Reference Wavelengths From Atomic Spectra in the Range 15 Å to 25000 Å

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This is a compilation of atomic lines with accurately known wavelengths covering the range from 15 Å to 25000 Å. The tables are a fairly complete record of available spectrum lines that meet the requirements for useful references with regard to wavelength accuracy and intensity. In general, wavelength uncertainties range from 0.0001 Å to 0.002 Å. Section 1, $\lambda > 2000$ Å, gives λ_{air} and λ_{vac} for 3341 lines belonging to thirteen different spectra of ten elements. Section 2, $\lambda < 2000$ Å, contains 2091 lines belonging to 59 different spectra of 28 elements. The lines of section 2 are listed both by spectrum (i.e. element and ionization stage) and in a finding list arranged in order of decreasing wavelength. Detailed explanations of the data and the sources used for the compilation are included.

Key words: Optical spectra, atomic; reference wavelengths; standard wavelengths, vacuum ultraviolet.

Contents

Introduction

These tables of atomic lines with accurately known wavelengths, covering the range from 15 Å to 25000 Å, have been compiled to serve as a convenient source of reference in spectroscopic work. The material is extracted from many sources, including some unpublished reports, and is drawn from the spectra of many different atoms and ions. This makes the tables a fairly complete record of available spectrum lines that meet the requirements for useful references with regard to wavelength accuracy and intensity.

At the time when the creation of an international system of wavelength standards was initiated, some 65 years ago (see ref. [2]), the rule was established that at least three independent and concordant measurements of each wavelength were required for the average to be adopted as standard. This had the purpose of reducing the statistical errors and, especially, of assuring international agreement on the absolute scale, which was a crucial point at the time. The situation is now different in that the statistical errors can be smoothed by means of the combination principle and the absolute scale is secured by a frame of adopted standards, in particular the wavelengths of the ^{86}Kr I lines. For that reason we feel justified in accepting wavelengths as standards on the basis of a single investigation if it is judged to have been carried out with the necessary care. Certainly, if we want to extend the system of available standards this is at present the only practicable procedure.

The material contained in this compilation is divided into two sections, one for wavelengths above 2000 Å and one for the region below that limit. Section 1, $\lambda > 2000$ Å, gives the wavelength in standard air and in vacuum for 3341 lines belonging to thirteen different spectra of ten elements. There is a separate table for each spectrum, the lines being listed in order of increasing wavelength and the tables arranged in order of increasing Z. In the case of Ne I, Fe I, Kr I, Cd I and Th I, II the data represent for each spectrum a synthesis of measurements made at several different laboratories, further smoothed and extended by use of the Ritz combination principle. For the other spectra, Ne II, Si I, Ar I, Ar II, Cu II, Ge I and Hg I, the data derive

in each case essentially from one set of measurements, judged to be significantly superior to earlier work. Most of the wavelengths between 2000 and 10000 Å have wavelength uncertainties of less than 0.0015 Å. In general, for calculated wavelengths the uncertainty increases with increasing wavelength because of the relation $\delta\lambda \propto \lambda^2\delta\sigma$.

In the spectral region above 2000 Å, wavelength standards are used either for interpolation in grating or prism spectra in which case one needs a large number of closely spaced references, or for calibrating the etalon in interferometric work, which requires only a few (in principle only one) but highly accurate references. Especially useful sources for grating measurements are hollow-cathode or electrodeless discharge lamps of thorium or iron, or hollow-cathode discharges producing Ar I and Ar II. For interferometric measurements discharge lamps of Kr^{86} or Hg^{198} are most useful.

In section 2, $\lambda < 2000$ Å, we have listed 2091 lines in 59 different spectra of 28 elements. In the vacuum-ultraviolet region it is desirable to have as wide a choice as possible of reference spectra. One wants to include especially the spectra of such elements as carbon, nitrogen, oxygen, aluminum, and silicon, which almost invariably appear on spectrograms of this region. It is unfortunate that the wavelengths of the strong lines of O II and O III cannot yet be considered as established with the desired precision for inclusion in the compilation. It is desirable, also, to improve the data for Si III and Si IV.

The extension of the standard wavelength system into the vacuum ultraviolet is essentially based on the combination principle. Since in this process the wave numbers are the primary data, they have been included in that set of tables (section 2.2.a) where the lines are arranged by element and ionization stage. The same lines are also given (without wave numbers) in a finding list (section 2.2.b) arranged in order of decreasing wavelength.

Detailed explanation of the data and the sources used for this compilation are to be found in the text accompanying each spectrum. The main purpose of the intensity figures is to aid the identification of the lines. Considerable efforts have been made to bring them on a reasonably uniform scale, but it should be remembered that they are usually based on visual estimates of plate blackening, uncorrected for plate sensitivity and spectrograph efficiency, and are thus consistent only over a limited wavelength range. Moreover, the relative intensities even within the same spectrum depend to some extent upon the light source.

Estimates of the accuracy of the listed wavelengths are included. We wish to emphasize, however, that the accuracy that is actually obtained in the use of these standards is highly dependent on the way they are applied. There are two points that need special attention. The first is that all wavelengths are more or less dependent on the conditions in the light source. Therefore, we have indicated the kind of light source for which the data should be strictly valid, and have tried to avoid lines that may easily be affected. The second point is connected with the imaging properties of the spectrograph and especially of the concave grating. Since the image of the slit depends strongly on which part of the grating surface is active in its formation, even small differences in the distribution of the light on the grating may result in significant shifts in the positions of the spectrum lines. This effect is often overlooked and is probably the most common source of errors in spectroscopic measurements. It is most serious in the vacuum ultraviolet where the source cannot be imaged on the slit. It should be noted that such shifts may occur even between lines emitted simultaneously from the same light source if they come preponderantly from different parts of the source. Careful attention to the light source is, therefore, essential for attaining the potential accuracy of the standards.

Further information pertaining to the derivation and proper use of wavelength standards may be found in refs. [1] and [2]. References [3] and [4] give additional information on wavelength standards in the infrared.

References

[1] Edlén, B., "Wavelength Measurements in the Vacuum Ultra-violet" in Reports on Progress in Physics **26**, 181–212 (1963).

[2] Edlén, B., "The History and Present State of Wavelength Standards" in *Polarisation, matière et rayonnement*, Presses universitaires de France, Paris, 219–227 (1969).

[3] Rao, K. N., Humphreys, C. J., and Rank, D. H., *Wavelength Standards in the Infrared*, Academic Press, New York, 1966.

[4] Humphreys, C. J., "First Spectra of Neon, Argon, and Xenon 136 in the 1.2–4.1 μm Region", J. Phys. Chem. Ref. Data **2**, 519–529 (1974).

1. Wavelengths Greater Than 2000 Å

1.1. Synopsis of the selected data

Spectrum	Range (Å)	Uncertainties (Å)	Number of lines	Page
Ne I	3352–17162	0.0003–0.002	159	827
Ne II	2757– 4635	.002 – .003	171	829
Si I	2008–11018	.0005– .002	80	831
Ar I	3947–20616	.0001– .003	193	832
Ar II	2000–10923	.0001– .0011	404	834
Fe I	2084– 5763	.0003– .0010	684	838
Cu II	2000–10080	.0005– .0014	461	844
Ge I	2019–11125	.0004– .0012	81	848
^{86}Kr I	3425–25234	.0001– .0017	198	849
^{114}Cd I	4678– 6438	.0003– .0004	4	851
^{198}Hg I	2537– 5791	.0002– .0003	24	852
Th I, II	3025– 9475	.0005– .003	882	853

1.2. Tables With Comments and References

Ne I

The list contains 159 calculated wavelengths of the following transition arrays: 3*s*-4*p* (3352–3754 Å), 3*s*-3*p* (5400–8082 Å), 3*p*-3*d* (7051–9547 Å) and 3*p*-4*s* (8865–17161 Å). The Paschen notation for these transition arrays are 1*s*-3*p*, 1*s*-2*p*, 2*p*-3*d*, and 2*p*-2*s*, respectively. In 1955 the International Astronomical Union adopted as secondary standards the calculated wavelengths of the 3*s*-3*p* transitions and, as provisional standards, the calculated wavelengths of 3*s*-4*p*. In 1958, values of the 4*s* and 3*d* levels were adopted for calculating infrared wavelength standards from the 3*p*-4*s* and 3*p*-3*d* transitions. Improved values of the 4*s* levels led to a revised list of the 3*p*-4*s* transitions presented at the 1964 International Astronomical Union meeting. The wavelengths of the 3*s*-3*p* and 3*s*-4*p* transitions are probably accurate to ±0.0003 Å, but the uncertainty increases with wavelength as a consequence of the relation $\Delta\lambda \propto \lambda^2 \Delta\sigma$. A difficulty with the neon lines is their isotopic structure, the ^{20}Ne line being accompanied by a satellite from the 10 percent ^{22}Ne in natural neon. This makes the observed wavelengths slightly dependent on resolution and self-absorption.

A complete discussion and tables of the data are to be found in the Reports of Commission 14 in the Trans. Int. Astron. Union, volumes IX (1957), X (1960), XIIB (1966). The intensities are basically from the references listed, but the scales of Meggers and of Humphreys and Paul have been joined with the aid of Hardy's observations, and Paschen's intensities are modified to a more open scale.

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Humphreys, C. J., Paul, E., and Adams, K. B., NAVWEPS Rpt. 7205, 25 (1961), N.O.L. Corona.
Hardy, J. D., Phys. Rev. **38**, 2162 (1931).
Paschen, F., Ann. Phys. (Leipz.) **60**, 405 (1919).

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
5	3351.7492	3352.7126	15	3682.2426	3683.2909	50	6678.2762	6680.1202
70	3369.8080	3370.7760	15	3685.7357	3686.7850	2	6717.0430	6718.8974
200	3369.9078	3370.8758	15	3701.2250	3702.2783	70	6929.4673	6931.3788
10	3375.6490	3376.6185	10	3754.2156	3755.2826	50	7024.0504	7025.9874
70	3417.9035	3418.8839	800	5400.5617	5402.0632	70	7032.4131	7034.3524
10	3418.0062	3418.9865	800	5852.4878	5854.1101	7	7051.2923	7053.2366
10	3423.9126	3424.8944	400	5881.8952	5883.5254	20	7059.1074	7061.0538
30	3447.7028	3448.6908	70	5944.8342	5946.4812	70	7173.9381	7175.9155
10	3450.7650	3451.7537	100	5975.5340	5977.1892	70	7245.1666	7247.1631
15	3454.1949	3455.1845	70	6029.9969	6031.6667	30	7438.8984	7440.9472
15	3460.5243	3461.5156	70	6074.3377	6076.0194	5	7472.4386	7474.4964
15	3464.3387	3465.3309	30	6096.1631	6097.8507	50	7488.8712	7490.9335
30	3466.5787	3467.5715	10	6128.4499	6130.1462	30	7535.7741	7537.8490
70	3472.5711	3473.5654	100	6143.0626	6144.7628	10	7544.0443	7546.1215
15	3498.0640	3499.0649	100	6163.5939	6165.2996	1	7833.0303	7835.1855
30	3501.2163	3502.2180	200	6217.2812	6219.0013	3	7839.0546	7841.2114
10	3510.7212	3511.7253	200	6266.4950	6268.2283	4	7927.1177	7929.2983
30	3515.1907	3516.1960	10	6304.7890	6306.5325	7	7936.9961	7939.1793
400	3520.4717	3521.4783	70	6334.4278	6336.1794	20	7943.1814	7945.3663
3	3562.9541	3563.9717	100	6382.9917	6384.7562	2	7944.1412	7946.3263
70	3593.5262	3594.5516	400	6402.2460	6404.0157	20	8082.4581	8084.6806
50	3593.6396	3594.6651	200	6506.5281	6508.3259	10	8118.5492	8120.7815
15	3600.1691	3601.1963	10	6532.8822	6534.6870	6	8128.9108	8131.1459
10	3609.1790	3610.2085	200	6598.9529	6600.7755	30	8136.4057	8138.6428
15	3633.6646	3634.7004	15	6652.0927	6653.9295	3	8248.6824	8250.9498

Ne I —Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
15	8259.3790	8261.6493	100	8783.7533	8786.1654	20	10844.477	10847.448
25	8266.0772	8268.3493	3	8792.5050	8794.9195	30	11143.020	11146.072
8	8267.1166	8269.3890	5	8830.9072	8833.3321	30	11177.525	11180.586
60	8300.3263	8302.6077	70	8853.8669	8856.2979	11	11390.434	11393.553
15	8301.5597	8303.8414	10	8865.3063	8867.7405	10	11409.134	11412.258
15	8365.7486	8368.0476	50	8865.7552	8868.1895	15	11522.746	11525.900
20	8376.3614	8378.6634	30	8919.5007	8921.9495	9	11525.019	11528.175
80	8377.6065	8379.9088	20	8988.5564	8991.0240	5	11536.345	11539.503
10	8417.1591	8419.4721	60	9148.6717	9151.1825	3	11601.537	11604.713
40	8418.4274	8420.7408	60	9201.7591	9204.2844	8	11614.081	11617.260
15	8463.3575	8465.6830	40	9220.0583	9222.5885	1	11688.002	11691.201
8	8484.4435	8486.7746	20	9221.5802	9224.1108	10	11766.792	11770.013
50	8495.3598	8497.6940	20	9226.6903	9229.2223	10	11789.044	11792.270
6	8544.6959	8547.0433	10	9275.5197	9278.0649	2	11789.889	11793.116
10	8571.3524	8573.7071	60	9300.8527	9303.4048	6	11984.912	11988.192
6	8582.9029	8585.2607	15	9310.5839	9313.1386	30	12066.334	12069.636
40	8591.2587	8593.6188	30	9313.9726	9316.5282	5	12459.389	12462.798
60	8634.6470	8637.0188	60	9326.5069	9329.0659	2	12595.004	12598.450
5	8635.3175	8637.6894	20	9373.3079	9375.8796	7	12689.201	12692.672
30	8647.0411	8649.4162	50	9425.3789	9427.9647	1	12769.525	12773.018
150	8654.3831	8656.7602	4	9433.0077	9435.5956	9	12912.014	12915.546
40	8655.5224	8657.8998	30	9459.2096	9461.8045	4	13219.241	13222.856
50	8679.4925	8681.8765	50	9486.6819	9489.2843	4	15230.714	15234.876
50	8681.9211	8684.3057	50	9534.1629	9536.7782	2	17161.930	17166.617
20	8704.1116	8706.5022	30	9547.4050	9550.0238			
2	8767.5360	8769.9437	100	9665.4198	9668.0706			
40	8771.6563	8774.0652	8	10295.417	10298.239			
15	8778.7329	8781.1436	20	10562.408	10565.302			
120	8780.6210	8783.0323	4	10620.665	10623.575			
5	8782.0012	8784.4129	15	10798.043	10801.001			

Ne II

The Fe-Ne hollow cathode, which is frequently used as a source of wavelength standards, produces numerous lines of Fe II and Ne II in addition to Fe I and Ne I. Unfortunately there are no reliable interferometric measurements available for either Fe II or Ne II. However, the Ne II spectrum has been analysed by W. Persson so thoroughly that the wavelengths calculated from his level system should be sufficiently accurate to become useful as auxiliary standards in many cases. We have, therefore, included a list of 171 Ne II lines which have been selected by Persson for this purpose. The levels involved are well interconnected by three sets of measurements with large gratings. In addition to his own measurements, Persson has used unpublished measurements communicated by H. M. Crosswhite and by J. Ehrhardt. The uncertainties in the selected wavelengths are estimated not to exceed 0.003 Å for the longest wavelengths and 0.002 Å for the shortest wavelengths. The intensity figures are those given in Persson's paper.

Persson, W., Phys. Scr. **3**, 133 (1971).

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
7	2756.6186	2757.4333	9	3151.1370	3152.0495	15	3309.7377	3310.6904
8	2762.9218	2763.7380	7	3154.7936	3155.7070	9	3311.2714	3312.2245
7	2770.5747	2771.3928	10	3164.4294	3165.3453	30	3319.7230	3320.6782
9	2792.0172	2792.8405	12	3164.6638	3165.5798	8	3320.1971	3321.1525
8	2794.2195	2795.0434	10	3165.6489	3166.5651	100	3323.7340	3324.6903
10	2809.4842	2810.3118	7	3166.1803	3167.0967	15	3327.1522	3328.1093
6	2872.9604	2873.8035	9	3176.1201	3177.0389	10	3329.1577	3330.1153
8	2906.8167	2907.6682	9	3187.5762	3188.4979	6	3330.7350	3331.6930
9	2910.0609	2910.9133	10	3188.7414	3189.6635	20	3334.8361	3335.7952
9	2910.4075	2911.2599	10	3194.5773	3195.5007	9	3336.0925	3337.0519
8	2925.6182	2926.4744	15	3198.5861	3199.5106	15	3344.3961	3345.3577
15	2955.7254	2956.5890	6	3198.9157	3199.8403	30	3345.4538	3346.4156
15	2963.2366	2964.1021	10	3208.9655	3209.8926	15	3345.8289	3346.7908
15	2967.1831	2968.0495	12	3209.3560	3210.2832	7	3353.5667	3354.5306
15	3001.6681	3002.5432	12	3213.7336	3214.6620	20	3355.0175	3355.9817
10	3027.0159	3027.8972	15	3214.3278	3215.2563	9	3356.3084	3357.2729
10	3035.9219	3036.8055	15	3218.1926	3219.1221	12	3357.8190	3358.7840
10	3037.7199	3038.6039	20	3230.0686	3231.0011	9	3360.2716	3361.2372
10	3039.5857	3040.4702	12	3230.4193	3231.3519	10	3362.7075	3363.6737
10	3044.0868	3044.9724	12	3232.0214	3232.9544	12	3367.2166	3368.1839
10	3045.5558	3046.4418	15	3232.3715	3233.3046	10	3371.7969	3372.7655
12	3047.5575	3048.4440	10	3243.3968	3244.3326	8	3374.0616	3375.0307
10	3054.6759	3055.5642	10	3244.0957	3245.0317	12	3377.1551	3378.1250
10	3059.1049	3059.9943	9	3248.1317	3249.0687	50	3378.2165	3379.1866
9	3071.0872	3071.9796	6	3255.4238	3256.3627	8	3379.3196	3380.2901
10	3094.0058	3094.9040	7	3263.4112	3264.3521	6	3386.2025	3387.1747
9	3132.1884	3133.0961	9	3269.8713	3270.8139	15	3388.4188	3389.3916
8	3135.8148	3136.7235	9	3270.8000	3271.7428	7	3390.5518	3391.5251
12	3141.3320	3142.2421	9	3275.1796	3276.1235	6	3393.1826	3394.1566
10	3143.7207	3144.6313	15	3297.7256	3298.6753	8	3411.3594	3412.3381

Ne II — Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
10	3413.1449	3414.1240	9	3644.8586	3645.8973	12	4369.8637	4371.0917
7	3414.8880	3415.8675	6	3659.8933	3660.9358	9	4377.9835	4379.2136
12	3416.9131	3417.8932	20	3664.0732	3665.1168	6	4396.3121	4397.5471
12	3428.6839	3429.6670	20	3694.2134	3695.2648	15	4397.9908	4399.2263
9	3438.9335	3439.9192	9	3701.7753	3702.8287	15	4409.2978	4410.5362
7	3440.7480	3441.7342	15	3709.6216	3710.6770	10	4421.3904	4422.6320
8	3443.7065	3444.6934	25	3713.0800	3714.1363	9	4429.6441	4430.8879
8	3453.0679	3454.0572	25	3727.1046	3728.1646	9	4439.2530	4440.4993
9	3454.7720	3455.7618	9	3734.9373	3735.9993	9	4439.4600	4440.7064
10	3456.6080	3457.5983	8	3751.2438	3752.3100	9	4439.9924	4441.2389
10	3459.3209	3460.3118	7	3753.7792	3754.8461	9	4442.6857	4443.9329
8	3477.6476	3478.6432	10	3766.2596	3767.3297	9	4446.4421	4447.6903
20	3481.9331	3482.9298	10	3777.1342	3778.2072	9	4468.9126	4470.1668
9	3503.5801	3504.5824	6	3790.9174	3791.9940	8	4471.5872	4472.8420
7	3537.9751	3538.9862	8	3799.9639	3801.0428	9	4508.1293	4509.3937
8	3542.2412	3543.2534	6	3806.2488	3807.3293	7	4553.1711	4554.4475
12	3542.8450	3543.8574	10	3818.4232	3819.5069	10	4569.0574	4570.3380
7	3543.7894	3544.8020	12	3829.7498	3830.8364	8	4580.4185	4581.7021
12	3557.8039	3558.8202	8	3942.2619	3943.3778	8	4588.1356	4589.4212
10	3561.2006	3562.2177	8	4062.9746	4064.1221	9	4616.0920	4617.3850
9	3565.8256	3566.8439	7	4080.5156	4081.6676	7	4634.7664	4636.0643
25	3568.4999	3569.5189	9	4150.6914	4151.8618			
10	3571.2305	3572.2502	8	4219.3695	4220.5579			
10	3574.1825	3575.2030	15	4219.7453	4220.9338			
20	3574.6119	3575.6325	10	4233.8510	4235.0432			
8	3594.1594	3595.1850	12	4250.6450	4251.8417			
7	3612.3261	3613.3564	9	4257.8033	4259.0018			
9	3628.0342	3629.0686	7	4322.7478	4323.9635			
7	3632.6801	3633.7157	8	4341.5132	4342.7338			
15	3643.9273	3644.9658	8	4365.7455	4366.9724			

Si I

These lines were interferometrically measured by Radziemski and Andrew and have stated uncertainties of less than ± 0.002 Å in all cases and less than ± 0.001 Å for many of the lines. (See Kaufman, Radziemski, and Andrew for the wavelengths below 2100 Å.) The spectroscopic source used for the observation and measurement of these lines was a cooled silicon tetrachloride electrodeless-discharge lamp without carrier gas. The intensities are those of Radziemski and Andrew.

Radziemski, L. J., Jr., and Andrew, K. L., J. Opt. Soc. Am. **55**, 474 (1965).

Kaufman, V., Radziemski, L. J., Jr., and Andrew, K. L., J. Opt. Soc. Am. **56**, 911 (1966).

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
9	2008.4432	2009.0928	70	4102.9359	4104.0938	200	7409.0818	7411.1226
9	2010.9930	2011.6430	25	4747.9936	4749.3215	275	7415.9462	7417.9888
120	2058.1323	2058.7908	25	4755.2756	4756.6054	425	7423.4969	7425.5416
12	2082.0206	2082.6837	25	4772.7847	4774.1192	100	7680.2668	7682.3807
10	2084.4628	2085.1264	50	4782.9905	4784.3277	90	7918.3857	7920.5639
100	2124.1225	2124.7939	30	4947.6067	4748.9876	120	7932.3490	7934.5310
110	2207.9783	2208.6668	40	5006.0607	5007.4571	140	7944.0011	7946.1863
115	2210.8940	2211.5832	35	5517.5350	5519.0677	60	8502.2207	8504.5567
110	2211.7441	2212.4334	80	5665.5536	5667.1259	40	8536.1645	8538.5097
120	2216.6688	2217.3592	120	5684.4843	5686.0616	120	8556.7803	8559.1311
120	2218.0569	2218.7476	100	5690.4251	5692.0040	50	8648.4622	8650.8378
50	2218.9148	2219.6056	90	5701.1048	5702.6866	40	8728.0110	8730.4081
55	2303.0585	2303.7675	45	5747.6670	5749.2612	75	8742.4509	8744.8519
300	2435.1545	2435.8931	45	5754.2195	5755.8155	35	8790.3889	8792.8029
65	2438.7674	2439.5069	45	5762.9769	5764.5752	120	10585.1412	10588.0414
65	2443.3643	2444.1048	70	5772.1453	5773.7461	120	10660.9748	10663.8956
70	2452.1180	2452.8605	70	5780.3839	5781.9869	60	10749.3837	10752.3285
425	2506.8973	2507.6525	90	5793.0714	5794.6778	80	10786.8560	10789.8109
375	2514.3161	2515.0730	100	5797.8591	5799.4668	130	10869.5408	10872.5181
500	2516.1125	2516.8699	90	6125.0207	6126.7160	80	11017.9648	11020.9824
350	2519.2023	2519.9604	100	6145.0151	6146.7158			
425	2524.1079	2524.8671	160	6155.1338	6156.8372			
450	2528.5086	2529.2689	160	6237.3199	6239.0454			
110	2532.3814	2533.1426	40	6238.2871	6240.0128			
85	2568.6407	2569.4104	125	6243.8129	6245.5401			
45	2577.1514	2577.9231	180	6254.1876	6255.9176			
190	2631.2819	2632.0664	45	6527.1989	6529.0022			
1000	2881.5792	2882.4245	45	6555.4624	6557.2733			
150	2987.6453	2988.5168	180	7003.5665	7005.4980			
300	3905.5227	3906.6290	400	7289.1730	7291.1815			

Ar I

The table contains 193 calculated wavelengths which have been selected from a comprehensive list by G. Norlén on the basis of his extensive interferometric measurements in the region from 3500 to 10000 Å. In his derivation of level values, Norlén included the precision measurements in the extraphotographic infrared by Humphreys and Paul and others in order to incorporate the levels of $5s$ and $3d$ (Paschen notation $2s$ and $3d$) in the level system. We have come to the conclusion that Norlén's data are significantly superior to earlier results and should replace the wavelengths and levels previously adopted by the International Astronomical Union. There is a close agreement with the old data in the case of $4s$-$5p$, but for the $4s$-$4p$ transitions (the group of strong lines in the red) the new wavelengths are systematically longer by an amount of the order of 0.001 Å. This may partly be due to the use of different wavelength standards. Norlén's standards consisted of ^{86}Kr I lines, including the primary standard. His light source for the argon lines was a water-cooled hollow cathode, inner surface 26 cm^2, run at 0.5 A and a pressure of 0.2 torr. In a different light source the wavelengths may be different by amounts that for some transitions could exceed the stated uncertainty.

