses. Ramsay, I.A.; Munro, I.H. *The Triplet State*, Cambridge Univ. Press, Cambridge, England, 1967, p.415–23.

67C001 Etude en spectroscopie par eclair des colorants thiaziniques en solution aqueuse. Faure, J.; Bonneau, R.; Joussot-Dubien, J. Photochem. Photobiol. **6**: 331–9 (1967).

67E027 Quantum yields of triplet formation in solutions of chlorophyll. Bowers, P.G.; Porter, G. Proc. R. Soc. London, Ser. A **296**: 435–44 (1967).

67E031 Triplet state quantum yields for some aromatic hydrocarbons and xanthene dyes in dilute solution. Bowers, P.G.; Porter, G. Proc. R. Soc. London, Ser. A **299**: 348–53 (1967).

67E105 Triplet-triplet absorption spectra of benzophenone and its derivatives. Godfrey, T.S.; Hilpern, J.W.; Porter, G. Chem. Phys. Lett. **1**: 490–2 (1967).

67E106 Triplet-triplet absorption studies on aromatic and heterocyclic molecules at 77° K. Henry, B.R.; Kasha, M. J. Chem. Phys. **47**: 3319–27 (1967).

67E107 The laser photolysis of methylene blue. Danziger, R.M.; Bar-Eli, K.H.; Weiss, K. J. Phys. Chem. **71**: 2633–40 (1967).

67E108 Application of electron spin resonance in the study of triplet states. II. Effect of triplet-triplet reabsorption on quantitative phosphorescence measurements. Brinen, J.S.; Hodgson, W.G. J. Chem. Phys. **47**: 2946–50 (1967).

67E109 Solvent dependence of the quantum yield of triplet state production of 9-phenylanthracene. Horrocks, A.R.; Medinger, T.; Wilkinson, F. Photochem. Photobiol. **6**: 21–8 (1967).

67F505 Radiationless transitions in cyanine dyes. Buettner, A.V. J. Chem. Phys. **46**: 1398–401 (1967).

680379 Transient species in the radiolysis of solutions of stilbene. Dainton, F.S.; Peng, C.T.; Salmon, G.A. J. Phys. Chem. **72**: 3801–7 (1968).

680386 The pulse radiolysis of benzene-biacetyl solutions. Cundall, R.B.; Evans, G.B.; Griffiths, P.A.; Keene, J.P. J. Phys. Chem. **72**: 3871–7 (1968).

680553 Yield of triplet states in the pulse radiolysis of an aliphatic hydrocarbon glass containing naphthalene. Land, E.J.; Swallow, A.J. J. Chem. Phys. **49**: 5552–3 (1968).

680727 Extinction coefficients of triplet-triplet transitions. Land, E.J. Proc. Roy. Soc. (London) Ser. A **305**: 457–71 (1968).

686045 Fluorescence quenching and the charge transfer in the excited state. III. Flash photolytic studies. Yamashita, H.; Kokubun, H.; Koizumi, M. Bull. Chem. Soc. Jpn. **41**: 2312–19 (1968).

686058 Laser photolysis and spectroscopy: a new technique for the study of rapid reactions in the nanosecond time range. Novak, J.R.; Windsor, M.W. Proc. Roy. Soc. (London) Ser. A **308**: 95–110 (1968).

687111 The lowest triplet state of stilbene. Herkstroeter, W.G.; McClure, D.S. J. Am. Chem. Soc. **90**: 4522–7 (1968).

687142 Flash photolysis of thiopyronine. Morita, M.; Kato, S. Z. Naturforsch. Teil B **23**: 931–3 (1968).

687213 The photoreduction of phenazine in acidic methanol. Bailey, D.N.; Roe, D.K.; Hercules, D.M. J. Am. Chem. Soc. **90**: 6291–7 (1968).

68B002 Triplet-triplet absorption spectrum of N,N-dimethylaniline (DMA) measured by the flash photolysis technique. Kimura, K.; Arimitsu, S.; Yamamoto, N.; Tsubomura, H. Bull. Chem. Soc. Jpn. **41**: 1274 (1968).

68B003 Une methode cinetique pour mesurer les coefficients d'extinction moleculaire des transitions triplet-triplet. Lavalette, D. C.R. Seances Acad. Sci., Ser. B **266**: 279–82 (1968).

68B004 The polarization of the allowed triplet-triplet absorption in anthracene. Hochstrasser, R.M.; Marchetti, A.P. Chem. Phys. Lett. **1**: 597–8 (1968).

68B005 Absorption des β-dicetones sous forte excitation optique. Astier, R.; Meyer, Y.H. J. Chim. Phys. Phys.-Chim. Biol. **65**: 1407–9 (1968).

68B006 Nanosecond flash photolysis and the absorption spectra of excited singlet states. Porter, G.; Topp, M.R. Nature **220**: 1228–9 (1968).

68B007 Determination of T-T^* absorption spectra by means of two-quantum photosensitized reactions. Zhuravlyeva, T.S. Opt. Spectrosc. (USSR) **25**: 389–91 (1968) Translated **from**: Opt. Spektrosk.

68B008 Acidity constants of anthracene derivatives in singlet and triplet excited states. Vander Donckt, E.; Porter, G. Trans. Faraday Soc. **64**: 3218–23 (1968).

68D211 Application of electron spin resonance in the study of triplet states. III. Extinction coefficients of triplet-triplet transitions. Brinen, J.S. J. Chem. Phys. **49**: 586–90 (1968).

68E098 Triplet state formation efficiencies of aromatic hydrocarbons in solution. Horrocks, A.R.; Wilkinson, F. Proc. R. Soc. London, Ser. A **306**: 257–73 (1968).

68E100 A flash-photolysis investigation of flavin photosensitization of purine nucleotides. Knowles, A.; Roe, E.M.F. Photochem. Photobiol. **7**: 421–36 (1968).

68E102 Dichroisme de l'anthracene triplet. Meyer, Y.H.; Astier, R. J. Phys. (Paris) **29**: 1075–80 (1968).

68E103 Triplet→triplet fluorescence of rubrene in solution. Yildiz, A.; Kissinger, P.T.; Reilley, C.N. J. Chem. Phys. **49**: 1403–6 (1968).

68E104 Measurement of extinction coefficients of triplet absorption and quantum yields of triplet formation. Dawson, W.R. J. Opt. Soc. Am. **58**: 222–7 (1968).

68E105 Quantum efficiencies of triplet formation in aromatic molecules. Windsor, M.W.; Dawson, W.R. Mol. Cryst. **4**: 253–8 (1968).

68E106 Triplet-triplet absorption of naphthalene and phenanthrene impurities in benzophenone crystals. Gaevskii, A.S.; Nelipovich, K.I.; Faidysh, A.N. Opt. Spectrosc. (USSR) **24**: 554–5 (1968) Translated **from**: Opt. Spektrosk.

68E107 Singlet-singlet absorption and intersystem crossing from the $^1B_{3u}^-$ state of naphthalene. Bonneau, R.; Faure, J.; Joussot-Dubien, J. Chem. Phys. Lett. **2**: 65–7 (1968).

690087 Yields of excited states in the pulse radiolysis of solutions of substituted anthracenes. Kemp, T.J.; Roberts, J.P. Trans. Faraday Soc. **65**: 725–31 (1969).

690520 Absorption spectrum of the triplet state of duroquinone. Land, E.J. Trans. Faraday Soc. **65**: 2815–22 (1969).

692001 Nanosecond pulse radiolysis of polystyrene and poly(-methylmethacrylate) Ho, S.K.; Siegel, S. J. Chem. Phys. **50**: 1142–52 (1969).

696019 Radiative and radiationless processes in aromatic molecules. Pyrene. Kropp, J.L.; Dawson, W.R.; Windsor, M.W. J. Phys. Chem. **73**: 1747–52 (1969).

696020 Radiationless deactivation and anomalous fluorescence of singlet 1,12-benzperylene. Dawson, W.R.; Kropp, J.L. J. Phys. Chem. **73**: 1752–58 (1969).

696073 Triplet excimers favoured by charge transfer in electron-donor-acceptor-complexes. Briegleb, G.; Schuster, H.; Herre, W. Chem. Phys. Lett. **4**: 53–8 (1969).

696115 Quantitative ESR studies of organic triplet states. Extinction coefficients of $T \rightarrow T'$ transitions. Brinen, J.S. *Molecular Luminescence*, Lim, E.C. (ed.), W.A. Benjamin, Inc., New York, 1969, p.333–49.

697009 Studies of the transient intermediates of a thiopyronine aqueous solution under flash excitation. Morita, M.; Kato, S. Bull. Chem. Soc. Jpn. **42**: 25–35 (1969).

697061 Investigation of transient states in the photochemical reactions of dyes. III. Flash-photolysis of phenosafranine and neutral red in aqueous solutions. Chibisov, A.K.; Skvortsov, B.V.; Karyakin, A.V.; Rygalov, L.N. High Energy Chem. **3**: 190–4 (1969) Translated from: Khim. Vys. Energ. **3**: 210–6 (1969).

697092 Flash photolysis of camphorquinone and biacetyl. Singh, A.; Scott, A.R.; Sopchyshyn, F. J. Phys. Chem. **73**: 2633–43 (1969).

697225 Blitzlichtphotolyse an Acridin und Acridan im Temperaturbereich von +25 °C bis −180 °C. Zanker, V.; Prell, G. Ber. Bunsenges. Phys. Chem. **73**: 791–5 (1969).

697226 Die Untersuchung angeregter Zustaende aromatischen Kohlenwasserstoffe mit Hilfe der Laser-Blitzspektroskopie. Mueller, A.; Sommer, U. Ber. Bunsenges. Phys. Chem. **73**: 819–26 (1969).

697253 Optical detection of the triplet state of uracil. Whillans, D.W.; Herbert, M.A.; Hunt, J.W.; Johns, H.E. Biochem. Biophys. Res. Commun. **36**: 912–8 (1969).

697272 The triplet state of chloranil. Kemp, D.R.; Porter, G. Chem. Commun. : 1029–30 (1969).

69B001 Polarized excitation spectrum of the triplet-triplet absorption of aromatic hydrocarbons. Lavalette, D. Chem. Phys. Lett. **3**: 67–70 (1969).

69B002 Experimental and theoretical study of triplet-triplet absorption in the phenylnaphthalenes. Brinen, J.S.; Orloff, M.K. J. Chem. Phys. **51**: 527–31 (1969).

69B003 Spectres d'absorption triplet-triplet de colorants derives du triphenylmethane. Nouchi, G.; Silvie, C. C.R. Seances Acad. Sci., Ser. B **268**: 546–8 (1969).

69B004 Low-energy triplet-triplet transitions in naphthalene and some monosubstituted derivatives. Melhuish, W.H. J. Chem. Phys. **50**: 2779 (1969).

69B005 Triplet absorption spectra of cyanine dyes. Pierce, R.A.; Berg, R.A. J. Chem. Phys. **51**: 1267 (1969).

69B006 Low-energy triplet state of tetracene. Astier, R.; Bokobza, A.; Meyer, Y.H. J. Chem. Phys. **51**: 5174–5 (1969).

69B007 Etude et interpretation des spectres d'absorption triplet-triplet. Classification des etats triplets superieurs. I. Les matieres colorantes. Nouchi, G. J. Chim. Phys. Phys.-Chim. Biol. **66**: 548–53 (1969).

69E207 First allowed triplet-triplet transition in benzene. Astier, R.; Meyer, Y.H. Chem. Phys. Lett. **3**: 399–401 (1969).

69E208 Triplet-triplet spectra and triplet quantum yields of some aromatic hydrocarbons in liquid solution. Heinzelmann, W.; Labhart, H. Chem. Phys. Lett. **4**: 20–4 (1969).

69E209 The triplet state of lycopene. Sykes, A.; Truscott, T.G. Chem. Commun. : 274–6 (1969).

69E210 Polarization of electronic transitions of aromatic hydrocarbons. Gallivan, J.B.; Brinen, J.S. J. Chem. Phys. **50**: 1590–5 (1969).

69E211 Etude et interpretation des spectres d'absorption triplet-triplet. Classification des etats triplets superieurs. II. Les hydrocarbures aromatiques. Nouchi, G. J. Chim. Phys. Phys.-Chim. Biol. **66**: 554–65 (1969).

69E212 L'absorption triplet-triplet des hydrocarbures aromatiques alternants. II. Coefficients d'extinction moleculaire et forces d'oscillateur. Lavalette, D. J. Chim. Phys. Phys.-Chim. Biol. **66**: 1853–9 (1969).

69E213 L'absorption triplet-triplet des hydrocarbures aromatiques alternants. III. Polarisation des transitions. Lavalette, D. J. Chim. Phys. Phys.-Chim. Biol. **66**: 1860–4 (1969).

69E214 Absorptions-, Emissions- und Polarisationsgradmessungen an 9-C-und 10-N-substituierten Acridanen. Zanker, V.; Schneider, B. Z. Phys. Chem. (Frankfurt) **68**: 19–29 (1969).

69E215 Polarized triplet-triplet absorption spectra in three benzene derivatives. Cadogan, K.D.; Albrecht, A.C. J. Phys. Chem. **73**: 1868–77 (1969).

69E216 Radiative and radiationless processes in aromatic molecules. Coronene and benzcoronene. Dawson, W.R.; Kropp, J.L. J. Phys. Chem. **73**: 693–9 (1969).

69E217 A metastable state of retinol (vitamin A). Sykes, A.; Truscott, T.G. Chem. Commun. 929–30 (1969).

69E218 The photoreduction of fluorenone. Davis, G.A.; Carapellucci, P.A.; Szoc, K.; Gresser, J.D. J. Am. Chem. Soc. **91**: 2264–72 (1969).

69F389 Direct determination of the extinction coefficients for triplet ← triplet transitions in naphthalene, phenanthrene, and triphenylene. Hadley, S.G.; Keller, R.A. J. Phys. Chem. **73**: 4351–5 (1969).

69N001 Etude par spectroscopie d'eclairs du transfert d'energie chlorophylle-carotenoide. Mathis, P. Photochem. Photobiol. **9**: 55–63 (1969).

700011 Reactions of electrons photoejected from aromatic amino acids in frozen aqueous solutions of divalent metal salts. Santus, R.; Helene, A.; Helene, C.; Ptak, M. J. Phys. Chem. **74**: 550–61 (1970).

700114 Excitation transfer in the pulse radiolysis of naphthalene and benzophenone solutions. Holroyd, R.A.; Theard, L.M.; Peterson, F.C. J. Phys. Chem. **74**: 1895–900 (1970).

700277 Radiolysis transients in viscous liquids. Biphenyl in liquid paraffin. Fuller, J.; Peteleski, N.; Ruppel, D.; Tomlinson, M. J. Phys. Chem. **74**: 3066–73 (1970).

701073 Investigation of aromatic triplet molecules in polystyrene by the method of pulsed radiolysis. Shekk, Yu.B.; Alfimov, M.V.; Nikoforov, V.I. Bull. Acad. Sci. USSR, Div. Chem. Sci. (Engl. Transl.) : 2309–14 (1970) Translated from: Izv. Akad. Nauk SSSR, Ser. Khim. : 2454–60 (1970).

703001 The metastable state of β-carotene excited by pulse radiolysis. Land, E.J.; Sykes, A.; Truscott, T.G. Chem. Commun. : 332 (1970).

706135 The fluorescence and phosphorescence of 1,2,5,6-dibenzacridine and 1,2,7,8-dibenzacridine in glassy and liquid solution. Kropp, J.L.; Lou, J.J. J. Phys. Chem. **74**: 3953–9 (1970).

706157 Polarized spectroscopy of excited states of substituted anthracenes on a nanosecond time scale. Kliger, D.S.; Albrecht, A.C. J. Chem. Phys. **53**: 4059–65 (1970).

707036 Triplet-triplet absorption via intramolecular energy transfer. Brinen, J.S.; Gerhardt, G.E.; Kazan, J. Chem. Phys. Lett. **5**: 150–2 (1970).

707061 Effect of solvent on the flash photolysis and laser photolysis of N,N,N',N'-tetramethyl-paraphenylene diamine in solution. Richards, J.T.; Thomas, J.K. Trans. Faraday Soc. **66**: 621–32 (1970).

707152 Mechanism of photodissociation of hydroquinone derivatives. Yamada, H.; Nakashima, N.; Tsubomura, H. J. Phys. Chem. **74**: 2897–903 (1970).

707186 Photochemistry of phenoxazine. A flash-photolytic study. Gegiou, D.; Huber, J.R.; Weiss, K. J. Am. Chem. Soc. **92**: 5058–62 (1970).

707199 Triplett-Lebensdauern von Diphenylpolyenen und deuterierten Stilbenen in eingefrorener Loesung bei 77 °K. Heinrich, G.; Holzer, G.; Blume, H.; Schulte-Frohlinde, D. Z. Naturforsch. Teil B **25**: 496–9 (1970).

707230 Polarization measurements on low-lying T-T absorptions with CW argon-ion laser photoselection. Langelaar, J.; Wegdam-Van Beek, J.; Van Voorst, J.D.W.; Lavalette, D. Chem. Phys. Lett. **6**: 460–4 (1970).

707240 Direct determination of triplet ← triplet absorption extinction coefficients. II. Quinoline, isoquinoline, quinoxaline. Hadley, S.G. J. Phys. Chem. **74**: 3551–2 (1970).

707305 Photochemical reactions of duroquinone. Part 2. Flash photolytic investigations. Nafisi-Movaghar, J.; Wilkinson, F. Trans. Faraday Soc. **66**: 2268–78 (1970).

707337 Photoreduction of phenazine in alcohols and by EDTA in the aqueous solution. Iwaoka, T.; Niizuma, S.; Koizumi, M. Bull. Chem. Soc. Jpn. **43**: 2786–95 (1970).

707346 Formation of ions and excited states in the laser photolysis of solutions of pyrene. Richards, J.T.; West, G.; Thomas, J.K. J. Phys. Chem. **74**: 4137–41 (1970).

707364 A study of the intermediate compositions in the photochemical reactions of dyes. IV. Oxidation-reduction transformations of methylene blue and methylene green in pulsed photoexcitation. Chibisov, A.K.; Roitman, G.P.; Karyakin, A.V. High Energy Chem. **4**: 235–6 (1970) Translated from: Khim. Vys. Energ. **4**: 273–4 (1970).

707561 Transient species in the laser photolysis at 265 mμ of the halogenobenzenes in solution. Loeff, I.; Lutz, H.; Lindqvist, L. Isr. J. Chem. **8**: 141–6 (1970).

70B002 Die Uebergangsmomentrichtung von Triplett-Triplett-Absorptionsbanden. Eine neue Methode zur Bestimmung der Anisotropie der Absorption bei der Photoselektion. Kuball, H.-G.; Euing, W.; Karstens, T. Ber. Bunsenges. Phys. Chem. **74**: 316–23 (1970).

70B003 Polarization of the triplet-triplet absorption spectrum of 1,2-benzopyrene. Pavlopoulos, T.G. Ber. Bunsenges. Phys. Chem. **74**: 989–92 (1970).

70B004 Polarization of the triplet-triplet absorption spectrum of pyrene. Pavlopoulos, T.G. J. Chem. Phys. **52**: 3307–8 (1970).

70B005 Search for the first ${}^3A_{1g}^- \leftarrow {}^3B_{2u}^+$ transition in naphthalene. Pavlopoulos, T.G. J. Chem. Phys. **53**: 4230–3 (1970).

70B006 Dianthrone photochromism 1950–1970. Bercovici, T.; Korenstein, R.; Muszkat, K.A.; Fischer, E. Pure Appl. Chem. **24**: 531–65 (1970).

70E288 Nanosecond flash photolysis. Porter, G.; Topp, M.R. Proc. R. Soc. London, Ser. A **315**: 163–84 (1970).

70E290 Triplet-triplet absorption of biphenyl. Meyer, Y.H.; Astier, R.; Leclercq, J.M. Chem. Phys. Lett. **4**: 587–90 (1970).

70E291 Absorption and emission spectra and triplet decay of some aromatic and N-heterocyclic compounds in polymethylmethacrylate. West, M.A.; McCallum, K.J.; Woods, R.J.; Formosinho, S.J. Trans. Faraday Soc. **66**: 2135–47 (1970).

70E293 Spectral characteristics of the triplet states of cyanin and thiazine dyes. Chibisov, A.K.; Kuz'min, V.A.; Roitman, G.P.; Levkoev, I.I.; Karyakin, A.V. Bull. Acad. Sci. USSR, Phys. Ser. **34**: 1144–7 (1970) Translated from: Izv. Akad. Nauk SSR, Ser. Fiz.

70E294 The location, polarization and assignment of low lying excited triplet states in pyrene. Langelaar, J.; Wegdam-van Beek, J.; ten Brink, H.T.; van Voorst, J.D.W. Chem. Phys. Lett. **7**: 368–70 (1970).

70E295 A simple apparatus for measuring the absorption spectrum and lifetimes of photo-produced short lived species using commercial subunits. Slifkin, M.A.; Walmsley, R.H. J. Phys. E **3**: 160–2 (1970).

70E296 Pheophytin-a and pheophytin-b: Quantitative absorption spectra of the singulet-and triplet-state. Zanker, V.; Rudolph, E.; Prell, G. Z. Naturforsch., Teil B **25B**: 1137–43 (1970).

710186 Pulse radiolysis studies of acetone solutions of biphenyl and anthracene: Formation of ions and excited singlet state. Arai, S.; Kira, A.; Imamura, M. J. Chem. Phys. **54**: 5073–81 (1971).

710278 Aromatic solute molecular ion and triplet state formation in polystyrene and polymethylmethacrylate. Siegel, S.; Stewart, T. J. Chem. Phys. **55**: 1775–86 (1971).

710617 Yields of excited singlet and triplet states of some aromatics in the pulse radiolysis of cyclohexane solutions. Baxendale, J.H.; Wardman, P. Trans. Faraday Soc. **67**: 2997–3007 (1971).

713035 The in vitro photochemistry of biological molecules. II. The triplet states of β-carotene and lycopene excited by pulse radiolysis. Land, E.J.; Sykes, A.; Truscott, T.G. Photochem. Photobiol. **13**: 311–20 (1971).

716169 Flash spectroscopy and photoreduction of phenazine. Japar, S.M.; Abrahamson, E.W. J. Am. Chem. Soc. **93**: 4140–4 (1971).

716235 Studies on triplet energy transfer by means of an emission-absorption flash technique. II. Mixed triplet-triplet annihilation in ethanol. Kikuchi, K.; Kokubun, H.; Koizumi, M. Bull. Chem. Soc. Jpn. **44**: 1527–34 (1971).

716243 Triplet states in the pyrene-tetracyanobenzene charge-transer system. Teitelbaum, Z.; Potashnik, R.; Ottolenghi, M. Mol. Photochem. **3**: 107–22 (1971).

716244 Temperature dependence of the deactivation of electronically excited indazoles in solution. Bircher, P.; Pantke, E.R.; Labhart, H. Chem. Phys. Lett. **11**: 347–9 (1971).

716330 Ionization processes in polar solution of tryptophan at 77 ° K. Moan, J. Isr. J. Chem. **9**: 637–43 (1971).

717009 Photoreduction of benzophenone in benzene. II. Flash photolysis study of primary photochemical reactions. Buettner, A.V.; Dedinas, J. J. Phys. Chem. **75**: 187–91 (1971).

717071 Properties of the triplet states of thymine and uracil in aqueous solution. Whillans, D.W.; Johns, H.E. J. Am. Chem. Soc. **93**: 1358–2 (1971).

717126 Intersystem crossing in the charge-transfer quenching of molecular fluorescence. Goldschmidt, C.R.; Potashnik, R.; Ottolenghi, M. J. Phys. Chem. **75**: 1025–31 (1971).

717154 Photoreduction of nitrogen heterocycles. I. The photoreduction of phenazine: Evidence for singlet-state reactivity. Davis, G.A.; Gresser, J.D.; Carapellucci, P.A. J. Am. Chem. Soc. **93**: 2179–82 (1971).

717171 The primary process of the photochemical dimerization of carbostyril. Yamamuro, T.; Tanaka, I.; Hata, N. Bull. Chem. Soc. Jpn. **44**: 667–71 (1971).

717179 Nanosecond laser photolysis of acetophenone in organic solvents. Lutz, H.; Lindqvist, L. Chem. Commun. : 493–4 (1971).

717266 Triplet and radical formation as observed on flashing aromatic hydroxyl derivatives in liquid and solid solution. de Groot, R.L. Mol. Photochem. **3**: 1–22 (1971).

717460 Weak triplet-triplet absorption bands of naphthalene. Astier, R.; Meyer, Y.H. Chem. Phys. Lett. **11**: 523–5 (1971).

717463 Direct observation of triplet exciplexes by flash photoconductivity and flash spectroscopy. Formation of three-component exciplexes between porphyrins and nitro aromatics. Roy, J.K.; Whitten, D.G. J. Am. Chem. Soc. **93**: 7093–4 (1971).

717489 Detection and lifetime of the triplet state of acetone in solution. Porter, G.; Yip, R.W.; Dunston, J.M.; Cessna, A.J.; Sugamori, S.E. Trans. Faraday Soc. **67**: 3149–54 (1971).

717520 Photochemistry of methylated p-benzoquinones. Kemp, D.R.; Porter, G. Proc. Roy. Soc. (London) Ser. A **326**: 117–30 (1971).

719059 Triplet-triplet absorption and energy transfer from high triplet states. Alfimov, M.V.; Batekha, I.G.; Sheck, Yu.B.; Gerko, V.I. Spectrochim. Acta **27**: 329–41 (1971).

71B001 Triplet-triplet absorption studies on coumarin and related molecules. Henry, B.R.; Hunt, R.V. J. Mol. Spectrosc. **39**: 466–70 (1971).

71B002 A flash photolysis study of the triplet state of acridine orange in basic solvents. Kellmann, A. Photochem. Photobiol. **14**: 85–93 (1971).

71B003 Observation and interpretation of triplet-triplet absorption spectra of substituted naphthalenes. Takemura, T.; Hara, K.; Baba, H. Bull. Chem. Soc. Jpn. **44**: 977–84 (1971).

71B005 The second triplet level of 1,5-dichloroanthracene in fluid solutions. Roberts, J.P.; Dixon, R.S. J. Phys. Chem. **75**: 845–8 (1971).

71B006 Use of a silicon photodiode for detection of weak transient absorption in flash photolysis experiments. Melhuish, W.H. J. Phys. E **4**: 60–1 (1971).

71E360 Triplet-triplet extinction coefficients via energy transfer. Bensasson, R.; Land, E.J. Trans. Faraday Soc. **67**: 1904–15 (1971).

