Selected Tables of Atomic Spectra

A Atomic Energy Levels - Second Edition

B Multiplet Tables

H I, D, T

Data Derived from the Analyses of Optical Spectra

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Abstract

The present publication is the sixth Section of a series being prepared in response to the persistent need for a current revision of two sets of tables containing data on atomic spectra as derived from analyses of optical spectra. As in the previous sections, Part A contains the atomic energy levels and Part B the multiplet tables. The spectra of hydrogen and of the isotopes deuterium and tritium are included. The form of presentation is described in detail in the text to Section 1.

Key words: Atomic energy levels, H I, D, T; hydrogen spectra, H I, D, T; multiplet tables, H I, D, T; spectra H I, D, T; wavelengths, hydrogen spectra H I, D, T.

Foreword

The National Standard Reference Data System provides effective access to the quantitative data of physical science, critically evaluated and compiled for convenience, and readily accessible through a variety of distribution channels. The System was established in 1963 by action of the President's Office of Science and Technology and the Federal Council for Science and Technology, with responsibility to administer it assigned to the National Bureau of Standards.

The System now comprises a complex of data centers and other activities, carried on in academic institutions and other laboratories both in and out of government. The independent operational status of existing critical data projects is maintained and encouraged. Data centers that are components of the NSRDS produce compilations of critically evaluated data, critical reviews of the state of quantitative knowledge in specialized areas, and computations of useful functions derived from standard reference data. In addition, the centers and projects establish criteria for evaluation and compilation of data and make recommendations on needed improvements in experimental techniques. They are normally closely associated with active research in the relevant field.

The technical scope of the NSRDS is indicated by the principal categories of data compilation projects now active or being planned: nuclear properties, atomic and molecular properties, solid state properties, thermodynamic and transport properties, chemical kinetics, and colloid and surface properties and mechanical properties.

The NSRDS receives advice and planning assistance from the National Research Council of the National Academy of Sciences-National Academy of Engineering. An overall Review Committee considers the program as a whole and makes recommendations on policy, long-term planning, and international collaboration. Advisory Panels, each concerned with a single technical area, meet regularly to examine major portions of the program, assign relative priorities, and identify specific key problems in need of further attention. For selected specific topics, the Advisory Panels sponsor subpanels which make detailed studies of users' needs, the present state of knowledge, and existing data resources, as a basis for recommending one or more data compilation activities. This assembly of advisory services contributes greatly to the guidance of NSRDS activities.

The NSRDS-NBS series of publications is intended primarily to include evaluated reference data and critical reviews of long-term interest to the scientific and technical community.

LAWRENCE M. KUSHNER, *Acting Director*

Preface

The present publication is the sixth Section of a series that is being prepared in response to the increasing demand for a current revision of two sets of tables containing data on atomic spectra as derived from analyses of optical spectra.

The first set, Atomic Energy Levels, NBS Circular 467, consists of three Volumes published, respectively, in 1949, 1952, and 1958, and a fourth one on rare-earth spectra, still in course of preparation. This Circular has been reprinted as NSRDS–NBS 35, Volumes I, II, and III.

The second set consists of two Multiplet Tables; one published in 1945 by the Princeton University Observatory containing multiplets having wavelengths longer than 3000 Å; the other, An Ultra-Violet Multiplet Table, NBS Circular 488, appearing in five Sections, the first in 1950, the second in 1952, and the others in 1962. The 1945 Princeton Multiplet Table has been reprinted as NSRDS–NBS 40.

The present series includes both sets of data, the energy levels and multiplet tables, as parts A and B, respectively, for selected spectra contained in Volume I of "Atomic Energy Levels." The Sections are being published at irregular intervals as revised analyses become available. A flexible paging system permits the arrangement of the various Sections by atomic number, regardless of the order in which the separate spectra are published. Section 1 includes three spectra of silicon, $Z=14$: Si II, Si III, Si IV. Section 2 contains similar data for Si I. Section 3 covers all the spectra of carbon, $Z=6$: C I, C II, C III, C IV, C V, C VI. Section 4 includes four spectra of nitrogen, $Z=7$: N IV, N V, N VI, N VII. Section 5 is scheduled to include the remaining spectra of nitrogen: N I, N II, N III. The form of presentation of the data is described in detail in the text of Section 1. All Sections are arranged identically and the same conversion factor, cm^{-1} to eV, 0.000123981 is used throughout.

The manuscript has been prepared by Charlotte E. Moore who has published the earlier tables. She appreciates the cordial cooperation of numerous atomic spectroscopists. She is particularly indebted to J. D. Garcia and the late J. E. Mack, who carried out the extensive calculations on hydrogen-like spectra, especially for inclusion in this Series. W. C. Martin and his colleagues in the Spectroscopy Section of the National Bureau of Standards have provided valuable suggestions regarding details in the text and tables. Special thanks are due Isabel D. Murray for her meticulous care in preparing the tabular data. The splendid work of Barbara N. Somerville in typing the press copy of this difficult tabular material is, also, gratefully acknowledged.

Washington, D.C., March 24, 1972.

Contents

NSRDS--NBS 3, SECTION 6

HYDROGEN $Z = 1$

A H I Atomic Energy Levels

B H I Multiplet Table

HYDROGEN

Part A H I

1 electron $Z=1$

Ground state $1s\ ^2S_{01/2}$

$1s\ ^2S_{01/2}$ **109678.764** cm^{-1}, 911.754 Å (Vac) I P 13.598 eV

The data quoted here refer to the light isotope of hydrogen $^1_1$H I. Deuterium and tritium are being handled separately.

The energy levels of the spectra of the hydrogen isoelectronic sequence H I to Ca XX have been calculated by Garcia and Mack and reported in a paper entitled "Energy Level and Line Tables for One-Electron Atomic Spectra." For H I the level values are derived to six decimal places to $n=50$, with $R=109677.576$ cm $^{-1}$.

In the present table the calculated values have been rounded off to three decimals. Intervals are quoted to four places only in cases of resolved levels. For further details users should consult the original paper.

For unresolved groups the term designations in Part B have no real significance. The center of gravity of all levels having a given value of n has been used to derive the quoted wavelength, regardless of the arbitrary designation entered with "etc." throughout.

Since the publication of "Atomic Energy Levels," Humphreys has reported the observation of the first member of the Sixth Series of H I at 12.37 μ, the second line of the Pfund Series and the third, fourth and fifth lines of the Brackett Series.

The Lamb shift and both fine and hyperfine structure of H I have been widely discussed in the literature. In 1964 Edlén and Svensson derived accurate "centre-of-gravity" wavelengths of the Lyman lines, $1s-np$, $n=2$ to 7, and discussed "the various factors pertinent to their use as standards."

Observations of H I in the radiofrequency range have been of far-reaching significance. For example, the transition between the two hyperfine structure levels F=0 and F=1 of the ground term $1s\ ^2S_{01/2}$, 0.0475 cm^{-1}, is well known as the 21-cm line whose observed frequency is 1420 Mc/s. The presence of ground state hydrogen atoms in the interstellar medium was first established by the detection of this line.

A limited bibliography of work on H I was published by the writer in 1968. Many other papers could be quoted, as for example, the recent work by Shyn and his associates on the measurement of the $2s\ ^2S_{01/2}-2p\ ^2P^\circ_{11/2}$ energy separation as 9911.250 ± 0.063 MHz, as determined by an atomic-beam radiofrequency method.

A more recent paper by Hänsch and his co-workers on Laser Saturation Spectroscopy is of far-reaching importance. These authors have succeeded for the first time in resolving the single fine structure components of H α, and have observed the Lamb shift directly in the optical absorption spectrum.

An excellent general summary of the astrophysical importance of "The Spectra of Hydrogen" is contained in the Presidential Address to the Royal Society of Canada given by Herzberg in 1967.