Our list includes lines of the following transition arrays: $4s$-$np(n=4-5)$, $4p$-$ns(n=5-7)$, $4p$-$nd(n=3-6)$. In Paschen notation these are: $1s$-$np(n=2-3)$, $2p$-$ns(n=2-4)$, $2p$-$nd(n=3-6)$. The uncertainties for the selected lines, as estimated by Norlén, range as follows:

λ (Å)	Δλ (Å)
< 8000	0.0001–0.0003
8000–10500	.0003– .0007
10500–12000	.0006– .0011
12000–15000	.0011– .0019
>15000	.0017– .0031

The intensities have been obtained by transforming those given in the references cited below onto a reasonably uniform scale.

Norlén, G., Phys. Scr. **8**, 249 (1973).
Meggers, W. F. and Humphreys, C. J., J. Res. Nat. Bur. Stand. (U.S.) **10**, 427 (1933).
Meggers, W. F., J. Res. Nat. Bur. Stand. (U.S.) **14**, 487 (1935).
Humphreys, C. J. and Kostkowski, H. J., J. Res. Nat. Bur. Stand. (U.S.) **49**, 73 (1952).
Humphreys, C. J. and Paul, E., J. Opt. Soc. Am. **49**, 1186 (1959).
Trans. Int. Astron. Union IX, 201 (1957); XIA, 97 (1962); XIIB, 173 (1966).

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
15	3947.5046	3948.6219	30	4522.3230	4523.5912	25	5882.6242	5884.2546
50	3948.9789	3950.0965	30	4596.0967	4597.3844	40	5888.5841	5890.2160
100	4044.4179	4045.5604	15	4628.4409	4629.7371	100	5912.0853	5913.7236
10	4045.9654	4047.1084	30	4702.3161	4703.6319	5	5927.1258	5928.7680
5	4054.5258	4055.6710	12	5151.3907	5152.8257	25	5928.8130	5930.4557
500	4158.5905	4159.7630	25	5162.2846	5163.7225	10	5942.6686	5944.3151
80	4164.1795	4165.3535	35	5187.7462	5189.1909	15	5987.3016	5988.9600
80	4181.8836	4183.0621	5	5439.9891	5441.5011	12	5998.9987	6000.6603
130	4190.7129	4191.8938	20	5451.6520	5453.1671	10	6025.1500	6026.8185
80	4191.0294	4192.2104	35	5495.8738	5497.4007	120	6032.1274	6033.7978
300	4198.3170	4199.4999	5	5524.9570	5526.4917	60	6043.2233	6044.8967
500	4200.6745	4201.8580	50	5558.7020	5560.2457	20	6052.7229	6054.3989
300	4259.3619	4260.5608	20	5572.5413	5574.0887	35	6059.3725	6061.0502
200	4272.1689	4273.3712	5	5588.7200	5590.2717	5	6090.7848	6092.4709
150	4300.1008	4301.3104	60	5606.7330	5608.2895	18	6098.8031	6100.4914
150	4333.5612	4334.7796	35	5650.7043	5652.2726	20	6105.6351	6107.3252
60	4335.3379	4336.5568	18	5739.5196	5741.1116	5	6127.4160	6129.1120
40	4345.1680	4346.3895	5	5802.0798	5803.6885	18	6145.4411	6147.1419
5	4363.7945	4365.0209	12	5834.2633	5835.8807	10	6155.2385	6156.9420
150	4510.7332	4511.9984	20	5860.3103	5861.9346	15	6170.1740	6171.8814

Ar I — Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
20	6173.0964	6174.8046	30	7435.3683	7437.4162	200	11488.1091	11491.2543
18	6212.5031	6214.2219	40	7436.2970	7438.3451	200	11668.7098	11671.9040
10	6215.9383	6217.6581	5	7471.1641	7473.2216	12	11719.4878	11722.6958
15	6296.8722	6298.6136	3000	7503.8691	7505.9355	300	12112.3260	12115.6407
20	6307.6570	6309.4013	2500	7514.6518	7516.7211	100	12139.7378	12143.0599
5	6364.8937	6366.6534	5	7628.8818	7630.9819	150	12343.3932	12346.7707
15	6369.5748	6371.3358	4000	7635.1060	7637.2078	400	12402.8269	12406.2205
35	6384.7169	6386.4820	5	7670.0575	7672.1687	500	12439.3210	12442.7245
120	6416.3071	6418.0806	2500	7723.7611	7725.8868	700	12487.6632	12491.0798
5	6431.5550	6433.3327	2000	7724.2072	7726.3330	150	12702.2810	12705.7559
3	6493.9694	6495.7638	10	7891.0750	7893.2459	75	12733.4182	12736.9015
20	6604.8534	6606.6776	3000	7948.1764	7950.3627	40	12746.2322	12749.7190
3	6632.0837	6633.9152	3000	8006.1567	8008.3587	300	12802.7391	12806.2413
10	6660.6761	6662.5154	5000	8014.7857	8016.9900	60	12933.1954	12936.7330
12	6664.0510	6665.8911	5	8046.1169	8048.3296	250	12956.6587	12960.2027
150	6677.2817	6679.1254	10	8053.3085	8055.5232	200	13008.2642	13011.8223
8	6719.2184	6721.0733	3000	8103.6931	8105.9214	150	13213.9926	13217.6065
200	6752.8335	6754.6975	6000	8115.3110	8117.5424	200	13228.1067	13231.7245
12	6756.1631	6758.0280	5	8119.1811	8121.4136	750	13272.6361	13276.2660
20	6766.6117	6768.4794	1500	8264.5225	8266.7943	600	13313.2099	13316.8508
8	6827.2488	6829.1328	6	8384.7240	8387.0283	800	13367.1114	13370.7669
200	6871.2891	6873.1850	3000	8408.2096	8410.5202	850	13504.1914	13507.8842
12	6879.5824	6881.4805	4000	8424.6475	8426.9626	15	13544.2023	13547.9059
10	6887.0881	6888.9882	3000	8521.4422	8523.7834	25	13573.6173	13577.3289
18	6888.1742	6890.0746	15	8605.7762	8608.1403	55	13599.3334	13603.0521
70	6937.6642	6939.5779	10	8620.4602	8622.8282	500	13622.6593	13626.3842
15	6951.4776	6953.3951	800	8667.9442	8670.3250	300	13678.5504	13682.2905
15	6960.2500	6962.1698	6	8678.4083	8680.7920	000	13718.5771	13722.3281
1500	6965.4307	6967.3519	20	8761.6862	8764.0924	30	13825.7153	13829.4955
70	7030.2514	7032.1901	10	8799.0875	8801.5038	12	13907.4775	13911.2799
1500	7067.2181	7069.1667	6	9075.3945	9077.8856	120	14093.6399	14097.4929
50	7068.7358	7070.6849	7000	9122.9674	9125.4713	7	14249.1936	14253.0889
20	7107.4778	7109.4372	150	9194.6385	9197.1619	40	15030.513	15034.621
15	7125.8200	7127.7844	3000	9224.4992	9227.0306	70	15046.504	15050.616
10	7147.0416	7149.0117	100	9291.5313	9294.0809	5	15329.345	15333.534
10	7158.8387	7160.8120	250	9354.2198	9356.7864	20	15989.490	15993.859
50	7206.9804	7208.9667	4000	9657.7863	9660.4351	5	16180.021	16184.442
500	7272.9359	7274.9400	900	9784.5028	9787.1860	20	16519.865	16524.377
25	7311.7159	7313.7304	400	10470.0535	10472.9225	10	16740.076	16744.649
20	7316.0050	7318.0207	200	10673.5656	10676.4898	300	16940.584	16945.211
50	7353.2930	7355.3188	10	10681.7728	10684.6992	12	18427.764	18432.796
2000	7383.9805	7386.0145	5	10880.9424	10883.9229	4	19965.728	19971.179
20	7392.9801	7395.0165	12	11078.8689	11081.9030	50	20616.228	20621.855
12	7412.3368	7414.3785	8	11393.7018	11396.8214			
10	7425.2942	7427.3393	12	11441.8321	11444.9647			

Ar II

The table consists of 404 lines from 2000 to 10923 Å selected from a large list of wavelengths calculated by G. Norlén on the basis of his extensive interferometric measurements in the region 3464–8771 Å. The light source was a water-cooled hollow cathode, emitting Ar I and Ar II simultaneously. The stated uncertainties for the selected lines are as follows:

λ(Å)	Δλ(Å)
2000–3000	0.0001
3000–5000	.0001–0.0002
5000–7000	.0002– .0005
7000–9000	.0004– .0007
> 9000	.0006– .0011

The intensities have been taken from Minnhagen's comprehensive description of Ar II. It should be noted that his scale is much contracted from a linear scale and that the relative intensities are often found to be rather different in the hollow cathode.

Norlén, G., Phys. Scr. **8**, 249 (1973)
Minnhagen, L., Ark. Fys. **25**, 203 (1963).

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
2	1999.9989	2000.6470	3	2230.3197	2231.0130	5	2481.4746	2482.2239
2	2003.9096	2004.5583	6	2234.6724	2235.3666	4	2482.1504	2482.8999
2	2015.3168	2015.9675	3	2235.7591	2236.4535	4	2491.0346	2491.7861
2	2023.1159	2023.7681	5	2243.6597	2244.3558	3	2497.2223	2497.9753
3	2025.1842	2025.8367	6	2252.2463	2252.9443	4	2499.5263	2500.2798
3	2032.1778	2032.8316	3	2255.4067	2256.1054	4	2501.8362	2502.5902
3	2042.3613	2043.0170	2	2263.0687	2263.7690	4	2503.9347	2504.6892
4	2046.4930	2047.1494	3	2274.9262	2275.6291	4	2512.2576	2513.0141
5	2050.7924	2051.4496	3	2275.3618	2276.0648	4	2515.5935	2516.3508
5	2057.5129	2058.1714	8	2282.6205	2283.3250	6	2516.7887	2517.5462
3	2058.0837	2058.7422	4	2285.7998	2286.5050	4	2522.4985	2523.2574
2	2063.7652	2064.4248	4	2286.9247	2287.6302	7	2534.7088	2535.4705
4	2073.4253	2074.0868	3	2290.4249	2291.1311	7	2536.0150	2536.7770
4	2079.6531	2080.3158	2	2305.8593	2306.5689	6	2544.6841	2545.4482
2	2086.8119	2087.4759	7	2313.7194	2314.4307	3	2549.7872	2550.5524
5	2103.3518	2104.0191	5	2317.7460	2318.4582	6	2562.0866	2562.8547
2	2110.8965	2111.5653	3	2324.4270	2325.1407	4	2564.4165	2565.1852
3	2119.9838	2120.6543	6	2354.1317	2354.8520	4	2570.4108	2571.1809
4	2126.6643	2127.3362	4	2360.0592	2360.7808	3	2600.9600	2601.7373
4	2129.4239	2130.0963	4	2371.7390	2372.4633	3	2616.8118	2617.5929
3	2129.8088	2130.4813	3	2379.8621	2380.5882	2	2649.6014	2650.3903
6	2151.0518	2151.7286	3	2387.9319	2388.6598	2	2686.3230	2687.1207
2	2158.8832	2159.5615	2	2405.7805	2406.5124	5	2692.5945	2693.3938
2	2162.2904	2162.9695	2	2408.2072	2408.9397	2	2741.0679	2741.8788
5	2174.5839	2175.2654	5	2414.2218	2414.9557	4	2764.6461	2765.4628
6	2187.3153	2187.9995	6	2420.4561	2421.1914	4	2769.7387	2770.5566
4	2191.5787	2192.2638	2	2434.3602	2435.0986	5	2806.1672	2806.9940
5	2195.4437	2196.1296	4	2459.9525	2460.6968	4	2844.1289	2844.9649
2	2210.3171	2211.0061	3	2470.3581	2471.1048	3	2874.5819	2875.4255
6	2219.9624	2220.6534	5	2479.0565	2479.8052	18	2891.6125	2892.4602

Ar II—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
10	2896.7463	2897.5954	10	3509.7785	3510.7824	10	3830.3941	3831.4809
9	2931.4809	2932.3385	20	3514.3877	3515.3927	6	3841.5187	3842.6084
8	2932.5903	2933.4482	15	3519.9936	3521.0001	10	3845.4055	3846.4962
20	2942.8933	2943.7538	12	3521.2601	3522.2669	30	3850.5813	3851.6733
10	2955.3884	2956.2520	18	3535.3196	3536.3300	20	3868.5284	3869.6251
15	2979.0503	2979.9197	18	3545.5956	3546.6086	11	3872.1371	3873.2347
9	3000.4450	3001.3198	15	3548.5144	3549.5282	12	3875.2645	3876.3630
6	3014.4822	3015.3604	7	3556.9041	3557.9201	6	3880.3332	3881.4330
8	3028.9137	3029.7956	25	3559.5081	3560.5247	12	3891.4017	3892.5043
10	3033.5083	3034.3913	20	3561.0304	3562.0474	15	3891.9792	3893.0820
10	3093.4019	3094.2999	12	3565.0298	3566.0479	11	3900.6266	3901.7316
12	3139.0176	3139.9271	25	3576.6156	3577.6366	10	3911.5760	3912.6839
7	3161.3726	3162.2877	18	3581.6084	3582.6307	12	3914.7675	3915.8762
15	3169.6685	3170.5856	20	3582.3546	3583.3772	10	3925.7188	3926.8304
12	3181.0376	3181.9576	30	3588.4407	3589.4648	25	3928.6233	3929.7356
9	3194.2307	3195.1541	12	3605.8792	3606.9078	12	3931.2359	3932.3490
9	3204.3210	3205.2470	12	3622.1375	3623.1703	15	3932.5466	3933.6600
9	3212.5186	3213.4466	10	3637.0310	3638.0676	15	3944.2717	3945.3881
7	3221.6253	3222.5556	12	3639.8329	3640.8702	12	3946.0971	3947.2140
6	3236.8106	3237.7448	7	3650.8896	3651.9298	9	3952.7291	3953.8477
14	3243.6887	3244.6246	12	3655.2782	3656.3196	20	3968.3594	3969.4821
15	3249.8003	3250.7378	10	3660.4370	3661.4797	10	3974.4766	3975.6009
12	3263.5712	3264.5121	9	3669.6024	3670.6475	9	3974.7590	3975.8834
6	3273.3172	3274.2606	10	3678.2701	3679.3174	12	3979.3559	3980.4815
12	3281.7016	3282.6472	9	3680.0609	3681.1087	9	3988.1576	3989.2854
10	3293.6403	3294.5889	7	3682.5448	3683.5932	12	3992.0535	3993.1824
9	3307.2283	3308.1804	6	3709.9088	3710.9643	10	3994.7919	3995.9215
12	3350.9243	3351.8875	6	3714.7337	3715.7904	25	4013.8566	4014.9911
6	3361.7448	3362.7108	12	3718.2065	3719.2641	12	4033.8093	4034.9491
6	3366.5801	3367.5473	9	3720.4265	3721.4847	12	4035.4600	4036.6002
12	3376.4359	3377.4056	8	3724.5165	3725.5757	15	4038.8043	4039.9454
10	3388.5309	3389.5037	30	3729.3087	3730.3692	15	4042.8937	4044.0359
5	3397.8958	3398.8709	6	3746.4476	3747.5125	12	4052.9207	4054.0655
4	3414.4583	3415.4377	6	3754.0498	3755.1167	25	4072.0047	4073.1545
8	3421.6107	3422.5920	12	3763.5053	3764.5747	12	4072.3849	4073.5348
7	3429.6147	3430.5980	11	3766.1186	3767.1887	12	4076.6284	4077.7794
9	3430.4153	3431.3988	25	3780.8398	3781.9137	9	4076.9432	4078.0943
12	3454.0952	3455.0848	12	3786.3824	3787.4577	12	4079.5738	4080.7255
10	3464.1272	3465.1193	8	3796.5934	3797.6714	15	4082.3872	4083.5397
20	3476.7474	3477.7428	10	3799.3820	3800.4607	8	4112.8153	4113.9757
9	3480.5055	3481.5018	10	3803.1724	3804.2521	9	4128.6400	4129.8046
8	3490.8733	3491.8723	11	3808.5748	3809.6559	15	4131.7235	4132.8890
20	3491.2439	3492.2430	5	3719.0159	3820.0997	12	4156.0860	4157.2578
25	3491.5360	3492.5351	8	3825.6729	3826.7585	12	4178.3658	4179.5435
7	3499.4765	3500.4777	12	3826.8072	3827.8930	10	4189.6511	4190.8317

Ar II — Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
12	4201.9715	4203.1554	25	4545.0519	4546.3261	3	5378.0787	5379.5741
11	4203.4109	4204.5951	4	4547.7589	4549.0338	5	5384.3752	5385.8724
9	4217.4308	4218.6187	7	4563.7429	4565.0221	8	5402.6048	5404.1068
11	4218.6649	4219.8531	7	4564.4054	4565.6847	5	5443.6893	5445.2023
10	4222.6373	4223.8266	25	4579.3494	4580.6327	8	5498.1841	5499.7116
5	4226.6089	4227.7992	25	4589.8978	4591.1839	7	5500.3324	5501.8605
10	4226.9876	4228.1780	10	4598.7627	4600.0511	4	5507.7629	5509.2929
20	4228.1580	4229.3488	25	4609.5673	4610.8585	4	5519.3436	5520.8768
8	4229.8696	4231.0608	12	4637.2328	4638.5313	8	5577.6846	5579.2333
12	4237.2198	4238.4129	25	4657.9012	4659.2053	8	5691.6611	5693.2404
4	4255.6034	4256.8013	10	4682.2759	4683.5864	5	5724.3248	5725.9128
25	4266.5271	4267.7279	7	4710.8238	4712.1418	3	5756.5983	5758.1949
8	4275.1596	4276.3627	12	4721.5910	4722.9119	5	5786.5553	5788.1600
20	4277.5282	4278.7319	25	4726.8683	4728.1906	6	5812.7592	5814.3708
12	4300.6495	4301.8593	12	4732.0532	4733.3769	3	5828.0739	5829.6896
8	4309.0934	4310.3054	25	4735.9058	4737.2305	7	5843.7775	5845.3974
9	4309.2391	4310.4512	25	4764.8646	4766.1969	3	5886.0977	5887.7290
25	4331.1995	4332.4174	6	4792.0819	4793.4215	6	5950.9031	5952.5517
15	4332.0297	4333.2478	35	4806.0205	4807.3638	4	5978.0021	5979.6580
8	4337.0708	4338.2902	25	4847.8095	4849.1639	7	5985.9142	5987.5722
50	4348.0640	4349.2863	5	4867.5560	4868.9156	4	6019.4970	6021.1640
15	4352.2049	4353.4282	30	4879.8635	4881.2264	5	6027.2513	6028.9204
10	4367.8316	4369.0591	15	4889.0422	4890.4075	8	6046.8977	6048.5720
15	4370.7532	4371.9814	12	4904.7516	4906.1211	6	6049.0751	6050.7501
20	4371.3290	4372.5574	25	4933.2091	4934.5861	6	6077.4297	6079.1122
6	4374.8579	4376.0872	6	4942.9214	4944.3010	3	6101.9194	6103.6085
20	4379.6668	4380.8974	5	4949.3979	4950.7793	12	6103.5390	6105.2286
8	4383.7535	4384.9851	25	4965.0795	4966.4650	50	6114.9234	6116.6160
10	4385.0566	4386.2886	15	4972.1597	4973.5471	4	6118.7225	6120.4161
20	4400.9863	4402.2225	30	5009.3344	5010.7316	5	6120.0941	6121.7882
5	4404.9022	4406.1394	20	5017.1628	5018.5621	15	6123.3619	6125.0567
12	4420.9124	4422.1538	10	5017.6340	5019.0335	12	6138.6559	6140.3549
25	4426.0011	4427.2439	30	5062.0371	5063.4484	40	6172.2778	6173.9858
20	4430.1890	4431.4329	10	5090.4951	5091.9139	3	6174.4032	6176.1118
15	4430.9963	4432.2404	8	5125.7655	5127.1937	6	6187.1350	6188.8470
10	4433.8380	4435.0829	20	5141.7827	5143.2152	6	6201.1002	6202.8159
7	4439.4614	4440.7078	25	5145.3083	5146.7417	7	6239.7121	6241.4382
8	4448.8792	4450.1280	8	5165.7728	5167.2116	25	6243.1201	6244.8471
12	4460.5574	4461.8094	10	5176.2292	5177.6709	3	6375.9549	6377.7176
10	4474.7594	4476.0150	8	5216.8139	5218.2663	15	6399.2065	6400.9755
15	4481.8107	4483.0682	6	5264.7824	5266.2477	8	6437.6003	6439.3795
8	4490.9816	4492.2415	15	5286.8870	5288.3581	20	6483.0825	6484.8739
7	4498.5384	4499.8003	6	5305.6880	5307.1642	12	6500.2156	6502.0117
7	4530.5523	4531.8226	5	5308.0709	5309.5477	6	6509.1000	6510.8985
6	4535.4903	4536.7620	2	5359.0660	5360.5564	6	6614.3475	6616.1742

Ar II — Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
6	6620.9665	6622.7950	5	7077.0237	7078.9750	2	8754.0102	8756.4144
50	6638.2207	6640.0539	4	7121.7368	7123.7001	15	8771.8602	8774.2692
30	6639.7403	6641.5739	15	7233.5365	7235.5300	3	8926.0755	8928.5262
100	6643.6976	6645.5322	2	7280.4539	7282.4600	7	9017.5912	9020.0667
15	6666.3588	6668.1996	4	7284.2325	7286.2396	4	9279.7085	9282.2550
50	6684.2929	6686.1385	7	7348.0530	7350.0773	4	9475.2493	9477.8486
20	6756.5525	6758.4175	2	7428.5787	7430.6248	3	9508.4513	9511.0596
3	6799.2913	6801.1678	4	7440.4934	7442.5426	2	9739.7703	9742.4413
9	6808.5312	6810.4101	2	7654.0310	7656.1379	5	9906.3907	9909.1069
8	6818.3841	6820.2657	2	8017.5274	8019.7324	3	10110.6681	10113.4396
15	6861.2688	6863.1619	3	8165.3937	8167.6387	20	10467.1771	10470.0453
20	6863.5350	6865.4288	2	8327.9001	8330.1890	12	10812.8956	10815.8576
20	6886.6125	6888.5125	2	8345.1712	8347.4648	3	10829.4575	10832.4240
5	6990.1124	6992.0402	2	8376.0777	8378.3796	7	10923.4426	10926.4346
3	7054.9873	7056.9326	6	8604.0163	8606.3799			

Fe I

For many years the iron arc in air was the only source of internationally adopted wavelength standards. In 1955 a final list was published by Edlén, comprising about one thousand Fe I wavelengths calculated on the basis of the combination principle from all precision measurements made up to that time. At about the same time there appeared the first extensive measurements of iron wavelengths emitted from low-pressure sources, either hollow cathodes or microwave-excited electrodeless lamps. These sources are now practically the only ones used for producing iron standards. Crosswhite et al. describe a sealed-off hollow-cathode discharge tube with iron electrodes and neon carrier gas at about 3 torr. This gives an iron spectrum with very sharp lines. The pressure shift in the atmospheric arc makes the arc wavelengths systematically longer. The difference increases roughly as λ^2 from about 0.0006 Å at 2100 Å for most of the lines and is about twice as large for transitions from the high even levels (see Trans. I.A.U. X).