71E361 Triplet states of polycyclic aromatic hydrocarbons in fluid solution and in the solid state. Slifkin, M.A.; Walmsley, R.H. Photochem. Photobiol. **13**: 57–65 (1971).

71E367 Flash photolysis studies of orotic acid. Herbert, M.A.; Johns, H.E. Photochem. Photobiol. **14**: 693–704 (1971).

720206 The radiation-induced formation of excited states of aromatic hydrocarbons in benzene and cyclohexane. II. Yields of excited singlet and triplet state solute molecules. Dainton, F.S.; Morrow, T.; Salmon, G.A.; Thompson, G.F. Proc. Roy. Soc. (London) Ser. A **328**: 457–79 (1972).

720243 Yields and reactions of lowest excited singlet and triplet states in the radiolysis of naphthalene and 1-methylnaphthalene. Holroyd, R.A.; Capellos, C. J. Phys. Chem. **76**: 2485–91 (1972).

720392 Pulse radiolysis of 9,10-anthraquinones. Part 2. Triplet excited states. Hulme, B.E.; Land, E.J.; Phillips, G.O. J. Chem. Soc., Faraday Trans. 1 **68**: 2003–12 (1972).

720440 Excited states in the nanosecond pulse radiolysis and laser flash photolysis of N,N-dimethylaniline. Land, E.J.; Richards, J.T.; Thomas, J.K. J. Phys. Chem. **76**: 3805–12 (1972).

720447 Pulse radiolysis of solutions of stilbene. I. Evidence for triplet and singlet excited state formation. Dainton, F.S.; Robinson, E.A.; Salmon, G.A. J. Phys. Chem. **76**: 3897–904 (1972).

720464 Sensitized triplet-triplet absorption of biphenylene. Tetreau, C.; Lavalette, D.; Land, E.J.; Peradejordi, F. Chem. Phys. Lett. **17**: 245–7 (1972).

723043 Nanosecond irradiation studies of biological molecules. I. Coenzyme Q 6 (ubiquinone-30). Bensasson, R.; Chachaty, C.; Land, E.J.; Salet, C. Photochem. Photobiol. **16**: 27–37 (1972).

726156 Photochemical characteristics of cyanine dyes. Part 1. 3,3′-Diethyloxadicarbocyanine iodide and 3,3′-diethylthiadicarbocyanine iodide. Dempster, D.N.; Morrow, T.; Rankin, R.; Thompson, G.F. J. Chem. Soc., Faraday Trans. 2 **68**: 1479–96 (1972).

726177 Triplet ← triplet absorption and intersystem crossing in phthalazine. Alvarez, V.L.; Hadley, S.G. J. Phys. Chem. **76**: 3937–40 (1972).

727000 Measurement of the triplet-triplet absorption spectrum of tetracene using cw argon laser excitation. Pavlopoulos, T.G. J. Chem. Phys. **56**: 227–32 (1972).

727036 Photoreactions in aqueous solutions of thymine, pH 12. Whillans, D.W.; Johns, H.E. J. Phys. Chem. **76**: 489–93 (1972).

727041 Primary products in the flash photolysis of tryptophan. Santus, R.; Grossweiner, L.I. Photochem. Photobiol. **15**: 101–5 (1972).

727069 Transient species obtained by the flash photolysis of chloranil in various solutions. Kawai, K.; Shirota, Y.; Tsubomura, H.; Mikawa, H. Bull. Chem. Soc. Jpn. **45**: 77–81 (1972).

727073 Study of triplet quantum yields using a tunable dye laser. Soep, B.; Kellmann, A.; Martin, M.; Lindqvist, L. Chem. Phys. Lett. **13**: 241–4 (1972).

727098 Primary photochemical processes in aromatic molecules. Part 15. The photochemistry of aromatic carbonyl compounds in aqueous solution. Ledger, M.B.; Porter, G. J. Chem. Soc., Faraday Trans. 1 **68**: 539–53 (1972).

727105 Primary photoprocesses in isoquinoline N-oxides. Lohse, C. J. Chem. Soc., Perkin Trans. 2 : 229–33 (1972).

727348 Absorption spectrum and decay kinetics of triplet pentacene in solution, studied by flash photolysis. Hellner, C.; Lindqvist, L.; Roberge, P.C. J. Chem. Soc., Faraday Trans. 2 **68**: 1928–37 (1972).

727374 Quenching of triplet states by Schiff base nickel(II) complexes. Adamczyk, A.; Wilkinson, F. J. Chem. Soc., Faraday Trans. 2 **68**: 2031–41 (1972).

727440 Predissociation mechanism for the decomposition of electronically excited hydrocarbon molecules. Smirnov, V.A.; Plotnikov, V.G.; Zavyalov, Yu.A.; Alfimov, M.V. Opt. Spectrosc. (Engl. Transl.) **33**: 124–7 (1972) Translated from: Opt. Spektrosk. **33**: 230–6 (1972).

72A022 Photochemical reactions of aromatic ketones with nucleic acids and their components. I. Purine and pyrimidine bases and nucleosides. Charlier, M.; Helene, C. Photochem. Photobiol. **15**: 71–87 (1972).

72B001 Triplet-triplet spectroscopy of polyacenes. Meyer, Y.H.; Astier, R.; Leclercq, J.M. J. Chem. Phys. **56**: 801–15 (1972).

72B002 The light-induced conversion of triphenylamine to the excited triplet state of 11,12-dihydrocarbazole. Foerster, E.W.; Grellmann, K.H. Chem. Phys. Lett. **14**: 536–8 (1972).

72B003 Triplet-triplet absorption spectra of aromatic hydrocarbons. I. Naphthalene. Wild, U.P.; Kaenzig, H.; Ranalder, U.B. Helv. Chim. Acta **55**: 2724–30 (1972).

72B004 Triplet-triplet absorption in 4-N-dimethylaminopyridine. Testa, A.C. J. Chem. Phys. **57**: 3019–20 (1972).

72E276 The triplet-triplet absorption observed for some tetracyanobenzene complexes. Matsumoto, S.; Nagakura, S.; Iwata, S.; Nakamura, J. Chem. Phys. Lett. **13**: 463–5 (1972).

72E277 Triplet state of rhodamine 6G molecules. Ketsle, G.A.; Levshin, L.V.; Slavnova, T.D.; Chibisov, A.K. Sov. Phys. Doklady **16**: 986–8 (1972) Translated from: Dokl. Akad. Nauk SSSR **201**: 60–3 (1971).

733001 The in vitro photochemistry of biological molecules. III. Absorption spectra, lifetimes and rates of oxygen quenching of the triplet states of β-carotene, retinal and related polyenes. Truscott, T.G.; Land, E.J.; Sykes, A. Photochem. Photobiol. **17**: 43–51 (1973).

733002 The triplet state of retinal: Is it involved in vision‘ Bensasson, R.; Land, E.J.; Truscott, T.G. Photochem. Photobiol. **17**: 53–5 (1973).

733184 Laser flash photolysis studies of chlorin and porphyrin systems. I. Energetics of the triplet state of bacteriochlorophyll. Connolly, J.S.; Gorman, D.S.; Seely, G.R. Ann. N.Y. Acad. Sci. **206**: 649–69 (1973).

736051 Photochemical characteristics of the mode-locking dyes 1,1′-diethyl-4,4′carbocyanine iodide (cryptocyanine, DCI) and 1,1′-diethyl-2,2′dicarbocyanine iodide (DDI). Dempster, D.N.; Morrow, T.; Rankin, R.; Thompson, G.F. Chem. Phys. Lett. **18**: 488–92 (1973).

736218 Blitzspektroskopische Untersuchung der Triplettbildung von Naphthalin, 1-Methoxynaphthalin und 1-Cyanonaphthalin in Loesung in Gegenwart der Fluoreszenzloescher Tetrachlorokohlenstoff oder Diaethylamin. Hermann, H.; Koltzenburg, G.; Schulte-Frohlinde, D. Ber. Bunsenges. Phys. Chem. **77**: 677–81 (1973).

737046 The primary process of the photochemical dimerization of carbostyril (2-quinolone) in an aqueous solution. Yamamuro, T.; Hata, N.; Tanaka, I. Bull. Chem. Soc. Jpn. **46**: 29–34 (1973).

737055 Quantitative studies of biphotonic reactions. Bagdasaryan, Kh.S.; Kiryukhin, Yu.I.; Sinitsina, Z.A. J. Photochem. **1**: 225–40 (1973).

737069 Lebensdauer der Triplett-Zustaende von partiell deuterierten trans-Stilbenen und strukturverwandten Verbindungen. Heinrich, G.; Guesten, H.; Mark, F.; Olbrich, G.; Schulte-Frohlinde, D. Ber. Bunsenges. Phys. Chem. **77**: 103–8 (1973).

737098 Mechanism of photoinduced anion formation of pyromellitic dianhydride in n-donor solvents. Achiba, Y.; Kimura, K. Chem. Phys. Lett. **19**: 45–8 (1973).

737101 Laser induced transient absorption in liquid pyrene. Hodgkinson, K.A.; Munro, I.H. Chem. Phys. Lett. **19**: 260–2 (1973).

737113 Interaction between excited β-naphthol and pyridine. Hydrogen-bond formation in S* and H-transfer reaction in T. Kikuchi, K.; Watarai, H.; Koizumi, M. Bull. Chem. Soc. Jpn. **46**: 749–54 (1973).

737125 Reaction patterns and kinetics of the photoconversion of N-methyldiphenylamine to N-methylcarbazole. Foerster, E.W.; Grellmann, K.H.; Linschitz, H. J. Am. Chem. Soc. **95**: 3108–15 (1973).

737127 Flash photolysis study of 4-N-dimethylaminopyridine. Testa, A.C. J. Am. Chem. Soc. **95**: 3128–31 (1973).

737140 Quantum yield of triplet state formation of 9-cyanoanthracene in three solvents. Vander Donckt, E.; Barthels, M.R.; Delestinne, A. J. Photochem. **1**: 429–32 (1973).

737158 Flash photolysis studies of solute triplets: an anomalous heavy atom effect of xenon. Head, D.A.; Singh, A.; Cook, M.G.; Quinn, M.J. Can. J. Chem. **51**: 1624–33 (1973).

737185 Primary photoprocesses in retinol. Rosenfeld, T.; Alchalal, A.; Ottolenghi, M. Chem. Phys. Lett. **20**: 291–7 (1973).

737190 Triplet state of ketones in solutions. Quenching rate studies of thioxanthenone triplets by flash absorption. Yip, R.W.; Szabo, A.G.; Tolg, P.K. J. Am. Chem. Soc. **95**: 4471–2 (1973).

737198 Effects of solvent and substituents on the absorption spectra of triplet acetophenone and the acetophenone ketyl radical studied by nanosecond laser photolysis. Lutz, H.; Breheret, E.; Lindqvist, L. J. Phys. Chem. **77**: 1758–62 (1973).

737287 Primary processes in excited β-naphthol systems: A pulsed laser photolysis study. Klaening, U.K.; Goldschmidt, Ch.R.; Ottolenghi, M.; Stein, G. J. Chem. Phys. **59**: 1753–9 (1973).

737318 Photolysis of aromatic thioacid O-esters: the nature of the reactive excited state. Wirz, J. J. Chem. Soc., Perkin Trans. 2 : 1307–12 (1973).

737439 Photochemistry of flavins. I. Conventional and laser flash photolysis study of alloxazine. Dekker, R.H.; Srinivasan, B.N.; Huber, J.R.; Weiss, K. Photochem. Photobiol. **18**: 457–66 (1973).

737463 Excited singlet and triplet states of aromatic hydrocarbons determined by a laser photolysis technique. Hodgkinson, K.A.; Munro, I.H. J. Mol. Spectry. **48**: 57–71 (1973).

737466 Photoreactions of aromatic compounds. XXIX. Pathway and intermediates of the photoreactions of 3,5-dinitroanisole with nucleophiles. de Gunst, G.P.; Havinga, E. Tetrahedron **29**: 2167–71 (1973).

737469 The primary photochemical processes of 4-nitropyridine N-oxide. III. Its photochemical behavior in an aqueous solution. Hata, N.; Ono, I.; Osaka, K. Bull. Chem. Soc. Jpn. **46**: 3363–6 (1973).

737473 Photoenolization of ortho-methyl-substituted acetophenones: Solvent effects on the triplet state reactivity. Lutz, H.; Breheret, E.; Lindqvist, L. J. Chem. Soc., Faraday Trans. 1 **69**: 2096–102 (1973).

73B001 Triplet-triplet absorption spectra of quinoline and isoquinoline. Kreibich, U.T.; Wild, U.P. J. Mol. Spectrosc. **47**: 189–93 (1973).

73E284 Triplet-triplet absorption spectra; of organic molecules. Labhart, H.; Heinzelmann, W. *Organic Molecular Photophysics*, J.B. Birks (ed.), John Wiley and Sons, New York, N.Y., 1973, Vol. 1, p.297–355.

73E342 On the apparent absence of triplet-triplet absorption in pure organic molecular crystals. Priestley, E.B.; Robinson, G.W. Mol. Phys. **26**: 159–67 (1973).

73E344 Prediction of laser action properties of organic dyes from their structure and the polarization characteristics of their electronic transitions. Pavlopoulos, T.G. IEEE J. Quantum Electron. **QE-9**: 510–6 (1973).

73E345 Triplet-triplet absorption and phosphorescence of metal-porphyrin complexes in liquid solutions. Tsvirko, M.P.; Sapunov, V.V.; Solovev, K.N. Opt. Spectrosc. **34**: 635–8 (1973) Translated from: Opt. Spektrosk. **34**: 1094–100 (1973).

73E346 Measurement of molar triplet extinction coefficients of organic molecules by means of cw laser excitation. Pavlopoulos, T.G. J. Opt. Soc. Am. **63**: 180–4 (1973).

73E347 The triplet state of β-carotene and of analog polyenes of different length. Mathis, P.; Kleo, J. Photochem. Photobiol. **18**: 343–6 (1973).

741006 Equilibria between triplet states of aromatic hydrocarbons. Kira, A.; Thomas, J.K. J. Phys. Chem. **78**: 196–9 (1974).

741013 On the role of the triplet state in the photoisomerization of retinal isomers. Rosenfeld, T.; Alchalel, A.; Ottolenghi, M. J. Phys. Chem. **78**: 336–41 (1974).

743062 Triplet states of ubiquinone analogs studied by ultraviolet and electron nanosecond irradiation. Amouyal, E.; Bensasson, R.; Land, E.J. Photochem. Photobiol. **20**: 415–22 (1974).

746168 Interactions of triplet eosin with aromatics and intermolecular complexes of the ground state of eosin with aniline and pyridine in aqueous solutions and in ethanol. Chrysochoos, J. Mol. Photochem. **6**: 23–42 (1974).

746270 9,10-Diphenylanthracene as a fluorescence quantum yield standard. Heinrich, G.; Schoof, S.; Gusten, H. J. Photochem. **3**: 315–20 (1974).

746499 Intersystem crossing, ionic dissociation and cis-trans isomerization mechanisms in the photolysis of retinol and related molecules. Rosenfeld, T.; Alchalel, A.; Ottolenghi, M. *Excited States of Biological Molecules* (Proc. of the Int. Conf. at the Calouste Gulbenkian Foundation Centre, Lisbon, Portugal, April 18–24, 1974) J.B. Birks (ed.), Wiley, London, 1976, p.540–54.

747022 Laser flash photolysis of substituted stilbenes in solution. Bent, D.V.; Schulte-Frohlinde, D. J. Phys. Chem. **78**: 446–50 (1974).

747038 Increased quantum yield of photoreduction of dyes (a catalytic effect). Steiner, U.; Hafner, M.; Schreiner, S.; Kramer, H.E.A. Photochem. Photobiol. **19**: 119–28 (1974).

747049 Extinction coefficients for triplet-triplet absorption in ethanol solutions of anthracene, naphthalene, 2,5-diphenyloxazole, 7-diethylamino-4-methyl coumarin and 4-methyl-7-aminocarbostyril. Dempster, D.N.; Morrow, T.; Quinn, M.F. J. Photochem. **2**: 329–41 (1974).

747050 The photochemical characteristics of rhodamine 6G-ethanol solutions. Dempster, D.N.; Morrow, T.; Quinn, M.F. J. Photochem. **2**: 343–59 (1974).

747056 Time resolved molecular spectroscopy using high power solid state lasers in pulse transmission mode. A re-examination of the $S_n \leftarrow S_1$ spectra of naphthalene and anthracene. Bebelaar, D. Chem. Phys. **3**: 205–16 (1974).

747093 Flash-spectroscopic study of phthalazine. Kanamaru, N.; Nagakura, S.; Kimura, K. Bull. Chem. Soc. Jpn. **47**: 745–6 (1974).

747187 Primary photochemical processes of cationic acridine orange in aqueous solution studied by flash photolysis. Kellmann, A. Photochem. Photobiol. **20**: 103–8 (1974).

747189 Triplet states and cis-trans photoisomerization processes in the Schiff bases of retinal isomers. Rosenfeld, T.; Alchalel, A.; Ottolenghi, M. Photochem. Photobiol. **20**: 121–5 (1974).

747229 Formation and reactions of long lived xanthene dye radicals. II. Photochemical reduction of rhodamine-B and fluorescein derivatives. Krueger, U.; Memming, R. Ber. Bunsenges. Phys. Chem. **78**: 679–85 (1974).

747233 Quenching of triplet states of diazines by H-atom donors. Formation of azyl radicals. Bent, D.V.; Hayon, E.; Moorthy, P.N. Chem. Phys. Lett. **27**: 544–7 (1974).

747236 Triplet state of α-nitronaphthalene. Capellos, C.; Porter, G. J. Chem. Soc., Faraday Trans. 2 **70**: 1159–64 (1974).

747293 Spectroscopic studies of formation and decay of triplet exciplexes. Evidence for a limited role of charge-transfer interactions in a nonpolar solvent. Roy, J.K.; Carroll, F.A.; Whitten, D.G. J. Am. Chem. Soc. **96**: 6349–55 (1974).

747334 Laser photolysis of retinal and its protonated and unprotonated n-butylamine Schiff base. Fisher, M.M.; Weiss, K. Photochem. Photobiol. **20**: 423–32 (1974).

747346 Picosecond flash photolysis: transient absorption in Sn(IV), Pd(II), and Cu(II) porphyrins. Magde, D.; Windsor, M.W.; Holten, D.; Gouterman, M. Chem. Phys. Lett. **29**: 183–8 (1974).

747347 Triplet-triplet absorption of biphenyl and related compounds. Lavalette, D.; Tetreau, C. Chem. Phys. Lett. **29**: 204–9 (1974).

747376 Laser photolysis study of trans → cis photoisomerization of trans-1-phenyl-2-(2-naphthyl)ethylene. Sumitani, M.; Nagakura, S.; Yoshihara, K. Chem. Phys. Lett. **29**: 410–3 (1974).

747389 Kinetics and mechanism of photochemical solvolysis of arylmethylacetates. Ivanov, V.B.; Ivanov, V.L.; Kuzmin, M.G. Mol. Photochem. **6**: 125–32 (1974).

747390 The triplet state of phenylpyridyl ketones in perfluorocarbon solvent. Blanchi, J.-P.; Watkins, A.R. Mol. Photochem. **6**: 133–42 (1974).

747417 The primary photochemical process of diphenylacetylene. Ota, K.; Murofushi, K.; Hoshi, T.; Inoue, H. Tetrahedron Lett. : 1431–4 (1974).

747587 Ionic photodissociation in excited singlet and triplet states of the 1-methylnaphthalene-pyromellitic dianhydride charge-transfer complex. Achiba, Y.; Kimura, K. Oyo Denki Kenkyusho Hokoku **26**: 114–23 (1974, Publ. 1975).

747630 Laser study of triplet porphyrin quenching by oxygen in porphyrin-globins. Alpert, B.; Lindqvist, L. *Excited States of Biological Molecules* (Proc. of the Int. Conf. at the Calouste Gulbenkian Foundation Centre, Lisbon, Portugal, April 18–24, 1974) J.B. Birks (ed.), Wiley, London, 1976, p.425–33.

747633 Singlet-triplet quantum efficiencies of retinal isomers. Azerad, R.; Bensasson, R.; Cooper, M.B.; Dawe, E.A.; Land, E.J. *Excited States of Biological Molecules* (Proc. of the Int. Conf. at the Calouste Gulbenkian Foundation Centre, Lisbon, Portugal, April 18–24, 1974) J.B. Birks (ed.), Wiley, London, 1976, p.531–9.

74B002 Location of the first ${}^3B_2^- \leftarrow {}^3B_2^+$ transition in phenanthrene. Pavlopoulos, T.G. Chem. Phys. Lett. **27**: 245–8 (1974).

74B003 Spectroscopic studies of some laser dyes. Pavlopoulos, T.G.; Hammond, P.R. J. Am. Chem. Soc. **96**: 6568–79 (1974).

74B004 Polarization measurement and configuration analysis of the triplet-triplet absorption spectra of substituted naphthalenes. Hara, K.; Takemura, T.; Baba, H. J. Mol. Spectrosc. **50**: 90–105 (1974).

74B006 Chemische Gesellschaft Fribourg. Wild, U.P. Chimia **28**: 125–7 (1974).

74B007 Triplet-triplet absorption of porphyrins and their derivatives. Sapunov, V.V.; Solov'ev, K.N.; Tsvirko, M.P. Zh. Prikl. Spektrosk. **21**: 667–71 (1974).

751124 Nanosekunden-Pulsradiolyse und Laserphotolyse von Benzophenon in Benzol und Cyclohexan. Brede, O.; Helmstreit, W.; Mehnert, R. Z. Phys. Chem. (Leipzig) **256**: 505–12 (1975).

753103 Kinetic studies of the tryptophan triplet state in solid film and in wool keratin. Ghiggino, K.P.; Nicholls, C.H.; Pailthorpe, M.T. Photochem. Photobiol. **22**: 169–73 (1975).

756077 Flash photolysis and phosphorescence of benzoic acid at 77-K. Acuna, A.U.; Ceballos, A.; Garcia Dominguez, J.A.; Molera, M.J. An. Quim. **71**: 22–7 (1975).

756162 Electron transfer reaction in the triplet state. Role of ferrocene as an electron donor. Kikuchi, K.; Kokubun, H.; Kikuchi, M. Bull. Chem. Soc. Jpn. **48**: 1378–81 (1975).

756270 Triplet-triplet absorption studies of the intersystem crossing mechanism of 2-aminopurines. Wierzchowski, K.L.; Berens, K.; Szabo, A.G. J. Lumin. **10**: 331–43 (1975).

756293 Excited singlet yield in T-T annihilation. A comparative study of naphthalene and anthracene in solution. Tfibel, F.; Lindqvist, L. Chem. Phys. **10**: 471–8 (1975).

757004 Flash photolytic kinetic studies of the quenching of tetracene triplets by tetracene radical anions. Levin, G.; Szwarc, M. Chem. Phys. Lett. **30**: 116–9 (1975).

757066 Formation and reactions of the triplet state of sym-triazine in solution studied by laser spectroscopy. Bent, D.V.; Hayon, E. Chem. Phys. Lett. **31**: 325–7 (1975).

757078 Determination of the pK values of the lumiflavin triplet state by flash photolysis. Schreiner, S.; Steiner, U.; Kramer, H.E.A. Photochem. Photobiol. **21**: 81–4 (1975).

757090 Triplet-sensitized cis-trans isomerization of the protonated Schiff base of retinal isomers. Alchalel, A.; Honig, B.; Ottolenghi, M.; Rosenfeld, T. J. Am. Chem. Soc. **97**: 2161–6 (1975).

757112 Activation-controlled hydrogen abstraction by benzophenone triplet. Topp, M.R. Chem. Phys. Lett. **32**: 144–9 (1975).

757141 The determination of molar absorption coefficients of metastable states. Ranalder, U.B.; Kaenzig, H.; Wild, U.P. J. Photochem. **4**: 97–107 (1975).

757148 Mechanism of photoreduction of thiazine dyes by EDTA studied by flash photolysis. III. Consequences of a newly found pK_T of thionine on the mechanism in basic solutions. Bonneau, R.; Pereyre, J. Photochem. Photobiol. **21**: 173–7 (1975).

757161 Excited state chemistry of aromatic amino acids and related peptides. I. Tyrosine. Bent, D.V.; Hayon, E. J. Am. Chem. Soc. **97**: 2599–606 (1975).

757162 Excited state chemistry of aromatic amino acids and related peptides. II. Phenylalanine. Bent, D.V.; Hayon, E. J. Am. Chem. Soc. **97**: 2606–12 (1975).

757163 Excited state chemistry of aromatic amino acids and related peptides. III. Tryptophan. Bent, D.V.; Hayon, E. J. Am. Chem. Soc. **97**: 2612–9 (1975).

757167 Photochemical rearrangements of indazoles. Investigation of the triplet excited states of 1- and 2-methylindazole. Ferris, J.P.; Prabhu, K.V.; Strong, R.L. J. Am. Chem. Soc. **97**: 2835–9 (1975).

757282 Determination of triplet quantum yields by laser flash absorption spectroscopy. Amand, B.; Bensasson, R. Chem. Phys. Lett. **34**: 44–8 (1975).

757309 Chemistry of the triplet state of diazines in solution studied by laser spectroscopy. Bent, D.V.; Hayon, E.; Moorthy, P.N. J. Am. Chem. Soc. **97**: 5065–71 (1975).

757353 Laser photoionization of phenothiazine in alcoholic and aqueous micellar solution. Electron transfer from triplet states to metal ion acceptors. Alkaitis, S.A.; Beck, G.; Graetzel, M. J. Am. Chem. Soc. **97**: 5723–9 (1975).

757361 Photosensitizing properties of N-formylkynurenine. Walrant, P.; Santus, R.; Grossweiner, L.I. Photochem. Photobiol. **22**: 63–5 (1975).

757413 Rate constants of triplet-state ionic photodissociation of weak charge-transfer complexes formed between pyromellitic dianhydride (PMDA) and naphthalenes. Achiba, Y.; Kimura, K. J. Phys. Chem. **79**: 2626–8 (1975).

757427 The photochemistry of benz(de)anthracen-7-ones. Part II. Flash photolysis. Bentley, P.; McKellar, J.F.; Phillips, G.O. J. Chem. Soc., Perkin Trans. 2 : 1259–62 (1975).

757439 Phenyl substitution effects on triplet-triplet absorption spectra. I. Study of 1,3,6,8-tetraphenylpyrene. Rulliere, C.; Colson, E.C.; Roberge, P.C. Can. J. Chem. **53**: 3269–75 (1975).