H I—Continued

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H I

Config.	Desig.	J	Level	Interval
$1s$	$1s\ ^2S$	$0\frac{1}{2}$	0.000	
				0.0353
$2p$	$2p\ ^2P^\circ$	$0\frac{1}{2}$	82258.913	
$2s$	$2s\ ^2S$	$0\frac{1}{2}$	82258.949	0.3306
$2p$	$2p\ ^2P^\circ$	$1\frac{1}{2}$	82259.279	
				0.0105
$3p$	$3p\ ^2P^\circ$	$0\frac{1}{2}$	97492.205	0.098
$3s$	$3s\ ^2S$	$0\frac{1}{2}$	97492.215	0.036
$3p, 3d$	$3d\ ^2D$ $3p\ ^2P^\circ$	$1\frac{1}{2}$	97492.313	
$3d$	$3d\ ^2D$	$2\frac{1}{2}$	97492.349	
				0.0044
$4p$	$4p\ ^2P^\circ$	$0\frac{1}{2}$	102823.842	0.041
$4s$	$4s\ ^2S$	$0\frac{1}{2}$	102823.846	0.015
$4p, 4d$	$4d\ ^2D$ $4p\ ^2P^\circ$	$1\frac{1}{2}$	102823.887	0.008
$4d, 4f$	$4d\ ^2D$ $4f\ ^2F^\circ$	$2\frac{1}{2}$	102823.902	
$4f$	$4f\ ^2F^\circ$	$3\frac{1}{2}$	102823.910	
				0.0023
$5p$	$5p\ ^2P^\circ$	$0\frac{1}{2}$	105291.621	0.021
$5s$	$5s\ ^2S$	$0\frac{1}{2}$	105291.624	0.008
$5p, 5d$	$5d\ ^2D$ $5p\ ^2P^\circ$	$1\frac{1}{2}$	105291.645	0.003
$5d, 5f$	$5d\ ^2D$ $5f\ ^2F^\circ$	$2\frac{1}{2}$	105291.653	0.0000
$5g$	$5g\ ^2G$	$3\frac{1}{2}$	105291.656	0.0023
$5f$	$5f\ ^2F^\circ$	$3\frac{1}{2}$	105291.657	
$5g$	$5g\ ^2G$	$4\frac{1}{2}$	105291.659	
				0.0013
$6p$	$6p\ ^2P^\circ$	$0\frac{1}{2}$	106632.141	0.012
$6s$	$6s\ ^2S$	$0\frac{1}{2}$	106632.143	0.004
$6p, 6d$	$6d\ ^2D$ $6p\ ^2P^\circ$	$1\frac{1}{2}$	106632.155	0.002
$6d, 6f$	$6d\ ^2D$ $6f\ ^2F^\circ$	$2\frac{1}{2}$	106632.159	0.0000
$6g$	$6g\ ^2G$	$3\frac{1}{2}$	106632.161	0.001
$6f$	$6f\ ^2F^\circ$	$3\frac{1}{2}$	106632.162	0.001
$6g, 6h$	$6g\ ^2G$ $6h\ ^2H^\circ$	$4\frac{1}{2}$	106632.163	
$6h$	$6h\ ^2H^\circ$	$5\frac{1}{2}$	106632.164	
				0.0008
$7p$	$7p\ ^2P^\circ$	$0\frac{1}{2}$	107440.431	0.015
$7s$	$7s\ ^2S$	$0\frac{1}{2}$	107440.432	
etc.	$7i\ ^2I$	to $6\frac{1}{2}$	to .446	
				0.010
$8s, 8p$	$8s\ ^2S$ $8p\ ^2P^\circ$	$0\frac{1}{2}$	107965.042	
etc.	$8k\ ^2K^\circ$	to $7\frac{1}{2}$	to .052	

H I

Config.	Desig.	J	Level	Interval
$9s, 9p$	$9s\ ^2S$ $9p\ ^2P^\circ$	$0\frac{1}{2}$	108324.713	0.007
etc.	$9l\ ^2L$	to $8\frac{1}{2}$	to .720	
$10s, 10p$	$10s\ ^2S$ $10p\ ^2P^\circ$	$0\frac{1}{2}$	108581.983	0.005
etc.	$10m\ ^2M^\circ$	to $9\frac{1}{2}$	to .988	
$11s, 11p$	$11s\ ^2S$ $11p\ ^2P^\circ$	$0\frac{1}{2}$	108772.334	0.004
etc.	$11n\ ^2N$	to $10\frac{1}{2}$	to .338	
$12s, 12p$	$12s\ ^2S$ $12p\ ^2P^\circ$	$0\frac{1}{2}$	108917.111	0.003
etc.		to $11\frac{1}{2}$	to .114	
$13s, 13p$	$13s\ ^2S$ $13p\ ^2P^\circ$	$0\frac{1}{2}$	109029.782	0.002
etc.		to $12\frac{1}{2}$	to .784	
$14s, 14p$	$14s\ ^2S$ $14p\ ^2P^\circ$	$0\frac{1}{2}$	109119.183	0.002
etc.		to $13\frac{1}{2}$	to .185	
$15s, 15p$	$15s\ ^2S$ $15p\ ^2P^\circ$	$0\frac{1}{2}$	109191.307	0.001
etc.		to $14\frac{1}{2}$	to .308	
$16s, 16p$	$16s\ ^2S$ $16p\ ^2P^\circ$	$0\frac{1}{2}$	109250.335	0.001
etc.		to $15\frac{1}{2}$	to .336	
$17s, 17p$	$17s\ ^2S$ $17p\ ^2P^\circ$	$0\frac{1}{2}$	109299.256	0.001
etc.		to $16\frac{1}{2}$	to .257	
$18s, 18p$	$18s\ ^2S$ $18p\ ^2P^\circ$	$0\frac{1}{2}$	109340.252	0.001
etc.		to $17\frac{1}{2}$	to .253	
$19s, 19p$	$19s\ ^2S$ $19p\ ^2P^\circ$	$0\frac{1}{2}$	109374.947	0.001
etc.		to $18\frac{1}{2}$	to .948	
$20s, 20p$	$20s\ ^2S$ $20p\ ^2P^\circ$	$0\frac{1}{2}$	109404.570	
etc.		to $19\frac{1}{2}$	.570	
$21s, 21p$	$21s\ ^2S$ $21p\ ^2P^\circ$	$0\frac{1}{2}$	109430.062	
etc.		to $20\frac{1}{2}$	.062	
$22s, 22p$	$22s\ ^2S$ $22p\ ^2P^\circ$	$0\frac{1}{2}$	109452.157	0.001
etc.		to $21\frac{1}{2}$	to .158	

H I – Continued

Config.	Desig.	J	Level	Interval
23*s*, etc.	23*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109471.434	
24*s*, etc.	24*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109488.351 to .352	0.001
25*s*, etc.	25*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109503.280	
26*s*, etc.	26*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109516.519	
27*s*, etc.	27*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109528.315	
28*s*, etc.	28*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109538.869	
29*s*, etc.	29*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109548.351	
30*s*, etc.	30*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109556.900	
31*s*, etc.	31*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109564.635 to .636	0.001
32*s*, etc.	32*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109571.657	
33*s*, etc.	33*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109578.050	
34*s*, etc.	34*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109583.887	
35*s*, etc.	35*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109589.231	
36*s*, etc.	36*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109594.136	
37*s*, etc.	37*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109598.649	

H I – Continued

Config.	Desig.	J	Level	Interval
38*s*, etc.	38*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109602.810	
39*s*, etc.	39*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109606.655	
40*s*, etc.	40*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109610.216	
41*s*, etc.	41*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109613.519	
42*s*, etc.	42*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109616.589	
43*s*, etc.	43*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109619.447	
44*s*, etc.	44*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109622.113	
45*s*, etc.	45*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109624.602	
46*s*, etc.	46*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109626.932	
47*s*, etc.	47*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109629.114	
48*s*, etc.	48*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109631.161	
49*s*, etc.	49*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109633.084	
50*s*, etc.	50*s* ^{2}S, etc.	$0\frac{1}{2}$, etc.	109634.893	
	.....	.....	.....	
	Limit	.....	109678.764	

August, 1971.

HYDROGEN

Part B

H I ($Z = 1$)

I P 13.598 eV Limit 109678.764 cm^{-1} 911.754 Å (Vac)

Anal A List B August 1971

The data given here refer to the light isotope of hydrogen $^{1}_{1}$ H I.