The present list consists of 684 Fe I wavelengths from 2084 Å to 5763 Å calculated from a system of energy levels that was derived by H. M. Crosswhite in 1964 (unpublished) by using all available measurements on low-pressure sources. Wavelengths longer than 2250 Å were taken directly from an unpublished, comprehensive list of lines from a Fe-Ne hollow cathode, compiled at Johns Hopkins University in 1965. When calculating the wavelengths below 2250 Å we have added to Crosswhite's list the levels $w\ ^5P_1 = 46\ 410.377$ cm^{-1} and $v\ ^5P_3 = 47\ 966.583$ cm^{-1} obtained by adding the appropriate correction to the arc-in-air values of Edlén. The uncertainties are probably less than 0.0010 Å everywhere and should decrease to less than 0.0003 Å for the shortest wavelengths.

The intensities have been taken from N.B.S. Monograph 32 whenever possible, and for the rest we quote (in parentheses) the figures given by Russell and Moore. The two scales are very roughly equal for the short wavelengths up to about 3700 Å; from 3700 to 4500 Å the figures of Russell and Moore are generally larger by a factor 2 to 5, and this factor may increase to 10 for the longest wavelengths.

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Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
(50)	2084.1212	2084.7847	(4)	2132.0169	2132.6899	(15)	2245.6529	2246.3494
(25)	2087.5109	2088.1750	(5)	2153.0068	2153.6839	(10)	2250.7904	2251.4880
(30)	2090.3832	2091.0479	(5)	2157.7945	2158.4727	(12)	2251.8739	2252.5717
(20)	2090.8546	2091.5194	(5)	2161.5794	2162.2583	(15)	2259.5106	2260.2101
(40)	2093.6849	2094.3502	(7)	2164.5488	2165.2283	(20)	2265.0543	2265.7550
(25)	2098.9387	2099.6050	(40)	2171.2970	2171.9779	(9)	2267.0847	2267.7859
(30)	2100.7978	2101.4646	(6)	2172.5851	2173.2662	(18)	2270.8619	2271.5638
(30)	2102.3536	2103.0206	(8)	2173.2138	2173.8951	(15)	2272.0696	2272.7718
(20)	2102.9104	2103.5775	(6)	2176.8406	2177.5226	(12)	2276.0258	2276.7289
(25)	2103.0530	2103.7202	(5)	2186.8925	2187.5766	(12)	2283.6551	2284.3599
(20)	2106.2600	2106.9278	(40)	2187.1945	2187.8787	(40)	2284.0857	2284.7905
(25)	2106.3948	2107.0626	(10)	2191.2043	2191.8893	(30)	2287.2498	2287.9553
(12)	2108.1365	2108.8047	(50)	2196.0421	2196.7281	(30)	2292.5240	2293.2306
(12)	2108.3019	2108.9701	(6)	2207.0684	2207.7567	(25)	2293.8478	2294.5548
(30)	2108.9591	2109.6274	(9)	2210.6887	2211.3778	(15)	2296.9269	2297.6345
(25)	2112.9688	2113.6379	(7)	2211.2361	2211.9253	(35)	2297.7870	2298.4948
(20)	2113.0869	2113.7561	(10)	2228.1715	2228.8643	(10)	2298.1693	2298.8772
(25)	2114.5997	2115.2691	(5)	2229.0729	2229.7658	(25)	2299.2201	2299.9283
(20)	2115.1693	2115.8388	(15)	2231.2131	2231.9065	(30)	2300.1416	2300.8499
(5)	2119.1362	2119.8066	(15)	2242.5718	2243.2677	(20)	2301.6839	2302.3925

Fe I—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
(20)	2303.5810	2304.2900	70	2535.6074	2536.3693	2	2764.3230	2765.1396
(4)	2306.3823	2307.0920	(7)	2539.3566	2540.1194	2	2766.9096	2767.7268
(30)	2308.9990	2309.7093	80	2540.9719	2541.7350	18	2767.5222	2768.3396
(40)	2313.1041	2313.8153	80	2545.9785	2546.7429	15	2778.2205	2779.0405
(40)	2320.3579	2321.0707	65	2549.6132	2550.3784	4	2781.8355	2782.6563
(8)	2369.4558	2370.1795	10	2576.6907	2577.4623	2	2789.8019	2790.6247
(15)	2371.4305	2372.1547	8	2605.6566	2606.4351	3	2791.7856	2792.6088
(20)	2373.6245	2374.3492	16	2606.8269	2607.6056	2	2795.0054	2795.8294
(10)	2374.5182	2375.2430	12	2618.0183	2618.7997	15	2804.5206	2805.3469
(25)	2389.9728	2390.7012	8	2632.2369	2633.0216	42	2813.2866	2814.1151
(4)	2429.8150	2430.5524	16	2635.8092	2636.5948	2	2817.5036	2818.3331
5	2443.8721	2444.6127	6	2641.6456	2642.4326	50	2823.2760	2824.1069
6	2453.4756	2454.2185	12	2643.9980	2644.7855	3	2825.6874	2826.5190
18	2457.5978	2458.3416	3	2647.5575	2648.3459	3	2828.8082	2829.6405
11	2462.1808	2462.9257	3	2662.0562	2662.8480	32	2832.4358	2833.2690
70	2462.6472	2463.3921	10	2666.8123	2667.6054	3	2835.4565	2836.2905
14	2465.1487	2465.8942	18	2679.0622	2679.8582	10	2838.1193	2838.9539
4	2467.7321	2468.4782	12	2689.2125	2690.0109	3	2840.4220	2841.2572
14	2468.8795	2469.6258	8	2699.1064	2699.9072	9	2843.6307	2844.4666
22	2474.8139	2475.5617	6	2706.0121	2706.8146	26	2843.9766	2844.8126
7	2479.4801	2480.2289	18	2706.5822	2707.3848	7	2845.5945	2846.4309
100	2479.7761	2480.5250	7	2708.5712	2709.3742	2	2848.7139	2849.5511
280	2483.2713	2484.0210	8	2711.6554	2712.4592	38	2851.7968	2852.6347
7	2486.6914	2487.4419	260	2719.0275	2719.8331	5	2863.4292	2864.2700
9	2487.0659	2487.8165	120	2720.9026	2721.7087	4	2863.8635	2864.7044
4	2487.3696	2488.1203	70	2723.5778	2724.3845	3	2866.6249	2867.4665
260	2488.1426	2488.8934	8	2724.9531	2725.7601	8	2869.3075	2870.1497
180	2489.7503	2490.5015	6	2728.0197	2728.8275	5	2872.3338	2873.1768
180	2490.6441	2491.3955	5	2728.8196	2729.6275	10	2874.1725	2875.0159
140	2491.1547	2491.9062	70	2733.5807	2734.3898	5	2877.3007	2878.1449
14	2496.5333	2497.2861	3	2734.0053	2734.8145	1	2887.8048	2888.6516
90	2501.1323	2501.8861	3	2734.2676	2735.0769	8	2894.5038	2895.3523
4	2501.6935	2502.4475	28	2735.4751	2736.2847	4	2895.0347	2895.8833
10	2507.8999	2508.6553	70	2737.3096	2738.1196	4	2899.4152	2900.2649
90	2510.8348	2511.5909	8	2742.2542	2743.0654	20	2912.1574	2913.0103
7	2512.3649	2513.1213	55	2742.4055	2743.2168	5	2920.6900	2921.5449
9	2517.6615	2518.4192	5	2743.5651	2744.3766	5	2923.8528	2924.7085
70	2518.1020	2518.8597	30	2744.0679	2744.8795	20	2929.0072	2929.8642
6	2519.6292	2520.3874	6	2744.5274	2745.3392	80	2936.9034	2937.7623
280	2522.8494	2523.6083	70	2750.1405	2750.9537	13	2941.3426	2942.2027
50	2524.2927	2525.0519	3	2750.8735	2751.6868	80	2947.8759	2948.7376
140	2527.4349	2528.1949	4	2754.0324	2754.8465	4	2948.4329	2949.2947
50	2529.1348	2529.8952	24	2756.3284	2757.1430	60	2953.9399	2954.8031
16	2529.8357	2530.5963	8	2757.3157	2758.1306	32	2957.3644	2958.2284
7	2530.6872	2531.4480	16	2762.0264	2762.8424	170	2966.8982	2967.7646

Fe I—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
8	2969.4743	2970.3414	40	3067.2441	3068.1355	13	3265.6166	3266.5580
60	2973.1322	2974.0002	(8)	3068.1732	3069.0649	15	3270.9997	3271.9425
120	2973.2352	2974.1032	34	3075.7193	3076.6128	(5)	3284.5872	3285.5335
1	2976.1282	2976.9969	24	3083.7413	3084.6368	(8)	3292.0207	3292.9688
1	2980.5341	2981.4039	20	3091.5769	3092.4745	(8)	3292.5893	3293.5376
28	2981.4451	2982.3151	(6)	3098.1891	3099.0883	(6)	3298.1316	3299.0814
140	2983.5698	2984.4403	(20)	3099.8951	3100.7947	(5)	3307.2331	3308.1852
1	2986.4557	2987.3270	(15)	3099.9679	3100.8675	(7)	3314.7412	3315.6952
12	2987.2902	2988.1617	26	3100.3031	3101.2028	(5)	3328.8658	3329.8233
5	2990.3913	2991.2635	26	3100.6651	3101.5649	(6)	3337.6642	3338.6240
120	2994.4269	2995.3002	(6)	3119.4944	3120.3989	(6)	3340.5643	3341.5248
1	2996.3850	2997.2587	(10)	3134.1097	3135.0179	(6)	3347.9251	3348.8875
36	2999.5118	3000.3863	(6)	3142.4536	3143.3639	6	3355.2275	3356.1918
5	3000.4508	3001.3255	(10)	3151.3519	3152.2645	12	3370.7829	3371.7512
110	3000.9477	3001.8226	(8)	3157.0358	3157.9498	(6)	3378.6785	3379.6488
10	3003.0302	3003.9055	(10)	3160.6575	3161.5725	(6)	3379.0184	3379.9887
4	3007.1452	3008.0216	(8)	3161.9467	3162.8620	(8)	3380.1097	3381.0803
10	3007.2823	3008.1588	(6)	3166.4353	3167.3517	8	3383.9785	3384.9502
28	3009.5689	3010.4460	7	3175.4454	3176.3641	7	3392.3037	3393.2775
5	3011.4817	3012.3592	(10)	3178.0133	3178.9326	15	3392.6514	3393.6252
8	3016.1815	3017.0602	14	3180.2236	3181.1434	22	3399.3335	3400.3090
20	3017.6272	3018.5062	6	3184.8947	3185.8157	(6)	3401.5184	3402.4945
18	3018.9826	3019.8620	7	3191.6591	3192.5819	15	3404.3535	3405.3304
60	3020.4907	3021.3704	11	3193.2258	3194.1490	30	3407.4585	3408.4361
280	3020.6391	3021.5189	24	3196.9281	3197.8522	23	3413.1312	3414.1103
160	3021.0727	3021.9526	11	3205.3985	3206.3248	15	3417.8408	3418.8211
26	3024.0325	3024.9131	(8)	3210.2293	3211.1568	8	3422.6563	3423.6378
18	3025.6384	3026.5194	7	3210.8280	3211.7556	16	3424.2840	3425.2660
38	3025.8425	3026.7235	15	3211.9859	3212.9138	7	3426.6285	3427.6110
18	3026.4614	3027.3426	6	3214.3956	3215.3241	32	3427.1192	3428.1019
19	3030.1484	3031.0306	7	3215.9380	3216.8669	8	3428.1925	3429.1755
19	3031.2144	3032.0969	5	3217.3770	3218.3063	400	3440.6058	3441.5919
19	3031.6336	3032.5161	12	3219.5827	3220.5125	80	3440.9887	3441.9749
95	3037.3887	3038.2726	(5)	3228.2490	3229.1810	40	3443.8762	3444.8632
17	3040.4271	3041.3119	(6)	3230.2076	3231.1401	16	3445.1487	3446.1360
7	3041.6372	3042.5222	7	3230.9631	3231.8958	5	3447.2776	3448.2655
12	3041.7384	3042.6234	7	3233.9675	3234.9010	8	3450.3286	3451.3173
6	3042.0192	3042.9043	(7)	3234.6130	3235.5466	8	3451.9144	3452.9035
19	3042.6644	3043.5497	(8)	3236.2222	3237.1562	8	3452.2751	3453.2642
(5)	3045.0783	3045.9642	22	3244.1869	3245.1230	60	3465.8603	3466.8529
130	3047.6043	3048.4909	(8)	3246.0047	3246.9412	(6)	3471.3435	3472.3375
6	3055.2620	3056.1505	(10)	3248.2047	3249.1417	80	3475.4500	3476.4451
65	3057.4456	3058.3346	(8)	3251.2335	3252.1713	32	3476.7016	3477.6970
100	3059.0856	3059.9750	(8)	3257.5923	3258.5317	80	3490.5737	3491.5727
(8)	3067.1182	3068.0096	(8)	3265.0465	3265.9879	6	3495.2867	3496.2868

Fe I—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
24	3497.8404	3498.8412	8	3659.5164	3660.5589	48	3799.5469	3800.6256
6	3506.4977	3507.5008	16	3669.5210	3670.5661	3	3807.5370	3808.6178
40	3513.8173	3514.8222	(6)	3676.3115	3677.3584	32	3812.9641	3814.0463
36	3521.2608	3522.2677	20	3677.6288	3678.6760	(5)	3814.5227	3815.6054
18	3526.0405	3527.0485	65	3679.9132	3680.9610	160	3815.8397	3816.9227
13	3526.1656	3527.1737	16	3682.2425	3683.2909	500	3820.4251	3821.5093
8	3533.1986	3534.2085	11	3683.0545	3684.1030	7	3821.1788	3822.2632
20	3536.5558	3537.5666	11	3684.1068	3685.1557	80	3824.4436	3825.5288
24	3541.0832	3542.0951	13	3685.9983	3687.0476	320	3825.8805	3826.9661
22	3542.0752	3543.0874	80	3687.4564	3688.5061	130	3827.8226	3828.9087
(5)	3545.6403	3546.6534	24	3694.0078	3695.0592	3	3833.3083	3834.3958
6	3553.7390	3554.7541	30	3701.0865	3702.1397	130	3834.2222	3835.3100
28	3554.9247	3555.9402	8	3704.4617	3705.5158	4	3839.2567	3840.3458
(7)	3556.8785	3557.8945	80	3705.5657	3706.6201	80	3840.4372	3841.5266
65	3558.5148	3559.5312	(20)	3707.8215	3708.8765	80	3841.0475	3842.1371
160	3565.3786	3566.3967	(8)	3707.9195	3708.9745	6	3843.2563	3844.3465
400	3570.0971	3571.1165	85	3709.2459	3710.3013	6	3846.8002	3847.8913
(6)	3571.9961	3573.0160	600	3719.9346	3720.9927	7	3850.8174	3851.9095
(5)	3582.1995	3583.2220	80	3722.5625	3723.6213	2	3852.5729	3853.6654
13	3584.6604	3585.6836	8	3724.3768	3725.4361	85	3856.3717	3857.4652
36	3585.3189	3586.3422	75	3727.6187	3728.6788	6	3859.2117	3860.3060
30	3585.7052	3586.7286	12	3732.3960	3733.4573	420	3859.9114	3861.0058
40	3586.9840	3588.0077	70	3733.3169	3734.3785	34	3865.5230	3866.6190
7	3589.1050	3590.1293	700	3734.8636	3735.9256	2	3867.2152	3868.3116
8	3594.6331	3595.6588	(6)	3735.3239	3736.3860	34	3872.5009	3873.5987
16	3603.2043	3604.2323	340	3737.1313	3738.1938	4	3873.7608	3874.8589
32	3606.6797	3607.7085	7	3738.3058	3739.3687	50	3878.0176	3879.1168
200	3608.8587	3609.8881	60	3743.3616	3744.4258	85	3878.5730	3879.6723
(8)	3612.0679	3613.0982	240	3745.5608	3746.6256	3	3885.5095	3886.6107
13	3617.7879	3618.8196	60	3745.8989	3746.9638	180	3886.2820	3887.3833
200	3618.7676	3619.7995	(6)	3746.9270	3747.9921	35	3887.0477	3888.1492
24	3621.4616	3622.4943	140	3748.2617	3749.3272	35	3888.5134	3889.6153
16	3622.0042	3623.0370	400	3749.4847	3750.5504	4	3893.3909	3894.4941
5	3625.1414	3626.1750	7	3753.6108	3754.6776	35	3895.6558	3896.7596
(7)	3631.0961	3632.1312	300	3758.2324	3759.3005	4	3897.8900	3898.9944
200	3631.4629	3632.4981	2	3760.5317	3761.6003	4	3898.0088	3899.1132
8	3632.0410	3633.0763	170	3763.7885	3764.8580	55	3899.7073	3900.8121
13	3638.2978	3639.3348	120	3767.1914	3768.2618	55	3902.9452	3904.0509
22	3640.3892	3641.4268	1	3774.8243	3775.8967	2	3903.8990	3905.0049
6	3645.8212	3646.8602	1	3776.4522	3777.5249	14	3906.4794	3907.5859
160	3647.8424	3648.8819	46	3787.8800	3788.9557	2	3916.7308	3917.8400
(5)	3649.3029	3650.3427	6	3790.0923	3791.1686	4	3917.1802	3918.2896
16	3649.5064	3650.5463	65	3795.0017	3796.0793	3	3918.6419	3919.7517
(5)	3650.2793	3651.3194	6	3797.5180	3798.5962	36	3920.2577	3921.3679
30	3651.4674	3652.5078	32	3798.5107	3799.5892	55	3922.9115	3924.0223

Fe I—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
(6)	3925.9405	3927.0522	(7)	4136.9973	4138.1641	(5)	4367.5781	4368.8056
70	3927.9197	3929.0319	8	4143.4151	4144.5836	1	4369.7707	4370.9988
75	3930.2962	3931.4090	40	4143.8688	4145.0374	6	4375.9294	4377.1590
2	3940.8770	3941.9925	2	4147.6687	4148.8384	170	4383.5445	4384.7761
1	3942.4390	3943.5550	(10)	4153.8985	4155.0697	85	4404.7499	4405.9871
4	3948.7740	3949.8916	4	4154.4996	4155.6710	(5)	4407.7081	4408.9461
4	3949.9527	3951.0707	(9)	4154.8045	4155.9760	(6)	4408.4140	4409.6522
3	3951.1636	3952.2819	4	4156.7989	4157.9709	48	4415.1222	4416.3622
2	3952.6014	3953.7200	(5)	4170.9008	4172.0765	(6)	4422.5670	4423.8089
4	3956.4544	3957.5740	(5)	4172.1218	4173.2979	6	4427.3088	4428.5520
4	3966.0610	3967.1832	(5)	4174.9121	4176.0888	(6)	4430.6142	4431.8583
3	3967.4198	3968.5423	4	4175.6355	4176.8125	5	4442.3379	4443.5851
55	3969.2570	3970.3800	8	4181.7544	4182.9330	2	4443.1930	4444.4404
3	3971.3215	3972.4450	3	4184.8913	4186.0707	5	4447.7179	4448.9664
6	3977.7407	3978.8659	13	4187.0384	4188.2184	(5)	4454.3800	4455.6303
2	3981.7711	3982.8973	13	4187.7947	4188.9749	5	4459.1176	4460.3692
4	3983.9561	3985.0829	8	4191.4296	4192.6107	3	4461.6521	4462.9043
8	3997.3919	3998.5222	(5)	4195.3292	4196.5113	6	4466.5508	4467.8044
3	3998.0527	3999.1831	11	4198.3036	4199.4865	6	4476.0171	4477.2731
(5)	4001.6608	4002.7923	13	4199.0949	4200.2781	(6)	4482.2518	4483.5094
40	4005.2414	4006.3737	34	4202.0286	4203.2125	6	4494.5632	4495.8241
(6)	4007.2710	4008.4039	(10)	4203.9840	4205.1684	10	4528.6133	4529.8832
4	4009.7126	4010.8462	4	4210.3428	4211.5289	2	4531.1474	4532.4179
(6)	4017.1494	4018.2848	(5)	4213.6483	4214.8353	(4)	4547.8462	4549.1211
4	4021.8669	4023.0036	2	4216.1828	4217.3704	(5)	4592.6506	4593.9374
(6)	4030.4885	4031.6274	7	4219.3600	4220.5484	3	4602.9401	4604.2296
(6)	4044.6098	4045.7525	4	4222.2124	4223.4016	(6)	4647.4329	4648.7342
300	4045.8130	4046.9560	11	4233.6019	4234.7941	(5)	4654.4974	4655.8006
3	4062.4413	4063.5886	17	4235.9362	4237.1290	(6)	4667.4528	4668.7594
120	4063.5939	4064.7415	3	4238.8092	4240.0028	(6)	4668.1323	4669.4391
(6)	4066.9753	4068.1238	(6)	4245.2565	4246.4518	(7)	4678.8451	4680.1547
(8)	4067.9774	4069.1262	3	4247.4255	4248.6213	(6)	4691.4116	4692.7245
100	4071.7372	4072.8869	12	4250.1181	4251.3146	(8)	4707.2717	4708.5888
(5)	4074.7857	4075.9362	24	4250.7866	4251.9833	(5)	4710.2828	4711.6008
(8)	4076.6286	4077.7796	36	4260.4733	4261.6725	2	4736.7715	4738.0965
(6)	4084.4914	4085.6445	(5)	4267.8264	4269.0276	(5)	4786.8062	4788.1444
4	4107.4888	4108.6479	12	4271.1530	4272.3551	(7)	4789.6499	4790.9889
3	4109.8020	4110.9618	100	4271.7593	4272.9615	2	4859.7406	4861.0982
(5)	4114.4457	4115.6066	8	4282.4021	4283.6072	6	4871.3172	4872.6778
8	4118.5442	4119.7062	14	4294.1243	4295.3324	4	4872.1363	4873.4971
(5)	4120.2064	4121.3688	100	4307.9015	4309.1132	4	4890.7540	4892.1198
(5)	4121.8022	4122.9650	6	4315.0837	4316.2974	8	4891.4919	4892.8579
2	4127.6081	4128.7725	95	4325.7615	4326.9779	1	4903.3087	4904.6778
32	4132.0578	4133.2234	4	4337.0457	4338.2651	5	4918.9925	4920.3658
4	4134.6762	4135.8424	4	4352.7340	4353.9575	12	4920.5018	4921.8754

Fe I—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
(10)	4938.8125	4940.1910	(6)	5142.9275	5144.3603	2	5393.1668	5394.6663
(4)	4946.3849	4947.7655	(6)	5150.8385	5152.2734	7	5397.1269	5398.6275
4	4957.2982	4958.6817	13	5167.4873	5168.9267	7	5405.7741	5407.2770
13	4957.5966	4958.9801	6	5171.5953	5173.0357	8	5429.6955	5431.2048
(8)	4966.0872	4967.4730	4	5191.4545	5192.9002	5	5434.5228	5436.0333
(7)	4985.2514	4986.6422	6	5192.3433	5193.7893	1	5445.0424	5446.5558
(7)	4985.5458	4986.9368	3	5194.9412	5196.3878	6	5446.9161	5448.4300
(8)	4994.1288	4995.5221	3	5202.3351	5203.7837	4	5455.6090	5457.1252
1	5001.8622	5003.2575	(7)	5208.5932	5210.0435	(10)	5476.5634	5478.0851
1	5005.7110	5007.1073	(6)	5215.1793	5216.6313	2	5497.5160	5499.0434
3	5006.1175	5007.5140	3	5216.2737	5217.7260	1	5501.4641	5502.9925
1	5012.0674	5013.4654	(5)	5217.3889	5218.8415	2	5506.7776	5508.3074
(10)	5014.9412	5016.3399	3	5226.8616	5228.3167	2	5569.6177	5571.1644
(6)	5022.2353	5023.6360	12	5227.1892	5228.6444	3	5572.8412	5574.3887
(7)	5041.0708	5042.4765	11	5232.9394	5234.3962	4	5586.7553	5588.3066
1	5041.7553	5043.1612	(6)	5250.6447	5252.1062	1	5602.9449	5604.5004
2	5049.8193	5051.2273	(8)	5263.3047	5264.7696	5	5615.6436	5617.2026
1	5051.6336	5053.0421	5	5266.5546	5268.0203	1	5624.5413	5626.1026
1	5068.7653	5070.1783	22	5269.5366	5271.0032	1	5658.8156	5660.3860
(10)	5074.7479	5076.1626	8	5270.3571	5271.8239	(6)	5662.5153	5664.0867
(6)	5079.2238	5080.6396	2	5281.7894	5283.2592	(7)	5701.5448	5703.1267
1	5083.3377	5084.7547	4	5283.6206	5285.0909	(10)	5709.3777	5710.9617
1	5098.6990	5100.1201	3	5302.2989	5303.7742	(5)	5753.1213	5754.7170
(6)	5107.4464	5108.8697	7	5324.1782	5325.6593	1	5762.9901	5764.5884
(8)	5107.6408	5109.0643	18	5328.0376	5329.5197			
2	5110.4125	5111.8366	3	5328.5306	5330.0129			
(6)	5123.7190	5125.1467	1	5339.9282	5341.4135			
(5)	5127.3581	5128.7867	2	5341.0233	5342.5089			
3	5139.2507	5140.6826	12	5371.4892	5372.9829			
4	5139.4621	5140.8940	(5)	5389.4786	5390.9771			

Cu II

The wavelengths and intensities are from Ross, who observed them with a water-cooled hollow cathode and interferometrically measured over one thousand lines of the spectrum. His measurements of the wavelengths of the 4*s*-4*p*, 4*p*-5*s* transitions between 2000 and 2855 Å differ only slightly from those of Reader et al. For consistency we have taken all wavelengths from Ross. Some 460 of these lines are included in our list. For the selected lines Ross states uncertainties of 0.0007 Å or less for wavelengths below 5000 Å, and of 0.0014 Å or less for the longer wavelengths.