757441 Study of the intermediate states in photochemical reactions of dyes. VII. Electron transfer in redox reactions of thiacarbocyanines. Lifanov, Yu.I.; Korobov, V.E.; Karyakin, A.V.; Chibisov, A.K. High Energy Chem. **9**: 232–6 (1975) Translated from: Khim. Vys. Energ. **9**: 265–70 (1975).

757469 An electro-optic shutter to assist flash photolysis studies of solid films. Ghiggino, K.P.; Nicholls, C.H.; Pailthorpe, M.T. J. Phys. E **8**: 900–2 (1975).

757485 Photodynamic sensitization by 8-methoxypsoralen via the singlet oxygen mechanism. Poppe, W.; Grossweiner, L.I. Photochem. Photobiol. **22**: 217–9 (1975).

757510 Studies on thymine and uracil triplet excited state in acetonitrile and water. Salet, C.; Bensasson, R. Photochem. Photobiol. **22**: 231–5 (1975).

757522 Triplet absorption of phthalimide solutions. Borisevich, N.A.; Bolot'ko, L.M.; Staneva, T.G. Zh. Prikl. Spektrosk. **23**: 633–7 (1975).

757534 An efficient photosensitizer: O-ethyl-1-thionaphthoate. Gisin, M.; Wirz, J. Helv. Chim. Acta **58**: 1768–71 (1975).

757573 Microsecond and nanosecond impulse photolysis of carbazoles. Two-quantum reaction in a liquid medium. Borovkova, V.A.; Bagdasar'yan, Kh.S.; Pikel'ni, V.F.; Kolosov, V.A.; Kiryukhin, Yu.I. Dokl. Phys. Chem. (Engl. Transl.) **224**: 973–6 (1975) Translated from: Dokl. Akad. Nauk SSSR **224**: 616–9 (1975).

757594 Absolute efficiency of the two-quanta sensitized decomposition of benzylamine. Sinitsyna, Z.A.; Kiryukhin, Yu.I.; Bagdasar'yan, Kh.S. Dokl. Phys. Chem. (Engl. Transl.) **225**: 1212–4 (1975) Translated from: Dokl. Akad. Nauk SSSR **225**: 361–3 (1975).

75B002 Anisotropy of the T-T absorption spectra of naphthalene and phenanthrene. Kuball, H.-G.; Euing, W. Chem. Phys. Lett. **30**: 457–62 (1975).

75B003 Matrix effect on the linewidth of the $^3B_{2u}^+$–$^3B_{1g}^-$ absorption spectrum of naphthalene. Haertel, H.; Khelladi, F.Z.; Ostertag, R. Chem. Phys. Lett. **30**: 472–6 (1975).

75B004 The triplet-triplet absorption spectra and electronic structures of some cyano-substituted benzenes. Morita, H.; Matsumoto, S.; Nagakura, S. Bull. Chem. Soc. Jpn. **48**: 420–3 (1975).

75E530 Degradation of the energy of electronic excitation of associated molecules. The triplet states of associates of rhodamine 6G. Chibisov, A.K.; Ketsle, G.A.; Levshin, L.V.; Slavnova, T.D. Opt. Spectrosc. **38**: 45–8 (1975) Translated from: Opt. Spektrosk. **38**: 83–8 (1975).

761024 Energy transfer from an alkene triplet state during pulse radiolysis. Barwise, A.J.G.; Gorman, A.A.; Rodgers, M.A.J. Chem. Phys. Lett. **38**: 313–6 (1976).

761030 Studies of higher triplet exciton bands through T-T absorption in naphthalene single crystal. Higuchi, M.; Nakayama, T.; Itoh, N. J. Phys. Soc. Jpn. **40**: 250–7 (1976).

761035 Triplet states of carotenoids from photosynthetic bacteria studied by nanosecond ultraviolet and electron pulse irrad iation. Bensasson, R.; Land, E.J.; Maudinas, B. Photochem. Photobiol. **23**: 189–93 (1976).

761069 Intermediates in the nanosecond pulse radiolysis of dimethylaniline solutions in cyclohexane. Zador, E.; Warman, J.M.; Hummel, A. J. Chem. Soc., Faraday Trans. 1 **72**: 1368–76 (1976).

761080 Pulse radiolysis of ethyl acetate and its solutions. Ramanan, G. J. Phys. Chem. **80**: 1553–8 (1976).

761088 The triplet state of 1,6-diphenyl-1,3,5-hexatriene and 1,8-diphenyl-1,3,5,7-octatetraene. Bensasson, R.; Land, E.J.; Lafferty, J.; Sinclair, R.S.; Truscott, T.G. Chem. Phys. Lett. **41**: 333–5 (1976).

761122 Triplet excited states of 1,4-disubstituted anthraquinones: Possible evidence for association of quinones in solution. Land, E.J.; McAlpine, E.; Sinclair, R.S.; Truscott, T.G. J. Chem. Soc., Faraday Trans. 1 **72**: 2091–100 (1976).

761168 The triplet excited state of bilirubin. Land, E.J. Photochem. Photobiol. **24**: 475–7 (1976).

766206 Excited states of six-membered aza-aromatic rings. X. Acid-base equilibria of electronically excited quinoxaline as an example of anomalous diazines. Grabowska, A.; Herbich, J.; Kirkor-Kaminska, E.; Pakula, B. J. Lumin. **11**: 403–12 (1976).

766377 The hydrogen bonding effect of pyridine on the deactivation of the excited states of acridone. Fushimi, K.; Kikuchi, K.; Kokubun, H. J. Photochem. **5**: 457–68 (1976).

766403 Properties of benzopyrene-DNA complexes investigated by fluorescence and triplet flash photolysis techniques. Geacintov, N.E.; Prusik, T.; Khosrofian, J.M. J. Am. Chem. Soc. **98**: 6444–52 (1976).

766421 Photochemical behaviour and spectroscopical properties of anilino naphthalenes. Fratev, F.; Polansky, O.E.; Zander, M. Z. Naturforsch. Teil A **31A**: 987–9 (1976).

766464 Picosecond time-resolved spectroscopy and the intersystem crossing rates of anthrone and fluorenone. Kobayashi, T.; Nagakura, S. Chem. Phys. Lett. **43**: 429–34 (1976).

766469 Intersystem crossing to the lowest triplet state of phenazine following singlet excitation with a picosecond pulse. Hirata, Y.; Tanaka, I. Chem. Phys. Lett. **43**: 568–70 (1976).

766528 Evidence for a triplet exciplex state from pulsed laser photolysis. Bell, I.P.; Rodgers, M.A.J. Chem. Phys. Lett. **44**: 249–52 (1976).

766652 The use of charge transfer complexing to elucidate some triplet-triplet spectra. Slifkin, M.A.; Al-Chalabi, A.O. Spectrochim. Acta, Part A **32A**: 661–2 (1976).

767023 Photochemistry of chlorpromazine (2-chloro-N-(3-dimethylaminopropyl)phenothiazine) in propan-2-ol solution. Davies, A.K.; Navaratnam, S.; Phillips, G.O. J. Chem. Soc., Perkin Trans. 2 : 25–9 (1976).

767071 Direct and sensitized photooxidation of cyanine dyes. Byers, G.W.; Gross, S.; Henrichs, P.M. Photochem. Photobiol. **23**: 37–43 (1976).

767094 Mechanism of quenching of the triplet states of organic compounds by tris-(β-diketonato) complexes of iron(III), ruthenium(III) and aluminium(III). Wilkinson, F.; Farmilo, A. J. Chem. Soc., Faraday Trans. 2 **72**: 604–18 (1976).

767144 Duroquinone triplet reduction, in cyclohexane, ethanol and water, and by durohydroquinone. Amouyal, E.; Bensasson, R. J. Chem. Soc., Faraday Trans. 1 **72**: 1274–87 (1976).

767147 Triplet triplet extinction coefficients of anthracene and 9-bromoanthracene determined by a ground state depletion method. Ledger, M.B.; Salmon, G.A. J. Chem. Soc., Faraday Trans. 2 **72**: 883–6 (1976).

767159 Behaviors of the triplet molecule in neat liquid of naphthalene derivatives at room temperature. Ohno, T.; Kato, S. Chem. Lett. (Tokyo) : 263–6 (1976).

767171 Laser photolysis studies of the triplet state of xanthone and its ketyl radical in fluid solution. Garner, A.; Wilkinson, F. J. Chem. Soc., Faraday Trans. 2 **72**: 1010–20 (1976).

767177 Laser photoionization and light-initiated redox reactions of tetramethylbenzidine in organic solvents and aqueous micellar solution. Alkaitis, S.A.; Graetzel, M. J. Am. Chem. Soc. **98**: 3549–54 (1976).

767180 Laser flash spectroscopy of tris(2,2′-bipyridine)ruthenium(II) in solution. Bensasson, R.; Salet, C.; Balzani, V. J. Am. Chem. Soc. **98**: 3722–4 (1976).

767189 Quenching of triplet states by inorganic ions. Energy transfer and charge transfer mechanisms. Treinin, A.; Hayon, E. J. Am. Chem. Soc. **98**: 3884–91 (1976).

767201 A laser-photolytic study of 9-fluorenone. Preliminary observations of transient absorption spectra. Nakajima, A. Mol. Photochem. **7**: 251–62 (1976).

767246 Photochemical investigations of oxazine, thiazine and selenazine dyes. The reactivity of protolytic triplet forms in electron transfer reactions. Vogelmann, E.; Kramer, H.E.A. Photochem. Photobiol. **23**: 383–90 (1976).

767261 Build-up of T-T absorption of acridine following singlet excitation with a picosecond pulse. Hirata, Y.; Tanaka, I. Chem. Phys. Lett. **41**: 336–8 (1976).

767269 Triplet excited states of nitronaphthalenes. II. b-Nitronaphthalene. Capellos, C.; Suryanarayanan, K. Int. J. Chem. Kinet. **8**: 529–39 (1976).

767270 Triplet excited states of nitronaphthalenes. III. 1,4-Dinitronaphthalene. Capellos, C.; Suryanarayanan, K. Int. J. Chem. Kinet. **8**: 541–8 (1976).

767488 Photochemical reactions of bifluorenylidene. Part 2. Flash photolytic investigations. Van Sinoy, A.; Vander Donckt, E. J. Chem. Soc., Faraday Trans. 1 **72**: 2312–23 (1976).

767526 Low temperature flash photolysis of 2-N-dimethylaminopyridine. Wolleben, J.; Testa, A.C. Mol. Photochem. **7**: 277–85 (1976).

767556 Electron transfer in the photochemistry of substituted benzoate and naphthoate esters. Coyle, J.D.; Kingston, D.H. J. Chem. Soc., Perkin Trans. 2 : 1475–9 (1976).

767574 The photoreduction of methylene blue by amines. I. A flash photolysis study of the reaction between triplet methylene blue and amines. Kayser, R.H.; Young, R.H. Photochem. Photobiol. **24**: 395–401 (1976).

767582 Excited state chemistry of indigoid dyes. IV. Triplet state spectra and lifetimes from flash photolysis at low temperatures. Schulte-Frohlinde, D.; Herrmann, H.; Wyman, G.M. Z. Phys. Chem. (Frankfurt Am Main) **101**: 115–21 (1976).

767626 Deactivation of triplet 2-naphtol and 1-anthrol by aromatic N-heterocycles. Yamamoto, S.; Kikuchi, K.; Kokubun, H. Bull. Chem. Soc. Jpn. **49**: 2950–1 (1976).

767647 Participation of triplet states in the photocoloration of photochromic spiropyrans of the phenanthridine series. Kuz'min, V.A.; Malkin, Ya.N.; Martynova, V.P.; Zakhs, E.R.; Efros, L.S. Dokl. Phys. Chem. (Engl. Transl.) **228**: 422–5 (1976) Translated from: Dokl. Akad. Nauk SSSR **228**: 127–30 (1976).

767764 Configuration of photoisomers of merocyanine dyes. Kuz'min, V.A.; Vinogradov, A.M.; Romanov, N.N.; Al'perovich, M.A.; Levkoev, I.I.; Babichev, F.S. Bull. Acad. Sci. USSR, Div. Chem. Sci. 25(8): 1755–7 (1976) Translation from: Izv. Akad. Nauk SSSR, Ser. Khim. (8): 1864–6 (1976).

767803 Photoreduction of methylene blue by aromatic amines. Nanosecond pulse photolysis. Romashov, L.V.; Kiryukhin, Yu.I.; Bagdasar'yan, Kh.S. Dokl. Phys. Chem. **230**: 961–4 (1976) Translated from: Dokl. Akad. Nauk SSSR **230**: 1145–8 (1976).

76B012 Phosphorescence and triplet-triplet absorption spectra of anthracene-d_{10} in polymethylmethacrylate under high pressures. Shaw, R.W.; Nicol, M. Chem. Phys. Lett. **39**: 108–12 (1976).

76E682 Features of the triplet-triplet absorption spectra of composite molecules. Gerko, V.I.; Alfimov, M.V.; Popov, L.S.; Kovalenko, N.P. Dokl. Phys. Chem. **230**: 811–3 (1976) Translated from: Dokl. Akad. Nauk SSSR **230**: 125–7 (1976).

771021 Triplet state quenching involving charge transfer interactions between N-methyl indole and aromatic carbonyl compounds in benzene solution. Wilkinson, F.; Garner, A. J. Chem. Soc., Faraday Trans. 2 **73**: 222–33 (1977).

771048 Radiation induced racemization of 1,1′-binaphthyl in tetrahydrofuran and toluene. Irie, M.; Yorozu, T.; Yoshida, K.; Hayashi, K. J. Phys. Chem. **81**: 973–6 (1977).

771059 Ion recombination processes in rigid solutions. Miller, J.R. Can. J. Chem. **55**: 1867–75 (1977).

771078 Excited states of protoporphyrin IX dimethyl ester: Reaction of the triplet with carotenoids. Chantrell, S.J.; McAuliffe, C.A.; Munn, R.W.; Pratt, A.C.; Land, E.J. J. Chem. Soc., Faraday Trans. 1 : 858–65 (1977).

773047 A pulsed laser study of excited states of aromatic molecules absorbed in globular proteins. Cooper, M.; Thomas, J.K. Radiat. Res. **70**: 312–24 (1977).

776081 Intersystem crossing in ahthracene-N,N-diethylaniline exciplex. Nishimura, T.; Nakashima, N.; Mataga, N. Chem. Phys. Lett. **46**: 334–8 (1977).

776104 Charge transfer triplet state of p-nitroaniline. Wolleben, J.; Testa, A.C. J. Phys. Chem. **81**: 429–31 (1977).

776146 Photophysical processes in the molecular complexes of 1,2,4,5-tetracyanobenzene with aromatic donors. Craig, B.B.; Rodgers, M.A.J.; Wood, B. J. Chem. Soc., Faraday Trans. 2 **73**: 349–55 (1977).

776171 Probabilities of intramolecular radiative and radiationless transitions of some amino derivatives of acridine. Morozov, Yu.V.; Savenko, A.K. Mol. Photochem. **8**: 1–43 (1977).

776187 The fluorescent state of cyano-substituted layered cyclophanes. Masuhara, H.; Mataga, N.; Yoshida, M.; Tatemitsu, H.; Sakata, Y.; Misumi, S. J. Phys. Chem. **81**: 879–83 (1977).

776190 The effect of chemical structure on the photosensitizing efficiencies of porphyrins. Cauzzo, G.; Gennari, G.; Jori, G.; Spikes, J.D. Photochem. Photobiol. **25**: 389–95 (1977).

776194 Triplet excited states of nitronaphthalenes. IV. 1,2- and 1,8-dinitronaphthalenes. Capellos, C.; Suryanarayanan, K. Int. J. Chem. Kinet. **9**: 399–407 (1977).

776195 The triplet state of 4-nitronaphthylamine. Capellos, C.; Lang, F. Int. J. Chem. Kinet. **9**: 409–15 (1977).

776213 Weak triplet-triplet absorption spectra of cyanobenzenes. Achiba, Y.; Kimura, K. Chem. Phys. Lett. **48**: 107–10 (1977).

776222 Luminescence and triplet absorption of o-, m-, and p-methylbenzoic acids. Acuna, A.U.; Ceballos, A.; Molera, M.J. J. Phys. Chem. **81**: 1090–3 (1977).

776227 Intersystem crossing processes of acridine. Kikuchi, K.; Uji-ie, K.; Miyashita, Y.; Kokubun, H. Bull. Chem. Soc. Jpn. 50(4): 879–82 (1977).

776258 Intersystem crossing and internal conversion quantum yields of acridine in polar and nonpolar solvents. Kellmann, A. J. Phys. Chem. **81**: 1195–8 (1977).

776262 P-type delayed fluorescence from rubrene. Liu, D.K.K.; Faulkner, L.R. J. Am. Chem. Soc. **99**: 4594–9 (1977).

776279 Polarized triplet-triplet absorption spectra using stretched polymer films: Biphenyl and fluorene. Ota, K.; Murofushi, K.; Hoshi, T.; Shibuya, E.; Yoshino, J. Z. Phys. Chem. (Frankfurt am Main) **104**: 181–8 (1977).

776335 Studies of the interaction of excited chloranil with acrylonitrile, methyl methacrylate, and styrene by means of laser photolysis. Kobashi, H.; Gyoda, H.; Morita, T. Bull. Chem. Soc. Jpn. **50**: 1731–8 (1977).

776412 Singlet → triplet intersystem crossing quantum yields of photosynthetic and related polyenes. Bensasson, R.; Dawe, E.A.; Long, D.A.; Land, E.J. J. Chem. Soc., Faraday Trans. 1 **73**: 1319–25 (1977).

776431 Proton-induced radiationless processes in excited 9,9′-bianthryl. Shizuka, H.; Ishii, Y.; Morita, T. Chem. Phys. Lett. **51**: 40–4 (1977).

776464 Two emitting states of excited p-(9-anthryl)-N,N-dimethylaniline derivatives in polar solvents. Siemiarczuk, A.; Grabowski, Z.R.; Krowczynski, A.; Asher, M.; Ottolenghi, M. Chem. Phys. Lett. **51**: 315–20 (1977).

777036 Triplet states of cyanine dyes and reactions of electron transfer with their participation. Chibisov, A.K. J. Photochem. **6**: 199–214 (1976/77).

777037 Laser photolysis of indole in cyclohexane. Pernot, C.; Lindqvist, L. J. Photochem. **6**: 215–20 (1976/77).

777041 Triplet state of rhodamine dyes and its role in production of intermediates. Korobov, V.E.; Shubin, V.V.; Chibisov, A.K. Chem. Phys. Lett. **45**: 498–501 (1977).

777045 Laser photolysis studies of duroquinone triplet state electron transfer reactions. Scheerer, R.; Graetzel, M. J. Am. Chem. Soc. **99**: 865–71 (1977).

777062 Anion and solvent effects on the rate of reduction of triplet excited thiazine dyes by ferrous ions. Wildes, P.D.; Lichtin, N.N.; Hoffman, M.Z.; Andrews, L.; Linschitz, H. Photochem. Photobiol. **25**: 21–5 (1977).

777088 Photoionization and recombination luminescence of N,N′-disubstituted dihydrophenazines in 3-methylpentane at 77 K. Bruehlmann, U.; Huber, J.R. J. Phys. Chem. **81**: 386–91 (1977).

777201 Photoreduction of 1,10-phenanthroline. Bandyopadhyay, B.N.; Harriman, A. J. Chem. Soc., Faraday Trans. 1 **73**: 663–74 (1977).

777238 Reversible photochemistry and photocyclization of 10H,10′H-bianthrylidene. Korenstein, R.; Muszkat, K.A.; Fischer, E. J. Chem. Soc., Perkin Trans. 2 : 564–9 (1977).

777241 Laser photolysis study of the photoracemization of 1,1′-binaphthyl. Irie, M.; Yoshida, K.; Hayashi, K. J. Phys. Chem. **81**: 969–72 (1977).

777242 Investigation of physical triplet quenching by electron donors. Steiner, U.; Winter, G.; Kramer, H.E.A. J. Phys. Chem. **81**: 1104–10 (1977).

777265 Laser investigation of some oxazole and oxadiazole derivatives. Fouassier, J.-P.; Lougnot, D.-J.; Wieder, F.; Faure, J. J. Photochem. 7(1): 17–28 (1977).

777315 Photoredox reactions of thionine. Ferreira, M.I.C.; Harriman, A. J. Chem. Soc., Faraday Trans. 1 **73**: 1085–92 (1977).

777316 Triplet-triplet absorption spectra and the spectra of the photoreduced states of rhodamine B and rhodamine 110. Dunne, A.; Quinn, M.F. J. Chem. Soc., Faraday Trans. 1 **73**: 1104–10 (1977).

777345 Lifetime enhancement of the first electronic triplet state of 3,5-dinitroanisole by hydrogen bonding to clusters in mixed aqueous solvent systems. Varma, C.A.G.O.; Plantenga, F.L.; van den Ende, C.A.M.; van Zeyl, P.H.M.; Tamminga, J.J.; le Cornelisse, J. Chem. Phys. **22**: 475–83 (1977).

777388 Photoionization of aromatic compounds in boric acid glass. Andreev, O.M.; Smirnov, V.A.; Alfimov, M.V. J. Photochem. **7**: 149–56 (1977).

777391 Mechanisms of deactivation of triplet 1-anthrol and 2-naphthol by aromatic N-heterocycles. Yamamoto, S.-A.; Kikuchi, K.; Kokubun, H. J. Photochem. **7**: 177–84 (1977).

777432 Flash photolysis of tryptophan and N-acetyl-L-tryptophanamide. The effect of bromide on transient yields. Volkert, W.A.; Kuntz, R.R.; Ghiron, C.A.; Evans, R.F.; Santus, R.; Bazin, M. Photochem. Photobiol. **26**: 3–9 (1977).

777434 Photochemistry of polyenes. XI. Flash photolytic studies of hindered isomers of retinal. Harriman, A.; Liu, R.S.H. Photochem. Photobiol. **26**: 29–32 (1977).

777455 Laser flash photolysis and quantum yields of the direct photochemical cis-trans isomerization of 4-nitro-4′-methoxystilbene in cyclohexane solutions in presence of quenchers. Model for the photoisomerization of nitrostilbenes. Goerner, H.; Schulte-Frohlinde, D. Ber. Bunsenges. Phys. Chem. **81**: 713–20 (1977).

777538 Abnormal broadening in triplet-to-triplet absorption spectra caused by aromatic solvents. Alfimov, M.V.; Gerko, V.I.; Popov, L.S.; Razumov, V.F. Chem. Phys. Lett. **50**: 398–401 (1977).

777602 Interaction of duroquinone lowest triplet with amines. Amouyal, E.; Bensasson, R. J. Chem. Soc., Faraday Trans. 1 **73**: 1561–8 (1977).

777603 Photochemistry of Michler's ketone in cyclohexane and alcohol solvents. Brown, R.G.; Porter, G. J. Chem. Soc., Faraday Trans. 1 **73**: 1569–73 (1977).

777617 Photochemistry of flavins. II. Photophysical properties of alloxazines and isoalloxazines. Grodowski, M.S.; Veyret, B.; Weiss, K. Photochem. Photobiol. **26**: 341–52 (1977).

777635 Picosecond-laser study of triplet state population of carbonyl derivatives of anthracene. Hirayama, S.; Kobayashi, T. Chem. Phys. Lett. **52**: 55–8 (1977).

77A178 Direct evidence of photodissociation of carbazole via the higher excited triplet state by a double excitation method. Yamamoto, S.; Kikuchi, K.; Kokubun, H. Chem. Lett. : 1173–6 (1977).

77A196 Intermediates from the photolysis of 2,3-dihydroxynaphthalene. Khudyakov, I.V.; Tatikolov, A.S.; Kuz'min, V.A. Bull. Acad. Sci. USSR, Div. Chem. Sci. **26**: 1197–9 (1977) Translated from: Izv. Akad. Nauk SSSR, Ser. Khim. : 1300–3 (1977).

77A203 The electron transfer reaction between triplet methylene blue and aromatic compounds. Kikuchi, K.; Tamura, S.-I.; Iwanaga, C.; Kokubun, H.; Usui, Y. Z. Phys. Chem. (Frankfurt am Main) **106**: 17–24 (1977).

77A216 The triplet state of 4-nitro-N,N-dimethylnaphthylamine. Capellos, C.; Lang, F. Int. J. Chem. Kinet. **9**: 943–52 (1977).

77B012 Two-quantum photoionization in liquid solutions. Quantitative investigation by means of nanosecond photolysis. Borovkova, V.A.; Bagdasar'yan, Kh.S. Dokl. Phys. Chem. **235**: 649–52 (1977) Translated from: Dokl. Akad. Nauk SSSR **235**: 132–5 (1977).

77B022 Triplet-triplet absorption of some carbonyl-containing compounds. Alfimov, M.V.; Buben, N.Ya.; Glagolev, V.L.; Kuyumdzhi, E.S.; Pomazan, Yu.V.; Shamshev, V.N. Opt. Spectrosc. **42**: 267–70 (1977) Translated from: Opt. Spektrosk. **42**: 476–82 (1977).

77C001 Dimerisation de la chlorophylle dans les solvants apolaires. Etude de l'equilibre et de l'etat triplet. Journeaux, R.; Chene, G.; Viovy, R. J. Chim. Phys. Phys.-Chim. Biol. **74**: 1203–10 (1977).

77E543 Excited singlet state decay pathways in the fluorescence probe molecule 1,8-anilinonaphthalene sulphonate (ANS). Fleming, G.R.; Porter, G.; Robbins, R.J.; Synowiec, J.A. Chem. Phys. Lett. **52**: 228–32 (1977).

77E663 Mechanism of the degradation of electronic excitation energy in hydrogen-bonded ion pairs. Ivanov, V.L.; Martynov, I.Yu.; Uzhinov, B.M.; Kuz'min, M.G. High Energy Chem. **11**: 361–4 (1977) Translated from: Khim. Vys. Energ. **11**: 327–31 (1977).

77E797 Etude par spectroscopie laser de derives de benzoine. Fouassier, J.-P.; Lougnot, D.-J.; Faure, J. C.R. Seances Acad. Sci., Ser. C **284**: 643–6 (1977).

78A163 Photooxidation of aromatic hydrocarbons by europium(III) salts. Levin, G. J. Phys. Chem. **82**: 1584–8 (1978).

78A180 Deactivation of the electronic excitation of triarylcarbonium ions in acid media. Ivanov, V.L.; Al'-Ainen, S.A.; Kuz'min, M.G. High Energy Chem. **12**: 39–42 (1978) Translated from: Khim. Vys. Energ. **12**: 48–52 (1978).