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C. J. Humphreys, J. Research Nat. Bur. Std. **50**, No. 1, 1–6, RP2380 (1953). C L; W L 4861 Å to 123684 Å

A Wavelengths calculated from term values derived by J. D. Garcia and J. E. Mack, J. Opt. Soc. Am. **55**, No. 6, 654–685 (1965). I P, T, C L; W L 914.0386 Å to 887313.171 Å. For higher values of n where the terms are unresolved, the wavelength derived from the statistical mean of the components is quoted.

P Predicted wavelength for series members having $n > 20$, i.e., for series carried further than in reference A. In calculating these wavelengths the following mean values have been used for the lower level:

$2p\ ^2P^\circ$ etc. 82259.102 cm^{-1}
$3d\ ^2D$ etc. 97492.296 cm^{-1}
$4f\ ^2F^\circ$ etc. 102823.890 cm^{-1}
$5g\ ^2G$ etc. 105291.649 cm^{-1}
$6h\ ^2H^\circ$ etc. 106632.159 cm^{-1}

New UV Multiplet Numbers start with UV 18. The Multiplet Numbers in the 1945 Multiplet Table ($\lambda > 3000$ Å) have been replaced. The newly-assigned numbers are printed in bold face type through number 14 to distinguish them from the older ones.

‡*Raie Ultime*

H I

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac						
215.6683‡	A	Lα	0.00	10.20	$0\frac{1}{2}$–$1\frac{1}{2}$	$1s\ ^2S$ — $2p\ ^2P^\circ$
215.6737	A		0.00	10.20	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 1
025.7219	A	Lβ	0.00	12.09	$0\frac{1}{2}$–$1\frac{1}{2}$	$1s\ ^2S$ — $3p\ ^2P^\circ$
025.7230	A		0.00	12.09	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 2
972.5367	A	Lγ	0.00	12.75	$0\frac{1}{2}$–$1\frac{1}{2}$	$1s\ ^2S$ — $4p\ ^2P^\circ$
972.5371	A		0.00	12.75	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 3

H I

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac						
949.7430	A	Lδ	0.00	13.05	$0\frac{1}{2}$–$1\frac{1}{2}$	$1s\ ^2S$ — $5p\ ^2P^\circ$
949.7432	A		0.00	13.05	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 4
937.8034	A	Lϵ	0.00	13.22	$0\frac{1}{2}$–$1\frac{1}{2}$	$1s\ ^2S$ — $6p\ ^2P^\circ$
937.8035	A		0.00	13.22	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 5
930.7483	A		0.00	13.32	$0\frac{1}{2}$–	$1s\ ^2S$ — $7p\ ^2P^\circ$
						UV 6
926.2257	A		0.00	13.39	$0\frac{1}{2}$–	$1s\ ^2S$ — $8p\ ^2P^\circ$
						UV 7

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac						
923.1504	A		0.00	13.43	0½–	1s ²S — 9p ²P° UV 8
920.9631	A		0.00	13.46	0½–	1s ²S —10p ²P° UV 9
919.3514	A		0.00	13.49	0½–	1s ²S —11p ²P° UV 10
918.1294	A		0.00	13.50	0½–	1s ²S —12p ²P° UV 11
917.1806	A		0.00	13.52	0½–	1s ²S —13p ²P° UV 12
916.4291	A		0.00	13.53	0½–	1s ²S —14p ²P° UV 13
915.8238	A		0.00	13.54	0½–	1s ²S —15p ²P° UV 14
915.3290	A		0.00	13.54	0½–	1s ²S —16p ²P° UV 15
914.9193	A		0.00	13.55	0½–	1s ²S —17p ²P° UV 16
914.5763	A		0.00	13.56	0½–	1s ²S —18p ²P° UV 17
914.2862	A		0.00	13.56	0½–	1s ²S —19p ²P° UV 18
914.0386	A		0.00	13.56	0½–	1s ²S —20p ²P° UV 19
913.826	P		0.00	13.57	0½–	1s ²S —21p ²P° UV 20
913.641	P		0.00	13.57	0½–	1s ²S —22p ²P° UV 21
913.480	P		0.00	13.57	0½–	1s ²S —23p ²P° UV 22
913.339	P		0.00	13.57	0½–	1s ²S —24p ²P° UV 23
913.215	P		0.00	13.58	0½–	1s ²S —25p ²P° UV 24
913.104	P		0.00	13.58	0½–	1s ²S —26p ²P° UV 25

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac						
913.006	P		0.00	13.58	0½–	1s ²S —27p ²P° UV 26
912.918	P		0.00	13.58	0½–	1s ²S —28p ²P° UV 27
912.839	P		0.00	13.58	0½–	1s ²S —29p ²P° UV 28
912.768	P		0.00	13.58	0½–	1s ²S —30p ²P° UV 29
912.703	P		0.00	13.58	0½–	1s ²S —31p ²P° UV 30
912.645	P		0.00	13.58	0½–	1s ²S —32p ²P° UV 31
912.592	P		0.00	13.59	0½–	1s ²S —33p ²P° UV 32
912.543	P		0.00	13.59	0½–	1s ²S —34p ²P° UV 33
912.498	P		0.00	13.59	0½–	1s ²S —35p ²P° UV 34
912.458	P		0.00	13.59	0½–	1s ²S —36p ²P° UV 35
912.420	P		0.00	13.59	0½–	1s ²S —37p ²P° UV 36
912.385	P		0.00	13.59	0½–	1s ²S —38p ²P° UV 37
912.353	P		0.00	13.59	0½–	1s ²S —39p ²P° UV 38
912.324	P		0.00	13.59	0½–	1s ²S —40p ²P° UV 39
912.296	P		0.00	13.59	0½–	1s ²S —41p ²P° UV 40
912.271	P		0.00	13.59	0½–	1s ²S —42p ²P° UV 41
912.247	P		0.00	13.59	0½–	1s ²S —43p ²P° UV 42
912.225	P		0.00	13.59	0½–	1s ²S —44p ²P° UV 43

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac						
912.204	P		0.00	13.59	$0\frac{1}{2}-$	$1s\ ^2S - 45p\ ^2P^\circ$ UV 44
912.185	P		0.00	13.59	$0\frac{1}{2}-$	$1s\ ^2S - 46p\ ^2P^\circ$ UV 45
912.166	P		0.00	13.59	$0\frac{1}{2}-$	$1s\ ^2S - 47p\ ^2P^\circ$ UV 46
912.149	P		0.00	13.59	$0\frac{1}{2}-$	$1s\ ^2S - 48p\ ^2P^\circ$ UV 47
912.133	P		0.00	13.59	$0\frac{1}{2}-$	$1s\ ^2S - 49p\ ^2P^\circ$ UV 48
912.118	P		0.00	13.59	$0\frac{1}{2}-$	$1s\ ^2S\ 50p\ ^2P^\circ$ UV 49
911.754	A		0.00	13.60	$0\frac{1}{2}-$	$1s\ ^2S$ —Limit UV 50
Air						
6562.9099	A		10.20	12.09	$1\frac{1}{2}-0\frac{1}{2}$	$2p\ ^2P^\circ - 3s\ ^2S$
6562.7520	A		10.20	12.09	$0\frac{1}{2}-0\frac{1}{2}$	1.01
6562.8520	A	Hα	10.20	12.09	$1\frac{1}{2}-2\frac{1}{2}$	$2p\ ^2P^\circ - 3d\ ^2D$
6562.7101	A		10.20	12.09	$0\frac{1}{2}-1\frac{1}{2}$	**1**
6562.7256	A		10.20	12.09	$0\frac{1}{2}-1\frac{1}{2}$	$2s\ ^2S - 3p\ ^2P^\circ$
6562.7720	A		10.20	12.09	$0\frac{1}{2}-0\frac{1}{2}$	1.02
4861.3752	A		10.20	12.75	$1\frac{1}{2}-0\frac{1}{2}$	$2p\ ^2P^\circ - 4s\ ^2S$
4861.2885	A		10.20	12.75	$0\frac{1}{2}-0\frac{1}{2}$	2.01
4861.3620	A	Hβ	10.20	12.75	$1\frac{1}{2}-2\frac{1}{2}$	$2p\ ^2P^\circ - 4d\ ^2D$
4861.2789	A		10.20	12.75	$0\frac{1}{2}-1\frac{1}{2}$	**2**
4861.2873	A		10.20	12.75	$0\frac{1}{2}-1\frac{1}{2}$	$2s\ ^2S - 4p\ ^2P^\circ$
4861.2980	A		10.20	12.75	$0\frac{1}{2}-0\frac{1}{2}$	2.02
4340.5001	A		10.20	13.05	$1\frac{1}{2}-0\frac{1}{2}$	$2p\ ^2P^\circ - 5s\ ^2S$
4340.4312	A		10.20	13.05	$0\frac{1}{2}-0\frac{1}{2}$	3.01
4340.4946	A	Hγ	10.20	13.05	$1\frac{1}{2}-2\frac{1}{2}$	$2p\ ^2P^\circ - 5d\ ^2D$
4340.4272	A		10.20	13.05	$0\frac{1}{2}-1\frac{1}{2}$	**3**