Ross, C. B., Ph. D. Thesis, Purdue Univ. (1969).
Ross, C. B., Los Alamos Scientific Laboratory Publ. LA-4498, UC-34, Physics 71 pp. (1970).
Reader, J., Meissner, K. W., and Andrew, K. L., J. Opt. Soc. Am. **50**, 221 (1960).

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
25	1999.6979	2000.3459	75	2218.1081	2218.7988	15	2529.3040	2530.0644
7	2025.4887	2026.1413	15	2218.5130	2219.2038	30	2544.8051	2545.5692
27	2035.8545	2036.5089	10	2224.6913	2225.3834	10	2571.7555	2572.5259
25	2037.1272	2037.7819	15	2226.7805	2227.4730	15	2590.5287	2591.3036
35	2043.8022	2044.4581	35	2228.8680	2229.5610	17	2598.8129	2599.5897
30	2054.9795	2055.6375	15	2229.8536	2230.5468	20	2600.2701	2601.0473
10	2078.6628	2079.3253	7	2231.5824	2232.2759	4	2614.4130	2615.1935
3	2093.6376	2094.3030	90	2242.6184	2243.3143	6	2620.6659	2621.4479
11	2098.3984	2099.0647	100	2247.0023	2247.6991	20	2666.2908	2667.0837
32	2104.7969	2105.4644	15	2248.9673	2249.6645	75	2689.2996	2690.0980
4	2111.2944	2111.9632	7	2254.9886	2255.6871	70	2700.9616	2701.7628
30	2112.1004	2112.7694	7	2263.2137	2263.9140	65	2703.1841	2703.9859
32	2117.3098	2117.9798	15	2263.7864	2264.4868	4	2711.8651	2712.6690
35	2122.9800	2123.6511	4	2265.3650	2266.0658	70	2713.5080	2714.3123
10	2125.1063	2125.7778	20	2276.2583	2276.9614	3	2715.4041	2716.2088
35	2126.0445	2126.7162	4	2278.3384	2279.0420	65	2718.7775	2719.5830
4	2130.0858	2130.7583	3	2280.9430	2281.6472	30	2721.6774	2722.4836
42	2134.3410	2135.0144	10	2286.6454	2287.3508	5	2731.9480	2732.7567
90	2135.9810	2136.6547	7	2289.4166	2290.1226	12	2737.3417	2738.1517
7	2145.4929	2146.1685	5	2291.0024	2291.7088	9	2739.7664	2740.5770
7	2146.9199	2147.5958	17	2294.3680	2295.0751	27	2745.2712	2746.0832
40	2148.9839	2149.6603	5	2309.5195	2310.2299	80	2769.6692	2770.4871
15	2151.8092	2152.4861	2	2323.0045	2323.7179	4	2788.2616	2789.0840
15	2161.3205	2161.9994	4	2323.9286	2324.6422	20	2791.7947	2792.6180
25	2174.9820	2175.6637	4	2336.1713	2336.8876	4	2795.2981	2796.1222
70	2179.4103	2180.0929	3	2355.0149	2355.7354	3	2795.6573	2796.4815
5	2180.7516	2181.4345	15	2369.8899	2370.6137	4	2797.2551	2798.0797
70	2189.6305	2190.3152	5	2376.3036	2377.0289	5	2797.4337	2798.2583
90	2192.2681	2192.9534	6	2400.1147	2400.8454	17	2799.5282	2800.3534
40	2195.6826	2196.3686	12	2403.3373	2404.0687	7	2799.6806	2800.5058
10	2200.5088	2201.1958	7	2424.4341	2425.1703	10	2810.8039	2811.6318
20	2209.8056	2210.4945	4	2468.5005	2469.2468	3	2830.2316	2831.0643
75	2210.2681	2210.9571	10	2485.7924	2486.5427	35	2837.3683	2838.2027
7	2212.7476	2213.4371	15	2506.2732	2507.0283	4	2840.4920	2841.3272
25	2215.1060	2215.7960	12	2526.5927	2527.3525	4	2846.8685	2847.7052

Cu II—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
9	2848.5001	2849.3372	2	3342.9640	3343.9251	16	3864.1369	3865.2324
9	2848.7253	2849.5625	6	3349.4566	3350.4194	6	3866.3046	3867.4007
5	2851.8950	2852.7330	20	3365.6475	3366.6144	3	3868.3710	3869.4676
7	2852.0766	2852.9146	20	3366.2696	3367.2367	7	3873.2074	3874.3053
3	2852.4044	2853.2425	15	3366.5618	3367.5290	14	3879.3965	3880.4960
3	2855.3207	2856.1595	45	3370.4538	3371.4220	28	3884.1307	3885.2314
10	2857.7485	2858.5879	10	3370.7845	3371.7527	14	3884.5339	3885.6347
6	2859.0053	2859.8450	10	3371.4075	3372.3759	9	3891.1276	3892.2302
2	2862.3234	2863.1639	17	3373.5914	3374.5604	15	3892.9236	3894.0266
60	2877.6998	2878.5441	30	3374.9515	3375.9208	10	3896.6915	3897.7955
27	2884.1955	2885.0414	4	3376.6139	3377.5836	4	3900.0556	3901.1605
3	2927.2540	2928.1106	12	3377.7037	3378.6737	9	3902.9666	3904.0722
2	2936.9553	2937.8143	9	3378.5094	3379.4796	17	3903.1766	3904.2823
10	2986.3346	2987.2058	11	3379.9595	3380.9301	4	3912.4910	3913.5991
7	3014.5446	3015.4229	20	3380.7117	3381.6825	9	3919.1725	3920.2824
6	3041.6788	3042.5638	4	3384.3321	3385.3038	14	3920.6545	3921.7648
7	3151.0505	3151.9630	10	3384.9450	3385.9169	13	3923.4503	3924.5613
3	3152.9000	3153.8130	4	3385.4656	3386.4376	12	3933.2683	3934.3818
3	3158.6729	3159.5873	4	3395.2149	3396.1894	5	3944.5821	3945.6986
5	3179.7846	3180.7043	7	3402.8301	3403.8065	4	3952.0660	3953.1845
7	3182.1717	3183.0920	3	3409.1598	3410.1379	5	3985.2144	3986.3415
9	3184.8404	3185.7614	3	3515.2291	3516.2344	12	3987.0236	3988.1512
5	3185.7249	3186.6461	4	3548.7423	3549.7562	15	3993.3022	3994.4314
5	3186.0148	3186.9361	3	3592.3527	3593.3778	9	3998.3674	3999.4979
3	3225.3388	3226.2701	5	3602.2330	3603.2607	14	4003.4758	4004.6077
4	3226.5812	3227.5128	7	3606.6575	3607.6863	9	4006.1650	4007.2976
5	3238.8232	3239.7579	3	3616.8635	3617.8949	5	4014.2360	4015.3707
9	3250.4652	3251.4028	4	3633.1158	3634.1514	4	4015.1962	4016.3311
7	3281.6963	3282.6419	4	3641.7928	3642.8307	10	4032.6469	4033.7864
40	3290.4175	3291.3653	3	3643.0145	3644.0527	60	4043.4844	4044.6267
6	3292.1231	3293.0713	5	3643.7565	3644.7949	50	4043.7506	4044.8930
4	3293.3325	3294.2810	100	3686.5551	3687.6045	13	4065.0094	4066.1574
5	3294.3353	3295.2841	7	3738.6487	3739.7116	12	4068.1057	4069.2545
9	3295.1018	3296.0508	5	3748.1908	3749.2562	4	4089.4786	4090.6330
9	3297.1983	3298.1478	3	3772.5255	3773.5972	7	4112.4816	4113.6420
8	3300.4370	3301.3873	15	3786.2695	3787.3448	50	4131.3633	4132.5286
9	3300.6409	3301.5913	17	3797.8488	3798.9271	20	4143.0169	4144.1853
11	3300.8814	3301.8318	3	3801.5562	3802.6355	30	4153.6233	4154.7945
25	3301.2286	3302.1791	10	3818.8786	3819.9624	50	4161.1404	4162.3135
20	3316.2756	3317.2299	3	3824.8322	3825.9175	27	4162.2967	4163.4701
7	3317.1383	3318.0929	14	3826.9208	3828.0067	37	4164.2840	4165.4580
5	3322.6362	3323.5922	6	3836.1645	3837.2528	40	4171.8507	4173.0267
15	3338.6475	3339.6075	8	3842.5889	3843.6788	12	4176.1248	4177.3019
6	3338.9360	3339.8961	4	3862.1244	3863.2194	50	4179.5124	4180.6904
6	3339.0850	3340.0452	4	3863.6402	3864.7356	4	4195.7735	4196.9557

Cu II—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
50	4211.8661	4213.0526	20	4926.4245	4927.7997	5	5535.0498	5536.5872
5	4216.9123	4218.1001	20	4931.5545	4932.9311	5	5555.5126	5557.0554
32	4230.4486	4231.6399	90	4931.6975	4933.0741	7	5593.7717	5595.3248
4	4251.0193	4252.2160	19	4937.2206	4938.5987	6	5615.2354	5616.7942
20	4255.6348	4256.8328	10	4937.9754	4939.3537	5	5635.5122	5637.0764
30	4279.9621	4281.1664	5	4940.0697	4941.4486	9	5641.2649	5642.8307
14	4285.2432	4286.4489	12	4943.0257	4944.4053	9	5721.7845	5723.3718
50	4292.4705	4293.6781	10	4951.6195	4953.0014	9	5759.4224	5761.0198
40	4365.3705	4366.5973	70	4953.7235	4955.1060	15	5805.9891	5807.5989
9	4378.3840	4379.6142	7	4955.9565	4957.3396	10	5825.8234	5827.4385
9	4440.8836	4442.1303	4	4969.8064	4971.1932	10	5833.5152	5835.1324
10	4444.8314	4446.0792	8	4973.6950	4975.0828	20	5897.9713	5899.6058
40	4506.0022	4507.2661	8	4974.1550	4975.5429	12	5937.5768	5939.2219
10	4515.5195	4516.7859	6	4980.0154	4981.4049	40	5941.1955	5942.8415
15	4516.0492	4517.3158	50	4985.5055	4986.8964	10	5993.2596	5994.9196
15	4541.0325	4542.3056	40	5006.8006	5008.1972	15	5995.5873	5997.2479
50	4555.9199	4557.1970	35	5009.8508	5011.2482	65	6000.1196	6001.7814
7	4557.5077	4558.7852	40	5012.6196	5014.0177	10	6023.2638	6024.9318
4	4575.6530	4576.9353	35	5021.2788	5022.6792	25	6072.2179	6073.8991
10	4596.9056	4598.1935	10	5024.0236	5025.4248	15	6080.3432	6082.0265
9	4597.9473	4599.2355	20	5039.0165	5040.4217	15	6099.9895	6101.6781
7	4608.4661	4609.7571	15	5041.3312	5042.7370	15	6105.7477	6107.4379
12	4649.2706	4650.5724	30	5047.3485	5048.7559	16	6107.4117	6109.1023
12	4661.3628	4662.6678	90	5051.7927	5053.2013	15	6110.8729	6112.5644
32	4671.7019	4673.0096	40	5058.9096	5060.3200	30	6114.4931	6116.1856
30	4673.5772	4674.8854	5	5060.6420	5062.0529	60	6150.3835	6152.0856
45	4681.9940	4683.3044	50	5065.4592	5066.8714	75	6154.2218	6155.9250
10	4758.4331	4759.7638	45	5067.0941	5068.5067	50	6172.0374	6173.7453
7	4766.7393	4768.0722	35	5072.3025	5073.7165	55	6186.8837	6188.5956
9	4807.0464	4808.3900	45	5088.2767	5089.6950	40	6188.6758	6190.3882
40	4812.9483	4814.2934	25	5088.9434	5090.3618	30	6198.0919	6199.8068
7	4832.2455	4833.5957	42	5093.8159	5095.2356	47	6204.2607	6205.9773
12	4851.2619	4852.6172	35	5100.0666	5101.4880	45	6208.4572	6210.1749
30	4854.9880	4856.3443	7	5108.3337	5109.7573	75	6216.9386	6218.6586
6	4861.5614	4862.9194	10	5120.7535	5122.1804	70	6219.8437	6221.5645
10	4873.3039	4874.6650	25	5124.4760	5125.9039	5	6236.3449	6238.0701
5	4889.7007	4891.0662	10	5158.0933	5159.5301	10	6257.8371	6259.5681
15	4901.4271	4902.7957	10	5183.3674	5184.8110	50	6261.8482	6263.5802
12	4906.5668	4907.9368	10	5269.9907	5271.4573	15	6265.6507	6267.3838
100	4909.7343	4911.1051	10	5276.5248	5277.9932	100	6273.3494	6275.0845
12	4912.3649	4913.7364	8	5365.5366	5367.0287	35	6288.6957	6290.4350
20	4912.9205	4914.2921	10	5368.3829	5369.8758	90	6301.0094	6302.7520
7	4915.8326	4917.2050	5	5437.5791	5439.0904	55	6305.9725	6307.7164
50	4918.3755	4919.7486	6	5469.6829	5471.2028	40	6312.4918	6314.2374
6	4920.0357	4921.4092	4	5527.1972	5528.7325	12	6326.4661	6328.2155

Cu II—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
40	6373.2679	6375.0299	10	6770.3617	6772.2304	30	7890.5669	7892.7376
75	6377.8405	6379.6037	30	6806.2159	6808.0943	70	7902.5527	7904.7267
6	6385.2637	6387.0289	40	6809.6469	6811.5262	40	7944.4385	7946.6238
7	6393.9575	6395.7250	32	6823.2025	6825.0854	40	7972.0327	7974.2254
40	6403.3844	6405.1545	7	6830.5316	6832.4165	120	7988.1634	7990.3605
15	6418.1613	6419.9353	25	6844.1573	6846.0459	50	8277.5600	8279.8353
85	6423.8841	6425.6597	7	6863.0618	6864.9555	80	8283.1605	8285.4373
17	6432.4169	6434.1948	32	6868.7911	6870.6863	25	8503.3960	8505.7323
20	6442.9646	6444.7453	27	6872.2313	6874.1274	75	8511.0612	8513.3996
8	6443.5875	6445.3684	27	6879.4040	6881.3021	20	8609.1337	8611.4986
75	6448.5586	6450.3408	22	6937.5531	6939.4668	50	9813.2130	9815.9039
6	6452.1172	6453.9003	15	6952.8714	6954.7892	25	9827.9783	9830.6732
17	6466.2460	6468.0329	15	6977.5721	6979.4966	20	9830.7978	9833.4935
20	6470.1468	6471.9348	20	7022.8604	7024.7971	60	9861.2795	9863.9835
95	6470.1682	6471.9562	30	7194.8965	7196.8795	60	9864.1366	9866.8413
15	6479.3172	6481.1077	40	7326.0081	7328.0265	20	9883.9692	9886.6793
75	6481.4366	6483.2276	30	7331.6942	7333.7141	55	9916.4194	9919.1383
40	6484.4208	6486.2126	25	7382.2766	7384.3102	50	9917.9537	9920.6730
12	6488.8169	6490.6099	100	7404.3537	7406.3932	55	9925.5944	9928.3158
9	6508.4015	6510.1998	27	7434.1562	7436.2037	45	9938.9977	9941.7227
22	6517.3171	6519.1178	50	7562.0152	7564.0972	50	9960.3535	9963.0843
17	6523.8207	6525.6231	70	7652.3334	7654.4398	45	10006.5878	10009.3311
40	6530.0828	6531.8869	100	7664.6485	7666.7582	55	10022.9693	10025.7171
10	6541.6381	6543.4453	15	7681.7884	7683.9028	55	10038.0930	10040.8449
12	6551.2865	6553.0963	45	7744.0966	7746.2278	65	10054.9385	10057.6949
20	6577.0804	6578.8971	80	7778.7381	7780.8786	45	10080.3539	10083.1172
75	6624.2920	6626.1214	75	7805.1842	7807.3319			
15	6631.4769	6633.3083	150	7807.6587	7809.8070			
80	6641.3964	6643.2304	100	7825.6539	7827.8071			
45	6660.9616	6662.8009	35	7860.5772	7862.7398			

Ge I

The wavelengths and intensities for lines below 4685 Å are given by Andrew and Meissner. Eight of them were excited in an atomic beam and the remainder in a liquid-nitrogen-cooled hollow cathode. The lines with wavelengths greater than 4685 Å are from Kaufman and Andrew and were observed in a hollow-cathode lamp. The intensities are from these authors. The uncertainties are all less than ±0.0012 Å and are about ±0.0004 Å for the shorter wavelengths.

Andrew, K. L., and Meissner, K. W., J. Opt. Soc. Am. **49**, 146 (1959).
Kaufman, V., and Andrew, K. L., J. Opt. Soc. Am. **52**, 1223 (1962).

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
7	2019.0684	2019.7198	15	2592.5340	2593.3093	6	5801.0289	5802.6374
8	2041.7121	2042.3676	8	2644.1836	2644.9712	10	5802.0932	5803.7020
8	2043.7695	2044.4254	15	2651.1720	2651.9613	6	6557.4882	6559.2996
5	2054.4609	2055.1188	12	2651.5683	2652.3577	8	7353.3342	7355.3600
5	2057.2382	2057.8966	15	2691.3411	2692.1400	7	7384.2078	7386.2418
8	2065.2149	2065.8748	15	2709.6237	2710.4270	10	7833.5752	7835.7305
8	2068.6562	2069.3168	6	2740.4264	2741.2372	10	8031.0387	8033.2474
6	2086.0208	2086.6847	15	2754.5878	2755.4020	6	8044.1647	8046.3769
25	2094.2582	2094.9237	3	2793.9249	2794.7487	10	8256.0128	8258.2823
5	2105.8241	2106.4918	2	2829.0076	2829.8400	5	9068.7854	9071.2747
5	2124.7438	2125.4153	100	3039.0671	3039.9515	5	9095.9569	9098.4536
5	2186.4508	2187.1348	4	3067.0214	3067.9128	6	9398.8678	9401.4465
20	2198.7144	2199.4010	10	3124.8164	3125.7223	4	9492.5589	9495.1630
4	2220.3747	2221.0659	100	3269.4889	3270.4314	7	9625.6642	9628.3043
5	2256.0007	2256.6995	150	4226.5625	4227.7528	5	10039.4356	10042.1878
10	2314.2014	2314.9128	20	4685.8286	4687.1400	4	10200.9522	10203.7482
15	2327.9181	2328.6326	3	5194.5834	5196.0300	10	10382.4269	10385.2721
4	2338.6060	2339.3228	2	5197.2822	5198.7295	10	10404.9125	10407.7638
4	2359.2326	2359.9540	6	5265.8915	5267.3571	8	10734.0679	10737.0085
12	2379.1443	2379.8702	3	5384.5989	5386.0961	8	10947.4161	10950.4146
5	2389.4725	2390.2007	6	5513.2631	5514.7947	10	11125.1300	11128.1767
4	2394.0804	2394.8097	8	5564.7408	5566.2861			
6	2397.8848	2398.6150	8	5607.0100	5608.5666			
20	2417.3672	2418.1018	6	5616.1353	5617.6943			
5	2436.4120	2437.1509	7	5621.4255	5622.9860			
4	2467.3681	2468.1141	6	56[illegible]	5665.7975			
15	2497.9625	2498.7156	5	56[illegible]	5666.4138			
15	2533.2305	2533.9919	10	569[illegible]	5693.5337			
10	2556.2979	2557.0647	6	5701 765	5703.3584			
12	2589.1878	2589.9623	5	5717 771	5719.4634			

^{86}Kr I

As a result of the adoption of a new definition of the meter, the ^{86}Kr I line at $\sigma = 1650763.73$ cm^{-1} ($\lambda_{vac} =$ 6057.80210 . . . Å) became the primary standard of length and wavelength. The Comité Consultatif pour la Définition du Mètre (C.C.D.M.) adopted, at its third session in October 1962, the vacuum wavelengths 4503.6162, 5651.1286, 6422.8006, and 6458.0720 Å as secondary standards with stated uncertainties of about 0.0001 Å. Kaufman and Humphreys critically evaluated all interferometric measurements of ^{86}Kr I lines, determined a best set of energy level values and calculated wavelengths and uncertainties for all observed krypton lines. The lines given below have been selected from that list, regard being paid to intensity, possible interference from close lines and estimated uncertainty. The uncertainties range from 0.0001 to 0.0002 Å for wavelengths shorter than 11500 Å. They are ≤ 0.0006 Å for $\lambda < 15000$ Å, ≤ 0.0011 Å for $\lambda < 20000$ Å and ≤ 0.0017 Å for the longest wavelengths. Kaufman and Humphreys indicate that the wavelengths of the lines at 6422 and 6458 Å should each be reduced by 0.0001 Å. The reader is advised to refer directly to Kaufman and Humphreys if he wants to have some wavelengths to the hundred-thousandths place.

C. R. Conf. Poids Mes. **6**, 85 (1960).
C.C.D.M., 3^e session (1962), Paris, Gauthier-Villars.
Kaufman, V., and Humphreys, C. J., J. Opt. Soc. Am. **59**, 1614 (1969).