78A195 Hydrogen atom abstraction by p-chloranil triplet from tetrachlorohydroquinone and the presence of a competitive deactivation process. Kobashi, H.; Nagumo, T.; Morita, T. Chem. Phys. Lett. **57**: 369–72 (1978).

78A237 Flash photolytic studies on the photochemical formation of five-membered sulfur heterocycles. Wolff, T. J. Am. Chem. Soc. **100**: 6157–9 (1978).

78A268 Transient absorption in the sensitized photoisomerization of stilbene. Sumitani, M.; Yoshihara, K.; Nagakura, S. Bull. Chem. Soc. Jpn. **51**: 2503–7 (1978).

78A304 Primary processes in the photochemistry of rhodamine dyes. Korobov, V.E.; Chibisov, A.K. J. Photochem. **9**: 411–24 (1978).

78A324 Electron transfer from aromatic molecules to dimethylmercury via a triplet exciplex. Vander Donckt, E.; Van Vooren, C. J. Chem. Soc., Faraday Trans. 1 **74**: 827–36 (1978).

78A345 Blitzlichtspektroskopische Untersuchungen des Triplettzustandes und der photolytisch gebildeten Radikalkationen des 3,4-Benzpyrens in waessrigen Natriumdodecylsulfat- und Coffeinloesungen. Bauer, H.; Reske, G. J. Photochem. **9**: 43–54 (1978).

78A368 Quantitative study of the photodissociation of carbazoles in the higher excited triplet state by a double excitation method. Yamamoto, S.-A.; Kikuchi, K.; Kokubun, H. Z. Phys. Chem. (Frankfurt am Main) **109**: 47–58 (1978).

78A378 Triplet states of copper and metal-free phthalocyanines. McVie, J.; Sinclair, R.S.; Truscott, T.G. J. Chem. Soc., Faraday Trans. 2 **74**: 1870–9 (1978).

78A386 Laser photolysis of dicarbocyanine dyes. Darmanyan, A.P.; Kuz'min, V.A. Bull. Acad. Sci. USSR, Div. Chem. Sci. **27**: 506–10 (1978) Translated from: Izv. Akad. Nauk SSSR, Ser. Khim. : 587–92 (1978).

78A411 Pulse radiolysis of benzene solutions of indolinospiropyrans. Vannikov, A.V.; Kryukov, A.Yu. High Energy Chem. **12**: 280–4 (1978) Translated from: Khim. Vys. Energ. **12**: 334–8 (1978).

78A447 The electron transfer reactions between triplet dyes and aromatic compounds in acetonitrile. Tamura, S.-I.; Kikuchi, K.; Kokubun, H.; Usui, Y. Z. Phys. Chem. (Wiesbaden) **111**: 7–18 (1978).

78B071 Radiationless deactivation of benzophenone triplets in aromatic solvents. Characterization of transient intermediates in the presence of diphenyl ether. Small, R.D.; Scaiano, J.C. J. Phys. Chem. **82**: 2064–6 (1978).

78B072 Mechanism of the photochemical reaction of diphenylamines with carbon tetrachloride. Wyrzykowska, K.; Grodowski, M.; Weiss, K.; Latowski, T. Photochem. Photobiol. **28**: 311–8 (1978).

78B081 Triplet-triplet absorption of some aryl-substituted 1,3,4-oxadiazoles. Rulliere, C.; Rayez, J.-C.; Roberge, P.C. Can J. Chem. **56**: 2781–5 (1978).

78B088 Tripletspectra of 4-nitrostilbenes in polar and non-polar solvents at different temperatures and the configuration of the triplet state. Goerner, H.; Schulte-Frohlinde, D. Ber. Bunsenges. Phys. Chem. **82**: 1102–7 (1978).

78B089 Formation and decay of triplet excimers as revealed by their absorption spectra: Intramolecular excimers of α,α-dinaphthylalkanes. Subudhi, P.C.; Lim, E.C. Chem. Phys. Lett. **56**: 59–61 (1978).

78B108 Mechanisms of antioxidant action. A photochemical study of transition metal dibutyl dithiocarbamates (and their photostabilizing role in a polyolefin matrix). Scott, G.; Sheena, H.H.; Harriman, A.M. Eur. Polym. J. **14**: 1071–7 (1978).

78B112 Dynamic behaviour of excited charge transfer systems in polar solvents. Masuhara, H.; Saito, T.; Maeda, Y.; Mataga, N. J. Mol. Struct. **47**: 243–59 (1978).

78B129 Polarized triplet-triplet absorption spectra using stretched polymer film technique: 4-Hydroxy- and 4,4'-dihydroxy-biphenyl. Hoshi, T.; Oka, M.; Komuro, M.; Yoshino, J.; Ota, K.; Murofushi, K. Z. Phys. Chem. (Wiesbaden) **112**: 129–37 (1978).

78E011 Triplet state of protoporphyrin IX. Lafferty, J.; Truscott, T.G. J. Chem. Soc., Chem. Commun. : 51–2 (1978).

78E019 Nonradiative relaxation processes of the higher excited triplet states of anthracenes studied by a double excitation method. Kobayashi, S.; Kikuchi, K.; Kokubun, H. Chem. Phys. **27**: 399–407 (1978).

78E057 Triplet-triplet absorption spectroscopy of some highly dipolar unsaturated nitro compounds. Cowley, D.J. Helv. Chim. Acta **61**: 184–97 (1978).

78E062 Flash photolysis study of aminopyridines. Wolleben, J.; Testa, A.C. J. Photochem. **8**: 125–30 (1978).

78E152 Polarized photochromism in solid solutions. Pasternak, C.; Slifkin, M.A.; Shinitzky, M. J. Chem. Phys. **68**: 2669–73 (1978).

78E157 Triplet excited state of furocoumarins: Reactions with nucleic acid bases and amino acids. Bensasson, R.V.; Land, E.J.; Salet, C. Photochem. Photobiol. **27**: 273–80 (1978).

78E208 Laser photolysis study of the photoisomerization of retinals. Veyret, B.; Davis, S.G.; Yoshida, M.; Weiss, K. J. Am. Chem. Soc. **100**: 3283–90 (1978).

78E308 265 nm Laser flash photolysis of some ortho-substituted anilides and related N-formylkynurenine derivatives. Pileni, M.P.; Santus, R.; Land, E.J. Photochem. Photobiol. **27**: 671–81 (1978).

78E394 Determination of the extinction coefficient for triplet-triplet absorption from the kinetics of triplet-triplet energy transfer. Romashov, L.V.; Borovkova, V.A.; Kiryukhin, Yu.I.; Bagdasar'yan, Kh.S. High Energy Chem. **12**: 132–4 (1978) Translated from: Khim. Vys. Energ. **12**: 156–9 (1978).

78E414 Effect of the nature of the donor on the intersystem crossing in 9,10-dicyanoanthracene exciplexes in heptane. Soboleva, I.V.; Sadovskii, N.A.; Kuz'min, M.G. Dokl. Phys. Chem. **238**: 70–3 (1978) Translated from: Dokl. Akad. Nauk SSSR **238**: 400–3 (1978).

78E467 Intersystem crossing efficiencies of retinal isomers in different solvents measured by laser flash absorption spectrophotometry. Bensasson, R.; Land, E.J. Nouv. J. Chim. **2**: 503–7 (1978).

78E495 Photophysical processes in fluorenone. Andrews, L.J.; Deroulede, A.; Linschitz, H. J. Phys. Chem. **82**: 2304–9 (1978).

78E534 A luminescence and flash photolysis study of the photosensitizer N-methyl-2-benzoyl-β-naphthiazoline. Raemme, G. J. Photochem. **9**: 439–47 (1978).

78E538 Interband transitions in molecular crystals. Triplet-triplet absorptions in ketone crystals. Morris, J.M.; Yoshihara, K. Mol. Phys. **36**: 993–1003 (1978).

78E554 Kinetic spectroscopy of triplet states of benzenoid hydrocarbons using modulated Hg resonance radiation. Sime, M.E.; Phillips, D. Chem. Phys. Lett. **56**: 138–42 (1978).

78E721 Triplet excited states of carbonyl-containing polyenes. Becker, R.S.; Bensasson, R.V.; Lafferty, J.; Truscott, T.G.; Land, E.J. J. Chem. Soc., Faraday Trans. 2 : 2246–55 (1978).

78F030 Mechanism of the photochemical cis $\rightleftharpoons$ trans isomerization of thioindigo and 6,6'-diethoxy-thioindigo in solution. Grellmann, K.H.; Hentzschel, P. Chem. Phys. Lett. **53**: 545–51 (1978).

78Z194 Physical properties of excited states: A general method for measuring triplet-triplet extinction coefficients, singlet-triplet intersystem crossing efficiencies, and related parameters. Bensasson, R.; Land, E.J. *Photochemical and Photobiological Reviews*, K.C. Smith (ed.), Plenum Press, New York, N.Y., 1978, Vol. 3, p.163–91.

79A028 Blitzphotolyse von Desoxybenzoinen in Loesung. Amirzadeh, G.; Kuhlmann, R.; Schnabel, W. J. Photochem. **10**: 133–44 (1979).

79A114 The triplet state of 8-methoxypsoralen. Sloper, R.W.; Truscott, T.G.; Land, E.J. Photochem. Photobiol. **29**: 1025–9 (1979).

79A147 Reversible photorearrangement of N-substituted phthalimides: a flash photolysis study. Coyle, J.D.; Harriman, A.; Newport, G.L. J. Chem. Soc., Perkin Trans. 2 : 799–802 (1979).

79A171 Polymer effect on the photochemical reaction of benzophenone with tetrahydrofuran and with diphenylamine in benzene. Kamachi, M.; Kikuta, Y.; Nozakura, S. Polym. J. **11**: 273–7 (1979).

79A177 Steady-state and nanosecond spectroscopic studies of triplet sensitized reaction of K-region arene oxides. Itoh, M.; Murata, K.; Tokumura, K.; Shudo, K.; Miyata, N.; Okamoto, T. Tetrahedron **35**: 1059–63 (1979).

79A178 Hydrogen atom abstraction of p-chloranil triplet in 1,4-dioxane in the presence and absence of tetrachlorohydroquinone. Kobashi, H.; Tomioka, Y.; Morita, T. Bull. Chem. Soc. Jpn. **52**: 1568–72 (1979).

79A230 Laser flash-photolysis of methylene blue solutions. Rehak, V.; Poskocil, J. Collect. Czech. Chem. Commun. **44**: 2015–23 (1979).

79A237 The photophysics and photochemistry of pentahelicene. Grellmann, K.-H.; Hentzschel, P.; Wismontski-Knittel, T.; Fischer, E. J. Photochem. **11**: 197–213 (1979).

79A241 Photochemistry and photooxidation of tetraphenyl-p-dioxin. George, M.V.; Kumar, Ch.V.; Scaiano, J.C. J. Phys. Chem. **83**: 2452–5 (1979).

79A289 Photochemical α-cleavage and hydrogen abstraction in deoxybenzoin: a laser spectroscopy investigation. Fouassier, J.-P.; Merlin, A. Can. J. Chem. **57**: 2812–7 (1979).

79A346 Flash photolysis of tricarbocyanine dyes. Shvedova, L.A.; Tatikolov, A.S.; Makin, S.M.; Romanov, N.N.; Kuz'min, V.A. Bull. Acad. Sci. USSR, Div. Chem. Sci. **28**: 696–701 (1979) Translated from: Izv. Akad. Nauk SSSR, Ser. Khim. : 749–56 (1979).

79A403 Mechanism for photoreduction of 2-[2'-5"-nitrofuryl-2")-vinyl]quinoline. Luzhkov, V.B.; Khudyakov, I.V. Bull. Acad. Sci. USSR, Div. Chem. Sci. **28**: 608–11 (1979) Translated from: Izv. Akad. Nauk SSSR, Ser. Khim. : 653–6 (1979).

79B007 Picosecond transient spectroscopy of molecules in solution. Greene, B.I.; Hochstrasser, R.M.; Weisman, R.B. J. Chem. Phys. **70**: 1247–59 (1979).

79B032 Optical absorption spectrum of excited ruthenium trisbipyridyl (Ru(bpy)$_3^{2+}$). Lachish, U.; Infelta, P.P.; Graetzel, M. Chem. Phys. Lett. **62**: 317–9 (1979).

79B037 Determination of the triplet and excited singlet absorption spectra of chlorophyll a with a tunable dye laser. Baugher, J.; Hindman, J.C.; Katz, J.J. Chem. Phys. Lett. **63**: 159–62 (1979).

79B042 A laser flash photolysis study of the reactivities of the triplet states of 8-methoxypsoralen and 4,5',8-trimethylpsoralen with nucleic acid bases in solution. Beaumont, P.C.; Parsons, B.J.; Phillips, G.O.; Allen, J.C. Biochim. Biophys. Acta **562**: 214–21 (1979).

79B043 The infrared and visible absorption spectra of the lowest triplet state of acridine isolated in an argon matrix. Mitchell, M.B.; Smith, G.R.; Jansen, K.; Guillory, W.A. Chem. Phys. Lett. **63**: 475–8 (1979).

79B044 Laser photolysis study of the spectral-kinetic characteristics of short-lived triplet exciplexes and the mechanism of atomic hydrogen transfer in the course of 2,6-diphenyl-1,4-benzoquinone triplet quenching with aromatic amines. Kuzmin, V.A.; Darmanyan, A.P.; Levin, P.P. Chem. Phys. Lett. **63**: 509–14 (1979).

79B050 Transannular interaction in the excited triplet states of [2.2]paracyclophane and related compounds. Ishikawa, S.; Nakamura, J.; Iwata, S.; Sumitani, M.; Nagakura, S.; Sakata, Y.; Misumi, S. Bull. Chem. Soc. Jpn. **52**: 1346–50 (1979).

79B061 Laserflash-photolysis of the p-chloranil/naphthalene system: Characterization of the naphthalene radical cation in a fluid medium. Gschwind, R.; Haselbach, E. Helv. Chim. Acta **62**: 941–55 (1979).

79B076 Picosecond relaxation processes in excited state quinoxaline. Anderson, R.W.,Jr.; Damschen, D.E.; Scott, G.W.; Talley, L.D. J. Chem. Phys. **71**: 1134–40 (1979).

79B077 A study of isomeric retinal triplets by low temperature spectroscopic and kinetic flash photolysis. Grodowski, M.; Liu, R.S.H.; Herkstroeter, W.G. Chem. Phys. Lett. **65**: 42–5 (1979).

79B086 Kynurenic acid. I. Spectroscopic properties. Pileni, M.P.; Giraud, M.; Santus, R. Photochem. Photobiol. **30**: 251–6 (1979).

79B087 Triplet excited states of pyrimidine nucleosides and nucleotides. Salet, C.; Bensasson, R.; Becker, R.S. Photochem. Photobiol. **30**: 325–9 (1979).

79B098 A study on electronic excited states of iridium(III) complexes containing bipyridine and phenanthroline ligands. Solvent effect on triplet-triplet absorption spectra. Ohashi, Y.; Kobayashi, T. Bull. Chem. Soc. Jpn. **52**: 2214–7 (1979).

79B104 A previously unreported intense absorption band and the pK$_a$ of protonated triplet methylene blue. Ohno, T.; Osif, T.L.; Lichtin, N.N. Photochem. Photobiol. **30**: 541–6 (1979).

79B114 Chemistry and photochemistry of the disodium salts of free-base porphyrin. Lee, C.Y.; Levin, G. J. Phys. Chem. **83**: 3165–8 (1979).

79B119 Photophysics of aryl substituted 1,3,4-oxadiazoles. II. SCF CI calculations in different molecular configurations and assignment of the $T_1 \rightarrow T_n$ spectra of αNPD and βNPD. Rulliere, C.; Rayez, J.-C.; Roberge, P.C. Chem. Phys. **44**: 337–47 (1979).

79B141 Determination of the photophysical constants of benzophenone by a nanosecond excitation method. Kiryukhin, Yu.I.; Sinitsyna, Z.A.; Bagdasar'yan, Kh.S. High Energy Chem. **13**: 432–7 (1979) Translated from: Khim. Vys. Energ. **13**: 515–21 (1979).

79B161 Absorption spectrum and quantum yield of formation of the lowest triplet excited state of tris(2,2'-bipyridine)ruthenium(II) in aqueous solution. Bensasson, R.V.; Salet, C.; Balzani, V. C. R. Hebd. Seances Acad. Sci., Ser. B **289**: 41–3 (1979).

79E099 Triplet deactivation in benzotriazole-type ultraviolet stabilizers. Werner, T. J. Phys. Chem. **83**: 320–5 (1979).

79E136 The triplet excited states of biliverdin and biliverdin dimethyl ester. Land, E.J. Photochem. Photobiol. 29(3) 483–7 (1979).

79E175 Biradicaloid intermediates in photochemistry: Spectroscopic and kinetic study of 1,4-perinaphthadiyl and related 1,8-naphthoquinodimethanes. Gisin, M.; Rommel, E.; Wirz, J.; Burnett, M.N.; Pagni, R.M. J. Am. Chem. Soc. **101**: 2216–8 (1979).

79E219 Reactivity of acridine dye triplet states in electron transfer reactions. Vogelmann, E.; Rauscher, W.; Kramer, H.E.A. Photochem. Photobiol. **29**: 771–6 (1979).

79E243 Flash photolysis of cyanine dyes. Pinacyanol chloride (1,1'-diethyl-2,2'-carbocyanine chloride). Arvis, M.; Mialocq, J.-C. J. Chem. Soc., Faraday Trans. 2 **75**: 415–21 (1979).

79E282 Triplet excited state of coumarin and 4',5'-dihydropsoralen: Reaction with nucleic acid bases and amino acids. Land, E.J.; Truscott, T.G. Photochem. Photobiol. **29**: 861–6 (1979).

79E297 Photophysics of aryl substituted 1,3,4-oxadiazoles. I. SCF CI calculations in different molecular configurations and assignment of the $T_1 \rightarrow T_n$ spectrum of 2,5-di-(1-naphthyl)-1,3,4-oxadiazole. Rulliere, C.; Rayez, J.-C.; Roberge, P.C. Chem. Phys. **39**: 1–12 (1979).

79E304 Studies on the photo-oxidation mechanism of polymers-IX. The photo-sensitized oxidation of cis-1,4-polybutadiene by N-methyl-2-benzoyl-β-naphthiazoline. Rabek, J.F.; Raemme, G.; Canbaeck, G.; Ranby, B.; Kagiya, V.T. Eur. Polym. J. **15**: 339–48 (1979).

79E325 The triplet state in trans → cis-photoisomerization of thioindigo. Karstens, T.; Kobs, K.; Memming, R. Ber. Bunsenges. Phys. Chem. **83**: 504–10 (1979).

79E378 Upper excited triplet state mechanism in the trans → cis photoisomerization of 4-bromostilbene. Goerner, H.; Schulte-Frohlinde, D. J. Am. Chem. Soc. **101**: 4388–90 (1979).

79E443 Picosecond spectroscopic measurement of very fast intersystem crossing for 9,10-dioxa-anti-bimanes. Huppert, D.; Dodiuk, H.; Kanety, H.; Kosower, E.M. Chem. Phys. Lett. **65**: 164–8 (1979).

79E543 Laser flash studies of thioindigo and indigo dyes. Evidence for a trans configuration of the triplet state. Goerner, H.; Schulte-Frohlinde, D. Chem. Phys. Lett. **66**: 363–9 (1979).

79E546 Triplet state photophysical properties and intersystem crossing quantum efficiencies of homologues of retinals in various solvents. Das, P.K.; Becker, R.S. J. Am. Chem. Soc. **101**: 6348–53 (1979).

79E640 Trans → cis photoisomerization of stilbene and 4-halogenated stilbenes. Evidence for an upper excited triplet pathway. Goerner, H.; Schulte-Frohlinde, D. J. Phys. Chem. **83**: 3107–18 (1979).

79E666 Lowest triplet properties of poly(2-vinylnaphthalene) in solution. Bensasson, R.V.; Ronfard-Haret, J.C.; Land, E.J.; Webber, S.E. Chem. Phys. Lett. **68**: 438–42 (1979).

79E678 Some furocoumarins and analogs: Comparison of triplet properties in solution with photobiological activities in yeast. Sa E Melo, M.T.; Averbeck, D.; Bensasson, R.V.; Land, E.J.; Salet, C. Photochem. Phobotiol. **30**: 645–51 (1979).

79E690 Laser photolysis study of the exciplex between triplet benzil and triethylamine. Encinas, M.V.; Scaiano, J.C. J. Am. Chem. Soc. **101**: 7740–1 (1979).

79E799 Excited states of six-membered azaaromatic rings. Part XII. Acid-base equilibria of "double" azines. Bulska, H.; Kotlicka, J. Pol. J. Chem. **53**: 2103–15 (1979).

79E828 Etude par spectroscopy picoseconde et par photolyse eclair conventionnelle de polymethine-cyanines. Mialocq, J.C.; Goujon, P.; Arvis, M. J. Chim. Phys. Phys.-Chim. Biol. **76**: 1067–75 (1979).

79E848 Mixed annihilation delayed fluorescence of Bengal Pink and anthracene. Ketsle, G.A.; Levshin, L.V.; Sokolova, L.K. Opt. Spectrosc. (USSR) **47**: 494–7 (1979) Translated from: Opt. Spektrosk. **47**: 893–9 (1979).

79E964 Systematic classification of molecules in terms of their luminescence spectroscopic properties. IV. Acridinone and its derivatives. Shcherbo, S.N.; Val'kova, G.A.; Shigorin, D.N.; Sorokina, R.S.; Rybakova, L.F. Russ. J. Phys. Chem. **53**: 318–320 (1979) Translated from: Zh. Fiz. Khim. **53**: 562–5 (1979).

79E965 Systematic classification of molecules in terms of luminescence spectroscopic properties. V. Linear quinacridinone and its derivatives. Shcherbo, S.N.; Val'kova, G.A.; Shigorin, D.N.; Moiseeva, Z.Z.; Bir, E.Sh. Russ. J. Phys. Chem. **53**: 320–2 (1979) Translated from: Zh. Fiz. Khim. **53**: 566–9 (1979).

79F576 Protonation of the ground and triplet states of rhodamine 6G in aqueous solutions. Kuznetsov, V.A.; Shamraev, V.N.; Nurmukhametov, R.N. Opt. Spectrosc. (USSR) **47**: 157–60 (1979) Translated from: Opt. Spektrosk. **47**: 279–83 (1979).

79N005 Light-initiated electron transfer in functional surfactant assemblies. 1. Micelles with transition metal counterions. Moroi, Y.; Braun, A.M.; Graetzel, M. J. Am. Chem. Soc. **101**: 567–72 (1979).

79N036 Absorption and emission studies of solubilization in micelles. Part 5. Pyrene-3-sodium sulphonate solubilised in didodecyldimethylammonium bromide inverted micelles in benzene. Hunter, T.F.; Younis, A.I. J. Chem. Soc., Faraday Trans. 1 **75**: 550–60 (1979).

79P066 Laser flash photolysis studies on homo- and copolymers of phenylisopropenyl ketone and of pivalophenone in solution. Naito, I.; Kuhlmann, R.; Schnabel, W. Polymer **20**: 165–70 (1979).

79R026 The effect of DNA binding on initial 8-methoxypsoralen photochemistry. Goyal, G.C.; Grossweiner, L.I. Photochem. Photobiol. **29**: 847–50 (1979).

80A030 Photodimerization of benzyl 9-anthroate in the presence of triethylamine. Role of exciplex and triplet formation. Costa, S.M. de B.; Melo, E.C.C. J. Chem. Soc., Faraday Trans. 2 **76**: 1–13.

80A032 Triplet excited state of the 4'5' photoadduct of psoralen and thymine. Bensasson, R.V.; Salet, C.; Land, E.J.; Rushton, F.A.P. Photochem. Photobiol. **31**: 129–33 (1980).

80A051 Laser flash photolysis of aromatic azo-hydrazone systems. McVie, J.; Mitchell, A.D.; Sinclair, R.S.; Truscott, T.G. J. Chem. Soc., Perkin Trans. 2 : 286–90 (1980).

80A074 Light induced redox reactions of water soluble porphyrins, sensitization of hydrogen generation from water by zincporphyrin derivatives. Kalyanasundaram, K.; Graetzel, M. Helv. Chim. Acta **63**: 478–85 (1980).

80A143 Kinetic and spectroscopic features of some carotenoid triplet states: Sensitization by singlet oxygen. Rodgers, M.A.J.; Bates, A.L. Photochem. Photobiol. **31**: 533–7 (1980).

80A196 Photochemistry of 5-methylphenazinium salts in aqueous solution. 2. Optical flash photolysis and fluorescence results and a proposed mechanism. Chew, V.S.F.; Bolton, J.R.; Brown, R.G.; Porter, G. J. Phys. Chem. **84**: 1909–16 (1980).

80A206 Dynamics of electron transfer in amine photooxidation. Peters, K.S.; Freilich, S.C.; Schaeffer, C.G. J. Am. Chem. Soc. **102**: 5701–2 (1980).

80A222 Chemistry of fluorenylidene. Direct observation of, and kinetic measurements on, a singlet and a triplet carbene at room temperature. Zupancic, J.J.; Schuster, G.B. J. Am. Chem. Soc. **102**: 5958–60 (1980).

80A235 The temperature dependence of the triplet lifetimes of some aryl iodides and bromides. Grieser, F.; Thomas, J.K. J. Chem. Phys. **73**: 2115–9 (1980).

80A338 Solvent effects in the photochemistry of xanthone. Scaiano, J.C. J. Am. Chem. Soc. **102**: 7747–53 (1980).

80A369 Heavy atom substituents as molecular probes for solvent effects on the dynamics of short-lived triplet exciplexes. Winter, G.; Steiner, U. Ber. Bunsenges. Phys. Chem. **84**: 1203–14 (1980).

80B001 Transient absorption spectra of 2-hydroxybenzophenone photostabilizers. Merritt, C.; Scott, G.W.; Gupta, A.; Yavrouian, A. Chem. Phys. Lett. **69**: 169–73 (1980).

80B010 Triplet sensitized cycloreversion of dinaphthyl dimethoxycarbonyl cyclobutane as studied by laser flash photolysis. Takamuku, S.; Schnabel, W. Chem. Phys. Lett. **69**: 399–402 (1980).

80B011 Triplet-triplet absorption of pyrazine related to the $n\pi^*(B_{3u})$–$n\pi^*(B_{2g})$ splitting. Inoue, A.; Webster, D.; Lim, E.C. J. Chem. Phys. **72**: 1419–20 (1980).