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
4340.4340	A		10.20	13.05	$0\frac{1}{2}-1\frac{1}{2}$	$2s\ ^2S - 5p\ ^2P^\circ$
4340.4385	A		10.20	13.05	$0\frac{1}{2}-0\frac{1}{2}$	3.02
4101.7662	A		10.20	13.22	$1\frac{1}{2}-0\frac{1}{2}$	$2p\ ^2P^\circ - 6s\ ^2S$
4101.7045	A		10.20	13.22	$0\frac{1}{2}-0\frac{1}{2}$	4.01
4101.7650	A	Hδ	10.20	13.22	$1\frac{1}{2}-2\frac{1}{2}$	$2p\ ^2P^\circ - 6d\ ^2D$
4101.7025	A		10.20	13.22	$0\frac{1}{2}-1\frac{1}{2}$	**4**
4101.7087	A		10.20	13.22	$0\frac{1}{2}-1\frac{1}{2}$	$2s\ ^2S - 6p\ ^2P^\circ$
4101.7110	A		10.20	13.22	$0\frac{1}{2}-0\frac{1}{2}$	4.02
3970.072	A	Hε	10.20	13.32		$2p\ ^2P^\circ - 7d\ ^2D$
						etc. **5** etc.
3889.049	A		10.20	13.39		$2p\ ^2P^\circ - 8d\ ^2D$
						etc. **6** etc.
3835.384	A		10.20	13.43		$2p\ ^2P^\circ - 9d\ ^2D$
						etc. **7** etc.
3797.898	A		10.20	13.46		$2p\ ^2P^\circ - 10d\ ^2D$
						etc. **8** etc.
3770.630	A		10.20	13.49		$2p\ ^2P^\circ - 11d\ ^2D$
						etc. **9** etc.
3750.152	A		10.20	13.50		$2p\ ^2P^\circ - 12d\ ^2D$
						etc. **10** etc.
3734.368	A		10.20	13.52		$2p\ ^2P^\circ - 13d\ ^2D$
						etc. **11** etc.
3721.938	A		10.20	13.53		$2p\ ^2P^\circ - 14d\ ^2D$
						etc. **12** etc.
3711.971	A		10.20	13.54		$2p\ ^2P^\circ - 15d\ ^2D$
						etc. **13** etc.
3703.853	A		10.20	13.54		$2p\ ^2P^\circ - 16d\ ^2D$
						etc. **14** etc.
3697.152	A		10.20	13.55		$2p\ ^2P^\circ - 17d\ ^2D$
						etc. **15** etc.
3691.555	A		10.20	13.56		$2p\ ^2P^\circ - 18d\ ^2D$
						etc. **16** etc.
3686.831	A		10.20	13.56		$2p\ ^2P^\circ - 19d\ ^2D$
						etc. **17** etc.

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
3682.808	A		10.20	13.56		$2p\ ^2P^o$—$20d\ ^2D$ etc. 18 etc.
3679.352	P		10.20	13.57		$2p\ ^2P^o$—$21d\ ^2D$ etc. 19 etc.
3676.363	P		10.20	13.57		$2p\ ^2P^o$—$22d\ ^2D$ etc. 20 etc.
3673.758	P		10.20	13.57		$2p\ ^2P^o$—$23d\ ^2D$ etc. 21 etc.
3671.476	P		10.20	13.57		$2p\ ^2P^o$—$24d\ ^2D$ etc. 22 etc.
3669.464	P		10.20	13.58		$2p\ ^2P^o$—$25d\ ^2D$ etc. 23 etc.
3667.682	P		10.20	13.58		$2p\ ^2P^o$—$26d\ ^2D$ etc. 24 etc.
3666.095	P		10.20	13.58		$2p\ ^2P^o$—$27d\ ^2D$ etc. 25 etc.
3664.677	P		10.20	13.58		$2p\ ^2P^o$—$28d\ ^2D$ etc. 26 etc.
3663.403	P		10.20	13.58		$2p\ ^2P^o$—$29d\ ^2D$ etc. 27 etc.
3662.256	P		10.20	13.58		$2p\ ^2P^o$—$30d\ ^2D$ etc. 28 etc.
3661.219	P		10.20	13.58		$2p\ ^2P^o$—$31d\ ^2D$ etc. 29 etc.
3660.277	P		10.20	13.58		$2p\ ^2P^o$—$32d\ ^2D$ etc. 30 etc.
3659.420	P		10.20	13.59		$2p\ ^2P^o$—$33d\ ^2D$ etc. 31 etc.
3658.639	P		10.20	13.59		$2p\ ^2P^o$—$34d\ ^2D$ etc. 32 etc.
3657.923	P		10.20	13.59		$2p\ ^2P^o$—$35d\ ^2D$ etc. 33 etc.
3657.267	P		10.20	13.59		$2p\ ^2P^o$—$36d\ ^2D$ etc. 34 etc.
3656.663	P		10.20	13.59		$2p\ ^2P^o$—$37d\ ^2D$ etc. 35 etc.
3656.107	P		10.20	13.59		$2p\ ^2P^o$—$38d\ ^2D$ etc. 36 etc.