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
2	3424.9403	3425.9224	5	4418.7604	4420.0012	5	5879.8990	5881.5287
1	3495.9883	3496.9886	10	4425.1890	4426.4316	6	5993.8488	5995.5090
2	3502.5520	3503.5540	60	4453.9165	4455.1667	2	6035.8327	6037.5041
2	3522.6719	3523.6791	80	4463.6889	4464.9416	6	6056.1253	6057.8021
2	3615.4737	3616.5048	60	4502.3533	4503.6162	2	6075.2544	6076.9364
1	3628.1547	3629.1891	4	4550.2966	4551.5722	4	6082.8601	6084.5441
8	3665.3239	3666.3678	2	4636.1292	4637.4275	2	6151.4055	6153.1079
1	3668.7343	3669.7792	2	4724.8728	4726.1946	2	6222.7325	6224.4540
5	3773.4222	3774.4941	4	4812.6348	4813.9798	3	6236.3507	6238.0759
2	3796.8819	3797.9599	2	5228.1764	5229.6319	1	6241.4035	6243.1301
3	3800.5417	3801.6207	2	5379.6357	5381.1316	2	6346.6808	6348.4356
2	3812.2133	3813.2954	5	5490.9350	5492.4606	3	6373.5889	6375.3510
2	3845.9767	3847.0675	5	5500.7090	5502.2372	2	6415.6780	6417.4514
2	3991.0787	3992.2073	2	5516.6651	5518.1976	10	6421.0257	6422.8005
1	3991.2565	3992.3852	4	5520.5095	5522.0430	20	6456.2876	6458.0719
2	4184.4698	4185.6491	50	5562.2244	5563.7690	2	6488.0682	6489.8610
2	4263.2848	4264.4848	200	5570.2885	5571.8353	2	6576.4193	6578.2358
100	4273.9687	4275.1715	8	5580.3858	5581.9353	4	6652.2335	6654.0704
10	4282.9666	4284.1717	10	5649.5606	5651.1286	6	6699.2284	6701.0780
4	4286.4861	4287.6921	5	5672.4499	5674.0240	2	6740.0969	6741.9574
5	4300.4857	4301.6955	4	5707.5111	5709.0946	5	6813.1074	6814.9876
1	4302.4435	4303.6538	2	5723.5684	5725.1562	2	6846.3996	6848.2888
40	4318.5511	4319.7656	2	5726.5869	5728.1755	2	6869.6293	6871.5248
100	4319.5788	4320.7936	2	5805.5402	5807.1499	10	6904.6777	6906.5826
10	4351.3588	4352.5819	1	5820.1171	5821.7307	10	7224.1044	7226.0953
50	4362.6409	4363.8670	4	5824.5177	5826.1325	8	7287.2581	7289.2660
80	4376.1206	4377.3503	2	5827.0892	5828.7047	6	7425.5411	7427.5863
20	4399.9652	4401.2011	10	5832.8555	5834.4725	10	7486.8615	7488.9233
5	4410.3671	4411.6058	5	5866.7486	5868.3747	3	7494.1450	7496.2087
2	4416.8815	4418.1219	300	5870.9144	5872.5416	100	7587.4114	7589.5003

^{86}Kr I—Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
400	7601.5440	7603.6367	5	9704.2421	9706.9035	4	17070.0074	17074.6699
100	7685.2438	7687.3590	200	9751.7581	9754.4324	60	17098.7706	17103.4409
120	7694.5385	7696.6563	50	9856.3137	9859.0163	70	17367.6060	17372.3495
4	7741.3577	7743.4881	3	10121.0043	10123.7787	12	17404.4430	17409.1965
15	7746.8273	7748.9592	8	10296.9714	10299.7934	15	17616.8539	17621.6652
4	7776.2552	7778.3950	50	11457.4813	11460.6182	65	17842.7376	17847.6103
5	7806.5037	7808.6517	15	11792.4250	11795.6528	70	18002.2291	18007.1453
80	7854.8215	7856.9826	150	11819.3767	11822.6118	8	18099.3717	18104.3143
3	7904.6130	7906.7875	4	12123.5373	12126.8550	260	18167.3150	18172.2761
20	7913.4232	7915.6001	10	12861.8924	12865.4106	9	18185.0358	18190.0017
4	7920.4451	7922.6239	2	12985.2882	12988.8400	10	18399.7862	18404.8105
18	7928.5971	7930.7781	110	13177.4118	13181.0158	15	18580.8954	18585.9691
2	7946.9786	7949.1646	100	13622.4153	13626.1402	30	18696.2941	18701.3992
10	7982.4010	7984.5965	240	13634.2197	13637.9478	17	18785.4602	18790.5896
150	8059.5035	8061.7199	80	13658.3936	13662.1283	5	18787.7158	18792.8457
400	8104.3639	8106.5924	20	13711.0362	13714.7852	3	19227.6884	19232.9381
600	8112.8991	8115.1299	60	13738.8514	13742.6080	4	20012.2713	20017.7345
300	8190.0538	8192.3054	55	14045.6571	14049.4971	14	20209.8776	20215.3946
5	8195.0684	8197.3214	14	14104.2976	14108.1535	30	20423.9639	20429.5392
300	8263.2399	8265.5113	5	14156.2637	14160.1337	14	20446.9708	20452.5524
10	8272.3532	8274.6271	3	14340.5758	14344.4960	9	20924.3500	20930.0616
150	8281.0497	8283.3259	200	14426.7932	14430.7368	60	21165.4708	21171.2481
500	8298.1072	8300.3880	160	14734.4356	14738.4628	180	21902.5128	21908.4907
2	8301.3987	8303.6804	55	14762.6724	14766.7073	12	22485.7755	22491.9122
10	8412.4299	8414.7417	45	14765.4720	14769.5077	18	23340.4161	23346.7855
3	8498.1925	8500.5274	40	14961.8939	14965.9830	12	24260.5061	24267.1261
300	8508.8698	8511.2076	12	15005.3066	15009.4074	18	24292.2207	24298.8494
5	8560.8758	8563.2277	14	15209.5262	15213.6826	60	25233.8197	25240.7048
4	8697.4871	8699.8759	170	15239.6152	15243.7797			
15	8764.1095	8766.5163	13	15326.4795	15330.6677			
5	8774.0917	8776.5013	150	15334.9577	15339.1483			
600	8776.7478	8779.1581	70	15372.0371	15376.2377			
200	8928.6916	8931.1430	20	15474.0260	15478.2543			
5	8977.9737	8980.4384	7	16573.0446	16577.5719			
3	8999.1757	9001.6462	20	16726.5129	16731.0819			
2	9111.6577	9114.1586	200	16785.1276	16789.7126			
2	9122.4479	9124.9517	100	16853.4881	16858.0917			
10	9362.0823	9364.6510	240	16890.4407	16895.0543			
2	9450.9010	9453.4938	160	16896.7524	16901.3678			
3	9540.9173	9543.5345	180	16935.8060	16940.4320			

^{114}Cd I

The Comité Consultatif pour la Définition du Mètre (C.C.D.M.) adopted, at its third session in October 1962, these four wavelengths as secondary standards with stated uncertainties of ± 0.0003 to ± 0.0004 Å.

C.C.D.M., 3^{e} session (1962), Paris, Gauthier-Villars.

Intensity	Air wavelength Å	Vacuum wavelength Å
80	4678.1487	4679.4581
140	4799.9104	4801.2521
280	5085.8203	5087.2379
26	6438.4685	6440.2480

^{198}Hg I

The Comité Consulatif pour la *Définition du Mètre* (C.C.D.M.) adopted, at its third session in October 1962, the four longest wavelengths listed below as secondary standards with stated uncertainties of ±0.0002 to ±0.0003 Å. The remainder of the wavelengths listed are the result of interferometric measurements by Kaufman from observation with a water-cooled electrodeless-discharge lamp containing argon as the carrier gas at 0.25 torr. The uncertainties are considered to be the same as those of the secondary standards, i.e., to about 5 parts in 10^8. The intensities are those of the author.

C.C.D.M., 3e session (1962). Paris, Gauthier-Villars.
Kaufman, V., J. Opt. Soc. Am. **52**, 866 (1962).

Intensity	Air wavelength Å	Vacuum wavelength Å
1000	2536.5067	2537.2688
4	2652.0429	2652.8324
7	2653.6829	2654.4728
12	2655.1305	2655.9207
6	2752.7830	2753.5968
15	2893.5983	2894.4465
4	2925.4134	2926.2695
80	2967.2834	2968.1499
20	3021.4997	3022.3797
5	3023.4763	3024.3568
90	3125.6701	3126.5762
90	3131.5511	3132.4587
100	3131.8423	3132.7499
18	3341.4814	3342.4422
200	3650.1567	3651.1967
25	3654.8394	3655.8806
3	3662.8827	3663.9260
25	3663.2809	3664.3243
125	4046.5715	4047.7146
18	4077.8380	4078.9893
150	4358.3374	4359.5624
100	5460.7530	5462.2705
15	5769.5982	5771.1983
15	5790.6626	5792.2683

Th I, II

The list contains 882 wavelengths taken from the work of Giacchetti, Stanley and Zalubas. The thorium electrodeless lamp emits a very large number of sharp and uniformly intense lines of the neutral and singly-ionized atoms. Valero has shown that the lines emitted by a cooled, thorium hollow-cathode lamp are sharper than those from the electrodeless lamp. Giacchetti et al. combined all existing interferometric measurements of thorium, derived accurate energy levels of atomic thorium and calculated 1375 wavelengths of Th I which they proposed as secondary standards. Their list of 1821 lines also includes weighted averages of 181 interferometrically measured Th I and Th II lines and 265 wavelengths measured by only one observer. References to the experimental papers can be found therein.

This list contains the strong, calculated Th I lines and a very few of the others in order to reduce the range between reference wavelengths. The intensities are those of Giacchetti et al. reduced by a factor of ten. According to the authors, the average standard deviation for the calculated lines is 0.0014 cm^{-1}. The uncertainties vary from about 0.003 Å at 9000 Å to about 0.0005 Å at 3000 Å.

Valero, F. P. J., J. Opt. Soc. Am. **58**, 484 (1968).
Giacchetti, A., Stanley, R. W., and Zalubas, R., J. Opt. Soc. Am. **69**, 474 (1970).

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
10	3002.3863	3003.2616	20	3245.9946	3246.9311	40	3417.4972	3418.4774
20	3025.4482	3026.3292	80	3249.8561	3250.7936	200	3421.2096	3422.1907
40	3034.6392	3035.5225	100	3257.3663	3258.3057	100	3422.6556	3423.6371
50	3047.8159	3048.7025	10	3270.0998	3271.0424	150	3423.9893	3424.9712
20	3059.6978	3060.5873	20	3285.5139	3286.4604	30	3428.6217	3429.6048
50	3060.4384	3061.3281	30	3288.3871	3289.3344	30	3428.7139	3429.6970
40	3061.8120	3062.7020	15	3289.6325	3290.5801	200	3437.3072	3438.2925
30	3068.9067	3069.7986	15	3301.4491	3302.3997	80	3442.5783	3443.5650
15	3076.4100	3077.3037	300	3304.2381	3305.1894	20	3449.9562	3450.9447
30	3077.7172	3078.6112	100	3309.3649	3310.3175	80	3451.7017	3452.6907
20	3093.7112	3094.6093	20	3318.3896	3319.3446	40	3457.0685	3458.0588
20	3104.9670	3105.8679	40	3320.4757	3321.4312	150	3461.0182	3462.0095
30	3108.5039	3109.4057	150	3330.4764	3331.4344	200	3461.2169	3462.2083
50	3116.2628	3117.1666	100	3333.1282	3334.0869	30	3470.9999	3471.9938
50	3124.3868	3125.2926	80	3337.8701	3338.8300	100	3471.2180	3472.2120
80	3136.2155	3137.1243	150	3348.7678	3349.7305	50	3480.0516	3481.0478
40	3136.8286	3137.7375	40	3360.9978	3361.9636	50	3488.8332	3489.8317
15	3139.8927	3140.8024	40	3365.3375	3366.3044	40	3489.5069	3490.5056
40	3145.6363	3146.5474	40	3367.5818	3368.5492	50	3496.8099	3497.8104
10	3152.2938	3153.2066	40	3372.8208	3373.7896	80	3498.6212	3499.6222
20	3161.3636	3162.2787	80	3374.9742	3375.9436	50	3503.7861	3504.7884
50	3171.2750	3172.1926	30	3376.3653	3377.3350	30	3506.1324	3507.1353
50	3181.6689	3182.5891	60	3380.8592	3381.8301	30	3506.6451	3507.6481
40	3192.5852	3193.5082	20	3390.8490	3391.8224	80	3511.1569	3512.1611
40	3195.6887	3196.6124	80	3396.7271	3397.7020	100	3518.4035	3519.4096
20	3202.5204	3203.4459	150	3398.5443	3399.5197	50	3521.0591	3522.0659
40	3211.1938	3212.1214	150	3405.5577	3406.5348	30	3523.7577	3524.7652
40	3214.3801	3215.3086	100	3408.7492	3409.7272	50	3526.6334	3527.6416
50	3232.3055	3233.2385	20	3412.1805	3413.1594	30	3529.3860	3530.3949
100	3244.4482	3245.3844	100	3413.0125	3413.9916	20	3531.2829	3532.2923

Th I, II — Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
100	3531.4502	3532.4596	50	3691.6135	3692.6642	80	3830.7732	3831.8601
20	3533.1821	3534.1920	100	3692.5662	3693.6173	30	3831.6393	3832.7265
50	3542.4972	3543.5095	40	3693.9941	3695.0455	20	3835.7107	3836.7989
15	3543.2091	3544.2216	100	3698.1054	3699.1579	30	3836.7206	3837.8090
20	3547.3370	3548.3505	40	3703.2292	3704.2830	150	3837.8747	3838.9635
100	3549.5952	3550.6093	50	3703.7744	3704.8284	80	3839.6947	3840.7839
100	3555.0130	3556.0285	50	3704.8609	3705.9152	60	3840.8000	3841.8895
30	3560.0248	3561.0416	200	3706.7666	3707.8213	40	3842.5495	3843.6395
20	3565.6035	3566.6217	30	3709.8617	3710.9172	20	3842.7431	3843.8331
100	3567.2633	3568.2819	60	3711.6221	3712.6781	100	3846.8872	3847.9783
100	3569.8198	3570.8392	300	3719.4345	3720.4925	80	3852.1348	3853.2272
50	3570.3572	3571.3767	40	3719.8358	3720.8939	20	3856.5171	3857.6107
30	3570.5232	3571.5427	40	3727.6112	3728.6713	30	3861.3514	3862.4463
40	3576.5572	3577.5783	100	3727.9024	3728.9626	80	3869.6628	3870.7598
20	3577.5988	3578.6202	30	3733.6720	3734.7337	40	3873.1475	3874.2454
60	3583.1014	3584.1242	100	3742.9229	3743.9870	50	3873.4734	3874.5714
80	3584.1754	3585.1984	30	3751.0213	3752.0874	150	3874.8618	3875.9601
100	3589.7496	3590.7740	30	3752.7902	3753.8568	30	3875.1578	3876.2562
80	3591.4519	3592.4768	40	3758.4665	3759.5346	50	3875.6454	3876.7439
200	3598.1195	3599.1461	40	3758.7058	3759.7740	50	3877.4621	3878.5611
60	3604.6556	3605.6839	20	3759.3166	3760.3849	40	3878.6615	3879.7609
20	3606.0907	3607.1193	50	3762.9332	3764.0025	100	3879.6440	3880.7436
30	3608.8818	3609.9112	30	3763.6681	3764.7375	80	3886.9153	3888.0168
150	3612.4270	3613.4574	80	3765.2400	3766.3099	200	3895.4187	3896.5225
60	3612.8661	3613.8965	40	3769.5836	3770.6546	50	3898.4371	3899.5416
20	3615.8499	3616.8811	150	3770.0558	3771.1269	50	3908.7498	3909.8570
60	3622.7951	3623.8281	150	3771.3702	3772.4416	50	3911.9088	3913.0168
100	3632.8305	3633.8661	40	3772.6494	3773.7212	20	3914.1585	3915.2671
40	3638.3191	3639.3561	30	3776.5031	3777.5759	50	3916.4169	3917.5261
50	3638.6440	3639.6811	40	3784.5762	3785.6511	100	3919.0233	3920.1331
200	3642.2484	3643.2864	50	3789.1674	3790.2435	20	3919.2750	3920.3850
20	3650.4350	3651.4752	15	3792.1032	3793.1800	50	3923.7989	3924.9100
50	3656.6934	3657.7351	20	3794.9819	3796.0595	100	3925.0931	3926.2046
40	3658.8083	3659.8506	20	3796.9991	3798.0772	30	3925.5951	3926.7067
60	3659.6289	3660.6714	50	3798.1035	3799.1819	30	3929.2900	3930.4026
50	3661.5738	3662.6168	40	3800.1973	3801.2763	150	3932.9107	3934.0242
150	3663.2023	3664.2457	40	3802.4211	3803.5006	20	3933.0341	3934.1476
80	3666.9812	3668.0256	50	3802.8638	3803.9434	20	3938.1517	3939.2666
10	3669.9252	3670.9704	300	3803.0749	3804.1546	40	3938.6140	3939.7289
200	3669.9683	3671.0135	60	3803.9837	3805.0636	50	3942.0724	3943.1882
80	3682.4859	3683.5343	40	3807.2728	3808.3535	40	3946.4825	3947.5995
30	3685.5863	3686.6356	50	3813.8143	3814.8968	60	3948.0298	3949.1473
30	3688.6577	3689.7077	40	3818.6852	3819.7689	100	3950.3946	3951.5127
60	3690.6237	3691.6742	60	3820.7918	3821.8761	50	3952.7603	3953.8790
50	3691.4112	3692.4619	300	3828.3844	3829.4706	80	3955.1696	3956.2889

Th I, II — Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
40	3955.8900	3957.0095	50	4083.4682	4084.6210	15	4230.8238	4232.0152
15	3956.4810	3957.6007	50	4085.4339	4086.5873	60	4235.4631	4236.6558
100	3959.2995	3960.4199	50	4088.7262	4089.8804	10	4243.2605	4244.4552
40	3962.4190	3963.5402	40	4089.1376	4090.2919	80	4250.3144	4251.5110
200	3967.3920	3968.5145	15	4096.0756	4097.2317	60	4253.5382	4254.7357
20	3967.6087	3968.7312	20	4097.3183	4098.4747	20	4255.2363	4256.4342
100	3973.1957	3974.3197	50	4097.7470	4098.9036	50	4256.2535	4257.4516
20	3979.9583	3981.0841	100	4100.3408	4101.4980	60	4257.4959	4258.6943
20	3987.2046	3988.3322	40	4102.6173	4103.7751	40	4258.5199	4259.7186
15	3990.0209	3991.1493	40	4109.3231	4110.4827	20	4259.4935	4260.6925
80	3990.4919	3991.6204	60	4112.7540	4113.9145	80	4260.3329	4261.5321
80	3991.7305	3992.8593	50	4115.7584	4116.9197	30	4269.9421	4271.1439
30	3998.0608	3999.1913	15	4123.6005	4124.7638	30	4272.3033	4273.5056
80	4001.0576	4002.1888	60	4127.4112	4128.5756	40	4272.8738	4274.0763
30	4001.8930	4003.0245	20	4131.6594	4132.8248	30	4280.5678	4281.7723
50	4005.0923	4006.2246	15	4131.7118	4132.8772	20	4286.2284	4287.4344
30	4009.0110	4010.1443	20	4134.0673	4135.2334	20	4288.6686	4289.8753
40	4009.7236	4010.8571	30	4135.4794	4136.6458	40	4291.8100	4293.0175
50	4011.5914	4012.7254	20	4138.0401	4139.2072	20	4299.6348	4300.8443
200	4012.4948	4013.6291	10	4143.6485	4144.8171	15	4304.9567	4306.1676
40	4014.7156	4015.8505	20	4150.0883	4151.2586	20	4306.3663	4307.5777
40	4018.0985	4019.2342	20	4154.7196	4155.8911	30	4314.3191	4315.5325
30	4024.8019	4025.9393	80	4158.5350	4159.7075	50	4315.2539	4316.4676
50	4027.0088	4028.1469	15	4161.7386	4162.9119	10	4317.8407	4319.0551
30	4030.2955	4031.4344	10	4163.9479	4165.1218	30	4328.9149	4330.1321
200	4030.8420	4031.9811	50	4170.5330	4171.7086	30	4330.8438	4332.0616
30	4031.0717	4032.2108	20	4178.8479	4180.0258	20	4335.7324	4336.9514
50	4033.7752	4034.9151	15	4179.2197	4180.3976	80	4337.2769	4338.4963
60	4033.9066	4035.0465	20	4179.6176	4180.7957	40	4338.1077	4339.3274
30	4035.7301	4036.8704	20	4184.1376	4185.3168	20	4340.8950	4342.1154
200	4036.0472	4037.1876	15	4192.3617	4193.5430	50	4342.4437	4343.6645
15	4039.0222	4040.1634	60	4193.0168	4194.1983	50	4346.4368	4347.6586
100	4043.3945	4044.5368	20	4194.9357	4196.1177	40	4349.0720	4350.2946
20	4044.5138	4045.6565	20	4208.8642	4210.0499	20	4351.2720	4352.4951
80	4048.2871	4049.4307	40	4210.7649	4211.9511	30	4353.4482	4354.6719
20	4054.3015	4055.4467	90	4210.9227	4212.1090	60	4359.3719	4360.5971
15	4056.0077	4057.1533	40	4213.0673	4214.2541	10	4360.1669	4361.3924
150	4059.2526	4060.3991	20	4214.8283	4216.0155	20	4369.8754	4371.1034
150	4064.3312	4065.4790	20	4216.3718	4217.5595	60	4374.1234	4375.3526
40	4067.4503	4068.5989	20	4220.0648	4221.2534	50	4378.1766	4379.4068
50	4069.4607	4070.6099	15	4223.5926	4224.7821	15	4384.6559	4385.8879
15	4070.2378	4071.3872	20	4226.2991	4227.4893	15	4387.7337	4388.9664
20	4072.6285	4073.7785	40	4227.3865	4228.5771	15	4391.3897	4392.6234
40	4075.5029	4076.6536	15	4228.7742	4229.9651	40	4393.7592	4394.9936
15	4080.3573	4081.5093	30	4229.1473	4230.3384	50	4401.5805	4402.8169

Th I, II — Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
20	4402.2451	4403.4816	20	4561.4934	4562.7720	20	4742.1174	4743.4438
50	4402.9270	4404.1637	40	4563.6605	4564.9396	20	4745.3371	4746.6643
80	4408.8825	4410.1208	15	4564.8350	4566.1145	40	4749.1997	4750.5280
20	4413.6323	4414.8719	30	4567.2399	4568.5200	30	4749.9711	4751.2995
50	4416.8447	4418.0851	20	4568.1424	4569.4227	10	4758.1501	4759.4807
40	4423.7204	4424.9626	10	4571.9563	4573.2376	30	4766.6004	4767.9332
40	4432.2522	4433.4967	20	4579.8269	4581.1103	10	4773.2408	4774.5754
40	4438.7465	4439.9927	50	4588.4262	4589.7119	40	4778.2936	4779.6296
30	4440.2744	4441.5209	50	4592.6661	4593.9529	15	4783.8615	4785.1989
15	4443.6655	4444.9130	80	4595.4207	4596.7083	20	4786.5308	4787.8689
20	4445.9010	4447.1490	20	4596.3078	4597.5956	15	4787.1476	4788.4859
20	4452.5650	4453.8149	10	4599.7049	4600.9936	40	4789.3867	4790.7256
60	4458.0016	4459.2529	15	4608.6199	4609.9109	15	4795.9129	4797.2535
15	4458.7388	4459.9903	15	4613.6043	4614.8967	50	4808.1335	4809.4773
20	4461.2410	4462.4931	20	4615.0237	4616.3165	20	4809.6138	4810.9581
20	4461.7891	4463.0414	15	4615.3338	4616.6266	15	4812.3754	4813.7204
20	4463.6655	4464.9183	20	4620.2407	4621.5348	15	4819.1926	4820.5394
40	4469.5252	4470.7795	15	4621.1626	4622.4569	15	4820.4646	4821.8118
20	4470.9902	4472.2449	20	4627.2980	4628.5940	15	4821.5876	4822.9351
20	4472.8460	4474.1012	20	4628.2013	4629.4976	30	4822.8547	4824.2025
20	4475.2211	4476.4769	15	4633.6182	4634.9158	30	4823.6069	4824.9548
40	4482.1692	4483.4268	15	4638.6847	4639.9837	20	4823.9971	4825.3452
30	4483.3465	4484.6044	30	4641.2539	4642.5536	50	4831.1210	4832.4710
15	4485.7131	4486.9717	15	4647.2507	4648.5519	30	4831.5974	4832.9475
30	4486.8970	4488.1559	20	4659.5701	4660.8746	40	4840.8429	4842.1954
20	4490.6689	4491.9288	30	4663.2025	4664.5080	40	4848.3624	4849.7169
20	4492.1006	4493.3608	20	4666.5158	4667.8222	20	4852.8682	4854.2240
100	4493.3336	4494.5942	50	4666.7985	4668.1049	30	4861.2165	4862.5745
80	4498.9400	4500.2021	80	4668.1717	4669.4785	30	4865.4771	4866.8362
50	4499.9832	4501.2456	50	4669.9842	4671.2915	15	4868.8812	4870.2412
50	4505.2163	4506.4800	80	4673.6607	4674.9689	30	4872.9167	4874.2778
20	4506.4730	4507.7371	20	4675.3762	4676.6849	30	4878.7328	4880.0953
20	4513.2232	4514.4890	20	4680.2376	4681.5476	40	4894.9547	4896.3216
40	4513.6807	4514.9467	20	4683.3523	4684.6631	10	4910.1573	4911.5282
30	4515.1179	4516.3843	50	4686.1946	4687.5062	20	4911.3788	4912.7500
30	4519.2589	4520.5264	30	4690.6215	4691.9342	20	4927.7805	4929.1561
50	4521.1938	4522.4617	30	4691.6355	4692.9485	15	4936.7744	4938.1524
20	4530.3189	4531.5893	30	4695.0381	4696.3520	30	4937.8293	4939.2075
30	4533.0765	4534.3476	50	4703.9897	4705.3059	30	4939.6418	4941.0206
30	4540.9988	4542.2720	20	4708.2939	4709.6113	20	4943.0637	4944.4434
20	4547.2494	4548.5242	10	4712.8408	4714.1594	20	4945.4582	4946.8385
30	4552.1536	4553.4297	80	4723.4379	4724.7593	15	4950.2506	4951.6322
50	4555.8125	4557.0895	40	4729.1279	4730.4509	20	4965.7313	4967.1170
30	4558.3458	4559.6236	20	4740.9585	4742.2846	15	4970.0782	4971.4651
50	4561.3478	4562.6263	15	4741.3037	4742.6299	15	4980.1858	4981.5753