80B017 Triplet states of protoporphyrin IX and protoporphyrin IX dimethyl ester. Sinclair, R.S.; Tait, D.; Truscott, T.G. J. Chem. Soc., Faraday Trans. 1 **76**: 417–25 (1980).

80B021 The triplet-triplet absorption of cyclohexadiene-1,3 and ergosterol. Sensitized total ground state depletion of dienes by triplet energy transfer from the ruby laser excited 2-fluorenylphenylketone. Toth, M. Chem. Phys. **46**: 437–43 (1980).

80B023 Nanosecond laser photolysis of the benzene monomer and eximer. Nakashima, N.; Sumitani, M.; Ohmine, I.; Yoshihara, K. J. Chem. Phys. **72**: 2226–30 (1980).

80B030 Laser flash photolysis investigation of primary processes in the sensitized polymerization of vinyl monomers. IV. Experiments with hydroxy alkylphenones. Eichler, J.; Herz, C.P.; Naito, I.; Schnabel, W. J. Photochem. **12**: 225–34 (1980).

80B055 Transient species in photochemistry of enones. The orthogonal triplet state revealed by laser photolysis. Bonneau, R. J. Am. Chem. Soc. **102**: 3816–22 (1980).

80B057 Protolytic reactions of acridine in the triplet state. Nishida, Y.; Kikuchi, K.; Kokubun, H. J. Photochem. **13**: 75–81 (1980).

80B066 Mechanistic studies of photochemical reactions of N-ethylphthalimide with olefins. Hayashi, H.; Nagakura, S.; Kubo, Y.; Maruyama, K. Chem. Phys. Lett. **72**: 291–4 (1980).

80B076 Photophysics and ionic photodissociation of polyesters with pendant 1-pyrenyl groups in solution. Masuhara, H.; Ohwada, S.; Seki, Y.; Mataga, N.; Sato, K.; Tazuke, S. Photochem. Photobiol. **32**: 9–15 (1980).

80B077 Intermediates in the room temperature flash photolysis and low temperature photolysis of purine solutions. Arce, R.; Jimenez, L.A.; Rivera, V.; Torres, C. Photochem. Photobiol. **32**: 91–5 (1980).

80B084 Nonradiative relaxation process of the higher excited states of meso-substituted anthracenes. Hamanoue, K.; Hirayama, S.; Nakayama, T.; Teranishi, H. J. Phys. Chem. **84**: 2074–8 (1980).

80B087 Direct observation of the 1,4-biradical of benzophenone with cis-3-methyl-2-pentene excited by the fourth harmonic of a Nd:YAG laser. Hayashi, H. Bull. Chem. Soc. Jpn. **53**: 2201–4 (1980).

80B088 Laser-photolysis study of biradical formation from the triplet state of 2,4,6-triisopropylbenzophenone. Hayashi, H.; Nagakura, S.; Ito, Y.; Umehara, Y.; Matsuura, T. Chem. Lett. : 939–42 (1980).

80B090 Extinction coefficients and quantum yields for triplet-triplet absorption using laser flash photolysis. Compton, R.H.; Grattan, K.T.V.; Morrow, T. J. Photochem. **14**: 61–6 (1980).

80B101 Laser flash photolysis study of substituted azobenzenes. Evidence for a triplet state in viscous media. Goerner, H.; Gruen, H.; Schulte-Frohlinde, D. J. Phys. Chem. **84**: 3031–9 (1980).

80B112 Assignment of transient species observed on laser flash photolysis of p-benzoquinone and methylated p-benzoquinones in aqueous solution. Ronfard-Haret, J.-C.; Bensasson, R.V.; Amouyal, E. J. Chem. Soc., Faraday Trans. 1 **76**: 2432–6 (1980).

80B130 Triplet-triplet absorption of aza- and diazaphenanthrenes. Petrov, S.N.; Bocherkov, A.I.; Shatrov, V.D.; Kuznetsov, V.S.; Batekha, I.G.; El'tsov, A.V. Zh. Prikl. Spektrosk. **33**: 675–9 (1980).

80C005 Effect of pH on the behavior of duroquinone triplets. Scaiano, J.C.; Neta, P. J. Am. Chem. Soc. **102**: 1608–11 (1980).

80E023 Two-photon stepwise dissociation of carbazole in solution. Martin, M.; Breheret, E.; Tfibel, F.; Lacourbas, B. J. Phys. Chem. **84**: 70–2 (1980).

80E040 Lifetimes, spectra, and quenching of the excited states of polypyridine complexes of iron(II), ruthenium(II), and osmium(II). Creutz, C.; Chou, M.; Netzel, T.L.; Okumura, M.; Sutin, N. J. Am. Chem. Soc. **102**: 1309–19 (1980).

80E137 Visual pigments. 11. Spectroscopy and photophysics of retinoic acids and all-trans-methyl retinoate. Takemura, T.; Chihara, K.; Becker, R.S.; Das, P.K.; Hug, G.L. J. Am. Chem. Soc. **102**: 2604–9 (1980).

80E156 Photophysical properties of aminomethylpsoralen in presence and absence of DNA. Salet, C.; De Sa E Melo, T.M.; Bensasson, R.; Land, E.J. Biochim. Biophys. Acta **607**: 379–83 (1980).

80E200 Triplet states of porphyrin esters. Bonnett, R.; Charalambides, A.A.; Land, E.J.; Sinclair, R.S.; Tait, D.; Truscott, T.G. J. Chem. Soc., Faraday Trans. 1 **76**: 852–9 (1980).

80E230 Spectral and electrical investigations of triplet excitons on pulsed electron excitation of molecular crystals. Kostin, A.K.; Vannikov, A.V. Radiat. Phys. Chem. **15**: 613–6 (1980).

80E234 Intersystem crossing of nitroanthracene derivatives studied by picosecond spectroscopy. Hamanoue, K.; Hirayama, S.; Nakayama, T.; Teranishi, H. Chem. Lett. : 407–10 (1980).

80E318 Excited state interaction between 2-N,N-dimethylaminopyridine and p-nitroaniline. Wolleben, J.; Testa, A.C. J. Photochem. **13**: 215–21 (1980).

80E361 Circular dichroism of chiral molecules in the lowest excited triplet state. Tetreau, C.; Lavalette, D. Nouv. J. Chim. **4**: 423–5 (1980).

80E375 Excited state properties of 5H-dibenzo(a,d)cycloheptene. Watkins, A.R.; Bayrakceken, F. J. Lumin. **21**: 239–46 (1980).

80E405 Low-lying electronically excited states of cycl[3.3.3]azine, a bridged 12π-perimeter. Leupin, W.; Wirz, J. J. Am. Chem. Soc. **102**: 6068–75 (1980).

80E416 Benzophenone triplet properties in acetonitrile and water. Reduction by lactams. Bensasson, R.V.; Gramain, J.-C. J. Chem. Soc., Faraday Trans. 1 **76**: 1801–10 (1980).

80E438 Studies of excited state absorption of the dye p-phenylene-bis-(5-phenyl-2-oxazole) in liquid solution and in the vapour phase. Marowsky, G.; Schomburg, H. J. Photochem. **14**: 1–10 (1980).

80E439 Quenching of excited 2,5-diphenyloxazole by CCl_4. Takahashi, T.; Kikuchi, K.; Kokubun, H. J. Photochem. **14**: 67–76 (1980).

80E441 Laser photochemistry of poly(N-vinylcarbazole) in solution. Masuhara, H.; Ohwada, S.; Mataga, N.; Itaya, A.; Okamoto, K.; Kusabayashi, S. J. Phys. Chem. **84**: 2363–8 (1980).

80E593 The photophysics of bonellin: A chlorin found in marine animals. Matthews, J.I.; Braslavsky, S.E.; Camilleri, P. Photochem. Photobiol. **32**: 733–8 (1980).

80E642 On the photolysis of hydroxy alkylphenones and O-substituted derivatives. Laser flash photolysis and photocuring studies. Eichler, J.; Herz, C.P.; Schnabel, W. Angew. Makromol. Chem. **91**: 39–54 (1980).

80E720 Polymeric charge-transfer complexes based on poly(vinyl alcohol acetal)s. 2. Geissler, U.; Schulz, R.C. Makromol. Chem. **181**: 1483–94 (1980).

80E778 Kinetic investigation of triplet exciplexes of phenazine and its mono-, di-, and tetrabenzo derivatives with an electron donor. Osipov, V.V.; Usacheva, M.N.; Dilung, I.I. Dokl. Phys. Chem. **254**: 765–8 (1980) Translated from: Dokl. Akad. Nauk SSSR **254**: 407–10 (1980).

80E867 Migration of electron excitation energy with involvement of excited acceptor molecules. Gurinovich, G.P.; Zen'kevich, E.I.; Sagun, E.I. Bull. Acad. Sci. USSR, Phys. Ser. **44**: 7–13 (1980) Translated from: Izv. Akad. Nauk SSSR, Ser. Fiz. **44**: 693–701 (1980).

80E884 Nanosecond laser photolysis and the time resolved absorption spectra of organic molecules. Nakayama, T.; Miyake, T.; Okamoto, M.; Hamanoue, K.; Teranishi, H. Mem. Fac. Ind. Arts, Kyoto Tech. Univ. Sci. Technol. **29**: 35–45 (1980).

80F001 Laser-induced two-photon ionization of acridine in aqueous solution. Kellmann, A.; Tfibel, F. Chem. Phys. Lett. **69**: 61–5 (1980).

80F299 Singlet and triplet states in the cis-trans photoisomerization of 4-cyanostilbenes in solution. Goerner, H. J. Photochem. **13**: 269–94 (1980).

80F372 Photochemical transformations of cis-1,2-dibenzoylalkenes. Lahiri, S.; Dabral, V.; Chauhan, S.M.S.; Chakachery, E.; Kumar, C.V.; Scaiano, J.C.; George, M.V. J. Org. Chem. **45**: 3782–90 (1980).

80F373 Role of proflavin as a photosensitizer for the light-induced hydrogen evolution from water. Kalyanasundaram, K.; Dung, D. J. Phys. Chem. **84**: 2251–6 (1980).

80N033 Interfacial electron transfer involving radical ions of carotene and diphenylhexatriene in micelles and vesicles. Almgren, M.; Thomas, J.K. Photochem. Photobiol. **31**: 329–35 (1980).

80N035 Zinc-porphyrin sensitized reduction of simple and functional quinones in vesicle systems. Pileni, M.-P. Chem. Phys. Lett. **71**: 317–21 (1980).

80N044 Light-driven redox processes in functional micellar units. III. Zn-tetraphenylporphyrin sensitized reactions in methyl viologene surfactant assemblies. Pileni, M.-P.; Braun, A.M.; Graetzel, M. Photochem. Photobiol. **31**: 423–7 (1980).

80N057 Chlorophyll a sensitized redox processes in microemulsion systems. Kiwi, J.; Graetzel, M. J. Phys. Chem. **84**: 1503–7 (1980).

80N064 Laser photolysis studies of the light-induced formation of spiropyran-merocyanine complexes in solution. Krongauz, V.; Kiwi, J.; Graetzel, M. J. Photochem. **13**: 89–97 (1980).

80N087 Zinc porphyrin sensitized reduction of simple and functional quinones in micellar systems. Pileni, M.-P.; Graetzel, M. J. Phys. Chem. **84**: 1822–5 (1980).

80N112 Light-induced redox reactions of proflavin in aqueous and micellar solution. Pileni, M.-P.; Graetzel, M. J. Phys. Chem. **84**: 2402–6 (1980).

80N143 Zinc porphyrin sensitized redox processes in microemulsions. Pileni, M.-P. Chem. Phys. Lett. **75**: 540–4 (1980).

81A024 The flavin sensitised photooxidation of ascorbic acid: A continuous and flash photolysis study. Heelis, P.F.; Parsons, B.J.; Phillips, G.O.; McKellar, J.F. Photochem. Photobiol. **33**: 7–13 (1981).

81A140 Triplet state of 5-nitro-2-furoic acid by laser flash photolysis. Spectrum, lifetime and reactivity. Kemp, T.J.; Martins, L.J.A. J. Chem. Soc., Faraday Trans. 1 **77**: 1425–35 (1981).

81A174 Laser flash photolysis study of the reactions of carbonyl triplets with phenols and photochemistry of p-hydroxypropiophenone. Das, P.K.; Encinas, M.V.; Scaiano, J.C. J. Am. Chem. Soc. **103**: 4154–62 (1981).

81A232 The photophysical and photochemical processes of tryptophan in interaction with polynucleotides: Laser flash photolysis study. Doan, T.L.; Toulme, J.J.; Santus, R.; Helene, C. Photochem. Photobiol. **34**: 309–13 (1981).

81A294 On the photoinitiation of free radical polymerization. Laser flash photolysis investigations on thioxanthone derivatives. Amirzadeh, G.; Schnabel, W. Makromol. Chem. **182**: 2821–35 (1981).

81A314 Quenching, radical formation, and disproportionation in the photoreduction of 4-carboxybenzophenone by 4-carboxybenzhydrol, hydrazine, and hydrazinium ion. Inbar, S.; Linschitz, H.; Cohen, S.G. J. Am. Chem. Soc. **103**: 7323–8 (1981).

81A345 Mechanism of photoreduction of 1- and 4-azoniaphenanthrene by dimethylformamide and phenol. Ivanov, V.L.; Al'-Ainen, S.A.; Kuz'min, M.G. J. Org. Chem. USSR **17**: 720–5 (1981) Translated from: Zh. Org. Khim. **17**: 822–7 (1981).

81A347 Photoinduced electron ejection from methylene blue in water and acetonitrile. Kamat, P.V.; Lichtin, N.N. J. Phys. Chem. **85**: 3864–8 (1981).

81A390 Investigation of photochemical processes involving acridone and its derivatives in ethanol solutions by flash photolysis. Shcherbo, S.N.; Val'kova, G.A.; Shigorin, D.N. Russ. J. Phys. Chem. **55**: 286–7 (1981) Translated from: Zh. Fiz. Khim. **55**: 509–10 (1981).

81A404 Time-resolved spectroscopy of carbonyl compounds. Lougnot, D.J.; Merlin, A.; Salvin, R.; Fouassier, J.P.; Faure, J. Nuovo Cimento Soc. Ital. Fis. B **63B**: 284–94 (1981).

81A434 Structure and properties of 5-deazaflavin radicals as compared to natural flavosemiquinones. Goldberg, M.; Pecht, I.; Kramer, H.E.A.; Traber, R.; Hemmerich, P. Biochim. Biophys. Acta **673**: 570–93 (1981).

81B008 Time-resolved resonance Raman spectroscopy: The triplet state of all-trans-retinal. Wilbrandt, R.; Jensen, N.-H. J. Am. Chem. Soc. **103**: 1036–41 (1981).

81B032 Transient photochemistry of Safranin-O. Baumgartner, C.E.; Richtol, H.H.; Aikens, D.A. Photochem. Photobiol. **34**: 17–22 (1981).

81B064 Time-resolved spectroscopy and chemical reactivity of energetic transient species of nitroaromatics. Capellos, C. J. Photochem. **17**: 213–25 (1981).

81B094 Triplet-triplet electronic absorption spectroscopy using a Fourier transform infrared spectrometer. Baiardo, J.; Mukherjee, R.; Vala, M. Appl. Spectrosc. **35**: 510–1 (1981).

81B097 Vibrational spectroscopy of the electronically excited state. 4. Nanosecond and picosecond time-resolved resonance Raman spectroscopy of carotenoid excited states. Dallinger, R.F.; Farquharson, S.; Woodruff, W.H.; Rodgers, M.A.J. J. Am. Chem. Soc. **103**: 7433–40 (1981).

81B111 Near infra-red absorption spectra of the chlorophyll a cations and triplet state in vitro and in vivo. Mathis, P.; Setif, P. Isr. J. Chem. **21**: 316–20 (1981).

81B115 Laser flash photolysis of the hematoporphyrin-β-carotene system. Poletti, A.; Murgia, S.M.; Cannistraro, S. Photobiochem. Photobiophys. **2**: 167–72 (1981).

81B119 Nature of the triplet-triplet transitions in various many fragment molecules. Glagolev, V.L.; Pomazan, Yu.V.; Shamshev, V.N. Opt. Spectrosc. (USSR) **50**: 86–9 (1981) Translated from: Opt. Spektrosk. **50**: 165–70 (1981).

81E015 "Fast" triplet excimer formation in fluid solutions of dinaphthylalkanes. Webster, D.; Baugher, J.F.; Lim, B.T.; Lim, E.C. Chem. Phys. Lett. **77**: 294–8 (1981).

81E016 Enhanced phosphorescence in intramolecular exciplex systems. Hatano, Y.; Yamamoto, M.; Nishijima, Y. Chem. Phys. Lett. **77**: 299–303 (1981).

81E042 Photophysical properties of nucleic acid components. II. Effect of N,N' dimethyl substitution on intersystem crossing in pyrimidine bases. Becker, R.S.; Bensasson, R.V.; Salet, C. Photochem. Photobiol. **33**: 115–6 (1981).

81E082 Photophysics of indole. Comparative study of quenching, solvent, and temperature effects by laser flash photolysis and fluorescence. Klein, R.; Tatischeff, I.; Bazin, M.; Santus, R. J. Phys. Chem. **85**: 670–7 (1981).

81E084 Properties of excited tetrakis(sulfonatophenyl)porphyrin in aqueous solutions. Photoredox reactions with quenchers. Nahor, G.S.; Rabani, J.; Grieser, F. J. Phys. Chem. **85**: 697–702 (1981).

81E091 Triplet absorption and phosphorescence emission in zinc cytochrome c. Dixit, S.N.; Waring, A.J.; Vanderkooi, J.M. FEBS Lett. **125**: 86–8 (1981).

81E098 The electronic triplet state of a peralkylated cyclobutadiene. Wirz, J.; Krebs, A.; Schmalstieg, H.; Angliker, H. Angew. Chem., Int. Ed. Engl. **20**: 192–3 (1981).

81E147 Relaxation mechanism of excited acridine in nonreactive solvents. Kasama, K.; Kikuchi, K.; Yamamoto, S.; Uji-ie, K.; Nishida, Y.; Kokubun, H. J. Phys. Chem. **85**: 1291–6 (1981).

81E149 Reactions of the excited singlet state of pyrene with metal ions. Intermolecular electron transfer in caffeine-solubilized aqueous solution. Nosaka, Y.; Kira, A.; Imamura, M. J. Phys. Chem. **85**: 1353–8 (1981).

81E151 Photophysical and photosensitizing properties of 2-amino-4 pteridinone: A natural pigment. Chahidi, C.; Aubailly, M.; Monzikoff, A.; Bazin, M.; Santus, R. Photochem. Photobiol. **33**: 641–9 (1981).

81E214 Observation of the triplet state of stilbene in fluid solution. Determination of the equilibrium constant ($^3t^* \rightleftharpoons {}^3p^*$) and of the rate constant for intersystem crossing ($^3p^* \rightarrow {}^1p$). Goerner, H.; Schulte-Frohlinde, D. J. Phys. Chem. **85**: 1835–41 (1981).

81E222 Intersystem crossing and lowest triplet sates of 4-chromanone, chromone, and flavone. Hamanoue, K.; Nakayama, T.; Miyake, T.; Teranishi, H. Chem. Lett. : 39–42 (1981).

81E271 Luminescence of porphyrins and metalloporphyrins. Part 3. Heavy-atom effects. Harriman, A. J. Chem. Soc., Faraday Trans. 2 **77**: 1281–91 (1981).

81E309 Picosecond triplet state dynamics and photodissociation in 2- and 9-iodoanthracene. Pineault, R.L.; Morgante, C.G.; Struve, W.S. J. Photochem. **17**: 435–49 (1981).

81E346 The triplet state energies of rubrene and diphenylisobenzofuran. Herkstroeter, W.G.; Merkel, P.B. J. Photochem. **16**: 331–41 (1981).

81E442 Photochemistry in solution. XX. Triplet reactivity of aliphatic aldehydes. Kossanyi, J.; Sabbah, S.; Chaquin, P.; Ronfart-Haret, J.C. Tetrahedron **37**: 3307–15 (1981).

81E457 Laser flash photolysis of phthalocyanines in solution and microemulsion. Jacques, P.; Braun, A.M. Helv. Chim. Acta **64**: 1800–6 (1981).

81E490 Analysis of the decay of 1-phenyl-2-(2-naphthyl)ethene triplets. A nanosecond laser pulse study. Goerner, H.; Eaker, D.W.; Saltiel, J. J. Am. Chem. Soc. **103**: 7164–9 (1981).

81E508 Quenching of the triplet state of poly(2-vinylnaphthalene) in solution: Effect of molecular weight. Pratte, J.F.; Noyes, W.A.,Jr.; Webber, S.E. Polym. Photochem. **1**: 3–13 (1981).

81E552 Deactivation mechanism of excited acridine and 9-substituted acridines in water. Kasama, K.; Kikuchi, K.; Nishida, Y.; Kokubun, H. J. Phys. Chem. **85**: 4148–53 (1981).

81E639 Investigation of the mechanism of photoisomerization by the trans-thioindigo method of picosecond flash photolysis. Krysanov, S.A.; Alfimov, M.V. Dokl. Phys. Chem. **258**: 460–2 (1981) Translated from: Dokl. Akad. Nauk SSSR **258**: 665–8 (1981).

81E648 Spectroscopic study of the triplet states of organoelemental derivatives of fluorene. Davydov, S.N.; Rodionov, A.N.; Shigorin, D.N.; Syutkina, O.P.; Krasnova, T.L. Russ. J. Phys. Chem. **55**: 444–5 (1981) Translated from: Zh. Fiz. Khim. **55**: 784–7 (1981).

81E649 Determination of the energies of the highly excited triplet states of derivatives of acridinone, linear quinacridinone, and phenanthridinone. Shcherbo, S.N.; Val'kova, G.A.; Shigorin, D.N. Russ. J. Phys. Chem. **55**: 452–3 (1981) Translated from: Zh. Fiz. Khim. **55**: 795–7 (1981).

81E650 The influence of the relative positions of the chromophoric groups on the luminescence-spectroscopic and photochemical properties of compounds with heteroatoms. Val'kova, G.A.; Sakhno, T.V.; Shigorin, D.N.; Andrievskii, A.M.; Poplavskii, A.N. Russ. J. Phys. Chem. **55**: 459–60 (1981) Translated from: Zh. Fiz. Khim. **55**: 803–5 (1981).

81E715 Effect of structure of donor and acceptor on kinetic spectral characteristics of triplet exciplexes. Levin, P.P. Bull. Acad. Sci. USSR, Div. Chem. Sci. **30**: 1970–2 (1981) Translated from: Izv. Akad. Nauk SSSR, Ser. Khim. : 2390–2 (1981).

81E716 Laser photolysis of rubrene. Darmanyan, A.P.; Kuz'min, V.A. Dokl. Phys. Chem. **260**: 938–41 (1981) Translated from: Dokl. Akad. Nauk SSSR **260**: 1167–70 (1981).

81E786 A study of the electronic states of iridium(III) complexes containing 1,10-phenanthroline ligands. The contribution of a dd excited state to the lowest triplet state. Ohashi, Y. Bull. Chem. Soc. Jpn. **54**: 3673–6 (1981).

81F070 The mechanism of the photo-induced decarboxylation of pyruvic acid in solution. Davidson, R.S.; Goodwin, D.; Fornier de Violet, Ph. Chem. Phys. Lett. **78**: 471–4 (1981).

81F111 Flash photolytic studies on the photoconversion of aryl vinyl ethers to dihydrofurans. Wolff, T. J. Org. Chem. **46**: 978–83 (1981).

81F121 Probing of chlorophyll a with a pulsed tunable laser: Monomer and dimer excited state lifetimes and their time resolved fluorescence spectra. Asano, M.; Koningstein, J.A. Chem. Phys. **57**: 1–10 (1981).

81F130 Photochemistry of anthraquinone-2,6-disodium sulphonate in aqueous solution. Harriman, A.; Mills, A. Photochem. Photobiol. **33**: 619–25 (1981).

81F201 Photodissociation reaction from higher excited triplet states of [2.2]paracyclophane. Ishikawa, S.; Nakamura, J.; Nagakura, S. Bull. Chem. Soc. Jpn. **54**: 685–6 (1981).

81F275 Observation of a triplet state of azulene generated by energy transfer in solution. Goerner, H.; Schulte-Frohlinde, D. J. Photochem. **16**: 169–77 (1981).

81F315 Mechanism and efficiency of photochemical attachment of aliphatic hydrocarbons to triphenylene in rigid solutions at 77 K. Lamotte, M. J. Phys. Chem. **85**: 2632–6 (1981).

81F390 Photochemical and thermal rearrangements of a benzoylnaphthobarrelene-like system. Demuth, M.; Amrein, W.; Bender, C.O.; Braslavsky, S.E.; Burger, U.; George, M.V.; Lemmer, D.; Schaffner, K. Tetrahedron **37**: 3245–61 (1981).

81N016 Static and dynamic phenomena in the quenching of phenanthrene triplets by conjugated dienes in anionic micelles. Selwyn, J.C.; Scaiano, J.C. Can. J. Chem. **59**: 663–8 (1981).

81N034 Reaction photoredox de la tetraphenyl porphyrine de zinc en solution dans le triton. Pradevan, G.-O.; Pileni, M.-P. J. Chim. Phys. Phys.-Chim. Biol. **78**: 203–5 (1981).

81N070 Dynamics and statistics of triplet-triplet annihilation in micellar assemblies. Rothenberger, G.; Infelta, P.P.; Graetzel, M. J. Phys. Chem. **85**: 1850–6 (1981).

81N156 Photochemical processes of benzophenone in microheterogeneous systems. Braun, A.M.; Krieg, M.; Turro, N.J.; Aikawa, M.; Gould, I.R.; Graf, G.A.; Lee, P.C.-C. J. Am. Chem. Soc. **103**: 7312–6 (1981).

81P245 Laser photochemistry of polymers having 1,2-trans-dicarbazolylcyclobutane groups in solution. Masuhara, H.; Shioyama, H.; Mataga, N.; Inoue, T.; Kitamura, N.; Tanabe, T.; Tazuke, S. Macromolecules **14**: 1738–42 (1981).

82A006 The triplet state of anthracene photodimers and the wavelength dependence of the photodissociation process. Yamamoto, S.; Grellmann, K.-H. Chem. Phys. Lett. **85**: 73–80 (1982).

82A082 Anion-induced triplet quenching of aromatic ketones by nanosecond laser photolysis. Shizuka, H.; Obuchi, H. J. Phys. Chem. **86**: 1297–302 (1982).

82A138 Primary processes in the photochemistry of aqueous sulphacetamide: A laser flash photolysis and pulse radiolysis study. Land, E.J.; Navaratnam, S.; Parsons, B.J.; Phillips, G.O. Photochem. Photobiol. **35**: 637–42 (1982).