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
3651.822	P		10.20	13.59		$2p\ ^2P^o$—$50d\ ^2D$ etc. 37 etc.
3645.979	A		10.20	13.60		$2p\ ^2P^o$—Limit etc. 38
18751.210	A		12.09	12.75	$1\frac{1}{2}$–$0\frac{1}{2}$	$3p\ ^2P^o$— $4s\ ^2S$
18750.830	A		12.09	12.75	$0\frac{1}{2}$–$0\frac{1}{2}$	39.01
18750.724	A		12.09	12.75	$0\frac{1}{2}$–$1\frac{1}{2}$	$3s\ ^2S$ — $4p\ ^2P^o$
18750.883	A		12.09	12.75	$0\frac{1}{2}$–$0\frac{1}{2}$	39.02
18751.015	A		12.09	12.75		$3d\ ^2D$ — $4f\ ^2F^o$ etc. 39 etc.
12818.140	A		12.09	13.05	$1\frac{1}{2}$–$0\frac{1}{2}$	$3p\ ^2P^o$— $5s\ ^2S$
12817.962	A		12.09	13.05	$0\frac{1}{2}$–$0\frac{1}{2}$	40.01
12817.945	A		12.09	13.05	$0\frac{1}{2}$–$1\frac{1}{2}$	$3s\ ^2S$ — $5p\ ^2P^o$
12817.983	A		12.09	13.05	$0\frac{1}{2}$–$0\frac{1}{2}$	40.02
12818.082	A		12.09	13.05		$3d\ ^2D$ — $5f\ ^2F^o$ etc. 40 etc.
10938.126	A		12.09	13.22	$1\frac{1}{2}$–$0\frac{1}{2}$	$3p\ ^2P^o$— $6s\ ^2S$
10937.998	A		12.09	13.22	$0\frac{1}{2}$–$0\frac{1}{2}$	41.01
10937.995	A		12.09	13.22	$0\frac{1}{2}$–$1\frac{1}{2}$	$3s\ ^2S$ — $6p\ ^2P^o$
10938.012	A		12.09	13.22	$0\frac{1}{2}$–$0\frac{1}{2}$	41.02
10938.095	A		12.09	13.22		$3d\ ^2D$ — $6f\ ^2F^o$ etc. 41 etc.
10049.374	A		12.09	13.32		$3d\ ^2D$ — $7f\ ^2F^o$ etc. 42 etc.
9545.972	A		12.09	13.39		$3d\ ^2D$ — $8f\ ^2F^o$ etc. 43 etc.
9229.015	A		12.09	13.43		$3d\ ^2D$ — $9f\ ^2F^o$ etc. 44 etc.
9014.911	A		12.09	13.46		$3d\ ^2D$ —$10f\ ^2F^o$ etc. 45 etc.
8862.784	A		12.09	13.49		$3d\ ^2D$ —$11f\ ^2F^o$ etc. 46 etc.
8750.473	A		12.09	13.50		$3d\ ^2D$ —$12f\ ^2F^o$ etc. 47 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
8665.019	A		12.09	13.52		$3d\ ^2D - 13f\ ^2F^\circ$ etc. 48 etc.
8598.392	A		12.09	13.53		$3d\ ^2D - 14f\ ^2F^\circ$ etc. 49 etc.
8545.383	A		12.09	13.54		$3d\ ^2D - 15f\ ^2F^\circ$ etc. 50 etc.
8502.483	A		12.09	13.54		$3d\ ^2D - 16f\ ^2F^\circ$ etc. 51 etc.
8467.254	A		12.09	13.55		$3d\ ^2D - 17f\ ^2F^\circ$ etc. 52 etc.
8437.955	A		12.09	13.56		$3d\ ^2D - 18f\ ^2F^\circ$ etc. 53 etc.
8413.318	A		12.09	13.56		$3d\ ^2D - 19f\ ^2F^\circ$ etc. 54 etc.
8392.397	A		12.09	13.56		$3d\ ^2D - 20f\ ^2F^\circ$ etc. 55 etc.
8374.476	P		12.09	13.57		$3d\ ^2D - 21f\ ^2F^\circ$ etc. 56 etc.
8359.004	P		12.09	13.57		$3d\ ^2D - 22f\ ^2F^\circ$ etc. 57 etc.
8345.553	P		12.09	13.57		$3d\ ^2D - 23f\ ^2F^\circ$ etc. 58 etc.
8333.784	P		12.09	13.57		$3d\ ^2D - 24f\ ^2F^\circ$ etc. 59 etc.
8323.426	P		12.09	13.58		$3d\ ^2D - 25f\ ^2F^\circ$ etc. 60 etc.
8314.261	P		12.09	13.58		$3d\ ^2D - 26f\ ^2F^\circ$ etc. 61 etc.
8306.112	P		12.09	13.58		$3d\ ^2D - 27f\ ^2F^\circ$ etc. 62 etc.
8298.836	P		12.09	13.58		$3d\ ^2D - 28f\ ^2F^\circ$ etc. 63 etc.
8292.308	P		12.09	13.58		$3d\ ^2D - 29f\ ^2F^\circ$ etc. 64 etc.
8286.432	P		12.09	13.58		$3d\ ^2D - 30f\ ^2F^\circ$ etc. 65 etc.
8281.123	P		12.09	13.58		$3d\ ^2D - 31f\ ^2F^\circ$ etc. 66 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
8276.309	P		12.09	13.58		$3d\ ^2D - 32f\ ^2F^\circ$ etc. 67 etc.
8271.932	P		12.09	13.59		$3d\ ^2D - 33f\ ^2F^\circ$ etc. 68 etc.
8267.938	P		12.09	13.59		$3d\ ^2D - 34f\ ^2F^\circ$ etc. 69 etc.
8264.286	P		12.09	13.59		$3d\ ^2D - 35f\ ^2F^\circ$ etc. 70 etc.
8260.936	P		12.09	13.59		$3d\ ^2D - 36f\ ^2F^\circ$ etc. 71 etc.
8257.856	P		12.09	13.59		$3d\ ^2D - 37f\ ^2F^\circ$ etc. 72 etc.
8255.019	P		12.09	13.59		$3d\ ^2D - 38f\ ^2F^\circ$ etc. 73 etc.
8233.208	A		12.09	13.59		$3d\ ^2D - 50f\ ^2F^\circ$ etc. 74 etc.
8203.568	A		12.09	13.60		$3d\ ^2D$ —Limit 75
40511.92	A		12.75	13.05	$1\frac{1}{2}-0\frac{1}{2}$	$4p\ ^2P^\circ - 5s\ ^2S$ 76.01
40511.17	A		12.75	13.05	$0\frac{1}{2}-0\frac{1}{2}$	
40510.87	A		12.75	13.05	$0\frac{1}{2}-1\frac{1}{2}$	$4s\ ^2S - 5p\ ^2P^\circ$ 76.02
40511.28	A		12.75	13.05	$0\frac{1}{2}-0\frac{1}{2}$	
40511.579	A		12.75	13.05		$4f\ ^2F^\circ - 5g\ ^2G$ 76
26251.57	A		12.75	13.22	$1\frac{1}{2}-0\frac{1}{2}$	$4p\ ^2P^\circ - 6s\ ^2S$ 77.01
26251.27	A		12.75	13.22	$0\frac{1}{2}-0\frac{1}{2}$	
26251.21	A		12.75	13.22	$0\frac{1}{2}-1\frac{1}{2}$	$4s\ ^2S - 6p\ ^2P^\circ$ 77.02
26251.31	A		12.75	13.22	$0\frac{1}{2}-0\frac{1}{2}$	
26251.512	A		12.75	13.22		$4f\ ^2F^\circ - 6g\ ^2G$ 77
21655.287	A		12.75	13.32		$4f\ ^2F^\circ - 7g\ ^2G$ etc. 78 etc.

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
19445.564	A		12.75	13.39		$4f\ ^2F^\circ$ — $8g\ ^2G$ etc. 79 etc.
18174.123	A		12.75	13.43		$4f\ ^2F^\circ$ — $9g\ ^2G$ etc. 80 etc.
17362.110	A		12.75	13.46		$4f\ ^2F^\circ$ — $10g\ ^2G$ etc. 81 etc.
16806.522	A		12.75	13.49		$4f\ ^2F^\circ$ — $11g\ ^2G$ etc. 82 etc.
16407.193	A		12.75	13.50		$4f\ ^2F^\circ$ — $12g\ ^2G$ etc. 83 etc.
16109.314	A		12.75	13.52		$4f\ ^2F^\circ$ — $13g\ ^2G$ etc. 84 etc.
15880.543	A		12.75	13.53		$4f\ ^2F^\circ$ — $14g\ ^2G$ etc. 85 etc.
15700.663	A		12.75	13.54		$4f\ ^2F^\circ$ — $15g\ ^2G$ etc. 86 etc.
15556.450	A		12.75	13.54		$4f\ ^2F^\circ$ — $16g\ ^2G$ etc. 87 etc.
15438.922	A		12.75	13.55		$4f\ ^2F^\circ$ — $17g\ ^2G$ etc. 88 etc.
15341.791	A		12.75	13.56		$4f\ ^2F^\circ$ — $18g\ ^2G$ etc. 89 etc.
15260.539	A		12.75	13.56		$4f\ ^2F^\circ$ — $19g\ ^2G$ etc. 90 etc.
15191.845	A		12.75	13.56		$4f\ ^2F^\circ$ — $20g\ ^2G$ etc. 91 etc.
15133.225	P		12.75	13.57		$4f\ ^2F^\circ$ — $21g\ ^2G$ etc. 92 etc.
15082.777	P		12.75	13.57		$4f\ ^2F^\circ$ — $22g\ ^2G$ etc. 93 etc.
15039.040	P		12.75	13.57		$4f\ ^2F^\circ$ — $23g\ ^2G$ etc. 94 etc.
15000.862	P		12.75	13.57		$4f\ ^2F^\circ$ — $24g\ ^2G$ etc. 95 etc.
14967.131	P		12.75	13.58		$4f\ ^2F^\circ$ — $25g\ ^2G$ etc. 96 etc.
14937.730	P		12.75	13.58		$4f\ ^2F^\circ$ — $26g\ ^2G$ etc. 97 etc.
14911.447	P		12.75	13.58		$4f\ ^2F^\circ$ — $27g\ ^2G$ etc. 98 etc.