Th I, II — Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
15	4982.4872	4983.8773	40	5194.4567	5195.9032	40	5407.6536	5409.1570
30	4985.3723	4986.7632	50	5195.8139	5197.2608	40	5410.7688	5412.2730
15	4989.3084	4990.7003	100	5199.1638	5200.6116	20	5415.5222	5417.0277
50	5002.0969	5003.4922	30	5199.3264	5200.7743	40	5417.4857	5418.9917
10	5017.5090	5018.9085	20	5205.1518	5206.6012	30	5424.0077	5425.5155
20	5019.8060	5021.2061	30	5209.7244	5211.1750	15	5431.1117	5432.6214
30	5028.6555	5030.0579	60	5211.2303	5212.6813	10	5434.1508	5435.6612
20	5029.8918	5031.2946	40	5213.3491	5214.8006	20	5449.4787	5450.9933
30	5039.2301	5040.6354	40	5219.1098	5220.5629	30	5452.2186	5453.7338
20	5044.7665	5046.1732	10	5220.9263	5222.3798	20	5464.2052	5465.7236
15	5047.0432	5048.4505	100	5231.1597	5232.6160	15	5470.7589	5472.2791
30	5050.7842	5052.1925	10	5234.1067	5235.5638	10	5479.0742	5480.5966
50	5051.8879	5053.2965	50	5247.6541	5249.1148	10	5492.6435	5494.1696
20	5058.3613	5059.7716	15	5254.2604	5255.7228	20	5496.1368	5497.6638
40	5059.8608	5061.2715	40	5258.3604	5259.8240	30	5499.2550	5500.7829
20	5061.6565	5063.0677	20	5260.1040	5261.5681	20	5504.3022	5505.8314
30	5062.9319	5064.3434	30	5266.7102	5268.1760	40	5509.9935	5511.5242
30	5064.9454	5066.3575	10	5272.9266	5274.3940	20	5514.8728	5516.4048
100	5067.9735	5069.3863	30	5281.0688	5282.5384	15	5524.5838	5526.1184
20	5081.4460	5082.8625	20	5294.3973	5295.8705	50	5539.2617	5540.8002
40	5090.0514	5091.4701	30	5296.2785	5297.7522	40	5548.1760	5549.7169
30	5090.5452	5091.9641	30	5297.7429	5299.2170	30	5557.0454	5558.5887
50	5096.4849	5097.9054	20	5298.2823	5299.7565	40	5558.3422	5559.8858
15	5098.9328	5100.3539	30	5300.5233	5301.9981	15	5559.8915	5561.4355
30	5100.6212	5102.0427	10	5308.3108	5309.7876	20	5571.1929	5572.7399
30	5101.1301	5102.5518	40	5312.0017	5313.4796	20	5572.4656	5574.0129
20	5109.7325	5111.1564	40	5312.5287	5314.0067	40	5573.3535	5574.9011
20	5111.0610	5112.4853	30	5312.9044	5314.3825	30	5579.3585	5580.9078
50	5115.0445	5116.4699	10	5326.2779	5327.7596	50	5587.0264	5588.5777
20	5125.9501	5127.3784	50	5326.9758	5328.4577	30	5595.0635	5596.6169
30	5128.4895	5129.9185	20	5330.0800	5331.5627	20	5601.6030	5603.1582
30	5134.7458	5136.1764	50	5343.5811	5345.0673	10	5606.3862	5607.9427
15	5137.4733	5138.9047	15	5347.9712	5349.4587	40	5615.3200	5616.8788
20	5140.7734	5142.2057	20	5351.1263	5352.6146	30	5639.7463	5641.3117
30	5143.9164	5145.3494	30	5358.7074	5360.1977	10	5657.9253	5659.4956
50	5151.6116	5153.0468	30	5360.1498	5361.6405	20	5665.1809	5666.7530
50	5154.2430	5155.6788	20	5362.5754	5364.0667	15	5667.1279	5668.7006
80	5158.6044	5160.0414	20	5369.2814	5370.7745	10	5685.1921	5686.7696
30	5160.7304	5162.1680	20	5369.4474	5370.9406	20	5700.9177	5702.4995
40	5161.5393	5162.9771	15	5370.7093	5372.2028	20	5719.6230	5721.2097
40	5163.4582	5164.8965	20	5372.7026	5374.1967	50	5720.1826	5721.7695
10	5168.9225	5170.3622	50	5386.6106	5388.1084	30	5725.3885	5726.9767
50	5176.9608	5178.4027	30	5390.4259	5391.9247	15	5748.7410	5750.3356
10	5184.4547	5185.8986	15	5393.9717	5395.4714	20	5753.0264	5754.6220
30	5187.3373	5188.7820	30	5394.7607	5396.2607	60	5760.5508	5762.1485

Th I, II — Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
20	5763.5287	5765.1272	20	6078.4213	6080.1041	20	6450.0052	6451.7877
15	5767.7796	5769.3792	20	6079.2230	6080.9060	80	6457.2831	6459.0676
20	5768.1811	5769.7808	40	6088.0309	6089.7163	20	6462.6141	6464.4000
15	5773.9464	5775.5476	30	6102.5948	6104.2841	50	6490.7375	6492.5310
20	5789.6449	5791.2504	15	6121.4078	6123.1022	15	6493.1977	6494.9919
15	5792.4303	5794.0366	20	6124.4805	6126.1757	10	6501.9922	6503.7887
20	5796.0684	5797.6755	15	6151.9930	6153.6956	10	6506.9889	6508.7868
20	5800.8295	5802.4380	20	6155.5814	6157.2849	15	6509.0506	6510.8490
50	5804.1411	5805.7504	20	6164.4796	6166.1855	40	6512.3641	6514.1634
10	5812.9726	5814.5843	50	6169.8221	6171.5295	80	6531.3424	6533.1469
10	5822.7929	5824.4072	20	6178.4317	6180.1413	15	6554.1604	6555.9709
10	5832.3705	5833.9874	20	6180.7050	6182.4153	10	6558.8759	6560.6877
10	5845.9187	5847.5392	50	6182.6218	6184.3326	10	6577.2148	6579.0316
20	5852.6811	5854.3035	20	6188.1255	6189.8377	40	6583.9065	6585.7250
15	5853.4747	5855.0973	40	6191.9057	6193.6190	50	6588.5401	6590.3599
15	5854.1206	5855.7434	40	6198.2228	6199.9378	40	6591.4850	6593.3055
10	5863.7182	5865.3435	50	6203.4929	6205.2093	50	6593.9397	6595.7610
10	5871.1828	5872.8101	50	6207.2205	6208.9378	20	6613.3732	6615.1997
20	5885.7013	5887.3325	10	6212.7191	6214.4379	15	6638.9121	6640.7455
20	5891.4511	5893.0839	10	6220.0114	6221.7322	40	6658.6777	6660.5163
15	5895.2823	5896.9161	40	6224.5276	6226.2496	80	6662.2692	6664.1088
15	5899.8442	5901.4792	40	6234.8555	6236.5803	40	6674.6971	6676.5401
15	5905.5706	5907.2071	15	6240.9543	6242.6807	20	6678.7072	6680.5512
10	5908.9578	5910.5952	20	6257.4239	6259.1548	20	6697.7124	6699.5616
10	5916.7280	5918.3675	40	6261.4177	6263.1496	30	6713.9708	6715.8243
10	5918.9446	5920.5847	30	6274.1171	6275.8525	50	6727.4586	6729.3158
10	5925.4036	5927.0454	10	6292.8920	6294.6324	15	6728.1208	6729.9782
15	5926.2324	5927.8744	15	6293.2423	6294.9828	15	6733.7478	6735.6066
10	5937.1618	5938.8068	20	6303.2509	6304.9940	20	6738.1805	6740.0405
40	5938.8251	5940.4706	15	6310.8103	6312.5555	20	6742.8844	6744.7457
15	5944.6475	5946.2945	10	6315.7751	6317.5216	15	6753.6597	6755.5239
10	5948.7996	5950.4477	50	6327.2782	6329.0278	80	6756.4534	6758.3184
50	5973.6648	5975.3195	10	6337.6207	6339.3730	40	6778.3131	6780.1839
40	5991.0071	5992.6665	50	6342.8596	6344.6134	40	6780.4126	6782.2840
50	5994.1289	5995.7891	10	6346.1198	6347.8744	30	6787.7367	6789.6100
30	6001.2026	6002.8647	80	6355.9108	6357.6681	30	6788.8409	6790.7146
20	6005.1652	6006.8284	15	6371.9441	6373.7057	40	6791.2356	6793.1099
30	6007.0724	6008.7361	50	6376.9311	6378.6943	20	6809.5107	6811.3899
10	6010.1605	6011.8251	20	6387.3962	6389.1620	15	6823.5086	6825.3916
20	6021.0359	6022.7034	10	6394.0497	6395.8173	40	6824.6798	6826.5631
40	6037.6977	6039.3697	10	6406.4464	6408.2172	50	6829.0359	6830.9204
80	6049.0509	6050.7258	50	6411.8992	6413.6716	40	6834.9254	6836.8114
30	6053.3812	6055.0573	40	6413.6149	6415.3877	15	6866.3670	6868.2615
10	6069.0204	6070.7008	20	6437.7616	6439.5409	20	6874.7538	6876.6506
10	6077.1055	6078.7880	10	6446.7717	6448.5534	10	6909.2201	6911.1261

Th I, II —Continued

Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å	Intensity	Air wavelength Å	Vacuum wavelength Å
80	6911.2272	6913.1339	15	7361.3485	7363.3764	10	8259.5119	8261.7823
20	6916.1286	6918.0365	20	7384.1750	7386.2090	40	8275.6292	8277.9039
15	6936.6524	6938.5659	50	7385.5012	7387.5356	50	8320.8572	8323.1441
80	6943.6109	6945.5263	10	7411.3175	7413.3589	50	8330.4509	8332.7405
10	6948.3951	6950.3118	20	7418.5505	7420.5938	10	8385.7277	8388.0322
20	6954.6567	6956.5750	80	7428.9404	7430.9865	20	8445.4874	8447.8080
10	6955.3156	6957.2341	50	7430.2541	7432.3005	50	8478.3596	8480.6891
10	6981.0856	6983.0110	20	7444.7489	7446.7993	15	8539.7947	8542.1408
100	6989.6564	6991.5841	15	7447.8504	7449.9016	10	8556.3278	8558.6784
50	7000.8058	7002.7366	20	7483.6266	7485.6875	50	8573.1219	8575.4770
10	7015.3187	7017.2534	20	7598.2042	7600.2960	10	8638.3626	8640.7353
10	7026.4616	7028.3992	10	7607.8238	7609.9182	15	8639.4446	8641.8177
40	7060.6542	7062.6011	15	7627.1756	7629.2751	40	8665.4869	8667.8671
10	7066.2852	7068.2336	15	7636.1756	7638.2776	10	8668.1159	8670.4967
15	7071.0952	7073.0449	10	7638.7809	7640.8836	20	8709.2361	8711.6280
15	7109.8606	7111.8208	10	7652.3211	7654.4275	40	8748.0329	8750.4354
10	7112.9197	7114.8806	20	7653.8290	7655.9358	40	8758.2435	8760.6487
15	7125.5224	7127.4867	15	7658.3242	7660.4322	10	8760.4493	8762.8551
20	7130.7236	7132.6893	10	7710.2694	7712.3914	20	8775.5732	8777.9831
20	7132.6131	7134.5793	10	7728.9512	7731.0783	10	8792.0582	8794.4725
40	7148.5600	7150.5306	10	7771.9480	7774.0867	20	8868.8342	8871.2693
40	7150.2852	7152.2562	10	7810.6251	7812.7742	10	8875.2326	8877.6695
20	7154.9542	7156.9265	10	7840.2988	7842.4559	50	8967.6410	8970.1028
30	7159.9468	7161.9204	10	7842.2692	7844.4268	80	9048.2524	9050.7361
10	7170.3598	7172.3362	50	7847.5399	7849.6990	40	9094.8309	9097.3272
50	7173.3728	7175.3500	10	7864.0226	7866.1861	20	9119.6361	9122.1391
40	7200.0455	7202.0299	40	7886.2843	7888.4538	10	9170.8253	9173.3422
40	7206.4841	7208.4702	15	7954.5942	7956.7821	50	9203.9633	9206.4891
50	7208.0064	7209.9930	10	7974.1600	7976.3532	50	9266.2079	9268.7506
10	7216.9075	7218.8964	50	7978.9742	7981.1688	10	9266.9209	9269.4638
50	7218.0541	7220.0433	20	8032.4329	8034.6419	40	9276.2756	9278.8210
15	7242.3547	7244.3505	20	8085.2196	8087.4429	50	9289.5628	9292.1118
20	7255.3537	7257.3530	20	8093.6255	8095.8511	30	9340.7057	9343.2686
10	7270.5583	7272.5617	15	8129.4070	8131.6422	50	9383.2736	9385.8480
50	7284.9043	7286.9116	20	8138.4765	8140.7142	40	9431.6026	9434.1901
20	7298.1429	7300.1537	50	8143.1392	8145.3781	50	9461.0297	9463.6251
20	7315.0670	7317.0824	40	8159.7294	8161.9728	50	9474.8818	9477.4810
30	7324.8077	7326.8257	40	8169.7878	8172.0339			
30	7328.2853	7330.3043	10	8207.4797	8209.7360			
15	7339.6065	7341.6285	10	8231.4084	8233.6711			

2. Wavelengths Less Than 2000 Å

2.1. Synopsis of the Selected Data

Spectrum	Range (Å)	Number of lines	Uncertainty (Å)	Page [a]
H I	1216– 931	6	[b]0.0001	860 (866)
D I	1215– 930	6	[b].0001	860 (866)
He I	591– 320	9	.0005	860 (866)
He II	304– 233	6	[b].0001	860 (866)
Li II	199– 169	4	.0010	860 (866)
Li III	135– 103	6	[b].0001	860 (866)
Be I	1661–1426	3	.0015	860 (866)
Be III	100– 83	4	.0015	861 (866)
Be IV	76– 58	6	[b].0001	860 (866)
B I	1826–1663	6	.0010	861 (866)
B II	1362– 586	6	.003 – 0.001	861 (866)
B IV	60– 49	4	.0008	861 (866)
B V	49– 37	6	[b].0001	860 (866)
C I	1994–1157	98	.0015– .0007	861 (866)
C II	1761– 549	37	.0010– .0005	861 (867)
C III	574– 291	23	.0017– .0004	861 (867)
C V	41– 33	5	.0005	861 (867)
C VI	34– 26	6	[b].0001	860 (867)
N I	1745– 953	42	.0010– .0005	861 (867)
N II	1086– 511	40	.003 – .001	862 (867)
N VII	25– 19	6	[b].0001	860 (868)
O I	1359– 769	65	.0007– .0003	862 (868)
O IV	286– 181	22	.0015– .0007	862 (868)
O V	220– 125	41	.0010– .0005	862 (868)
O VII	22– 17	5	.0010	862 (869)
O VIII	19– 15	6	[b].0001	860 (869)
Ne I	744– 583	19	.0002	862 (869)
Ne II	1994– 325	94	.0010– .0002	862 (869)
Na III	272– 196	29	.0020– .0010	862 (869)
Mg I	1828–1668	5	.0010– .0005	862 (870)
Mg II	1753– 907	25	.0015– .0005	862 (870)
Mg III	234– 169	12	.0015– .0008	863 (870)
Mg IV	184– 132	39	.0015– .0007	863 (870)
Al II	1991– 912	99	.0015– .0005	863 (870)
Al III	1936– 511	22	.0020– .0006	863 (871)
Si I	1992–1568	119	.0010– .0005	863 (871)
Si II	1817–1021	16	.0010– .0005	863 (872)
Si III	1436– 466	12	.003 – .001	863 (872)
Si IV	818– 362	11	.003 – .001	863 (872)
S I	1915–1263	51	.0010– .0006	863 (872)
Cl I	1397–1002	53	.0010– .0005	863 (872)
Cl II	1079– 538	152	.0007– .0002	864 (873)
Ar I	1067– 816	15	.0005– .0003	864 (874)
Ar II	1981– 476	95	.0004– .0001	864 (874)
Ca II	1851–1342	22	.0020– .0010	864 (874)
Sc IV	481– 195	54	.002 – .001	864 (875)
V V	485– 239	15	.002 – .001	864 (875)
Mn II	1935–1162	56	.002 – .001	864 (875)
Cu II	1990– 676	317	.0004– .0001	864 (875)
Zn I	1632–1404	6	.0010– .0008	864 (877)
Zn II	1969–1431	26	.003 – .001	865 (878)
Ge I	1999–1624	100	.0006– .0003	865 (878)
Ge II	1979– 862	21	.0006– .0003	865 (878)
Kr I	1236– 924	12	.002	865 (879)
Rb II	742– 497	9	.0010– .0005	865 (879)
Sr III	563– 322	12	.002 – .0007	865 (879)
Sr IV	710– 264	79	.002 – .0003	865 (879)
Xe I	1470–1068	12	.002	865 (879)
^{198}Hg I	1849–1213	14	.0002	865 (879)

[a] The first page number refers to the text, the number in parenthesis to the table.

[b] See the text for a discussion of possible wavelength shifts in hydrogen-like spectra.

2.2 Comments and Literature References

H I, D I, He II, Li III, Be IV, B V, C VI, N VII, O VIII

The theoretically calculated centers of gravity of the two components for the first six lines of the Lyman series, $1s\ ^2S_{1/2}-np\ ^2P_{1/2,\,3/2}$, are listed with wavelengths and wave numbers from Garcia and Mack, adjusted, if necessary, to correspond to the natural isotope mixture. The uncertainties are about 0.0001 Å for H I and D I and much less than that for the other spectra. However, the possibility exists that self-absorption could shift the observed position of the unresolved doublets toward longer wavelengths by up to one-sixth of the doublet interval. These intervals are, for all Z, 0.0054 Å for the first line (n=2) and decrease approximately as n^{-3}. The properties of the Lyman lines as wavelength standards are discussed by Edlén and Svensson. The intensity figures are roughly proportional to the theoretical f-values.

Garcia, J. D., and Mack, J. E., J. Opt. Soc. Am. **55**, 654 (1965).
Edlén, B., and Svensson, L. Å, Ark. Fys. **28**, 427 (1965).

^{4}He I

All wavelengths, except the line at 320 Å, were calculated by Martin from energy levels based on the most accurate observations available. Herzberg's measurement of the lines at 591, 584, and 537 Å with an uncertainty of 0.0005 Å fix the positions of the upper levels relative to the ground state and determine the uncertainty. The wavelengths of ^{3}He I may be found in Herzberg's paper. The intensities are proportional to the theoretical f-values. The line at 320 Å is from a double-excitation term ($1s2p\ ^3P$–$2p^2\ ^3P$) but may be fairly strong in some sources. The wavelength is from Tech and Ward, and its uncertainty is 0.0010 Å.

Martin, W. C., J. Res. Nat. Bur. Stand. (U.S.) **A64**, 19 (1960).
Herzberg, G., Proc. R. Soc. **A248**, 309 (1958).
Tech, J., and Ward, J. F., Phys. Rev. Lett. **27**, 367 (1971).

Li II

The wavelengths are derived from the theoretical calculations of Pekeris and of Accad et al. by using R=109728.622 for the natural isotope mixture of ^{6}Li and ^{7}Li.

Pekeris, C. L., Phys. Rev. **112**, 1649 (1958).
Accad, Y., Pekeris, C. L., and Schiff, B., Phys. Rev. **A4**, 516 (1971).

Be I

The wavelengths of these resonance lines have been calculated from the term system as determined by Johansson and slightly amended by Holmström

and Johansson. A hollow-cathode discharge was used in both cases. The estimated uncertainty is 0.0015 Å.

Johansson, L., Ark. Fys. **23**, 119 (1962).
Holmström, J. E., and Johansson, L., Ark. Fys. **40**, 133 (1969).

Be III

The wavelengths were derived by Löfstrand by combining his measurements with those of Svensson and theoretical calculations of Accad et al. A vacuum spark was used for the observations. The estimated uncertainty is ± 0.0015 Å.

Svensson, L. Å, Phys. Scr. **1**, 246 (1970).
Accad, Y., Pekeris, C. L., and Schiff, B., Phys. Rev. **A4**, 516 (1971).
Löfstrand, B., Phys. Scr. **8**, 57 (1973).

B I

The wavelengths have been calculated by the combination principle from measurements given in the references listed below. The observations were made in emission from hollow-cathode and high frequency sources and in absorption by using the flash-photolysis technique. The estimated uncertainties are 0.0010 Å.

Gunnvald, P. and Minnhagen, L., Ark. Fys. **22**, 327 (1962).
Edlén, B., Ölme, A., Herzberg, G., and Johns, J. W. C., J. Opt. Soc. Am. **60**, 889 (1970).
Litzén, U., Phys. Scr. **1**, 251 (1970).

B II

The data are based on the paper by A. Ölme. He used a sliding spark in vacuum to observe 76 lines between 630 and 9660 Å. The uncertainties vary from 0.003 Å at the longest wavelengths to 0.001 Å at the shortest wavelengths.

Ölme, A., Phys. Scr. **1**, 256 (1970).

B IV

The wavelengths have been derived by B. Löfstrand from measurements by Svensson and calculations by Accad et al. A vacuum spark was used for the observations. The estimated uncertainty is ± 0.0008 Å.

Svensson, L. Å., Phys. Scr. **1**, 246 (1970).
Accad, Y., Pekeris, C. L., and Schiff, B., Phys. Rev. **A4**, 516 (1971).

C I

The term system was revised and extended by Johansson by using his measurements of 450 lines between 2478 and 25843 Å. Measurements by Herzberg of the multiplet at 1329 Å and by Kaufman and Ward of the multiplets at 1560 and 1656 Å and some singlets have been used to connect the levels of the ground configuration to the rest of the term system. The tabulated wave numbers were obtained by adding 0.01 cm^{-1} to each of the odd levels as given by Johansson and adjusting the levels of the ground configuration as indicated by Kaufman and Ward. The uncertainties are estimated to be about 0.0015 Å at the longest wavelengths and about 0.0007 Å at the short-wave end. The intensities are those given by Junkes et al.

Johansson, L., Ark. Fys. **31**, 301 (1966).
Herzberg, G., Proc. R. Soc. **A248**, 309 (1958).
Kaufman, V., and Ward, J. F., J. Opt. Soc. Am. **56**, 1591 (1966).
Junkes, J., Salpeter, E. W., and Milazzo, G., "Atomic Spectra in the Vacuum Ultraviolet", Specola Vaticana (1965).

C II

Measurements by Herzberg of the multiplets at 1335 and 1760 Å emitted from a hollow cathode, with an estimated accuracy of 0.0007 Å, were combined by him with Glad's data, derived from a condensed hollow-cathode discharge, to calculate wavelengths by the combination principle. Edlén extended and very slightly corrected the list. When the fine-structure interval between two lines is less than 0.0010 Å we list a weighted mean based on the *LS* intensity ratio and rounded off to three decimals in the wavelength. The intensities are adjusted from those given by Edlén.

Glad, S., Ark. Fys. **7**, 7 (1953).
Herzberg, G., Proc. R. Soc. **A248**, 309 (1958).
Edlén, B. Rep. Prog. Phys. **26**, 181 (1963).

C III

The wavelengths were calculated by Bockasten by combining the results of his investigation (1920–9000 Å) with those of Edlén (1934). The estimated uncertainty in the level values corresponds to 0.0017 Å for the longest and 0.0004 Å for the shortest wavelengths. The intensities are adjusted values of those given by Edlén (1963).

Bockasten, K., Ark. Fys. **9**, 457 (1955).
Edlén, B., Nova Acta R. Soc. Sci. Ups. (IV) **9**, 153 (1934).
Edlén, B., Rep. Prog. Phys. **26**, 181 (1963).

C V

The wavelengths were obtained by combining Svensson's measurements with calculations by Accad et al. (see Edlén and Löfstrand). A vacuum spark was used for the observations. The estimated uncertainty is 0.0005 Å.

Svensson, L. Å., Phys. Scr. **1**, 246 (1970).
Accad, Y., Pekeris, C. L., and Schiff, B., Phys. Rev. **A4**, 516 (1971).
Edlén, B., and Löfstrand, B., J. Phys. **B3**, 1380 (1970).