82A152 Pulsed irradiation of water-soluble porphyrins. Bonnet, R.; Ridge, R.J.; Land, E.J.; Sinclair, R.S.; Tait, D.; Truscott, T.G. J. Chem. Soc., Faraday Trans. 1 **78**: 127–36 (1982).

82A153 Triplet state of 2-nitrothiophen. A laser flash-photolysis study. Martins, L.J.A.; Kemp, T.J. J. Chem. Soc., Faraday Trans. 1 **78**: 519–31 (1982).

82A154 Electron-transfer reactions of the 2-nitrothiophen triplet state studied by laser flash photolysis. Martins, L.J.A. J. Chem. Soc., Faraday Trans. 1 **78**: 533–43 (1982).

82A190 Cis $\rightleftharpoons$ trans photoisomerization of thioindigoid dyes. Klages, C.P.; Kobs, K.; Memming, R. Chem. Phys. Lett. **90**: 46–50 (1982).

82A205 Primary intermediates in the pulsed irradiation of retinoids. Lo, K.K.N.; Land, E.J.; Truscott, T.G. Photochem. Photobiol. **36**: 139–45 (1982).

82A259 Triplet state of 1,10-phenanthroline and benzophenone in benzene studied by pulse radiolysis. Teply, J.; Mehnert, R.; Brede, O.; Fojtik, A. Radiochem. Radioanal. Lett. **53**: 141–51 (1982).

82A288 Photokinetic aspects of specific hydrogen bonding in all-trans retinal at room temperature. Das, P.K.; Hug, G.L. Photochem. Photobiol. **36**: 455–61 (1982).

82A290 Electron transfer in the quenching of triplet states of zinc phthalocyanine and methylene blue by the use of Fe(III), Co(III), and organic oxidants. Ohno, T.; Kato, S.; Lichtin, N.N. Bull. Chem. Soc. Jpn. **55**: 2753–9 (1982).

82A292 Effect of conformation on ring opening of cis and trans dimers of acenaphthylene in the triplet state. Direct detection of hydrocarbon biradical, 1,1′-biacenaphthene-2,2′-diyl. Kobashi, H.; Ikawa, H.; Kondo, R.; Morita, T. Bull. Chem. Soc. Jpn. **55**: 3013–8 (1982).

82A297 Sensitized photoreduction of nitrate in homogeneous and micellar solutions. Frank, A.J.; Graetzel, M. Inorg. Chem. **21**: 3834–7 (1982).

82A306 Kinetics and mechanism of porphyrin-photosensitized reduction of methylviologen. Rougee, M.; Ebbesen, T.; Ghetti, F.; Bensasson, R.V. J. Phys. Chem. **86**: 4404–12 (1982).

82A365 Tris(2,2′-bipyridine)ruthenium(II)-sensitized photooxidation of phenols. Environmental effects on electron transfer yields and kinetics. Miedlar, K.; Das, P.K. J. Am. Chem. Soc. **104**: 7462–9 (1982).

82B014 Substituent effect on a photo-Smiles rearrangement by laser photolysis. Yokoyama, K.; Nakamura, J.; Mutai, K.; Nagakura, S. Bull. Chem. Soc. Jpn. **55**: 317–8 (1982).

82B043 Deazaflavin photocatalyzed methyl viologen reduction in water. A laser flash-photolysis study. Visser, A.J.W.G.; Fendler, J.H. J. Phys. Chem. **86**: 2406–9 (1982).

82B045 Photochemical reactions of triplet acetone with indole, purine, and pyrimidine derivatives. Kasama, K.; Takematsu, A.; Arai, S. J. Phys. Chem. **86**: 2420–7 (1982).

82B052 Comment on the publication of transient spectra obtained using flash techniques. Scaiano, J.C. J. Photochem. **18**: 395–6 (1982).

82B057 Detection of the triplet-triplet absorption of 1,3-dienes by pulse radiolysis. Gorman, A.A.; Gould, I.R.; Hamblett, I. J. Photochem. **19**: 89–94 (1982).

82B094 Mimicry of carotenoid function in photosynthesis: Synthesis and photophysical properties of a carotenopyropheophorbide. Liddell, P.A.; Nemeth, G.A.; Lehman, W.R.; Joy, A.M.; Moore, A.L.; Bensasson, R.V.; Moore, T.A.; Gust, D. Photochem. Photobiol. **36**: 641–5 (1982).

82B102 Laser flash studies of the photochemistry of anthrone. Scaiano, J.C.; Lee, C.W.B.; Chow, Y.L.; Buono-Core, G.E. J. Photochem. **20**: 327–34 (1982).

82B106 Triplet-triplet transitions of the rhodamine 6G molecule. Kuznetsov, V.A.; Shamraev, V.N.; Nurmukhametov, R.N. Opt. Spectrosc. (USSR) **52**: 501–3 (1982) Translated from: Opt. Spektrosk. **52**: 838–41 (1982).

82B118 A flash photolysis study of hematoporphyrin IX in neutral, aqueous and ethanolic solutions. Murgia, S.M.; Pasqua, A.; Poletti, A. Photobiochem. Photobiophys. **4**: 329–36 (1982).

82B121 Laser system and data analysis techniques for adsorbing and non-adsorbing excited transients. O'Dowd, R.F.; O'Hare, A.; Cooke, J.; Taaffe, J.K. J. Phys. E **15**: 736–40 (1982).

82C018 Excited-state redox properties of ruthenium(II) phthalocyanine from electron-transfer quenching. Prasad, D.R.; Ferraudi, G. J. Phys. Chem. **86**: 4037–40 (1982).

82E041 Laser photolysis studies of spiropyran-merocyanine aggregate formation in solution. Kalisky, Y.; Williams, D.J. Chem. Phys. Lett. **86**: 100–4 (1982).

82E129 Radiationless intermolecular energy transfer with participation of acceptor excited triplet states. Gurinovich, G.P.; Zenkevich, E.I.; Sagun, E.I. J. Lumin. **26**: 297–317 (1982).

82E133 Some properties of the triplet excited state of the photosensitizing furocoumarin: 3-carbethoxypsoralen. Ronfard-Haret, J.C.; Averbeck, D.; Bensasson, R.V.; Bisagni, E.; Land, E.J. Photochem. Photobiol. **35**: 479–89 (1982).

82E174 Photoprotection by carotenoids during photosynthesis: Motional dependence of intramolecular energy transfer. Moore, A.L.; Joy, A.; Tom, R.; Gust, D.; Moore, T.A.; Bensasson, R.V.; Land, E.J. Science **216**: 982–4 (1982).

82E181 Intersystem crossing in styrene and styrene derivatives. Bonneau, R. J. Am. Chem. Soc. **104**: 2921–3 (1982).

82E204 Triplet states of phenylethylenes in solution. Energies, lifetimes, and absorption spectra of 1,1-diphenyl-, triphenyl-, and tetraphenylethylene triplets. Goerner, H. J. Phys. Chem. **86**: 2028–35 (1982).

82E232 Electron transfer in the quenching of protonated triplet thionine and methylene blue by ground state thionine. Kamat, P.V.; Lichtin, N.N. J. Photochem. **18**: 197–209 (1982).

82E280 Electronic spectra of hexacene in solution (ground state, triplet state, dication and dianion). Angliker, H.; Rommel, E.; Wirz, J. Chem. Phys. Lett. **87**: 208–12 (1982).

82E287 Intramolecular singlet and triplet excimers with diphenanthrylpropanes. Zachariasse, K.A.; Busse, R.; Schrader, U.; Kuehnle, W. Chem. Phys. Lett. **89**: 303–8 (1982).

82E303 Intersystem crossing and predissociation of haloaromatics. Huppert, D.; Rand, S.D.; Reynolds, A.H.; Rentzepis, P.M. J. Chem. Phys. **77**: 1214–24 (1982).

82E338 Effect of substituent on the behaviour of the excited singlet and triplet states in carbonyl derivatives of anthracene of the type 9-X·CO·A. Hirayama, S. J. Chem. Soc., Faraday Trans. 1 **78**: 2411–21 (1982).

82E359 Nanosecond laser flash photolysis of 1-anilinonaphthalene. Nakamura, H.; Tanaka, J.; Nakashima, N.; Yoshihara, K. Bull. Chem. Soc. Jpn. **55**: 1795–7 (1982).

82E365 Photoprocesses in diphenylpolyenes. Oxygen and heavy-atom enhancement of triplet yields. Chattopadhyay, S.K.; Das, P.K.; Hug, G.L. J. Am. Chem. Soc. **104**: 4507–14 (1982).

82E373 Absorption triplet-triplet et cinetique de la desactivation du premier etat triplet de derives de l'amino-2-Δ^2-thiazoline. Corval, A.; Jardon, P.; Gautron, R. J. Chim. Phys. Phys.-Chim. Biol. **79**: 335–41 (1982).

82E429 Singlet mechanism for trans → cis photoisomerization of α,ω-diphenylpolyenes in solution: Laser flash study of the triplet states od diphenylbutadiene, diphenylhexatriene and diphenyloctatetraene. Goerner, H. J. Photochem. **19**: 343–56 (1982).

82E451 Generation of $^1O_2$ and the mechanism of internal conversion in 9,10-diphenylanthracene. Darmanyan, A.P. Chem. Phys. Lett. **91**: 396–400 (1982).

82E456 Properties of the triplet state of N,N,N',N'-tetraethyloxonine. Kamat, P.V.; Lichtin, N.N. Isr. J. Chem. **22**: 113–6 (1982).

82E474 Time-resolved resonance Raman spectra of the lowest triplet state of N,N,N',N'-tetramethyl-p-phenylenediamine in solution. Yokoyama, K. Chem. Phys. Lett. **92**: 93–6 (1982).

82E475 Solution photochemistry of o-hydroxybenzophenone at low temperatures. Scaiano, J.C. Chem. Phys. Lett. **92**: 97–9 (1982).

82E497 Picosecond laser photolysis studies of deactivation processes of excited hydrogen-bonding complexes. 2. Dibenzocarbazole-pyridine systems. Martin, M.M.; Ikeda, N.; Okada, T.; Mataga, N. J. Phys. Chem. 86(21); 4148–56 (1982).

82E509 Studies on triplet-singlet energy transfer with 1,3-dibromo-9,10-bis-[phenylethynyl]-anthracene. Fang, T.-S.; Lin, J.; Schneider, R.; Yamada, T.; Singer, L.A. Chem. Phys. Lett. **92**: 283–7 (1982).

82E527 Reactivity and decay pathways of photoexcited anilinonaphthalenes. Grellmann, K.H.; Schmitt, U. J. Am. Chem. Soc. **104**: 6267–72 (1982).

82E561 Relaxation mechanism of excited acridine in methyl methacrylate and poly(methyl methacrylate). Kasama, K.; Kikuchi, K.; Uji-ie, K.; Yamamoto, S.-A.; Kokubun, H. J. Phys. Chem. **86**: 4733–7 (1982).

82E614 Quenching of duroquinone by aromatic donors of electron and hydrogen atom. Levin, P.P.; Tatikolov, A.S.; Kuz'min, V.A. Bull. Acad. Sci. USSR, Div. Chem. Sci. **31**: 890–4 (1982) Translated from: Izv. Akad. Nauk SSSR, Ser. Khim. : 1005–10 (1982).

82E622 Photophysical and redox properties of water-soluble porphyrins in aqueous media. Kalyanasundaram, K.; Neumann-Spallart, M. J. Phys. Chem. **86**: 5163–9 (1982).

82E632 Triplet-triplet absorption of organic compounds lasing efficiently in the ultraviolet. Bolotko, L.M.; Gruzinskii, V.V.; Danilova, V.I.; Kopylova, T.N. Opt. Spectrosc. (USSR) **52**: 379–81 (1982) Translated from: Opt. Spektrosk. **52**: 635–8 (1982).

82E648 Quenching of phosphorescence of aromatic molecules through highly excited triplet states in solutions at 77°K by electron acceptors. Skvortsov, V.I.; Alfimov, M.V. Dokl. Phys. Chem. 263(1–3) 221–4 (1982) Translated from: Dokl. Akad. Nauk SSSR 263(3) 652–5 (1982).

82E680 Photochemical primary processes of xanthene dyes. I. Investigations of the primary processes of selenopyronine by flash excitation. Ortmann, W.; Kassem, A.; Hinzmann, S.; Fanghaenel, E. J. Prakt Chem. **324**: 1017–25 (1982).

82F150 Mechanistic and kinetic aspects of the photoinduced OCH_3 substitution in 3,5-dinitroanisole. A probe for solvent effects in thermal reactions. Varma, C.A.G.O.; Tamminga, J.J.; Cornelisse, J. J. Chem. Soc., Faraday Trans. 2 **78**: 265–84 (1982).

82F295 Photocatalytic cis→trans-isomerization of thioindigoid dyes. Klages, C.P.; Kobs, K.; Memming, R. Ber. Bunsenges. Phys. Chem. **86**: 716–20 (1982).

82F367 The adiabatic photodissociation of the anthracene-tetracene photodimer. Yamamoto, S.; Grellmann, K.-H. Chem. Phys. Lett. **92**: 533–40 (1982).

82F477 Fluorescence and triplet yield quenching of β-apo-14'-carotenal (C_{22} aldehyde) by aromatic molecules. Selvarajan, N.; Das, P.K.; Hug, G.L. J. Photochem. **20**: 355–66 (1982).

82F494 Effect of solvent polarity on the photoelimination of halogen in 9,10-dichloroanthracene by the action of amines. Soloveichik, O.M.; Klimakova, A.; Ivanov, V.L. J. Org. Chem. USSR **18**: 894–8 (1982) Translated from: Zh. Org. Khim. **18**: 1033–8 (1982).

82F498 Study of the trans→cis photoisomerization of 4-nitro-4'-dimethylaminostilbene in toluene solutions. Goerner, H.; Schulte-Frohlinde, D. J. Mol. Struct. **84**: 227–36 (1982).

82N068 Light-driven electron transfer from tetrathiafulvalene to porphyrins and $Ru(bpy)_3^{2+}$. Charge separation by organized assemblies. Graetzel, C.K.; Graetzel, M. J. Phys. Chem. **86**: 2710–4 (1982).

82N081 Enhancement of the intersystem crossing of pyrene by metal ions in sodium dodecyl sulfate micelle solutions. Nakamura, T.; Kira, A.; Imamura, M. J. Phys. Chem. **86**: 3359–63 (1982).

82N210 Laser flash photolysis studies on hematoporphyrin IX in aqueous and micellar systems. Murgia, S.M.; Poletti, A.; Pasqua, A. Med., Biol., Environ. **10**: 279–84 (1982).

82P060 Novel and efficient water-soluble photoinitiator for polymerization. Bonamy, A.; Fouassier, J.P.; Lougnot, D.J.; Green, P.N. J. Polym. Sci., Polym. Lett. Ed. **20**: 315–20 (1982).

82R150 Probing the microenvironment of benzo[a]pyrene diol epoxide-DNA adducts by triplet excited state quenching methods. Poulos, A.T.; Kuzmin, V.; Geacintov, N.E. J. Biochem. Biophys. Methods **6**: 269–81 (1982).

83A102 Mechanism of porphyrin ion production from the triplet state of magnesium octaethylporphyrin. Smalley, J.F.; Feldberg, S.W.; Brunschwig, B.S. J. Phys. Chem. **87**: 1757–65 (1983).

83A213 A flash photolysis study of 1-methylindole. Pepmiller, C.; Bedwell, E.; Kuntz, R.R.; Ghiron, C.A. Photochem. Photobiol. **38**: 273–80 (1983).

83A218 Laser-photolysis study of the photochemical primary processes of hydrogermanes in solution. Hayashi, H.; Mochida, K. Chem. Phys. Lett. **101**: 307–11 (1983).

83A225 On the photochemical synthesis of N,N′-dimethylindolo-[2,3-c]carbazole and the mechanism of its formation from N,N′-dimethyl-N,N′-diphenyl-1,4-phenylenediamine. Weller, H.; Grellmann, K.-H. J. Am. Chem. Soc. **105**: 6268–73 (1983).

83A249 Hydrogen-atom transfer reaction from triplet 2-naphthylammonium ion to ground-state aromatic ketones. Shizuka, H.; Fukushima, M. Chem. Phys. Lett. **101**: 598–602 (1983).

83A355 Mechanism of photoisomerization of thioindigoid dyes. Krysanov, S.A.; Alfimov, M.V. Dokl. Phys. Chem. **272**: 696–9 (1983) Translated from: Dokl. Akad. Nauk SSSR **272**: 637–40 (1983).

83B030 Transient absorption study of the intramolecular excited-state and ground-state proton transfer in 3-hydroxyflavone and 3-hydroxychromone. Itoh, M.; Tanimoto, Y.; Tokumura, K. J. Am. Chem. Soc. **105**: 3339–40 (1983).

83B041 Photo-oxidation of 1,4-dihydropyridines by various electron acceptors: A laser flash photolysis study. Martens, F.M.; Verhoeven, J.W.; Varma, C.A.G.O.; Bergwerf, P. J. Photochem. **22**: 99–113 (1983).

83B054 Photochemistry of 9,10-anthraquinone-2-sulfonate in solution. 1. Intermediates and mechanism. Loeff, I.; Treinin, A.; Linschitz, H. J. Phys. Chem. **87**: 2536–44 (1983).

83B067 Actinometry in monochromatic flash photolysis: The extinction coefficient of triplet benzophenone and quantum yield of triplet zinc tetraphenyl porphyrin. Hurley, J.K.; Sinai, N.; Linschitz, H. Photochem. Photobiol. **38**: 9–14 (1983).

83B068 The characterisation of the triplet state of crocetin, a water soluble carotenoid, by nanosecond laser flash photolyses. Craw, M.; Lambert, C. Photochem. Photobiol. **38**: 241–3 (1983).

83B098 The electronic absorption spectrum and structure of the emitting state of the tris(2,2′-bipyridyl)ruthenium(II) complex ion. Braterman, P.S.; Harriman, A.; Heath, G.A.; Yellowlees, L.J. J. Chem. Soc., Dalton Trans. : 1801–3 (1983).

83B112 Photoionization and triplet-triplet absorption of 4-pyrrolidinopyridine. Santos, O.; Testa, A.C.; O'Sullivan, M. J. Photochem. **23**: 369–77 (1983).

83B113 Two-step laser excitation fluorescence study of the ground- and excited-state proton transfer in 3-hydroxyflavone and 3-hydroxychromone. Itoh, M.; Fujiwara, Y. J. Phys. Chem. **87**: 4558–60 (1983).

83B117 Dynamics of the spiropyran-merocyanine conversion in solution. Kalisky, Y.; Orlowski, T.E.; Williams, D.J. J. Phys. Chem. **87**: 5333–8 (1983).

83B121 The triplet extinction coefficients of some bacterial carotenoids. Cogdell, R.J.; Land, E.J.; Truscott, T.G. Photochem. Photobiol. **38**: 723 5 (1983).

83B122 The role of a photochemical reaction on the deactivation of excited 4,5′,8-trimethylpsoralen in ethanol. Ishikawa, M.; Kikuchi, K.; Kokubun, H. Photochem. Photobiol. **38**: 727–9 (1983).

83B137 Absorption spectra and dynamics of the triplet state of bis[1-(1-pyrenyl)ethyl]ethers. Masuhara, H.; Tanaka, J.A.; Mataga, N.; De Schryver, F.C.; Collart, P. Polym. J. **15**: 915–7 (1983).

83E016 Phosphorescence spectra and triplet lifetimes of halogenoanthraquinones. Hamanoue, K.; Kajiwara, Y.; Miyake, T.; Nakayama, T.; Hirase, S.; Teranishi, H. Chem. Phys. Lett. **94**: 276–80 (1983).

83E018 Excited-states decay dynamics of phenylosazone D-glucose in the liquid phase. Maciejewski, A. Chem. Phys. Lett. **94**: 344–9 (1983).

83E025 Chemistry of singlet oxygen. 40. Enhanced $^1O_2$ formation in cyanoaromatic-sensitized photooxidations by substrate-enhanced intersystem crossing. Manring, L.E.; Gu, C.; Foote, C.S. J. Phys. Chem. **87**: 40–4 (1983).

83E026 Specific hydrogen-bonding effects in the photophysics of β-apo-14′-carotenal. Static and dynamic aspects of fluorescence and triplet yield quenching. Das, P.K.; Hug, G.L. J. Phys. Chem. **87**: 49–54 (1983).

83E088 Electron transfer reactions of the photoexcited triplet state of chloroaluminum phthalocyanine with aromatic amines, benzoquinones, and coordination compounds of iron(II) and iron(-III). Ohno, T.; Kato, S.; Yamada, A.; Tanno, T. J. Phys. Chem. **87**: 775–81 (1983).

83E216 Photophysics of aryl substituted 1,3,4-oxadiazoles: The triplet state of 2,5-diphenyl-1,3,4-oxadiazole. Rulliere, C.; Roberge, P.C. Chem. Phys. Lett. **97**: 247–52 (1983).

83E223 Sensitization and quenching processes of alkylcobalt(III) compounds. Al-Saigh, H.Y.; Kemp, T.J. J. Chem. Soc., Perkin Trans. 2 : 615–9 (1983).

83E258 Lifetime, triplet-triplet absorption spectrum and relaxation energy of an acyclic conjugated triene triplet: A pulse radiolysis study. Gorman, A.A.; Hamblett, I. Chem. Phys. Lett **97**: 422–6 (1983).

83E262 Electron-transfer quenching vs. exciplex-mediated quenching of the low-lying excited states in phthalocyanines. Prasad, D.R.; Ferraudi, G. Inorg. Chem. **22**: 1672–4 (1983).

83E278 Conformations of the triplet state of aromatic olefins. Observation of the transoid triplet states of 3,3-dimethyl-1-(2-naphthyl)-1-butene and 3,4-dihydrophenanthrene as a rigid planar triplet model. Arai, T.; Sakuragi, H.; Tokumaru, K.; Sakaguchi, Y.; Nakamura, J.; Hayashi, H. Chem. Phys. Lett. **98**: 40–4 (1983).

83E281 Triplet-related photophysics of 9,10-diphenylanthracene. A kinetic study of reversible energy transfer from anthracene triplet by nanosecond laser flash photolysis. Chattopadhyay, S.K.; Kumar, Ch.V.; Das, P.K. Chem. Phys. Lett. **98**: 250–4 (1983).

83E311 Photosensitization of pyrimidines by 2-methylnaphthoquinone in water: A laser flash photolysis study. Fisher, G.J.; Land, E.J. Photochem. Photobiol. **37**: 27–32 (1983).

83E324 Some photophysical properties of 3-carbethoxypsoralen, 8-methoxypsoralen and 5-methoxypsoralen triplet states. Craw, M.; Bensasson, R.V.; Ronfard-Haret, J.C.; Sa E Melo, M.T.; Truscott, T.G. Photochem. Photobiol. **37**: 611–5 (1983).

83E347 Effect of a polar substituent on olefin triplet lifetime. Caldwell, R.A.; Singh, M. J. Am. Chem. Soc. **105**: 5139–40 (1983).

83E383 Circular dichroism in excited triplet states. 2. Chiral dimerlike molecules in the binaphthyl and spirobifluorene series. Tetreau, C.; Lavalette, D.; Cabaret, D.; Geraghty, N.; Welvart, Z. J. Phys. Chem. **87**: 3234–9 (1983).

83E387 A laser flash photolysis study of pyrene-1-aldehyde. Intersystem crossing efficiency, photoreactivity and triplet state properties in various solvents. Kumar, C.V.; Chattopadhyay, S.K.; Das, P.K. Photochem. Photobiol. **38**: 141–52 (1983).

83E392 The $T_3(\pi,\pi^*)$ state of acridine. Periasamy, N. Chem. Phys. Lett. **99**: 322–5 (1983).

83E427 The fluorescence of some dipolar N,N-dialkyl-4-(dichloro-1,3,5-triazinyl)anilines. Part 3. Intersystem crossing yields from intramolecular charge-transfer excited states and triplet state properties. Cowley, D.J.; Pasha, I. J. Chem. Soc., Perkin Trans. 2 : 1139–45 (1983).

83E462 Photochemistry and sensitized evolution of hydrogen from water using water-soluble cationic porphyrins. Tetrakis-(trimethylaminophenyl)porphyrinatozinc and its free base. Kalyanasundaram, K. J. Chem. Soc., Faraday Trans. 2 **79**: 1365–74 (1983).

83E483 Transient absorption spectra of the excited states of triptycene and 3-acetyltriptycene. Sugawara, T.; Iwamura, H.; Nakashima, N.; Yoshihara, K.; Hayashi, H. Chem. Phys. Lett. **101**: 303–6 (1983).

83E509 Trans→cis photoisomerization of the quaternary iodides of 4-cyano- and 4-nitro-4'-azastilbene in ethanol solution: Singlet versus triplet mechanism. Goerner, H.; Schulte-Frohlinde, D. Chem. Phys. Lett. **101**: 79–85 (1983).

83E554 Excited and ionic states of polymers with pendant phenanthryl groups in solution. Model systems for photophysics in phenanthrene aggregates. Tamai, N.; Masuhara, H.; Mataga, N. J. Phys. Chem. **87**: 4461–7 (1983).

83E625 Studies on the triplet excited state of 4-thiouridine. Salet, C.; Bensasson, R.V.; Favre, A. Photochem. Photobiol. **38**: 521–5 (1983).

83E662 Absorption spectra and dynamics of some excited and ionic dicarbazolyl compounds with specific geometrical structures. Masuhara, H.; Tamai, N.; Mataga, N.; De Schryver, F.C.; Vandendriessche, J. J. Am. Chem. Soc. **105**: 7256–62 (1983).

83E667 Flash photolysis studies of hemato- and copro-porphyrins in homogeneous and microheterogeneous aqueous dispersions. Reddi, E.; Jori, G.; Rodgers, M.A.J.; Spikes, J.D. Photochem. Photobiol. **38**: 639–45 (1983).

83E737 Study of triplet states of some ketocyanine dyes, the polyenic bis-ω,ω'-dimethylamino ketones. Shvedova, L.A.; Borisevich, Yu.E.; Tatikolov, A.S.; Kuz'min, V.A.; Krasnaya, Zh.A. Bull. Acad. Sci. USSR, Div. Chem. Sci. **32**: 1290–3 (1983) Translated from: Izv. Akad. Nauk SSSR, Ser. Khim. : 1421–5 (1983).

83F075 Solvent effect on $^1O_2$ yield and the mechanism of polycyclic hydrocarbon triplet-state quenching by oxygen. Darmanyan, A.P. Chem. Phys. Lett. **96**: 383–9 (1983).