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
14888.010	P		12.75	13.58		$4f\ ^2F^\circ$ — $28g\ ^2G$ etc. 99 etc.
14867.017	P		12.75	13.58		$4f\ ^2F^\circ$ — $29g\ ^2G$ etc. 100 etc.
14848.142	P		12.75	13.58		$4f\ ^2F^\circ$ — $30g\ ^2G$ etc. 101 etc.
14678.114	P		12.75	13.59		$4f\ ^2F^\circ$ — $50g\ ^2G$ etc. 102 etc.
74578.80	A		13.05	13.22	$1\frac{1}{2}$–$0\frac{1}{2}$	$5p\ ^2P^\circ$ — $6s\ ^2S$ 103.01
74578.250	A		13.05	13.22		$5g\ ^2G$ — $6h\ ^2H^\circ$ 103
46525.098	A		13.05	13.32		$5g\ ^2G$ — $7h\ ^2H^\circ$ etc. 104 etc.
37395.370	A		13.05	13.39		$5g\ ^2G$ — $8h\ ^2H^\circ$ etc. 105 etc.
32960.929	A		13.05	13.43		$5g\ ^2G$ — $9h\ ^2H^\circ$ etc. 106 etc.
30383.737	A		13.05	13.46		$5g\ ^2G$ — $10h\ ^2H^\circ$ etc. 107 etc.
28722.126	A		13.05	13.49		$5g\ ^2G$ — $11h\ ^2H^\circ$ etc. 108 etc.
27575.156	A		13.05	13.50		$5g\ ^2G^\circ$ — $12h\ ^2H^\circ$ etc. 109 etc.
26744.018	A		13.05	13.52		$5g\ ^2G^\circ$ — $13h\ ^2H^\circ$ etc. 110 etc.
26119.352	A		13.05	13.53		$5g\ ^2G$ — $14h\ ^2H^\circ$ etc. 111 etc.
25636.276	A		13.05	13.54		$5g\ ^2G$ — $15h\ ^2H^\circ$ etc. 112 etc.
25254.015	A		13.05	13.54		$5g\ ^2G$ — $16h\ ^2H^\circ$ etc. 113 etc.
24945.738	A		13.05	13.55		$5g\ ^2G$ — $17h\ ^2H^\circ$ etc. 114 etc.
24693.137	A		13.05	13.56		$5g\ ^2G$ — $18h\ ^2H^\circ$ etc. 115 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
24483.323	A		13.05	13.56		$5g\ ^2G - 19h\ ^2H^\circ$ etc. 116 etc.
24306.989	A		13.05	13.56		$5g\ ^2G - 20h\ ^2H^\circ$ etc. 117 etc.
23017.983	P		13.05	13.59		$5g\ ^2G - 50h\ ^2H^\circ$ etc. 118 etc.
123685.270	A		13.22	13.32		$6h\ ^2H^\circ - 7i\ ^2I$ etc. 119 etc.
75004.488	A		13.22	13.39		$6h\ ^2H^\circ - 8i\ ^2I$ etc. 120 etc.
59066.034	A		13.22	13.43		$6h\ ^2H^\circ - 9i\ ^2I$ etc. 121 etc.
51272.598	A		13.22	13.46		$6h\ ^2H^\circ - 10i\ ^2I$ etc. 122 etc.
46712.353	A		13.22	13.49		$6h\ ^2H^\circ - 11i\ ^2I$ etc. 123 etc.
43752.617	A		13.22	13.50		$6h\ ^2H^\circ - 12i\ ^2I$ etc. 124 etc.
41696.572	A		13.22	13.52		$6h\ ^2H^\circ - 13i\ ^2I$ etc. 125 etc.
40197.716	A		13.22	13.53		$6h\ ^2H^\circ - 14i\ ^2I$ etc. 126 etc.
39064.836	A		13.22	13.54		$6h\ ^2H^\circ - 15i\ ^2I$ etc. 127 etc.
38184.101	A		13.22	13.54		$6h\ ^2H^\circ - 16i\ ^2I$ etc. 128 etc.
37483.714	A		13.22	13.55		$6h\ ^2H^\circ - 17i\ ^2I$ etc. 129 etc.
36916.270	A		13.22	13.56		$6h\ ^2H^\circ - 18i\ ^2I$ etc. 130 etc.
36449.295	A		13.22	13.56		$6h\ ^2H^\circ - 19i\ ^2I$ etc. 131 etc.
36059.849	A		13.22	13.56		$6h\ ^2H^\circ - 20i\ ^2I$ etc. 132 etc.
33293.900	P		13.22	13.59		$6h\ ^2H^\circ - 50i\ ^2I$ 133
190567.045	A		13.32	13.39		$7i\ ^2I - 8k\ ^2K^\circ$ etc. 134 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
113056.141	A		13.32	13.43		$7i\ ^2I - 9k\ ^2K^\circ$ etc. 135 etc.
87576.773	A		13.32	13.46		$7i\ ^2I - 10k\ ^2K^\circ$ etc. 136 etc.
75060.591	A		13.32	13.49		$7i\ ^2I - 11k\ ^2K^\circ$ etc. 137 etc.
67701.453	A		13.32	13.50		$7i\ ^2I - 12k\ ^2K^\circ$ etc. 138 etc.
62902.015	A		13.32	13.52		$7i\ ^2I - 13k\ ^2K^\circ$ etc. 139 etc.
59552.203	A		13.32	13.53		$7i\ ^2I - 14k\ ^2K^\circ$ etc. 140 etc.
57099.058	A		13.32	13.54		$7i\ ^2I - 15k\ ^2K^\circ$ etc. 141 etc.
55236.826	A		13.32	13.54		$7i\ ^2I - 16k\ ^2K^\circ$ etc. 142 etc.
53783.083	A		13.32	13.55		$7i\ ^2I - 17k\ ^2K^\circ$ etc. 143 etc.
52622.492	A		13.32	13.56		$7i\ ^2I - 18k\ ^2K^\circ$ etc. 144 etc.
51678.714	A		13.32	13.56		$7i\ ^2I - 19k\ ^2K^\circ$ etc. 145 etc.
50899.318	A		13.32	13.56		$7i\ ^2I - 20k\ ^2K^\circ$ etc. 146 etc.
277958.040	A		13.39	13.43		$8k\ ^2K^\circ - 9l\ ^2L$ etc. 147 etc.
162046.877	A		13.39	13.46		$8k\ ^2K^\circ - 10l\ ^2L$ etc. 148 etc.
123837.927	A		13.39	13.49		$8k\ ^2K^\circ - 11l\ ^2L$ etc. 149 etc.
105006.373	A		13.39	13.50		$8k\ ^2K^\circ - 12l\ ^2L$ etc. 150 etc.
93894.586	A		13.39	13.52		$8k\ ^2K^\circ - 13l\ ^2L$ etc. 151 etc.
86621.417	A		13.39	13.53		$8k\ ^2K^\circ - 14l\ ^2L$ etc. 152 etc.
81526.684	A		13.39	13.54		$8k\ ^2K^\circ - 15l\ ^2L$ etc. 153 etc.

H I—Continued

I A	Ref	Int	E P		J	Multiplet No.
			Low	High		
Air						
388592.763	A		13.43	13.46		$9l\ ^2L - 10m\ ^2M^\circ$ etc. 154 etc.
223343.698	A		13.43	13.49		$9l\ ^2L - 11m\ ^2M^\circ$ etc. 155 etc.
168760.287	A		13.43	13.50		$9l\ ^2L - 12m\ ^2M^\circ$ etc. 156 etc.

H I—Continued

I A	Ref	Int	E P		J	Multiplet No.
			Low	High		
Air						
141792.199	A		13.43	13.52		$9l\ ^2L - 13m\ ^2M^\circ$ etc. 157 etc.
125836.471	A		13.43	13.53		$9l\ ^2L - 14m\ ^2M^\circ$ etc. 158 etc.
115363.473	A		13.43	13.54		$9l\ ^2L - 15m\ ^2M^\circ$ etc. 159 etc.