N I

The tabulated values have been taken from an unpublished list of wavelengths calculated by Eriksson from the data contained in the references given below. It is an extension and slight improvement of a list made by Kaufman and Ward by combining their measurements on two vuv multiplets with Herzberg's measurement of a third vuv multiplet, Eriksson's measurement of a forbidden transition within the ground

configuration, and the higher energy levels as given by Eriksson and Johansson. The observations were made with hollow cathodes or electrodeless discharge lamps. The uncertainties are 0.0010 Å for the longest wavelengths and decrease to 0.0005 Å for the shortest. Wavelengths given with three decimals correspond to the theoretical (*LS*) center of gravity of two lines less than 0.010 Å apart. The intensities are based on those given by Kaufman and Ward.

Eriksson, K. B. S., Ark. Fys. **13**, 429 (1958).
Herzberg, G., Proc. R. Soc. **A248**, 309 (1958).
Eriksson, K. B. S., and Johansson, I., Ark. Fys. **19**, 235 (1961).
Eriksson, K. B. S., Ark. Fys. **33**, 357 (1966).
Kaufman, V., and Ward, J. F., Appl. Opt. **6**, 43 (1967).
Eriksson, K. B. S., and Pettersson, J. E., Phys. Scr. **3**, 211 (1971).

N II

The term system was derived by Eriksson on the basis of new observations with a spark-generated high frequency electrodeless discharge in the air region and a combination of new and old measurements in the vuv. His calculated wavelengths listed below range in uncertainty from 0.003 Å at the longest to 0.001 Å at the shortest wavelengths. The intensities are those given by Edlén.

Eriksson, K. B. S., Ark. Fys. **13**, 303 (1958).
Edlén, B., Rep. Prog. Phys. **26**, 181 (1963).

O I

The wavelengths are from Eriksson and Isberg and have stated uncertainties of 0.0005 Å or less. The wavelengths were calculated from energy levels based on observations with an electrodeless discharge maintained by pulsed high-frequency oscillations. The intensities are based on those given by Edlén.

Eriksson, K.B.S., and Isberg, H. B. S., Ark. Fys. **37**, 221 (1968).
Edlén, B., Rep. Prog. Phys. **26**, 181 (1963).

O IV

The spectrum was studied by Bromander in the wavelength region 500–8000 Å. A theta-pinch discharge was used as the light source. The levels were derived from these new measurements together with a number of combinations between levels with $n=2$ and $n=3$ from Edlén's wavelength list. The wavelengths are calculated from the derived level system and have estimated uncertainties ranging from 0.0015 to 0.0007 Å. The intensities are based on Edlén's observations.

Bromander, J., Ark. Fys. **40**, 257 (1969).
Edlén, B., Nova Acta R. Soc. Sci. Ups. (IV) **9**, 153 (1934).

O V

The spectrum was studied by Bockasten and Johansson who measured 126 lines in the wavelength region 340–7700 Å. A theta-pinch discharge was used as the light source. The levels were derived from these new measurements together with 31 additional lines in the region 172–287 Å measured by Edlén. The wavelengths are calculated from the derived level system and have estimated uncertainties ranging from 0.0010 to 0.0004 Å. The intensities are obtained from Edlén's observations.

Bockasten, K., and Johansson, K. B., Ark. Fys. **38**, 563 (1968).
Edlén, B., Nova Acta R. Soc. Sci. Ups. (IV) **9**, 153 (1934).

O VII

The wavelengths have been derived by B. Löfstrand from measurements by Svensson and calculations by Accad et al. A vacuum spark was used for the observations. The estimated uncertainty is 0.0010 Å.

Svensson, L. Å., Phys. Scr. **1**, 246 (1970).
Accad, Y., Pekeris, C. L. and Schiff, B., Phys. Rev. **A4**, 516 (1971).

Ne I

The list is extracted from the paper by Kaufman and Minnhagen. They used a high frequency pulsed discharge to measure the resonance line at 743 Å, thereby connecting all levels to the ground term. The uncertainties are about 0.0002 Å.

Kaufman, V., and Minnhagen, L., J. Opt. Soc. Am. **62**, 92 (1972).

Ne II

The data are taken from the work of Persson. He used a water-cooled hollow-cathode discharge to observe 1250 lines in the range from 300 to 11000 Å. For the first part of the list the uncertainties are estimated to range from 0.0010 Å at 1994 Å to 0.0003 Å at 1069 Å. The uncertainties in the shorter wavelengths are 0.0003 Å or less.

Persson, W., Phys. Scr. **3**, 133 (1971).

Na III

The list is extracted from the paper by Lundström and Minnhagen. They used a sliding spark source and observed 91 lines between 180 and 380 Å. The uncertainties range from 0.002 to 0.001 Å.

Lundström, T., and Minnhagen, L., Phys. Scr. **5**, 243 (1972).

Mg I

The wavelengths of these resonance lines have been calculated by G. Risberg from observations with a water-cooled hollow cathode with estimated uncertainties of 0.0010 to 0.0005 Å.

Risberg, G., Ark. Fys. **28**, 381 (1965).

Mg II

The wavelengths and wave numbers have been calculated by P. Risberg from observations with a water-cooled hollow cathode. The uncertainty is estimated to range from 0.0015 to 0.0005 Å, decreasing with wave-

length. The intensities are estimated from series relationships and theoretical formulae for *LS* coupling.

Risberg, P., Ark. Fys. **9**, 483 (1955).

Mg III

The data are from the references below. The authors used a high-voltage, water-cooled, sliding spark for the observation of the spectrum in the wavelength ranges 720–6600 Å and 157–234 Å, respectively. The intensities are from Lundström. The uncertainty is estimated to be 0.0015 Å or less.

Andersson, E., and Johannesson, G.-A., Phys. Scr. **3**, 203 (1971).
Lundström, T., Phys. Scr. **7**, 62 (1973).

Mg IV

With the exception of the lines at 160 Å, the wave numbers and wavelengths are averages of the calculated values from the two references. The mean difference between the two sets of data is 0.0004 Å. The wavelengths at 160 Å are from Johannesson et al., as are all of the intensities. The uncertainties are estimated to be 0.0015–0.0007 Å.

Johannesson, G.-A., Lundström, T., and Minnhagen, L., Phys. Scr. **6**, 129 (1972).
Artru, M.-C., and Kaufman, V., J. Opt. Soc. Am. **62**, 949 (1972).

Al II

The data are from a recent investigation by Kaufman and Hagan who have made them available in advance of publication. They used a water-cooled hollow cathode. The stated uncertainties are about 0.001 Å.

Al III

The wavelengths and wave numbers are from Isberg. He derived them on the basis of his measurements in the air region and measurements in the vuv by Kaufman and Ward (contained in the cited reference). Isberg used a sliding spark in vacuum and Kaufman and Ward used a water-cooled hollow cathode. The uncertainties range from 0.002 to 0.0006 Å, decreasing with the wavelength. The intensities are partly estimated from series relationships.

Isberg, B., Ark. Fys. **35**, 551 (1968).

Si I

Radziemski et al. (1967) used all available low-pressure source data (hollow cathode and electrodeless discharges) from the other listed references to redetermine the positions of the energy levels. Most of the listed wavelengths and wave numbers are calculated from these energy levels and some are taken from the measurements of Kaufman et al. The uncertainties are, in almost all cases, less than ±0.001 Å. The intensities are from Kaufman et al.

Litzén, U., Ark. Fys. **28**, 239 (1965).
Radziemski, L. J., Jr., and Andrew, K. L., J. Opt. Soc. Am. **55**, 474 (1965).
Litzén, U., Ark. Fys. **31**, 453 (1966).
Kaufman, V., Radziemski, L. J., Jr., and Andrew, K. L., J. Opt. Soc. Am. **56**, 911 (1966).
Radziemski, L. J., Jr., Andrew, K. L., Kaufman, V., and Litzén, U., J. Opt. Soc. Am. **57**, 336 (1967).

Si II

Shenstone reobserved the spectrum from 700 to 9500 Å and determined the energy levels. Kaufman and Ward measured a few vuv multiplets, determined both the positions of the upper levels with respect to the ground term, and the splitting of the ground term. The calculated values listed below have been adjusted by Kaufman and differ slightly from those published. The uncertainties are about 0.0010 Å. The intensities were estimated by Kaufman.

Shenstone, A. G., Proc. R. Soc. **A261**, 153 (1961).
Kaufman, V., and Ward, J. F., J. Opt. Soc. Am. **56**, 1591 (1966).

Si III and Si IV

The lists are based on the work of Toresson who used a sliding spark in vacuum. His intensities have been transformed to a linear scale. The uncertainties are probably in the range from 0.003 to 0.001 Å, but this estimate needs checking. New measurements of some key multiplets should be made in order to improve the accuracy and to make it possible to add to the lists a number of strong lines of potential value as references.

Toresson, Y., Ark. Fys. **18**, 389 (1960), Si III.
Toresson, Y., Ark. Fys. **17**, 179 (1960), Si IV.

S I

Jakobsson's investigation of the infrared spectrum of sulfur provided relative level values among some of the excited terms to better than ±0.01 cm^{-1}. Unpublished measurements by Kaufman in the spectral region below 2000 Å using an electrodeless discharge lamp led to the determination of the levels of the ground configuration to about ±0.03 cm^{-1} and provided an accurate connection between the ground and excited terms. Eriksson accurately measured two forbidden transitions within the ground configuration, redetermining the relative positions of the singlet levels. The list contains both calculated and measured wavelengths, all of which have uncertainties of 0.0010 Å or less. The intensities were estimated by Kaufman.

Jakobsson, L. R., Ark. Fys. **34**, 19 (1967).
Eriksson, K. B. S., J. Opt. Soc. Am. **63**, 631 (1973).

Cl I

Radziemski and Kaufman observed this spectrum from 950 to 12000 Å. They combined their measurements from electrodeless discharge lamps with the infrared data of Humphreys and Paul and some un-

published vuv measurements by L. Minnhagen so as to arrive at a list of calculated and measured vuv wavelengths. Those listed below have uncertainties of 0.0010 to 0.0003 Å. The intensities are based on those of Radziemski and Kaufman.

Radziemski, L. J., Jr., and Kaufman, V., J. Opt. Soc. Am. **59**, 424 (1969).
Humphreys, C. J., and Paul, E., Jr., J. Opt. Soc. Am. **49**, 1180 (1959).

Cl II

The data are from Radziemski and Kaufman who used high frequency pulsed discharge and ring discharge lamps, and have stated uncertainties of 0.0007 to 0.0002 Å. The wavelengths were calculated from energy levels derived from an analysis of the spectrum observed from 500 to 11000 Å.

Radziemski, L. J., Jr., and Kaufman, V., J. Opt. Soc. Am. **64**, 366 (1974).

Ar I

The data are from a recent investigation by L. Minnhagen. He used a high-frequency pulsed discharge lamp. The uncertainties range from 0.0005 to 0.0003 Å.

Minnhagen, L., J. Opt. Soc. Am. **63**, 1185 (1973).

Ar II

The wavelengths from 1983 to 1559 Å have been calculated by Norlén from his interferometric measurements in the visible region. The uncertainties are about 0.0001 Å. The data for the transitions to the ground term (λ 932–475 Å) were given by Minnhagen. Insignificant adjustments for some lines derive from the use of Norlén's improved relative values for the upper levels. The uncertainties for this group of lines decrease as λ^2 from 0.0004 Å for the longest wavelength to 0.0001 Å for the shortest.

Minnhagen, L., J. Opt. Soc. Am. **61**, 1257 (1971).
Norlén, G., Phys. Scr. **8**, 249 (1973).

Ca II

B. Edlén and P. Risberg observed the spectrum in the region 3000–12000 Å with a hollow cathode. Using their new measurements and some interferometric measurements of Wagman, they recalculated the term system with an accuracy of about ± 0.03 cm^{-1}, and derived Ritz wavelengths with uncertainties of less than 0.002 Å. The work of G. Risberg led to a slight revision of a few of the calculated wavelengths. The intensities are those of Edlén, slightly modified, and are based on *LS*-coupling intensity relations.

Edlén, B., and Risberg, P., Ark. Fys. **10**, 553 (1956).
Wagman, N. E., Univ. Pittsburgh Bull. **34**, 1 (1937).
Risberg, G., Ark. Fys. **37**, 231 (1968).
Edlén, B., Rep. Prog. Phys. **26**, 181 (1963).

Sc IV

The data are from Smitt, who used a sliding vacuum spark to record and measure some 300 lines from 180 to 2500 Å and included in his analysis about 100 additional lines from 2400 to 7700 Å, measured by J.-E. Holmström. We give the calculated wavenumbers and wavelengths for 54 lines from 481 to 195 Å. The uncertainties are estimated to range from 0.002 to 0.001 Å.

Smitt, R., Phys. Scr. **8**, 292 (1973).

V V

The data are from Ekberg, who derived the levels by combining his own measurements with those of Van Deurzen. The stated uncertainty of these calculated wavelengths is 0.001 Å. The light source was a sliding vacuum spark.

Ekberg, J. O., Phys. Scr. **9**, 96 (1974).
Van Deurzen, C. C. H., Ph.D. thesis, University of California, Berkeley, Cal. (1973).

Mn II

A complete analysis by Iglesias and Velasco using arcs and sparks in helium led to the calculation of these wavelengths by Iglesias. The energy levels were determined from visible and infrared lines with an accuracy of ± 0.02 cm^{-1}. The wavelengths have stated errors which vary from ± 0.002 Å at the longest wavelengths to ± 0.001 Å at the shortest. The intensities are adjusted values of those given by Iglesias.

Iglesias, L., An. R. Soc. Esp. Fis. Quim. **60-A**, 147 (1964).
Iglesias, L., and Velasco, R., Publ. Inst. Opt. Madrid No. 23, 228 pp. (1964).

Cu II

The wavelengths were calculated by Ross from a revised and extended term system based upon his observation and measurement of about 2000 lines between 2000 and 11000 Å and the measurement of a few vuv lines by Kaufman and Ward. Over 1000 lines were measured interferometrically by Ross. The estimated uncertainties in the calculated wavelengths are ± 0.0004 Å or less. The intensities given are primarily those of Shenstone.

Ross, C. B., Jr., Unpublished Ph. D. Thesis, Purdue Univ. (1969).
Kaufman, V., and Ward, J. F., J. Opt. Soc. Am. **56**, 1591 (1966).
Shenstone, A. G., Proc. R. Soc. Lond. **A235**, 195 (1936).

Zn I

These wavelengths for the resonance series were calculated by Johansson and Contreras from a level system based on their own grating measurements and on the interferometric measurements of Hetzler, Boreman and Burns. The uncertainty is 0.001 Å or less. The intensity figures are based on theoretical estimates.

Johansson, I., and Contreras, R., Ark. Fys. **37**, 513 (1968).
Hetzler, C. W., Boreman, R. W., and Burns, K., Phys. Rev. **48**, 656 (1935).

Zn II

The data are from Martin and Kaufman, who measured 130 lines in the range 2105–1400 Å using hollow cathode and sliding spark sources. They combined their data with those of Crooker and Dick to derive some revised level values. These calculated wavelengths have estimated uncertainties of 0.003 to 0.001 Å.

Martin, W. C., and Kaufman V., J. Res. Nat. Bur. Stand. (U.S.) **74A**, 11 (1970).
Crooker, A. M., and Dick, K. A., Can. J. Phys. **46**, 1241 (1968).

Ge I

Most of the wavelengths and wave numbers are from Kaufman and Andrew who calculated them from interferometrically determined energy levels. A few of the lines were directly measured against those which had been calculated. The measured values and the intensities are from Kaufman, Radziemski, and Andrew. The spectroscopic sources included both electrodeless and hollow-cathode discharges. The wavelength uncertainties are less than 0.001 Å.

Kaufman, V., and Andrew, K. L., J. Opt. Soc. Am. **52**, 1223 (1962).
Kaufman, V., Radziemski, L. J., Jr., and Andrew, K. L., J. Opt. Soc. Am. **56**, 911 (1966).

Ge II

The energy levels from which the wavelengths have been calculated are based upon the re-analysis of the spectrum by Shenstone, some interferometric measurements in the air region by Kaufman and Andrew, and the accurate measurements of a few vuv multiplets by Kaufman, Radziemski, and Andrew and by Kaufman and Ward. The spectroscopic sources were cooled hollow cathodes and electrodeless lamps. The uncertainties are estimated to be 0.0006 Å or less. The intensities are based on those given by Shenstone.

Shenstone, A. G., Proc. R. Soc. Lond. **A276**, 293 (1963).
Kaufman, V., and Andrew, K. L., J. Opt. Soc. Am. **52**, 1223 (1962).
Kaufman, V., Radziemski, L. J., Jr., and Andrew, K. L., J. Opt. Soc. Am. **56**, 911 (1966).
Kaufman, V., and Ward, J. F., J. Opt. Soc. Am. **56**, 1591 (1966).

Kr I and Xe I

Petersson determined the position of the ground level $^1S_0$ with respect to the excited levels by measuring three and five of the longest vuv wavelength lines in Kr I and Xe I, respectively, to ± 0.003 Å. This allowed him to calculate the vuv wavelengths with uncertainties of about 0.002 Å. He used a low-pressure electrodeless lamp excited by pulsed high-frequency oscillations. The intensities for Kr I are based on those observed by Boyce. The intensities for Xe I are estimated by analogy with Kr I.

Petersson, B., Ark. Fys. **27**, 317 (1964).
Boyce, J. C., Phys. Rev. **47**, 718 (1935).

Rb II

The wave numbers are from Reader, who extended the work of Reader and Epstein. About 540 lines of this spectrum have been observed and identified in the range 466 to 8870 Å. The light sources were sliding spark and pulsed, high-frequency electrodeless discharges. The uncertainties of the upper levels of these transitions relative to the ground ($^1S_0$) state are approximately 0.2 cm^{-1}, giving estimated uncertainties of 0.0010 to 0.0005 Å in the calculated wavelenghts. The intensities are from Reader and Epstein.

Reader, J., and Epstein, G. L., J. Opt. Soc. Am. **62**, 273 (1972).
Reader, J., private communication (1974).

Sr III

The wave numbers were calculated by Persson and Valind who observed and identified 590 lines of this spectrum in the range from 350 to 9770 Å. The light source was a sliding vacuum spark. They fixed the position of the ground level by using a weighted average of their own measurements and those of Reader, Epstein, and Ekberg of the first four resonance lines. This gives an estimated uncertainty in the absolute values ranging from 0.002 to 0.0007 Å, but the errors in the relative values are much smaller. The intensities are from unpublished observations kindly communicated by Persson.

Persson, W., and Valind, S., Phys. Scr. **5**, 187 (1972).
Reader, J., Epstein, G. L., and Ekberg, J. O., J. Opt. Soc. Am. **62**, 273 (1972).

Sr IV

The data are obtained from an investigation by Hansen and Persson in which they have measured and classified 570 Sr IV lines from 250 to 6000 Å. The light source was a sliding vacuum spark. The wavelengths for the first two lines in the list (λλ710 and 664) are the measured values by means of which the two ground levels were fixed. For the remaining lines we give wave numbers and wavelengths as calculated from the level system. The uncertainties in the absolute values range from 0.002 to 0.0003 Å, decreasing in proportion to λ^2.

Hansen, J. E., and Persson, W., to be published in Phys. Scr. (1974).

^{198}Hg I

Wavelengths and wave numbers for Hg 198 are taken from Herzberg (1956), who estimated the accuracy to be 0.0002 Å. The intensities are adapted from Junkes et al. (1965). The wavelengths of natural mercury are longer than those of Hg 198 by about 0.005 Å for λ 1849 and about 0.002 Å for the other lines, according to Edlén.

Herzberg, G., Proc. R. Soc. **A234**, 516 (1956).
Junkes, J., Salpeter, E. W., and Milazzo, G., "Atomic Spectra in the Vacuum Ultraviolet", Specola Vaticana (1965).
Edlén, B., Rep. Prog. Phys. **26**, 181 (1963).

2.2.a. Vacuum Ultraviolet Linelist by Spectrum

Intensity	Wavelength Å	Wave number cm^{-1}
	H I	
100	1215.6701	82259.16
20	1025.7223	97492.28
7	972.5368	102823.87
3	949.7430	105291.64
2	937.8035	106632.15
1	930.7483	107440.44
	D I	
100	1215.3394	82281.54
20	1025.4433	97518.80
7	972.2722	102851.85
3	949.4847	105320.29
2	937.5484	106661.16
1	930.4951	107469.67
	He I	
1	591.4117	169086.94
100	584.3340	171135.00
25	537.0296	186209.47
10	522.2128	191492.82
5	515.6165	193942.57
3	512.0982	195275.04
2	509.9979	196079.24
1	508.6431	196601.51
2	320.2926	312214.5
	He II	
100	303.7822	329183.2
20	256.3170	390142.0
7	243.0266	411477.6
3	237.3307	421352.9
2	234.3472	426717.3
1	232.5842	429951.8
	Li II	
100	199.2793	501808.2
25	178.0144	561752.2
10	171.5758	582832.7
5	168.7430	592617.3
	Li III	
100	134.9977	740753.3
20	113.9051	877924.1
7	107.9990	925934.1
3	105.4679	948155.7
2	104.1421	960226.7
1	103.3586	967505.0
	Be I	
100	1661.4790	60187.34
30	1491.7647	67034.70
15	1426.1167	70120.49
	Be III	
100	100.2552	997454
25	88.3088	1132390
10	84.7545	1179879
5	83.2001	1201921
	Be IV	
100	75.9277	1317042
20	64.0648	1560919
7	60.7431	1646277
3	59.3195	1685785
2	58.5739	1707246
1	58.1333	1720186
	B I	
100	1826.3996	54752.53
50	1825.8961	54767.63
40	1818.3494	54994.93
20	1817.8454	55010.18
16	1663.0324	60131.12
8	1662.6107	60146.37
	B II	
100	1362.461	73396.60
20	1230.168	81289.72
3	978.946	102150.63
3	864.069	115731.56
15	693.947	144103.17
5	586.1955	170591.55
	B IV	
100	60.3145	1657976
25	52.6807	1898228
10	50.4342	1982783
5	49.4555	2022018
	B V	
100	48.5874	2058148
20	40.9964	2439238
7	38.8709	2572622
3	37.9599	2634358
2	37.4828	2667893
1	37.2008	2688113
	C I	
2	1993.6212	50159.98
100	1930.9056	51789.17
3	1765.3659	56645.48
8	1763.9089	56692.27
50	1751.8270	57083.26
15	1658.1212	60309.22
12	1657.9068	60317.02
12	1657.3792	60336.22
30	1657.0082	60349.73
12	1656.9283	60352.64
15	1656.2672	60376.73
3	1608.4379	62172.12
2	1606.9600	62229.30
6	1602.9715	62384.14
40	1561.4384	64043.51
10	1561.3402	64047.54
10	1560.7090	64073.44
30	1560.6822	64074.54
	C I—Continued	
15	1560.3092	64089.86
2	1545.2485	64714.51
3	1543.9594	64768.54
8	1542.1769	64843.40
2	1541.5099	64871.46
4	1510.9812	66182.16
2	1492.7376	66991.01
15	1481.7631	67487.17
2	1472.2317	67924.09
3	1470.0940	68022.86
3	1468.4106	68100.84
12	1467.4024	68147.63
20	1463.3367	68336.97
10	1459.0314	68538.62
12	1364.1639	73304.97
4	1359.2753	73568.61
2	1357.6593	73656.18
6	1357.1345	73684.66
10	1354.2886	73839.50
4	1329.6005	75210.56
10	1329.5775	75211.86
2	1329.1233	75237.56
4	1329.1004	75238.86
3	1329.0853	75239.71
3	1328.8333	75253.98
2	1315.9184	75992.55
3	1313.4648	76134.51
2	1311.9244	76223.90
10	1311.3629	76256.54
2	1310.6372	76298.76
3	1289.9775	77520.73
5	1288.4226	77614.28
2	1288.0370	77637.52
8	1280.8471	78073.33
6	1280.5971	78088.57
2	1280.4043	78100.33
20	1280.3330	78104.68
6	1280.1351	78116.75
8	1279.8905	78131.68
2	1279.4978	78155.66
4	1279.2287	78172.10
3	1279.0559	78182.66
2	1277.9539	78250.08
8	1277.7230	78264.22
30	1277.5497	78274.84
3	1277.5131	78277.08
20	1277.2824	78291.22
10	1277.2452	78293.50
4	1276.7499	78323.87
2	1276.4823	78340.29
3	1274.9841	78432.35