83F081 Primary processes in the photoisomerization of a nitrochromene studied by nanosecond laser photolysis. Kellmann, A.; Lindqvist, L.; Monti, S.; Tfibel, F.; Guglielmetti, R. J. Photochem. **21**: 223–35 (1983).

83F096 Studies of the photoreactions of heterocyclic N-dioxides: Identification of the oxaziridine intermediate of quinoxaline-1,4-dioxide. Kawata, H.; Kikuchi, K.; Kokubun, H. J. Photochem. **21**: 343–50 (1983).

83F334 Kinetics of photochemical H-abstraction by $^3\pi\pi^*$-acridine in fluorene single crystals as studied by triplet-triplet absorption. Prass, B.; Fujara, F.; Stehlik, D. Chem. Phys. **81**: 175–84 (1983).

83F405 Sequential biphotonic processes in rhodium(III) phthalocyanines. Muralidharan, S.; Ferraudi, G. J. Phys. Chem. **87**: 4877–81 (1983).

83N056 Magnetic field effect on the photoinduced electron transfer reaction between duroquinone and aromatic amines in SDS micellar solution. Tanimoto, Y.; Shimizu, K.; Udagawa, H.; Itoh, M. Chem. Lett. : 353–6 (1983).

83N062 Laser photolysis of methylene blue in aqueous micellar systems. Murgia, S.M.; Poletti, A. Photobiochem. Photobiophys. **5**: 53–60 (1983).

83N073 Comparison of the photochemical processes of magnesium tetraphenylporphyrin in micellar and in microemulsion solution. Pileni, M.P.; Chevalier, S. J. Colloid Interface Sci. **92**: 326–31 (1983).

83N082 Thermo- and photochemical aspects of the valence isomerization of 9-tert-butylanthracene. Kraljic, I.; Mintas, M.; Klasinc, L.; Ranogajec, F.; Guesten, H. Nouv. J. Chim. **7**: 239–43 (1983).

83N127 Magnetic field effect on the hydrogen abstraction of xanthone from xanthene is SDS micelles. Tanimoto, Y.; Takashima, M.; Itoh, M. Chem. Phys. Lett. **100**: 442–4 (1983).

83N133 Magnetic field effects on the photolysis of p-benzoquinone derivatives in sodium dodecyl sulfate micelles. Tanimoto, Y.; Udagawa, H.; Katsuda, Y.; Itoh, M. J. Phys. Chem. **87**: 3976–82 (1983).

83P212 Triplet state of 4-biphenylcarbonyl and 2-naphthylcarbonyl chromophores in homopolymers, copolymers and model compounds. Hrdlovic, P.; Guyot, G.; Lemaire, J.; Lukac, I. Polym. Photochem. **3**: 119–29 (1983).

83Z042 Applications of holography in the investigation of photochemical reactions. Burland, D.M. Acc. Chem. Res. **16**: 218–24 (1983).

84A024 Photochemistry of benzothiazole models of pheomelanin. Lambert, C.; Sinclair, R.S.; Truscott, T.G.; Land, E.J.; Chedekel, M.R.; Liu, C.-T. Photochem. Photobiol. **39**: 5–10 (1984).

84A030 Photochemistry of alkyl esters of benzoylformic acid. Encinas, M.V.; Lissi, E.A.; Zanocco, A.; Stewart, L.C.; Scaiano, J.C. Can. J. Chem. **62**: 386–91 (1984).

84A122 Electron-transfer reactions of excited phthalocyanines: Spin restriction on reaction rate of electron transfer and energy transfer to cobalt compounds. Ohno, T.; Kato, S. J. Phys. Chem. **88**: 1670–4 (1984).

84A218 Transient absorption and two-step laser excitation fluorescence studies of the excited-state proton transfer and relaxation in the methanol solution of 7-hydroxyflavone. Itoh, M.; Adachi, T. J. Am. Chem. Soc. **106**: 4320–4 (1984).

84A221 Aromatic thioketone triplets and their quenching behaviour towards oxygen and di-t-butylnitroxy radical. A laser-flash-photolysis study. Kumar, C.V.; Qin, L.; Das, P.K. J. Chem. Soc., Faraday Trans. 2 **80**: 783–93 (1984).

84A222 Photochemistry of naphthylmethyl halides. Direct and sensitized paths to homolytic and heterolytic carbon-halogen bond cleavage. Slocum, G.H.; Schuster, G.B. J. Org. Chem. **49**: 2177–85 (1984).

84A227 A laser flash photolysis and pulse radiolysis study of amiloride in aqueous and alcoholic solution. Hamoudi, H.I.; Heelis, P.F.; Jones, R.A.; Navaratnam, S.; Parsons, B.J.; Phillips, G.O.; Vandenburg, M.J.; Currie, W.J.C. Photochem. Photobiol. **40**: 35–9 (1984).

84A253 Primary processes in the photoreduction of 1-chloro- and 1,8-dichloro-anthraquinones in ethanol studied by laser spectroscopy. Hamanoue, K.; Yokoyama, K.; Kajiwara, Y.; Nakajima, K.; Nakayama, T.; Teranishi, H. Chem. Phys. Lett. **110**: 25–8 (1984).

84A263 The triplet state of N-(n-butyl)-5-nitro-2-furamide by laser flash photolysis. Spectrum, lifetime, energy and electron-transfer reactions. Martins, L.J.A.; Kemp, T.J. J. Chem. Soc., Faraday Trans. 1 **80**: 2509–24 (1984).

84A264 Electron-transfer reactions of a photosensitized water-soluble zinc porphyrin. Le Roux, D.; Mialocq, J.-C.; Anitoff, O.; Folcher, G. J. Chem. Soc., Faraday Trans. 2 **80**: 909–20 (1984).

84A344 Laser flash photolysis study of photochemical ring opening of 2,3-di-2-naphthyloxiranes and resultant ylide behaviors. Das, P.K.; Griffin, G.W. J. Org. Chem. **49**: 3452–7 (1984).

84A355 Photochemical transformations and laser flash photolysis studies of 1,4- and 1,2-epoxy compounds containing 1,2-dibenzoylalkene moieties. Murty, B.A.R.C.; Kumar, C.V.; Dabral, V.; Das, P.K.; George, M.V. J. Org. Chem. **49**: 4165–71 (1984).

84B003 Photoenolization of 2-methylbenzophenone studied by picosecond and nanosecond laser spectroscopy. Nakayama, T.; Hamanoue, K.; Hidaka, T.; Okamoto, M.; Teranishi, H. J. Photochem. **24**: 71–8 (1984).

84B007 Triplet state of α-naphthylethylene derivatives. Structural effects on the equilibrium between planar and perpendicular triplet conformations. Lazare, S.; Bonneau, R.; Lapouyade, R. J. Phys. Chem. **88**: 18–23 (1984).

84B008 Photoexcited triplet state of oxotitanium(IV) tetraphenylporphyrin studied by ESR and laser photolysis. Proton-induced quenching of the triplet state. Hoshino, M.; Imamura, M.; Watanabe, S.; Hama, Y. J. Phys. Chem. **88**: 45–9 (1984).

84B017 Photoinduced electron transfer C-C bond cleavage reactions: oxidations and isomerizations. Reichel, L.W.; Griffin, G.W.; Muller, A.J.; Das, P.K.; Ege, S.N. Can. J. Chem. **62**: 424–36 (1984).

84B019 Laser photolysis studies of the anthracene dimer produced by photolytic dissociation of dianthracene in 2-methyltetrahydrofuran solution at 77 K. Hoshino, M.; Seki, H.; Imamura, M.; Yamamoto, S. Chem. Phys. Lett. **104**: 369–72 (1984).

84B022 Mechanistic studies of the photodecomposition of arylmethyl sulfones in homogeneous and micellar solutions. Gould, I.R.; Tung, C.; Turro, N.J.; Givens, R.S.; Matuszewski, B. J. Am. Chem. Soc. **106**: 1789–93 (1984).

84B025 Triplet, radical anion and radical cation spectra of furocoumarins. Bensasson, R.V.; Chalvet, O.; Land, E.J.; Ronfard-Haret, J.C. Photochem. Photobiol. **39**: 287–91 (1984).

84B026 Twenty-two carbon homologue of 11-cis retinal. Photophysical and photochemical properties. Das, P.K.; Becker, R.S. Photochem. Photobiol. **39**: 313–8 (1984).

84B027 Transient photochemistry of neutral red. Marks, G.T.; Lee, E.D.; Aikens, D.A.; Richtol, H.H. Photochem. Photobiol. **39**: 323–8 (1984).

84B028 Excitated state absorption spectra and intersystem crossing kinetics in the naphthaldehydes. Boldridge, D.W.; Justus, B.L.; Scott, G.W. J. Chem. Phys. **80**: 3179–84 (1984).

84B033 A laser flash photolysis study of paraquat reduction by photogenerated aromatic ketyl radicals and carbonyl triplets. Baral-Tosh, S.; Chattopadhyay, S.K.; Das, P.K. J. Phys. Chem. **88**: 1404–8 (1984).

84B051 The laser-flash photolysis of propanone, butanone, and 2-pentanone. Study of triplet decay processes in aliphatic carbonyl compounds. Naito, I.; Schnabel, W. Bull. Chem. Soc. Jpn. **57**: 771–5 (1984).

84B055 Excited-state absorption of tris(phenanthroline)rhodium(III). A handle on the excited-state behavior of a powerful photochemical oxidant. Indelli, M.T.; Carioli, A.; Scandola, F. J. Phys. Chem. **88**: 2685–6 (1984).

84B061 The photoionization mechanism of N,N,N′,N′-tetramethyl-p-phenylenediamine in acetonitrile. Nakamura, S.; Kanamaru, N.; Nohara, S.; Nakamura, H.; Saito, Y.; Tanaka, J.; Sumitani, M.; Nakashima. N.; Yoshihara. K. Bull. Chem. Soc. Jpn. **57**: 145–50 (1984).

84B066 Photoinduced electron-transfer processes involving substituted stilbene oxides. Das, P.K.; Muller, A.J.; Griffin, G.W. J. Org. Chem. **49**: 1977–85 (1984).

84B090 β-Naphthylethylene: A conformational study of the triplet state by laser flash photolysis. Lazare, S.; Lapouyade, R.; Robert, M.-P. Nouv. J. Chim. **8**: 407–9 (1984).

84B110 Photochemical debromination of meso-substituted bromoanthracenes studied by steady-state photolysis and laser photolysis. Hamanoue, K.; Tai, S.; Hidaka, T.; Nakayama, T.; Kimoto, M.; Teranishi, H. J. Phys. Chem. **88**: 4380–4 (1984).

84B116 Photoreduction of triplet thioxanthone by amines: Charge transfer generates radicals that initiate polymerization of olefins. Yates, S.F.; Schuster, G.B. J. Org. Chem. **49**: 3349–56 (1984).

84B120 Diffuse reflectance pulse radiolysis of opaque samples. Wilkinson, F.; Willsher, C.J.; Warwick, P.; Land, E.J.; Rushton, F.A.P. Nature **311**: 40–1 (1984).

84B128 Photochemical reactions of 4-nitroquinoline 1-oxide with DNA and related compounds. Kasama, K.; Takematsu, A.; Yamamoto, S., Arai, S. J. Phys. Chem. **88**: 4918–21 (1984).

84B139 Time-resolved absorption and resonance Raman spectra of the lowest excited triplet state of all-trans-1,3,5-heptatriene. Langkilde, F.W.; Wilbrandt, R.; Jensen, N.-H. Chem. Phys. Lett. **111**: 372–8 (1984).

84B154 Time-dependent picosecond transient absorption spectra of 9-acetylanthracene, benzophenone and acridine in solution. Hamanoue, K.; Nakajima, K.; Hidaka, T.; Nakayama, T.; Teranishi. H. Laser Chem. **4**: 287–95 (1984).

84E018 Intramolecular quenching of carbonyl triplets by β-phenyl rings. Wismontski-Knittel, T.; Kilp, T. J. Phys. Chem. **88**: 110–5 (1984).

84E033 Picosecond and nanosecond kinetic spectroscopic investigations of the relaxation and the solute-solvent reaction of electronically excited 3,5-dinitroanisole. Varma, C.A.G.O.; Plantenga, F.L.; Huizer, A.H.; Zwart, J.P.; Bergwerf, Ph.; van der Ploeg, P.M. J. Photochem. **24**: 133–99 (1984).

84E036 Triplet states of isomers of the C_{15}-aldehyde and the C_{18}-ketone: Lower homologues of retinal. Bensasson, R.V.; Land, E.J.; Liu, R.S.H.; Lo, K.K.N.; Truscott, T.G. Photochem. Photobiol. **39**: 263–5 (1984).

84E043 Nanosecond time-resolved $T_n \rightarrow T_1$ fluorescence, $T_n \leftarrow T_1$ absorption, and resonance Raman scattering spectra in diphenylamine. Kobayashi, T.; Koshihara, S. Chem. Phys. Lett. **104**: 174–8 (1984).

84E044 Detection of triplet-triplet absorption in microcrystalline benzophenone by diffuse-reflectance laser flash photolysis. Wilkinson, F.; Willsher, C.J. Chem. Phys. Lett. **104**: 272–6 (1984).

84E045 Luminescence and triplet-triplet absorption spectra of rhodium(III) porphyrins. Kalyanasundaram, K. Chem. Phys. Lett. **104**: 357–62 (1984).

84E056 Laser induced excited state properties of rubreneperoxide in solution. Bayrakceken, F. J. Lumin. **29**: 111–8 (1984).

84E077 Time-resolved spectroscopy of intramolecular energy transfer in a rigid spiran. Maki, A.H.; Weers, J.G.; Hilinski, E.F.; Milton, S.V.; Rentzepis, P.M. J. Chem. Phys. **80**: 2288–97 (1984).

84E092 Polymeric photosensitizers: Effects of intramolecular energy migration on sensitization efficiencies. Urruti, E.H.; Kilp, T. Macromolecules **17**: 50–4 (1984).

84E111 Laser flash photolysis study of (2-anthryl)ethylenes. Triplet-related photophysical behaviors. Wismontski-Knittel, T.; Das, P.K. J. Phys. Chem. **88**: 1168–73 (1984).

84E144 Short-lived olefin triplets and energy transfer from them to β-carotene. Kumar, C.V.; Chattopadhyay, S.K.; Das, P.K. Chem. Phys. Lett. **106**: 431–6 (1984).

84E162 Photochemistry and photophysics of osazones. Part 3. Properties of D-arabino-hexulose phenylosazone in excited singlet and triplet states. Maciejewski, A.; Wojtczak, J.; Szymanski, M. J. Chem. Soc., Faraday Trans. 2 **80**: 411–23 (1984).

84E203 Anomalous ortho effects in sterically hindered porphyrins: Tetrakis(2,6-dimethylphenyl)porphyrin and its sulfonato derivative. Lee, W.A.; Graetzel, M.; Kalyanasundaram, K. Chem. Phys. Lett. **107**: 308–13 (1984).

84E216 Photosensitization of phenylhydrazone derivatives by methylene blue and xanthene dyes. Grajcar, L.; Ivanoff, N.; Delouis, J.F.; Faure, J. J. Chim. Phys. Phys.-Chim. Biol. **81**: 33–8 (1984).

84E232 Electronic relaxation processes of rare-earth chelates of benzoyltrifluoroacetone. Tobita, S.; Arakawa, M.; Tanaka, I. J. Phys. Chem. **88**: 2697–702 (1984).

84E236 Photophysical behavior of exciplexes of 1,4-dicyanonaphthalene with methyl- and methoxy-substituted benzenes. Davis, H.F.; Chattopadhyay, S.K.; Das, P.K. J. Phys. Chem. **88**: 2798–803 (1984).

84E237 A laser flash photolysis study of triplets of trans-naphthylethylenes. Relative importance of planar and perpendicular forms. Wismontski-Knittel, T.; Das, P.K. J. Phys. Chem. **88**: 2803–8 (1984).

84E319 Role of geometric distortion in the quenching behaviors of all-trans 1,4-diphenyl-1,3-butadiene triplet. Chattopadhyay, S.K.; Kumar, C.V.; Das, P.K. J. Photochem. **26**: 39–47 (1984).

84E342 Photophysical behaviors of N-methylthioacridone triplet and efficiency of singlet oxygen generation from its quenching by oxygen. Kumar, C.V.; Davis, H.F.; Das, P.K. Chem. Phys. Lett. **109**: 184–9 (1984).

84E346 Photochemistry of water-soluble porphyrins: Comparative study of isomeric tetrapyridyl- and tetrakis(N-methylpyridiniumyl)porphyrins. Kalyanasundaram, K. Inorg. Chem. **23**: 2453–9 (1984).

84E390 Excited singlet- and triplet-absorptions of pentaphene. Menzel, R.; Rapp, W. Chem. Phys. **89**: 445–55 (1984).

84E393 Experimental study of singlet-triplet energy transfer in liquid solutions. Darmanyan, A.P. Chem. Phys. Lett. **110**: 89–94 (1984).

84E405 Effect of environment on decay pathways of the singlet excited state of N,N,N′,N′-tetramethylbenzidine. Hashimoto, S.; Thomas, J.K. J. Phys. Chem. **88**: 4044–9 (1984).

84E456 Acid-base properties in the triplet state of aromatic ketones studied by nanosecond laser flash photolysis. Shizuka, H.; Kimura, E. Can. J. Chem. **62**: 2041–6 (1984).

84E491 A pulse radiolysis study of the azulene triplet state. Gorman, A.A.; Hamblett, I.; Harrison, R.J. J. Am. Chem. Soc. **106**: 6952–5 (1984).

84E520 Photochemical and thermal transformations of 2(3H)-furanones and bis(benzofuranones). A laser flash photolysis study. Lohray, B.B.; Kumar, C.V.; Das, P.K.; George, M.V. J. Am. Chem. Soc. **106**: 7352–9 (1984).

84E529 Photophysics of chlorobenzene in cyclohexane. Previtali, C.M.; Ebbesen, T.W. J. Photochem. **27**: 9–15 (1984).

84E533 Fluorescence quenching mechanism of aromatic hydrocarbons by closed-shell heavy metal ions in aqueous and organic solutions. Masuhara, H.; Shioyama, H.; Saito, T.; Hamada, K.; Yasoshima, S.; Mataga, N. J. Phys. Chem. **88**: 5868–73 (1984).

84F039 Hydrogen atom transfer reaction from excited carbazole to pyridine. Kikuchi, K.; Yamamoto, S.; Kokubun, H. J. Photochem. **24**: 271–83 (1984).

84F068 Photoisomerization pathways of 8,16-methano[2.2]metacyclophane-1,9-diene. A model case for adiabatic electrocyclic ring closure in the excited singlet state. Wirz, J.; Persy, G.; Rommel, E.; Murata, I.; Nakasuji, K. Helv. Chim. Acta **67**: 305–17 (1984).

84F074 Photosensitization via charge transfer or reversible electron transfer. Oxirane isomerization and sulfur dioxide extrusion. Das, P.K.; Muller, A.J.; Griffin, G.W.; Gould, I.R.; Tung, C.-H.; Turro, N.J. Photochem. Photobiol. **39**: 281–5 (1984).

84F248 Primary photochemical and photophysical processes in 2,2,4-trimethyl-1,2-dihydroquinolines. Malkin, Ya.N.; Pirogov, N.O.; Kuzmin, V.A. J. Photochem. **26**: 193–202 (1984).

84F379 Quenching of triplet states of quinones by phenols. Kokrashvili, T.A.; Levin, P.P.; Kuz'min, V.A. Bull. Acad. Sci. USSR, Div. Chem. Sci. **33**: 702–8 (1984) Translated from: Iav. Akad. Nauk SSSR, Ser. Khim. : 765–71 (1984).

84F385 Photochemical reactions of nitroanthracene derivatives in fluid solutions. Hamanoue, K.; Amano, M.; Kimoto, M.; Kajiwara, Y.; Nakayama, T.; Teranishi, H. J. Am. Chem. Soc. **106**: 5993–7 (1984).

84N017 Triplet state properties of croconate dyes in homogeneous and polymer-containing solutions. Kamat, P.V.; Fox, M.A. J. Photochem. **24**: 285–92 (1984).

84N125 A water-soluble benzophenone in reverse micelles: Kinetics and spectroscopy. Lougnot, D.-J.; Scaiano, J.C. J. Photochem. **26**: 119–30 (1984).

84N163 Exploratory study of the effect of polyelectrolyte-surfactant aggregates on photochemical behavior. Abuin, E.B.; Scaiano, J.C. J. Am. Chem. Soc. **106**: 6274–83 (1984).

84N197 Magnetic field effect on the hydrogen abstraction reaction of xanthone in sodium dodecyl sulfate micellar solution. Tanimoto, Y.; Takashima, M.; Itoh, M. J. Phys. Chem. **88**: 6053–6 (1984).

84P005 Photophysical study on a new class of benzophenone containing photoinitiators of polymerization. Properties of poly(4-acryloxybenzophenone) and a model compound. Flamigni, L.; Barigelletti, F.; Bortolus, P.; Carlini, C. Eur. Polym. J. **20**: 171–5 (1984).

84P257 Excited-state annihilation processes in poly(vinylaromatics) in solution: Poly(2-vinylnaphthalene) and poly(4-vinylbiphenyl). Pratte, J.F.; Webber, S.E. Macromolecules **17**: 2116–23 (1984).

84R057 The triplet exciton of chlorophyll a and carotenoid in solution and in photosynthetic antenna proteins. Shepanski, J.F.; Williams, D.J.; Kalisky, Y. Biochim. Biophys. Acta. **766**: 116–25 (1984).

10. Indexes to Table 6

10.1. Compound Name Index

10.2. Formula Index

C_9H_7N	Isoquinoline **641.**
	Quinoline **961.**
C_9H_7NO	Carbostyril **247.**
	Isoquinoline-*N*-oxide **642.**
$C_9H_7NO_2$	*N*-Methylphthalimide **745.**
C_9H_8	1-Propynylbenzene **928.**
$C_9H_8N^+$	Quinoline, conjugate acid **962.**
$C_9H_8N_2O_2$	3-Amino-*N*-methylphthalimide **50.**
$C_9H_8O_2$	4-Chromanone **293.**
$C_9H_8O_3$	Methyl benzoylformate **711.**
C_9H_9N	1-Methylindole **729.**
	2-Methylindole **730.**
	3-Methylindole **731.**
$C_9H_9NO_2$	2-(*N*-Formylamino)acetophenone **17.**
$C_9H_9NO_3$	*trans*-1-Methoxy-β-nitrostyrene **681.**
$C_9H_{10}N_2$	1,3-Dimethylindazole **486.**
$C_9H_{10}O$	3-Methylacetophenone **691.**
	4-Methylacetophenone **692.**
	Propiophenone **926.**
$C_9H_{10}O_2$	4'-Hydroxypropiophenone **628.**
	3-Methoxyacetophenone **661.**
	4-Methoxyacetophenone **662.**
	2,3,5-Trimethyl-1,4-benzoquinone **1085.**
$C_9H_{10}O_4$	2,3-Dimethoxy-5-methyl-1,4-benzoquinone **450.**
$C_9H_{11}NO_2$	Phenylalanine **876.**
$C_9H_{11}NO_3$	Tyrosine **1112.**
$C_9H_{12}N_2$	4-Pyrrolidinopyridine **956.**
$C_9H_{12}N_2O_4$	*N*-Butyl-5-nitro-2-furamide **236.**
$C_9H_{12}N_2O_5S$	4-Thiouridine **1067.**
$C_9H_{12}N_2O_6$	Uridine **1116.**
$C_9H_{13}N_2O_9P$	Uridine monophosphate **1117.**
$C_{10}D_8$	Naphthalene-d_8 **769.**
$C_{10}H_2N_4$	1,2,4,5-Tetracyanobenzene **1023.**
$C_{10}H_2O_6$	1,2,4,5-Benzenetetracarboxylic anhydride **953.**
$C_{10}H_5BrN_2O$	4-Bromo-1-cyanoisoquinoline-*N*-oxide **217.**
$C_{10}H_6Br_2$	1,4-Dibromonaphthalene **361.**
$C_{10}H_6Cl_2$	1,4-Dichloronaphthalene **377.**
$C_{10}H_6F_3NaO_2$	4,4,4-Trifluoro-1-phenyl-1,3-butanedionatosodium **1083.**
$C_{10}H_6N_2O_4$	1,2-Dinitronaphthalene **517.**
	1,8-Dinitronaphthalene **519.**
$C_{10}H_6N_4O_2$	Alloxazine **31.**
$C_{10}H_7Br$	1-Bromonaphthalene **224.**
	2-Bromonaphthalene **225.**
$C_{10}H_7Cl$	1-Chloronaphthalene **279.**
	2-Chloronaphthalene **280.**
$C_{10}H_7F_3O_2$	4,4,4-Trifluoro-1-phenyl-1,3-butanedione **158.**
$C_{10}H_7I$	1-Iodonaphthalene **636.**
	2-Iodonaphthalene **637.**
$C_{10}H_7NO_2$	1-Nitronaphthalene **819.**
	2-Nitronaphthalene **820.**
$C_{10}H_7NO_3$	4-Hydroxyquinoline-2-carboxylic acid **643.**
$C_{10}H_7NaO_3S$	2-Naphthalenesulfonic acid, sodium salt **775.**
$C_{10}H_7O^-$	1-Naphthyloxide ion **797.**
	2-Naphthyloxide ion **798.**
$C_{10}H_7O_2^-$	2,3-Dihydroxynaphthalene, conjugate base **443.**
$C_{10}H_8$	Azulene **95.**
	Naphthalene **768.**
$C_{10}H_8N_2O_2$	1-Amino-4-nitronaphthalene **53.**
$C_{10}H_8N_2O_4$	1,4-Dinitronaphthalene **518.**
$C_{10}H_8O$	1-Naphthol **786.**
	2-Naphthol **787.**
$C_{10}H_8O_2$	1,5-Dihydroxynaphthalene **439.**
	1,8-Dihydroxynaphthalene **440.**
	2,3-Dihydroxynaphthalene **441.**
	2,7-Dihydroxynaphthalene **442.**
$C_{10}H_8O_3$	4-Hydroxy-6-methylcoumarin **623.**
	7-Hydroxy-4-methylcoumarin **624.**
$C_{10}H_8O_3S$	1-Naphthalenesulfonic acid **776.**
$C_{10}H_9ClN_2OS$	(2'-Chlorobenzoyl)amino-2-Δ^2-thiazoline **267.**
	(4'-Chlorobenzoyl)amino-2-Δ^2-thiazoline **268.**
$C_{10}H_9N$	2-Naphthylamine **766.**
$C_{10}H_9NO$	1-Methylisoquinoline-*N*-oxide **732.**
$C_{10}H_9NO_2$	*N*-Ethylphthalimide **577.**
$C_{10}H_{10}$	1-Butynylbenzene **237.**
$C_{10}H_{10}N^+$	2-Naphthylamine, conjugate acid **767.**
$C_{10}H_{10}N_2O$	7-Amino-4-methylcarbostyril **49.**
$C_{10}H_{10}N_2OS$	Benzoylamino-2-Δ^2-thiazoline **147.**
$C_{10}H_{10}O_2$	1-Benzoylacetone **146.**
$C_{10}H_{11}NO_2$	2-(*N*-Acetylamino)acetophenone **16.**
	2-(*N*-Formyl-*N*-methylamino)acetophenone **19.**
$C_{10}H_{12}$	1-Phenyl-1-butene **578.**
$C_{10}H_{12}N_2O_2$	2-(*N*-Formylamino)-3'-aminopropiophenone **55.**
	trans-4-Dimethylamino-β-nitrostyrene **465.**
	3,4,7,8-Tetramethyl-1,5-diazabicyclo[3,3,0]octa-3,7-diene-2,6-dione **1047.**
$C_{10}H_{12}O_2$	Duroquinone **552.**
	2-Hydroxy-2-methyl-1-phenylpropan-1-one **625.**
	4'-Methoxypropiophenone **682.**
$C_{10}H_{13}NO_2$	Methyl 4-dimethylaminobenzoate **717.**
$C_{10}H_{13}O_2^+$	Duroquinone, conjugate monoacid **554.**
$C_{10}H_{14}N_2O_5$	Thymidine **1070.**
$C_{10}H_{14}O_2$	Camphoroquinone **243.**
$C_{10}H_{15}NO$	8-(Dimethylamino)-3,5,7-octatrien-2-one **462.**
$C_{10}H_{15}N_2O_8P$	Thymidine 5'-monophosphate **1071.**
$C_{10}H_{16}$	Neo-alloocimene **806.**
$C_{10}H_{16}N_2$	*N,N,N',N'*-Tetramethyl-*p*-phenylenediamine **1049.**
$C_{11}H_6O_3$	Angelicin **640.**
	Psoralen **934.**
$C_{11}H_7N$	1-Naphthonitrile **314.**
$C_{11}H_7O_2^-$	1-Naphthoate ion **781.**
	2-Naphthoate ion **782.**