NSRDS-NBS 3, SECTION 6

DEUTERIUM AND TRITIUM Z = 1

A	D and T	Atomic Energy Levels
B	D	Multiplet Table
B	T	Multiplet Table

DEUTERIUM AND TRITIUM

Part A — D AND T

1 electron $Z = 1$

Ground state $1s\ ^2S_{01/2}$

$1s\ ^2S_{01/2}$ D($^2_1$H I)	**109708.608** cm^{-1}, 911.506 Å (Vac)	I P (D)13.602 eV
$1s\ ^2S_{01/2}$ T($^3_1$H I)	**109718.538** cm^{-1}, 911.423 Å (Vac)	I P (T)13.603 eV

The energy levels are quoted from the paper by Garcia and Mack, who calculated "Energy Levels and Line Tables for One-Electron Atomic Spectra" for the spectra of the hydrogen isoelectronic sequence H I to Ca XX. For D and T the level values are determined to six decimal places to $n = 50$, with R = 109707.420 (D) and 109717.350 (T), respectively.

In the present table the calculated values have been rounded off to three decimals. Intervals are given to four places only in cases of resolved levels. For further details users should consult the original paper, in which the formulas and constants are fully described.

REFERENCE

J. D. Garcia and J. E. Mack, J. Opt. Soc. Am. **55**, No. 6, 654–685 (1965). I P, T, C L.

Config.	Desig.	J	D Level	T Level	Interval
$1s$	$1s\ ^2S$	$0\frac{1}{2}$	0.000	0.000	
$2p$	$2p\ ^2P°$	$0\frac{1}{2}$	82281.296	82288.743	0.0353
$2s$	$2s\ ^2S$	$0\frac{1}{2}$	82281.331	82288.779	0.3307
$2p$	$2p\ ^2P°$	$1\frac{1}{2}$	82281.662	82289.109	
$3p$	$3p\ ^2P°$	$0\frac{1}{2}$	97518.732	97527.559	0.0105
$3s$	$3s\ ^2S$	$0\frac{1}{2}$	97518.743	97527.569	0.0978
$3d$	$3d\ ^2D$	$1\frac{1}{2}$	97518.840	97527.667	0.0002
$3p$	$3p\ ^2P°$	$1\frac{1}{2}$	97518.841	97527.667	0.0360
$3d$	$3d\ ^2D$	$2\frac{1}{2}$	97518.877	97527.703	
$4p$	$4p\ ^2P°$	$0\frac{1}{2}$	102851.820	102861.129	0.0044
$4s$	$4s\ ^2S$	$0\frac{1}{2}$	102851.824	102861.133	0.041
$4p$, $4d$	$4d\ ^2D$ $4p\ ^2P°$	$1\frac{1}{2}$	102851.866	102861.175	0.015
$4d$, $4f$	$4d\ ^2D$ $4f\ ^2F°$	$2\frac{1}{2}$	102851.881	102861.190	0.0076
$4f$	$4f\ ^2F°$	$3\frac{1}{2}$	102851.888	102861.198	
$5p$	$5p\ ^2P°$	$0\frac{1}{2}$	105320.271	105329.804	0.0023
$5s$	$5s\ ^2S$	$0\frac{1}{2}$	105320.274	105329.806	0.0211
$5p$, $5d$	$5d\ ^2D$ $5p\ ^2P°$	$1\frac{1}{2}$	105320.295	105329.827	0.0078
$5d$, $5f$	$5d\ ^2D$ $5f\ ^2F°$	$2\frac{1}{2}$	105320.303	105329.835	0.0039
$5f$, $5g$	$5g\ ^2G$ $5f\ ^2F°$	$3\frac{1}{2}$	105320.306	105329.839	0.0023
$5g$	$5g\ ^2G$	$4\frac{1}{2}$	105320.309	105329.841	
$6p$	$6p\ ^2P°$	$0\frac{1}{2}$	106661.156	106670.810	0.0013
$6s$	$6s\ ^2S$	$0\frac{1}{2}$	106661.157	106670.811	0.0122
$6p$, $6d$	$6d\ ^2D$ $6p\ ^2P°$	$1\frac{1}{2}$	106661.169	106670.823	0.0045
$6d$, $6f$	$6d\ ^2D$ $6f\ ^2F°$	$2\frac{1}{2}$	106661.174	106670.828	0.0022
$6f$, $6g$	$6g\ ^2G$ $6f\ ^2F°$	$3\frac{1}{2}$	106661.176	106670.830	0.0014
$6g$, $6h$	$6g\ ^2G$ $6h\ ^2H°$	$4\frac{1}{2}$	106661.178	106670.831	0.0009
$6h$	$6h\ ^2H°$	$5\frac{1}{2}$	106661.178	106670.832	
$7p$	$7p\ ^2P°$	$0\frac{1}{2}$	107469.666	107479.393	0.0018
$7s$	$7s\ ^2S$	$0\frac{1}{2}$	107469.667	107479.394	0.0077
$7p$, $7d$	$7d\ ^2D$ $7p\ ^2P°$	$1\frac{1}{2}$	107469.674	107479.401	0.0028
$7d$, $7f$	$7d\ ^2D$ $7f\ ^2F°$	$2\frac{1}{2}$	107469.677	107479.404	0.0014
$7f$, $7g$	$7g\ ^2G$ $7f\ ^2F°$	$3\frac{1}{2}$	107469.679	107479.406	0.0009
$7g$, $7h$	$7g\ ^2G$ $7h\ ^2H°$	$4\frac{1}{2}$	107469.679	107479.406	0.0006
$7h$, $7i$	$7i\ ^2I$ $7h\ ^2H°$	$5\frac{1}{2}$	107469.680	107479.407	0.0004
$7i$	$7i\ ^2I$	$6\frac{1}{2}$	107469.680	107479.407	
$8p$	$8p\ ^2P°$	$0\frac{1}{2}$	107994.419	108004.194	0.0006
$8s$	$8s\ ^2S$	$0\frac{1}{2}$	107994.420	108004.194	0.0052
$8p$, $8d$	$8d\ ^2D$ $8p\ ^2P°$	$1\frac{1}{2}$	107994.425	108004.199	0.0019
$8d$, $8f$	$8d\ ^2D$ $8f\ ^2F°$	$2\frac{1}{2}$	107994.427	108004.201	0.0009
$8f$, $8g$	$8g\ ^2G$ $8f\ ^2F°$	$3\frac{1}{2}$	107994.428	108004.202	0.0006
$8g$, $8h$	$8g\ ^2G$ $8h\ ^2H°$	$4\frac{1}{2}$	107994.428	108004.203	0.0004
$8h$, $8i$	$8i\ ^2I$ $8h\ ^2H°$	$5\frac{1}{2}$	107994.429	108004.203	0.0003
$8i$, $8k$	$8i\ ^2I$ $8k\ ^2K°$	$6\frac{1}{2}$	107994.429	108004.203	0.0002
$8k$	$8k\ ^2K°$	$7\frac{1}{2}$	107994.429	108004.204	

D and T—Continued

Config.	Desig.	J	D Level	T Level	Interval
$9p$	$9p\ ^2P^\circ$	$0\frac{1}{2}$	108354.188	108363.995	0.0004
$9s$	$9s\ ^2S$	$0\frac{1}{2}$	108354.188	108363.995	0.0036
$9p$, $9d$	$9d\ ^2D$ $9p\ ^2P^\circ$	$1\frac{1}{2}$	108354.192	108363.999	0.0013
$9d$, $9f$	$9d\ ^2D$ $9f\ ^2F^\circ$	$2\frac{1}{2}$	108354.193	108364.000	0.0007
$9f$, $9g$	$9g\ ^2G$ $9f\ ^2F^\circ$	$3\frac{1}{2}$	108354.194	108364.001	0.0004
$9g$, $9h$	$9g\ ^2G$ $9h\ ^2H^\circ$	$4\frac{1}{2}$	108354.194	108364.001	0.0003
$9h$, $9i$	$9i\ ^2I$ $9h\ ^2H^\circ$	$5\frac{1}{2}$	108354.195	108364.002	0.0002
$9i$, $9k$	$9i\ ^2I$ $9k\ ^2K^\circ$	$6\frac{1}{2}$	108354.195	108364.002	0.0001
$9k$, $9l$	$9l\ ^2L$ $9k\ ^2K^\circ$	$7\frac{1}{2}$	108354.195	108364.002	0.0001
$9l$	$9l\ ^2L$	$8\frac{1}{2}$	108354.195	108364.002	

Config.	Desig.	J	D Level	T Level	Interval
$10p$	$10p\ ^2P^\circ$	$0\frac{1}{2}$	108611.528	108621.359	0.0003
$10s$	$10s\ ^2S$	$0\frac{1}{2}$	108611.529	108621.359	0.0026
$10p$, $10d$	$10d\ ^2D$ $10p\ ^2P^\circ$	$1\frac{1}{2}$	108611.531	108621.362	0.0010
$10d$, $10f$	$10d\ ^2D$ $10f\ ^2F^\circ$	$2\frac{1}{2}$	108611.532	108621.363	0.0005
$10f$, $10g$	$10g\ ^2G$ $10f\ ^2F^\circ$	$3\frac{1}{2}$	108611.533	108621.363	0.0003
$10g$, $10h$	$10g\ ^2G$ $10h\ ^2H^\circ$	$4\frac{1}{2}$	108611.533	108621.363	0.0002
$10h$, $10i$	$10i\ ^2I$ $10h\ ^2H^\circ$	$5\frac{1}{2}$	108611.533	108621.364	0.0001
$10i$, $10k$	$10i\ ^2I$ $10k\ ^2K^\circ$	$6\frac{1}{2}$	108611.533	108621.364	0.0001
$10k$, $10l$	$10l\ ^2L$ $10k\ ^2K^\circ$	$7\frac{1}{2}$	108611.533	108621.364	0.0001
$10l$, $10m$	$10l\ ^2L$ $10m\ ^2M^\circ$	$8\frac{1}{2}$	108611.534	108621.364	0.0001
$10m$	$10m\ ^2M^\circ$	$9\frac{1}{2}$	108611.534	108621.364	
	.....	.....	.....	.....	
	Limit		109708.608	109718.538	

February 1972.

DEUTERIUM

Part B D($^2_1$H I)

I P 13.602 eV Limit 109708.608 cm^{-1} 911.506 Å (Vac)

Anal A List C February 1972

REFERENCE

A J. D. Garcia and J. E. Mack, J. Opt. Soc. Am. **55**, No. 6, 654–685 (1965). I P, T, C L; W L 925.9737 Å to 123652.691 Å. For higher values of n where the terms are unresolved, the wavelength derived from the statistical mean of the components is quoted.

New Multiplet Numbers have been assigned.

D **D**

I A	Ref	Int	E P Low	E P High	J	Multiplet No.	I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac							Air						
1215.3376	A		0.00	10.20	$0\frac{1}{2}$–$1\frac{1}{2}$	1s ^{2}S – 2p ^{2}P°	6561.0104	A	Dα	10.20	12.09		2p ^{2}P°—3d ^{2}D
1215.3430	A		0.00	10.20	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 1							etc. **1** etc.
1025.4429	A		0.00	12.09	$0\frac{1}{2}$–$1\frac{1}{2}$	1s ^{2}S —3p ^{2}P°	4860.0028	A	Dβ	10.20	12.75		2p ^{2}P°—4d ^{2}D
1025.4401	A		0.00	12.09	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 2							etc. **2** etc.
972.2721	A		0.00	12.75	$0\frac{1}{2}$–$1\frac{1}{2}$	1s ^{2}S —4p ^{2}P°	4339.2829	A	Dγ	10.20	13.06		2p ^{2}P°—5d ^{2}D
972.2725	A		0.00	12.75	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 3							etc. **3** etc.
949.4846	A		0.00	13.06	$0\frac{1}{2}$–$1\frac{1}{2}$	1s ^{2}S —5p ^{2}P°	4100.6191	A	Dδ	10.20	13.22		2p ^{2}P°—6d ^{2}D
949.4848	A		0.00	13.06	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 4							etc. **4** etc.
937.5483	A		0.00	13.22	$0\frac{1}{2}$–$1\frac{1}{2}$	1s ^{2}S —6p ^{2}P°	3968.9922	A	Dϵ	10.20	13.32		2p ^{2}P°—7d ^{2}D
937.5484	A		0.00	13.22	$0\frac{1}{2}$–$0\frac{1}{2}$	UV 5							etc. **5** etc.
930.4951	A		0.00	13.32	$0\frac{1}{2}$–	1s ^{2}S —7p ^{2}P°	3887.9909	A		10.20	13.39		2p ^{2}P°—8d ^{2}D
						UV 6							etc. **6** etc.
925.9737	A		0.00	13.39	$0\frac{1}{2}$–	1s ^{2}S —8p ^{2}P°							
						UV 7	18745.914	A		12.09	12.75		3d ^{2}D —4f ^{2}F°
													etc. **7** etc.
911.5055	A		0.00	13.60	$0\frac{1}{2}$–	1s ^{2}S — Limit	12814.595	A		12.09	13.06		3d ^{2}D —5f ^{2}F°
						UV 8							etc. **8** etc.
							10935.120	A		12.09	13.22		3d ^{2}D —6f ^{2}F°
													etc. **9** etc.
							10046.640	A		12.09	13.32		3d ^{2}D —7f ^{2}F°
													etc. **10** etc.
							9543.375	A		12.09	13.39		3d ^{2}D —8f ^{2}F°
													etc. **11** etc.

TRITIUM

Part B

T($^3_1$H I)

I P 13.603 eV Limit 109718.538 cm^{-1} 911.423 Å (Vac)

Anal A List D February 1972

REFERENCE

A J. D. Garcia and J. E. Mack, J. Opt. Soc. Am. **55**, No. 6, 654–685 (1965). I P, T, C L; W L 925.8900 Å to 123641.500 Å
For higher values of n where the terms are unresolved, the wavelength derived from the statistical mean of the components is quoted.

T							T						
I A	Ref	Int	E P Low	E P High	J	Multiplet No.	I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac							Air						
1215.2276	A		0.00	10.20	$0\frac{1}{2}-1\frac{1}{2}$	$1s\ ^2S - 2p\ ^2P^\circ$	6560.4166	A	Tα	10.20	12.09		$2p\ ^2P^\circ - 3d\ ^2D$
1215.2330	A		0.00	10.20	$0\frac{1}{2}-0\frac{1}{2}$	UV 1							etc. **1** etc.
1025.3501	A		0.00	12.09	$0\frac{1}{2}-1\frac{1}{2}$	$1s\ ^2S - 3p\ ^2P^\circ$	4859.5630	A	Tβ	10.20	12.75		$2p\ ^2P^\circ - 4d\ ^2D$
1025.3512	A		0.00	12.09	$0\frac{1}{2}-0\frac{1}{2}$	UV 2							etc. **2** etc.
972.1841	A		0.00	12.75	$0\frac{1}{2}-1\frac{1}{2}$	$1s\ ^2S - 4p\ ^2P^\circ$	4338.8902	A	Tγ	10.20	13.06		$2p\ ^2P^\circ - 5d\ ^2D$
972.1845	A		0.00	12.75	$0\frac{1}{2}-0\frac{1}{2}$	UV 3							etc. **3** etc.
949.3987	A		0.00	13.06	$0\frac{1}{2}-1\frac{1}{2}$	$1s\ ^2S - 5p\ ^2P^\circ$	4100.2479	A	Tδ	10.20	13.23		$2p\ ^2P^\circ - 6d\ ^2D$
949.3989	A		0.00	13.06	$0\frac{1}{2}-0\frac{1}{2}$	UV 4							etc. **4** etc.
937.4635	A		0.00	13.23	$0\frac{1}{2}-1\frac{1}{2}$	$1s\ ^2S - 6p\ ^2P^\circ$	3968.6329	A	Tε	10.20	13.33		$2p\ ^2P^\circ - 7d\ ^2D$
937.4636	A		0.00	13.23	$0\frac{1}{2}-0\frac{1}{2}$	UV 5							etc. **5** etc.
911.4230	A		0.00	13.60		$1s\ ^2S$ — Limit UV 6							