$C_{13}D_9N$	Acridine-d_9 **24.**
$C_{13}H_7ClOS$	2-Chlorothioxanthen-9-one **290.**
$C_{13}H_8$	Fluoren-9-ylidene **589.**
$C_{13}H_8Cl_2O$	4,4′-Dichlorobenzophenone **372.**
$C_{13}H_8NO_4S^-$	9,10-Dihydro-9-oxo-2-acridinesulfonate ion **424.**
$C_{13}H_8O$	Fluoren-9-one **586.**
$C_{13}H_8OS$	Thioxanthen-9-one **1069.**
	9*H*-Xanthene-9-thione **1120.**
$C_{13}H_8O_2$	6*H*-Dibenzo[*b*,*d*]pyran-6-one **350.**
	Xanthone **1121.**
$C_{13}H_8S_2$	9*H*-Thioxanthene-9-thione **1068.**
$C_{13}H_9ClO$	4-Chlorobenzophenone **266.**
$C_{13}H_9FO$	4-Fluorobenzophenone **595.**
$C_{13}H_9N$	Acridine **23.**
	Benzo[*f*]quinoline **139.**
	Benzo[*h*]quinoline **140.**
	4-Cyanobiphenyl **309.**
	Phenanthridine **859.**
$C_{13}H_9NO$	9(10*H*)-Acridinone **29.**
	6(5*H*)-Phenanthridinone **860.**
$C_{13}H_9NO_4S$	9,10-Dihydro-9-oxo-2-acridinesulfonic acid **425.**
$C_{13}H_{10}$	Fluorene **585.**
	1,4-Perinaphthyldiyl **851.**
$C_{13}H_{10}N^+$	Acridinium ion **28.**
	Benzo[*f*]quinolizinium **141.**
	Benzo[*h*]quinolizinium **142.**
$C_{13}H_{10}N_2$	9-Aminoacridine **33.**
$C_{13}H_{10}N_2O_2$	1-Amino-7-nitrofluorene **52.**
$C_{13}H_{10}O$	Benzophenone **133.**
	4-Biphenylcarboxaldehyde **175.**
	1-Hydroxyfluorene **621.**
	2-Hydroxyfluorene **622.**
$C_{13}H_{10}O_2$	2-Hydroxybenzophenone **613.**
	4-Hydroxybenzophenone **614.**
$C_{13}H_{10}O_3$	3-Formyl-2-methylfurochromene **601.**
	3-Formyl-8-methylfurochromene **602.**
$C_{13}H_{10}S$	Thiobenzophenone **1060.**
$C_{13}H_{11}ClO$	3-Chloro-1-(2-naphthyl)-1-propanone **281.**
$C_{13}H_{11}N$	Acridan **22.**
	2-Aminofluorene **44.**
$C_{13}H_{11}NO$	3-Aminobenzophenone **41.**
	4-Aminobenzophenone **42.**
$C_{13}H_{11}NS$	10-Methylphenothiazine **744.**
$C_{13}H_{11}N_3$	Proflavine **921.**
$C_{13}H_{11}N_4O_2^-$	Lumiflavine, negative ion **647.**
$C_{13}H_{11}O^+$	Benzophenone, conjugate acid **134.**
$C_{13}H_{12}$	2,3-Dihydrophenalene **426.**
	1-Methyl-1-(1-naphthyl)ethylene **738.**
	2-(1-Methylethenyl)naphthalene **739.**
	1-Methyl-2-vinylnaphthalene **762.**
	2-Methyl-3-vinylnaphthalene **763.**
$C_{13}H_{12}ClN_3S$	Azure C **99.**
$C_{13}H_{12}N_3^+$	Proflavine, conjugate monoacid **923.**
$C_{13}H_{12}N_4O_2$	Lumiflavine **645.**
$C_{13}H_{12}OS$	1-Naphthalenecarbothioic acid, *O*-ethyl ester **774.**

$C_{13}H_{13}N$	*N*-Methyldiphenylamine **718.**
$C_{13}H_{13}N_3^{2+}$	Proflavine, conjugate diacid **922.**
$C_{13}H_{13}N_4O_2^+$	Lumiflavine, conjugate monoacid **646.**
$C_{13}H_{14}$	2-Phenyl-2-norbornene **896.**
$C_{13}H_{14}Cl_2N_4$	4-(4,6-Dichloro-1,3,5-triazin-2-yl)-*N*,*N*-diethylaniline **379.**
$C_{13}H_{15}NO_4$	8-Methoxy-2,2,3-trimethyl-6-nitro-2*H*-chromene **686.**
$C_{13}H_{15}N_3O_2$	*N*-Acetyl-L-tryptophanamide **21.**
$C_{13}H_{17}N$	1,2-Dihydro-2,2,4,6-tetramethylquinoline **432.**
$C_{13}H_{18}O_2$	2-Hydroxy-2-methyl-1-[4-(2-propyl)phenyl]propan-1-one **626.**
$C_{13}H_{19}NO$	2-[1-(Butylimino)ethyl]-5-methylphenol **234.**
$C_{13}H_{20}N_2O$	1,9-Bis(dimethylamino)-1,3,6,8-nonatetraen-5-one **194.**
	1,9-Bis(dimethylamino)-1,4,6,8-nonatetraen-3-one **195.**
$C_{13}H_{20}O$	β-Ionone **638.**
$C_{14}D_{10}$	Anthracene-d_{10} **65.**
	Phenanthrene-d_{10} **855.**
$C_{14}D_{12}$	*trans*-Stilbene-d_{12} **1007.**
$C_{14}H_6Cl_2O_2$	1,8-Dichloroanthraquinone **371.**
$C_{14}H_6Cl_4$	1,5,9,10-Tetrachloroanthracene **1022.**
$C_{14}H_6O_8S_2^-$	Anthraquinone-2,6-disulfonate ion **77.**
$C_{14}H_7ClO_2$	1-Chloroanthraquinone **263.**
	2-Chloroanthraquinone **264.**
$C_{14}H_7Cl_3$	2,9,10-Trichloroanthracene **1077.**
$C_{14}H_7D_5$	*trans*-Stilbene-2,3,4,5,6-d_5 **1002.**
$C_{14}H_7O_5S^-$	9,10-Anthraquinone-2-sulfonate ion **78.**
$C_{14}H_8Br_2$	9,10-Dibromoanthracene **358.**
$C_{14}H_8Cl_2$	1,5-Dichloroanthracene **369.**
	9,10-Dichloroanthracene **370.**
$C_{14}H_8O_2$	Anthraquinone **76.**
$C_{14}H_9Br$	9-Bromoanthracene **215.**
	9-Bromophenanthrene **227.**
$C_{14}H_9Cl$	1-Chloroanthracene **262.**
$C_{14}H_9F_3O$	4-(Trifluoromethyl)benzophenone **1082.**
$C_{14}H_9I$	2-Iodoanthracene **632.**
	9-Iodoanthracene **633.**
$C_{14}H_9NO_2$	1-Aminoanthraquinone **36.**
	2-Aminoanthraquinone **37.**
	9-Nitroanthracene **815.**
$C_{14}H_9NO_3$	1-Amino-4-hydroxyanthraquinone **45.**
$C_{14}H_{10}$	Anthracene **64.**
	Benz[*a*]azulene **108.**
	Diphenylacetylene **527.**
	Phenanthrene **854.**
$C_{14}H_{10}Cl_2$	4,4′-Dichlorostilbene **378.**
$C_{14}H_{10}D_2$	*trans*-Stilbene-2,2′-d_2 **1001.**
	trans-Stilbene-4,4′-d_2 **1003.**
	trans-Stilbene-7,7′-d_2 **1004.**
$C_{14}H_{10}N_2O$	2,5-Diphenyl-1,3,4-oxadiazole **545.**
$C_{14}H_{10}N_2O_2$	1,4-Diaminoanthraquinone **335.**
$C_{14}H_{10}N_2O_4$	*trans*-2,4-Dinitrostilbene **522.**
	cis-4,4′-Dinitrostilbene **523.**
	trans-4,4′-Dinitrostilbene **524.**

$C_{17}H_{16}N_6O_5$	3-[[4-[(2,4-Dinitrophenyl)azo]phenyl]-(2-hydroxyethyl)amino]-4-propanenitrile **521.**
$C_{17}H_{16}O_3$	4-(2-Methylpropionyloxy)benzophenone **746.**
$C_{17}H_{17}NO$	4-(Dimethylamino)chalcone **455.**
$C_{17}H_{18}$	1-(1-Cyclohepten-1-yl)naphthalene **319.**
	2-(1-Cyclohepten-1-yl)naphthalene **320.**
$C_{17}H_{18}N_2$	*trans*-4-Cyano-4′-dimethylaminostilbene **311.**
$C_{17}H_{19}ClN_2O$	Pyronine **955.**
$C_{17}H_{19}ClN_2S$	Chlorpromazine **292.**
	Thioflavine **1061.**
	Thiopyronine **1065.**
$C_{17}H_{19}NOS$	*O*-(2-Phenylethyl) 4-(dimethylamino)-benzenecarbothioate **886.**
$C_{17}H_{19}N_2S^+$	Thiopyronine cation **1066.**
$C_{17}H_{19}N_2Se^+$	Selenopyronine **995.**
$C_{17}H_{19}N_3$	Acridine Orange, free base **26.**
$C_{17}H_{20}N_2O$	4,4′-Bis(dimethylamino)benzophenone **190.**
$C_{17}H_{20}N_2S$	4,4′-Bis(dimethylamino)thiobenzophenone **200.**
	Promazine **924.**
$C_{17}H_{20}N_3^+$	Acridine Orange, conjugate monoacid **25.**
$C_{17}H_{20}N_3S^+$	Neomethylene Blue cation **807.**
$C_{17}H_{21}N_3$	Auramine O **93.**
$C_{17}H_{21}N_4O_6^+$	Riboflavine, conjugate monoacid **987.**
$C_{17}H_{24}N_2O$	*all-trans*-1,13-Bis(dimethylamino)-1,3,5,8,10,12-tridecahexaen-7-one **201.**
	all-trans-1,13-Bis(dimethylamino)-1,3,6,8,10,12-tridecahexaen-5-one **202.**
$C_{17}H_{24}N_4O_5$	γ-[2-(Formylamino)phenyl]-γ-oxo-α-aminobutyryl-L-lysine **597.**
$C_{17}H_{24}O$	(*E*,*E*,*E*)-5-Methyl-7-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2,4,6-heptatrienal **750.**
$C_{18}D_{12}$	Triphenylene-d_{12} **1096.**
$C_{18}D_{14}$	*p*-Terphenyl-d_{14} **1015.**
$C_{18}H_{11}Br$	2-Bromotriphenylene **230.**
$C_{18}H_{12}$	Benz[*a*]anthracene **106.**
	Benzo[*c*]phenanthrene **131.**
	Chrysene **295.**
	Benz[*b*]anthracene **1021.**
	Triphenylene **1095.**
$C_{18}H_{12}N_2$	2,2′-Biquinoline **184.**
$C_{18}H_{12}N_2O$	2-(1-Naphthyl)-5-phenyl-1,3,4-oxadiazole **803.**
	2-(2-Naphthyl)-5-phenyl-1,3,4-oxadiazole **804.**
$C_{18}H_{12}O_2$	2,6-Diphenyl-1,4-benzoquinone **531.**
	3-Methoxybenzanthrone **663.**
$C_{18}H_{13}Bi$	9-Phenyl-9*H*-9-bismafluorene **880.**
$C_{18}H_{13}NO_2$	4-Nitro-*p*-terphenyl **825.**
$C_{18}H_{13}N_2^+$	2,2′-Biquinoline, conjugate monoacid **186.**
$C_{18}H_{13}P$	9-Phenyl-9*H*-9-phosphafluorene **897.**
$C_{18}H_{13}Sb$	9-Phenyl-9*H*-9-stibafluorene **899.**

$C_{18}H_{14}$	1-(1-Naphthyl)-1-phenylethylene **800.**
	trans-1-(1-Naphthyl)-2-phenylethylene **801.**
	trans-1-(2-Naphthyl)-2-phenylethylene **802.**
	m-Terphenyl **1012.**
	o-Terphenyl **1013.**
	p-Terphenyl **1014.**
$C_{18}H_{14}N_2$	Tricyclo[8.2.2.2^{4,7}]hexadeca-4,6,10,12,13,15-hexaene-5,15-dicarbonitrile **1079.**
$C_{18}H_{14}N_2O_2$	*N*,*N*′-Dimethylindigo **487.**
$C_{18}H_{15}ClN_4$	Phenosafranin **869.**
$C_{18}H_{15}N$	Triphenylamine **1092.**
$C_{18}H_{16}$	1,6-Diphenyl-1,3,5-hexatriene **541.**
$C_{18}H_{16}N^+$	Triphenylamine, conjugate acid **1093.**
$C_{18}H_{16}N_2$	*N*,*N*′-Diphenyl-*p*-phenylenediamine **547.**
	[1,1′:4′,1″-Terphenyl]-4,4″-diamine **1011.**
$C_{18}H_{16}O$	9-Butyrylanthracene **239.**
$C_{18}H_{16}O_2S$	1-[[(Phenylmethyl)sulfonyl]methyl]-naphthalene **892.**
$C_{18}H_{17}N_2^+$	*N*,*N*′-Diphenyl-*p*-phenylenediamine, conjugate acid **548.**
$C_{18}H_{20}$	1-(1-Cycloocten-1-yl)naphthalene **325.**
$C_{18}H_{22}N_3^+$	6,6′-Biquinoline, conjugate monoacid **187.**
$C_{18}H_{22}N_4O_4$	D-Glucose phenylosazone **603.**
$C_{18}H_{23}N_3^{2+}$	6,6′-Biquinoline, conjugate diacid **185.**
$C_{18}H_{26}O$	(*E*,*E*,*E*)-6-Methyl-8-(2,6,6-trimethyl-1-cyclohexen-1-yl)-3,5,7-octatrien-2-one **751.**
	(*E*,*E*,*Z*)-6-Methyl-8-(2,6,6-trimethyl-1-cyclohexen-1-yl)-3,5,7-octatrien-2-one **752.**
	(*E*,*Z*,*E*)-6-Methyl-8-(2,6,6-trimethyl-1-cyclohexen-1-yl)-3,5,7-octatrien-2-one **753.**
	(*E*,*Z*,*Z*)-6-Methyl-8-(2,6,6-trimethyl-1-cyclohexen-1-yl)-3,5,7-octatrien-2-one **754.**
$C_{19}H_{12}O_6$	Dicumarol **380.**
$C_{19}H_{13}NO$	2-(4-Biphenylyl)benzoxazole **178.**
	2-(1-Naphthyl)-5-phenyloxazole **805.**
$C_{19}H_{14}$	1-(1*H*-Inden-3-yl)naphthalene **630.**
$C_{19}H_{14}O$	4-Benzoylbiphenyl **879.**
$C_{19}H_{15}^+$	Triphenylmethyl cation **1101.**
$C_{19}H_{15}N$	9-Phenylacridan **874.**
	N-Phenylacridan **875.**
$C_{19}H_{16}$	Triphenylmethane **1100.**
$C_{19}H_{16}N_2$	5,10-Dihydro-5-methyl-10-phenylphenazine **422.**
$C_{19}H_{16}N_3^+$	9-Phenylproflavine, conjugate monoacid **898.**
$C_{19}H_{16}OS$	*O*-(2-Phenylethyl) 1-naphthalenecarbothioate **888.**
	O-(2-Phenylethyl) 2-naphthalenecarbothioate **889.**
$C_{19}H_{17}ClN_2O_3$	6-Chloro-1,3,3-trimethyl-6′-nitrospiro-(2,2′-indolin[2*H*-1]benzopyran) **291.**

$C_{28}H_{31}ClN_2O_3$	Rhodamine B **983.**
	Rhodamine 6G **984.**
$C_{28}H_{32}N_2O_3^{2+}$	Rhodamine 6G cation, conjugate monoacid **985.**
$C_{28}H_{44}O$	Ergosterol **564.**
$C_{29}H_{16}$	Pyranthrene **937.**
$C_{29}H_{20}O$	3-Benzyl-3-phenylphenanthro[9,10-*b*]furan-2(3*H*)-one **162.**
$C_{29}H_{22}O_2$	3-Benzyl-3,4,5-triphenyl-2(3*H*)-furanone **163.**
	10,11-Dihydro-5,7:14,16-dietheno-8*H*,13*H*-diindeno[2,1-*h*:1',2'*i*][1,4]dioxacyclotridecin **414.**
$C_{29}H_{26}N_2$	*meso*(DL)-2,4-Di(*N*-carbazolyl)pentane **367.**
	rac(DD,LL)-2,4-Di(*N*-carbazolyl)pentane **368.**
$C_{29}H_{34}FN_2^+$	1-Ethyl-2-[5-(1-ethyl-1,3-dihydro-3,3-dimethyl-2*H*-indol-2-ylidene)-3-fluoro-1,3-pentadienyl]-3,3-dimethyl-3*H*-indolium **572.**
$C_{29}H_{35}N_2^+$	1-Ethyl-2-[5-(1-ethyl-1,3-dihydro-3,3-dimethyl-2*H*-indol-2-ylidene)-1,3-pentadienyl]-3,3-dimethyl-3*H*-indolium **573.**
$C_{30}H_{18}$	9,10-Bis(phenylethynyl)anthracene **211.**
$C_{30}H_{18}F_9LaO_6$	Tris(4,4,4-trifluoro-1-phenyl-1,3-butanedionato)lanthanum(III) **1107.**
$C_{30}H_{18}F_9LuO_6$	Tris(4,4,4-trifluoro-1-phenyl-1,3-butanedionato)lutetium(III) **1108.**
$C_{30}H_{24}IrN_6^{3+}$	Tris(2,2'-bipyridine)iridium(III) ion **1103.**
$C_{30}H_{24}N_6Os^{2+}$	Tris(2,2'-bipyridine)osmium(II) ion **1104.**
$C_{30}H_{24}N_6Ru^{2+}$	Tris(2,2'-bipyridine)ruthenium(II) ion **1105.**
$C_{30}H_{40}O$	*β-apo*-8'-Carotenal **252.**
$C_{30}H_{44}$	(*all-E*)-3,8-Dimethyl-1,10-bis(2,6,6-trimethyl-1-cyclohexen-1-yl)-1,3,5,7,9-decapentaene **477.**
$C_{31}H_{24}$	1,3-Di(9-phenanthryl)propane **526.**
$C_{31}H_{34}N_4O_4$	Bonellin **213.**
$C_{31}H_{42}ClN_3$	Ethyl Violet **568.**
$C_{31}H_{42}O_2$	*β-apo*-8'-Carotenoic acid, methyl ester **256.**
$C_{32}H_{16}AlClN_8$	Chloroaluminum phthalocyanine **261.**
$C_{32}H_{16}ClInN_8$	Chloroindium(III) phthalocyanine **276.**
$C_{32}H_{16}CuN_8$	Copper(II) phthalocyanine **297.**
$C_{32}H_{16}MgN_8$	Magnesium(II) phthalocyanine **653.**
$C_{32}H_{16}N_8Zn$	Zinc(II) phthalocyanine **1130.**
$C_{32}H_{18}N_8$	Phthalocyanine **907.**
$C_{32}H_{22}$	Anthracene-tetracene photodimer **72.**
$C_{32}H_{24}$	[2.2](1,4)(9,10)-Anthracenophane **73.**
	anti-[2.2](1,4)-Anthracenophane **74.**
	syn-[2.2](1,4)-Anthracenophane **75.**
$C_{32}H_{24}O$	4-(4-*p*-Terphenylylmethyl)benzophenone **1016.**
$C_{32}H_{24}O_2$	(*E*)-10-(1,3-Dimethyl-10-oxo-9-anthracenylidene)-2,4-dimethyl-9-anthracenone **1046.**
$C_{32}H_{29}NO_4S_3$	(*Z*)-*N*,*N*-Dibutyl-2,3-dihydro-3-oxo-2-(3-oxonaphtho[1,2-*b*]thien-2(3*H*)-ylidene)naphtho[1,8-*bc*]thiopyran-6-sulfonamide **362.**
	(*E*)-*N*,*N*-Dibutyl-2,3-dihydro-3-oxo-2-(3-oxonaphtho[1,2-*b*]thien-2(3*H*)-ylidene)naphtho[1,8-*bc*]thiopyran-6-sulfonamide **363.**
$C_{32}H_{32}N_2O_4$	2,2'-(1,4-Phenylene)bis[5-(4-butoxyphenyl)oxazole] **884.**
$C_{32}H_{34}N_4O_4$	Deuteroporphyrin, dimethyl ester **333.**
$C_{32}H_{36}N_2$	*N*,*N*,*N'*,*N'*-Tetraethyl-[1,1':4',1'':4'',1'''-quaterphenyl]-4,4'''-diamine **1027.**
$C_{32}H_{36}N_4Pd$	Palladium(II) etioporphyrin I **838.**
$C_{32}H_{36}N_4Zn$	Zinc(II) etioporphyrin I **1126.**
$C_{32}H_{40}N_4$	Etiochlorin II **579.**
$C_{33}H_{20}BrN_8ORh$	Bromo(methanol)(phthalocyaninato)rhodium(III) **222.**
$C_{33}H_{20}ClN_8ORh$	Chloro(methanol)(phthalocyaninato)rhodium(III) **277.**
$C_{33}H_{20}IN_8ORh$	Iodo(methanol)(phthalocyaninato)rhodium(III) **635.**
$C_{33}H_{30}O_4$	10,11,13,14,16,17-Hexahydro-5,7:20,22-dietheno-8*H*,19*H*-diindeno[2,1-*n*:1',2'-*o*][1,4,7,10]tetraoxacyclononadecin **609.**
$C_{33}H_{34}N_4O_6$	Biliverdin **169.**
$C_{33}H_{36}N_4O_6$	Bilirubin **168.**
$C_{34}H_{24}O_3$	1,4-Diphenyl-2,3-dibenzoyl-1,4-epoxy-1,4-dihydronaphthalene **538.**
$C_{34}H_{32}N_4O_4Zn$	Zinc(II) protoporphyrin **1132.**
$C_{34}H_{34}N_4O_4$	Protoporphyrin IX **930.**
$C_{34}H_{36}MgN_4O_4$	Magnesium(II) mesoporphyrin **651.**
$C_{34}H_{36}N_4O_3$	Methyl pyropheophorbide *a* **747.**
$C_{34}H_{38}N_4O_4$	Mesoporphyrin **657.**
$C_{34}H_{38}N_4O_6$	Hematoporphyrin IX **604.**
$C_{35}H_{38}N_4O_6$	Biliverdin, dimethyl ester **170.**
$C_{35}H_{50}$	(*all-E*)-3,7,12-Trimethyl-1,14-bis(2,6,6-trimethyl-1-cyclohexen-1-yl)-1,3,5,7,9,11,13-tetradecaheptaene **1086.**
$C_{36}H_{20}CdN_4$	Cadmium(II) tetrabenzoporphyrin **240.**
$C_{36}H_{20}N_4Pd$	Palladium(II) tetrabenzoporphyrin **839.**
$C_{36}H_{20}N_4Zn$	Zinc(II) tetrabenzoporphyrin **1133.**
$C_{36}H_{22}N_4$	Tetrabenzoporphine **1020.**
$C_{36}H_{24}$	[2.2](2,7)-Pyrenophane **948.**
$C_{36}H_{24}N_6Rh^{3+}$	Tris(1,10-phenanthroline)rhodium(III) ion **1106.**
$C_{36}H_{26}O$	*rac*-Bis[1-(1-pyrenyl)ethyl]ether **212.**
$C_{36}H_{28}N_8O_2RuS_2$	Bis(dimethylsulfoxide)phthalocyaninatoruthenium(II) **205.**
$C_{36}H_{36}MgN_4O_5$	Methylchlorophyllide *a* **712.**
$C_{36}H_{36}N_4O_6$	Photoprotoporphyrin isomer "A", dimethyl ester **903.**
	Photoprotoporphyrin isomer "B", dimethyl ester **904.**
$C_{36}H_{38}N_4O_4$	Protoporphyrin IX, dimethyl ester **931.**
$C_{36}H_{38}N_4O_8$	Coproporphyrin III **298.**

10.3. Author Index