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}
	C I—Continued			C II—Continued			N I	
2	1266.4151	78963.05	60	903.6235	110665.56	20	1745.2603	57298.04
10	1261.5520	79267.44	40	858.5590	116474.23	40	1745.2485	57298.43
5	1261.4258	79275.37	20	858.0918	116537.65	100	1742.7309	57381.20
5	1261.1224	79294.44	120	687.346	145487.1	20	1742.7192	57381.59
3	1260.9963	79302.37	60	687.0526	145549.27	250	1494.6751	66904.17
4	1260.9267	79306.75	4	636.2511	157170.65	50	1492.8195	66987.33
5	1260.7353	79318.79	2	635.9945	157234.07	400	1492.6254	66996.05
8	1194.6146	83709.00	20	595.022	168061.0	30	1411.9483	70824.12
10	1194.4883	83717.85	10	594.8000	168123.74	20	1411.932	70824.93
6	1194.4056	83723.65	10	560.4369	178432.2	6	1326.570	75382.39
4	1194.3010	83730.98	5	560.2394	178495.11	12	1319.675	75776.23
4	1194.2294	83736.00	2	549.5700	181960.44	6	1319.001	75814.98
10	1194.0636	83747.63	10	549.5110	181979.99	12	1310.944	76280.90
4	1193.9953	83752.42	4	549.3785	182023.86	18	1310.5403	76304.40
10	1193.3933	83794.67	2	549.3195	182043.41	30	1243.307	80430.69
4	1193.2644	83803.72		C III		50	1243.178	80439.00
30	1193.2402	83805.42	120	574.2809	174130.82	4	1228.790	81380.87
4	1192.4508	83860.90	10	565.5280	176825.89	4	1225.369	81608.05
2	1192.2173	83877.32	200	538.3120	185765.89	6	1225.0257	81630.94
20	1189.6308	84059.69	120	538.1487	185822.25	150	1200.7098	83287.07
15	1189.4470	84072.68	40	538.0801	185845.94	350	1200.2233	83317.83
8	1189.2488	84086.69	40	535.2885	186815.15	500	1199.5496	83364.62
6	1189.0651	84099.68	40	511.5225	195494.81	5	1177.6948	84911.64
15	1188.9926	84104.81	10	492.6500	202983.86	9	1176.5098	84997.17
6	1188.8330	84116.10	1	477.6246	209369.47	7	1168.5358	85577.18
4	1158.9667	86283.75	15	460.0487	217368.31	2	1168.3344	85591.93
15	1157.9095	86362.53	25	450.7338	221860.45	10	1167.4485	85656.89
3	1157.4055	86400.14	15	433.3391	230766.17	2	1164.3246	85886.70
4	1156.5602	86463.29	1	411.9577	242743.39	3	1163.8836	85919.25
	C II		10	389.0898	257010.06	300	1134.9803	88107.26
6	1760.8191	56791.75	6	389.0045	257066.42	200	1134.4149	88151.17
2	1760.4735	56802.90	2	388.9687	257090.11	100	1134.1653	88170.57
12	1760.3954	56805.42	300	386.2028	258931.29	2	1100.3597	90879.37
600	1335.7077	74866.68	5	363.8598	274911.21	2	1098.2599	91053.13
90	1335.6627	74869.20	3	363.7852	274887.52	2	1098.0951	91066.80
300	1334.5323	74932.62	1	363.7538	274831.16	5	1097.2372	91138.00
2	1323.9955	75528.96	16	322.5741	310006.32	2	965.0413	103622.51
15	1323.9513	75531.48	10	310.1697	322404.20	4	964.6256	103667.16
10	1323.9059	75534.07	4	291.3261	343258.03	6	963.9903	103735.48
2	1323.8617	75536.59		C V		6	953.9699	104825.11
2	1141.7445	87585.27	5	40.7306	2455154	4	953.6549	104859.73
4	1141.6246	87594.47	100	40.2679	2483370	2	953.4152	104886.10
4	1139.3317	87770.75	25	34.9729	2859359		N II	
2	1138.9358	87801.26	10	33.4264	2991648	150	1085.701	92106.4
10	1066.1332	93796.91	5	32.7545	3053017	30	1085.546	92119.5
2	1065.9199	93815.68		C VI		2	1085.529	92121.0
18	1065.8913	93818.20	100	33.7360	2964195	80	1084.580	92201.6
300	1037.0182	96430.32	20	28.4656	3513015	30	1084.562	92203.1
150	1036.3367	96493.74	7	26.9898	3705107	40	1083.990	92251.8
60	904.4801	110560.75	3	26.3573	3794016	150	916.704	109086.5
300	904.1416	110602.14	2	26.0260	3842310	60	916.015	109168.5
120	903.9616	110624.17	1	25.8303	3871429	30	915.962	109174.8

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}
	N II—Continued	
30	915.612	109216.6
100	775.965	128871.7
10	748.369	133624.0
15	746.984	133871.6
5	745.841	134076.9
5	672.001	148809.4
5	671.773	148859.9
3	671.630	148891.5
4	671.411	148940.2
15	671.386	148945.7
5	671.016	149027.8
25	660.286	151449.5
30	645.178	154995.9
20	644.837	155078.0
10	644.634	155126.7
3	635.197	157431.4
3	582.156	171775.2
5	574.650	174019.0
3	533.815	187330.8
8	533.729	187361.1
3	533.650	187388.9
5	533.581	187412.9
3	533.511	187437.6
5	529.867	188726.6
2	529.722	188778.4
2	529.637	188808.7
1	529.491	188860.5
2	529.413	188888.5
2	529.355	188909.2
1	513.849	194609.6
2	510.758	195787.4
	N VII	
100	24.7810	4035348
20	20.9098	4782437
7	19.8258	5043927
3	19.3613	5164954
2	19.1179	5230695
1	18.9741	5270333
	O I	
10	1358.5123	73609.93
15	1355.5977	73768.20
30	1306.0286	76568.00
90	1304.8576	76636.71
150	1302.1685	76794.98
30	1217.6477	82125.56
50	1152.1512	86794.16
10	1041.6876	95998.07
30	1040.9425	96066.78
50	1039.2304	96225.05
10	1028.1571	97261.40
30	1027.4307	97330.17
	O I—Continued	
50	1025.7618	97488.52
30	999.4974	100050.28
15	990.8010	100928.44
30	990.2043	100989.26
12	990.1269	100997.16
60	988.7734	101135.41
12	988.6549	101147.53
4	978.6170	102185.02
12	977.9594	102253.73
20	976.4481	102412.00
6	973.8852	102681.51
20	973.2342	102750.19
30	971.7381	102908.39
2	952.9413	104938.26
6	952.3178	105006.97
10	950.8846	105165.23
4	950.7327	105182.03
12	950.1121	105250.74
20	948.6855	105409.01
3	939.2346	106469.67
2	938.6249	106538.83
6	938.0200	106607.54
5	937.8405	106627.93
10	936.6295	106765.80
30	935.1930	106929.80
3	930.8862	107424.51
5	929.5168	107582.78
10	922.0727	108451.31
10	922.0081	108458.92
15	882.8895	113264.46
8	879.5507	113694.41
10	879.1001	113752.69
6	879.0194	113763.13
8	878.9720	113769.27
10	878.2007	113869.19
30	877.8787	113910.96
10	877.7983	113921.39
5	812.1594	123128.54
7	812.0936	123138.51
4	811.7064	123197.25
5	811.4968	123229.07
20	811.0512	123296.78
7	810.6650	123355.51
10	792.9671	126108.63
9	792.9381	126113.25
7	792.5063	126181.96
9	792.2330	126225.49
30	791.9732	126266.90
10	791.5136	126340.22
2	770.6986	129752.41
3	770.3464	129811.73
	O I—Continued	
8	769.4083	129970.00
3	769.3528	129979.38
	O IV	
8	285.8335	349854.0
4	285.7103	350004.9
120	279.9330	357228.3
60	279.6309	357614.3
30	260.5560	383794.7
2	260.5465	383808.6
45	260.3889	384041.0
60	238.5792	419148.0
540	238.5697	419164.7
300	238.3598	419533.9
1	214.2046	466843.4
5	214.1516	466958.9
2	214.0277	467229.3
1	213.9747	467344.9
9	207.2386	482535.7
5	207.1826	482666.1
2	203.0437	492504.9
1	202.8847	492890.9
15	196.0063	510187.8
8	195.8596	510569.7
2	181.2756	551646.1
1	181.1497	552029.6
	O V	
450	220.3527	453817.9
50	215.2448	464587.4
30	215.1028	464894.1
10	215.0398	465030.2
100	207.7956	481242.1
15	202.3906	494094.2
5	202.3316	494238.1
5	202.2805	494363.0
3	202.2216	494506.9
4	202.1580	494662.6
30	194.5919	513896.1
4	193.0058	518119.1
75	192.9111	518373.6
425	192.9035	518393.9
300	192.7979	518677.8
100	192.7501	518806.4
50	185.7450	538372.5
250	172.1689	580824.9
8	170.2194	587477.2
2	168.0084	595208.2
10	167.9892	595276.3
5	166.2351	601557.6
3	166.1504	601864.3
1	166.1128	602000.4
3	164.7087	607132.4

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}
	O V—Continued	
8	164.6569	607323.6
2	164.6256	607439.1
2	164.5887	607575.2
3	164.5739	607629.9
1	164.1766	609100.1
2	156.2269	640094.7
2	153.9516	649554.6
15	151.5468	659862.2
9	151.4774	660164.3
3	151.4470	660296.9
8	139.0289	719274.9
5	138.1090	724065.6
3	138.0511	724369.3
1	138.0255	724503.9
8	135.5232	737880.8
4	124.6159	802465.8
	O VII	
25	21.8040	4586305
100	21.6020	4629201
25	18.6285	5368116
10	17.7685	5627922
5	17.3962	5748392
	O VIII	
100	18.9689	5271784
20	16.0059	6247697
7	15.1762	6589280
3	14.8206	6747377
2	14.6343	6833252
1	14.5243	6885029
	Ne I	
35	743.7196	134459.29
100	735.8963	135888.72
18	629.7388	158795.99
20	626.8232	159534.62
12	619.1024	161524.17
15	618.6717	161636.62
15	615.6283	162435.68
12	602.7263	165912.78
6	600.0366	166656.51
3	598.8908	166975.34
7	598.7056	167026.99
10	595.9200	167807.76
5	591.8303	168967.35
3	589.9114	169516.99
3	589.1793	169727.63
3	587.2128	170296.00
2	586.3141	170557.05
2	585.2473	170867.95
2	582.5982	171644.88
	Ne II	
9	1994.0957	50148.045
	Ne II—Continued	
7	1954.0479	51175.818
7	1949.6947	51290.082
7	1939.8749	51549.717
20	1938.8269	51577.580
9	1933.5298	51718.882
30	1930.0345	51812.545
9	1928.7866	51846.067
7	1924.1654	51970.583
8	1920.1812	52078.418
50	1916.0818	52189.839
20	1907.4940	52424.804
6	1906.4987	52452.174
7	1904.5068	52507.031
10	1889.7120	52918.116
10	1888.1064	52963.116
7	1881.6889	53143.749
7	1871.0970	53444.583
8	1859.3605	53781.932
8	1858.4108	53809.416
7	1857.9530	53822.675
9	1853.1147	53963.199
9	1849.3784	54072.222
7	1848.8229	54088.469
8	1845.9968	54171.275
8	1843.9105	54232.566
7	1842.3413	54278.760
8	1833.9099	54528.307
7	1803.7301	55440.667
8	1798.2814	55608.649
7	1796.5170	55663.263
7	1765.8981	56628.410
8	1758.5549	56864.871
7	1758.1060	56879.391
8	1756.8363	56920.500
8	1751.6980	57087.467
8	1744.4164	57325.763
7	1742.8712	57376.585
8	1738.7356	57513.058
8	1730.6473	57781.848
8	1694.5989	59011.016
6	1483.5029	67408.023
8	1475.9603	67752.502
9	1428.5822	69999.470
8	1423.5645	70246.201
9	1418.3779	70503.075
7	1415.7144	70635.714
7	1413.9570	70723.507
6	1409.7467	70934.727
8	1405.3752	71155.374
8	1403.6827	71241.169
8	1399.5333	71452.389
	Ne II—Continued	
7	1391.8544	71846.594
6	1391.7029	71854.418
5	1388.4901	72020.679
8	1387.5158	72071.250
6	1239.1674	80699.346
9	1229.8367	81311.605
7	1229.6873	81321.490
5	1073.7789	93129.041
7	1068.6488	93576.115
50	462.3908	216267.28
100	460.7284	217047.61
9	456.8962	218868.11
12	456.3485	219130.78
20	455.2730	219648.44
15	454.6540	219947.46
18	447.8146	223306.68
25	446.5902	223918.94
30	446.2552	224087.02
20	445.0393	224699.27
12	407.1377	245617.15
15	405.8538	246394.13
6	362.4544	275896.79
9	361.4321	276677.13
4	357.5346	279693.24
2	356.8762	280209.20
5	356.8001	280268.96
3	356.5398	280473.58
3	356.4399	280552.21
4	356.1288	280797.26
4	355.9480	280939.95
4	355.6550	281171.38
6	354.9620	281720.28
3	353.9297	282542.02
5	353.2145	283114.07
9	352.9549	283322.35
3	352.2436	283894.41
2	330.7887	302307.75
2	327.6210	305230.74
3	327.2605	305566.94
5	326.7856	306011.07
4	326.5376	306243.42
2	324.5686	308101.27
	Na III	
20	272.4493	367040.7
20	272.0717	367550.2
50	268.6251	372266.0
50	267.8713	373313.6
70	267.6428	373632.3
25	266.8945	374679.9
30	251.3725	397816.0
3	217.1111	460593.6

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}
	Na III—Continued	
12	216.1177	462710.9
12	215.8592	463265.0
8	215.4814	464077.2
8	215.0790	464945.4
8	215.0455	465017.8
8	214.5868	466011.9
7	214.2300	466788.0
5	207.9957	480779.2
7	207.8847	481035.9
6	207.4593	482022.3
10	207.2959	482402.2
6	206.8729	483388.6
8	203.3240	491825.8
8	203.2819	491927.7
8	203.0527	492482.9
8	202.7607	493192.1
8	202.4910	493849.2
6	202.1825	494602.7
6	202.1485	494685.9
5	196.0525	510067.5
6	195.5285	511434.2
	Mg I	
10	1827.9351	54706.54
5	1747.7937	57214.99
3	1707.0606	58580.23
2	1683.4135	59403.11
1	1668.4288	59936.63
	Mg II	
60	1753.4744	57029.63
30	1750.6637	57121.19
50	1737.6283	57549.71
6	1737.6124	57550.23
30	1734.8523	57641.80
20	1482.8903	67435.87
10	1480.8797	67527.43
30	1478.0030	67658.86
15	1475.9998	67750.69
10	1369.4231	73023.45
5	1367.7082	73115.01
20	1367.2565	73139.17
10	1365.5442	73230.88
6	1309.4434	76368.32
10	1308.2807	76436.19
3	1307.8754	76459.89
5	1306.7139	76527.85
25	1240.3947	80619.50
50	1239.9252	80650.02
10	1026.1133	97455.13
20	1025.9681	97468.92
5	946.7694	105622.34
10	946.7032	105629.72
	Mg II—Continued	
2	907.4115	110203.58
4	907.3752	110207.99
	Mg III	
80	234.2644	426868.1
100	231.7336	431530.0
10	188.5296	530420.6
20	187.1966	534197.7
20	186.5143	536152.0
12	182.9720	546531.6
15	182.2421	548720.7
4	171.8997	581734.7
15	171.3941	583450.5
15	170.8041	585466.2
6	169.7427	589126.8
7	169.1416	591220.7
	Mg IV	
4	184.1927	542909.6
11	183.4399	545137.6
14	181.3441	551437.7
20	180.7947	553113.7
25	180.6144	553665.7
12	180.0693	555341.7
20	172.3099	580349.8
25	171.6551	582563.5
11	160.8023	621881.6
14	160.2283	624109.6
10	148.1186	675134.5
9	147.8854	676199.1
11	147.7487	676825.1
8	147.6314	677362.5
17	147.5352	677804.3
4	147.4973	677978.7
10	147.3201	678794.2
11	147.2538	679099.5
11	147.0518	680032.3
11	147.0063	680243.1
20	146.9526	680491.6
10	146.8381	681022.2
11	146.5264	682471.1
11	140.9635	709403.4
8	140.9142	709651.7
11	140.8658	709895.4
11	140.5574	711453.2
11	140.5222	711631.4
11	140.4732	711879.7
10	140.4251	712123.4
17	140.1719	713409.6
10	140.1186	713681.2
7	139.9903	714335.0
8	138.3915	722587.6
10	138.2617	723266.2
	Mg IV—Continued	
6	137.9661	724815.6
9	133.1967	750769.4
3	132.5123	754646.8
5	132.1238	756865.9
	Al II	
70	1990.5310	50237.85
5	1962.7634	50948.58
7	1962.7349	50949.32
6	1962.6910	50950.46
7	1962.5904	50953.07
22	1939.2606	51566.05
15	1936.9066	51628.72
15	1934.7129	51687.26
40	1934.5032	51692.86
20	1932.3768	51749.74
15	1931.0481	51785.35
20	1929.9775	51814.08
6	1926.0291	51920.30
5	1924.7537	51954.70
8	1910.8252	52333.41
2	1906.4082	52454.66
2	1899.1943	52653.91
100	1862.3111	53696.72
12	1859.9796	53764.03
70	1858.0262	53820.55
3	1856.2741	53871.35
9	1856.0957	53876.53
30	1855.9286	53881.38
9	1855.8054	53884.96
6	1836.9635	54437.66
25	1834.8077	54501.62
40	1832.8374	54560.21
60	1828.5876	54687.02
2	1807.5851	55322.43
7	1807.4168	55327.58
40	1767.7308	56569.70
70	1763.9521	56690.88
30	1765.8150	56631.07
50	1763.8692	56693.55
30	1761.9751	56754.49
35	1760.1044	56814.81
6	1750.6124	57122.87
5	1739.7382	57479.91
90	1724.9838	57971.56
50	1724.9519	57972.63
90	1721.2714	58096.59
50	1721.2435	58097.53
80	1719.4400	58158.47
10	1686.2505	59303.17
8	1681.8089	59459.79
150	1670.7867	59852.05

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}
	Al II—Continued	
10	1644.8089	60797.34
10	1644.2348	60818.56
15	1625.6271	61514.72
5	1618.3990	61789.46
12	1596.0586	62654.34
50	1569.3853	63719.22
100	1539.8303	64942.22
80	1371.2401	72926.69
80	1350.1782	74064.30
70	1266.6481	78948.53
70	1258.8585	79437.05
50	1211.9531	82511.44
60	1211.8983	82515.18
50	1210.0817	82639.05
40	1209.1914	82699.89
50	1208.3522	82757.33
50	1191.8111	83905.91
40	1190.0518	84029.96
30	1189.1854	84091.18
30	1179.3541	84792.18
40	1177.4371	84930.23
10	1158.2103	86340.11
30	1157.0881	86423.84
20	1142.9529	87492.67
3	1132.7256	88282.63
40	1056.6613	94637.71
30	1055.2802	94761.56
20	1054.6031	94822.40
50	1049.9233	95245.05
45	1048.5588	95369.00
35	1047.8893	95429.93
35	990.8623	100922.20
30	989.6475	101046.08
20	989.0525	101106.87
35	987.7772	101237.41
30	986.5712	101361.16
20	985.9802	101421.92
30	955.9766	104605.07
25	954.8466	104728.86
30	954.3050	104788.30
25	953.1822	104911.74
15	952.6301	104972.54
20	935.2752	106920.40
25	935.0198	106949.61
20	934.0150	107064.66
20	933.9382	107073.47
10	933.4077	107134.32
5	932.9385	107188.20
4	932.4075	107249.25
20	921.3670	108534.38
10	920.7160	108611.12
15	920.3166	108658.26
5	911.9457	109655.65
	Al III	
14	1935.949	51654.25
1	1935.863	51656.54
20	1935.840	51657.16
100	1862.7895	53682.93
200	1854.7164	53916.60
70	1611.8735	62039.61
8	1611.8141	62041.90
40	1605.7661	62275.57
60	1384.1319	72247.45
30	1379.6696	72481.12
4	893.896	111869.84
2	892.0242	112104.58
20	856.7457	116720.75
10	855.0340	116954.42
2	726.9152	137567.63
1	725.6826	137801.30
15	696.2170	143633.38
30	695.8289	143713.50
5	560.4331	178433.43
10	560.3173	178470.32
2	511.1907	195621.72
4	511.1384	195641.74
	Si I	
10	1991.8537	50204.49
200	1988.9937	50276.68
100	1986.3640	50343.24
4	1984.4400	50392.05
60	1983.2330	50422.72
60	1980.6185	50489.28
80	1979.2056	50525.32
80	1977.5978	50566.40
10	1954.9681	51151.73
8	1904.6647	52502.68
80	1901.3377	52594.55
9	1887.6928	52974.72
6	1881.8538	53139.90
6	1875.8129	53310.22
35	1874.8423	53337.82
5	1873.1036	53387.33
7	1853.1521	53962.11
50	1852.4717	53981.93
14	1851.7829	54002.01
80	1850.6719	54034.43
50	1848.7480	54090.66
40	1848.1504	54108.15
60	1847.4737	54127.97
40	1846.1118	54167.90
40	1845.5203	54185.26
40	1843.7700	54236.70
80	1841.4490	54305.06
25	1841.1520	54313.82
8	1838.0120	54406.61
40	1836.5102	54451.10
2	1829.8975	54647.87
6	1822.4553	54871.03
2	1817.9562	55006.83
50	1814.0794	55124.38
20	1809.1047	55275.96
4	1808.4301	55296.58
6	1799.1193	55582.75
5	1790.2548	55857.97
5	1783.2315	56077.97
30	1776.8241	56280.19
2	1772.2254	56426.23
60	1770.9223	56467.75
25	1770.6295	56477.09
14	1769.7859	56504.01
10	1766.3541	56613.79
20	1766.0627	56623.13
10	1765.6215	56637.28
18	1765.0296	56656.27
16	1763.6607	56700.25
2	1759.5832	56831.64
8	1747.4141	57227.42
5	1745.3475	57295.18
4	1743.8941	57342.93
4	1740.2988	57461.40
20	1704.4416	58670.24
14	1702.8694	58724.41
16	1700.6360	58801.53
18	1700.4194	58809.02
2	1699.7162	58833.35
50	1697.9409	58894.86
40	1696.2065	58955.09
18	1695.5075	58979.39
12	1693.4681	59050.42
25	1693.2934	59056.51
12	1690.7889	59143.99
12	1689.2902	59196.46
4	1687.0923	59273.58
20	1686.8185	59283.20
14	1682.6734	59429.24
3	1676.8207	59636.67
40	1675.2052	59694.18
16	1672.5960	59787.30
8	1671.1169	59840.22
14	1668.5204	59933.34
14	1667.6288	59965.38
12	1666.3762	60010.46
7	1664.5111	60077.70
3	1660.4748	60223.74
8	1653.3760	60482.31

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}
	Si I—Continued	
5	1651.0279	60568.33
18	1633.9851	61200.07
8	1633.3277	61224.70
9	1633.2230	61228.63
20	1629.9477	61351.66
6	1627.7459	61434.65
4	1627.0498	61460.93
14	1625.7051	61511.77
7	1625.5320	61518.32
2	1623.4971	61595.43
18	1622.8806	61618.83
12	1620.4049	61712.97
3	1619.5266	61746.44
14	1616.5794	61859.01
10	1615.9488	61883.15
5	1614.6309	61933.66
6	1614.5665	61936.13
5	1608.9157	62153.66
4	1605.8370	62272.82
12	1597.9620	62579.71
6	1595.7552	62666.25
14	1594.9493	62697.92
14	1594.5655	62713.01
12	1592.4234	62797.37
4	1592.0200	62813.28
4	1591.1233	62848.68
3	1590.5763	62870.29
4	1590.4768	62874.23
3	1589.1733	62925.80
3	1587.7620	62981.73
4	1586.7913	63020.26
3	1586.1372	63046.25
2	1584.3455	63117.55
2	1580.3001	63279.12
2	1575.1268	63486.95
6	1574.8435	63498.37
5	1573.8840	63537.08
2	1573.6350	63547.14
2	1571.4058	63637.29
2	1568.1963	63767.53
	Si II	
3	1817.4517	55022.095
30	1816.9290	55037.925
15	1808.0129	55309.340
100	1533.4318	65213.205
50	1526.7071	65500.450
15	1309.2766	76378.055
8	1304.3711	76665.300
8	1265.0022	79051.245
80	1264.7379	79067.765
40	1260.4223	79338.490
4	1197.3941	83514.695
20	1194.5004	83717.005
8	1193.2898	83801.940
4	1190.4160	84004.250
6	1023.7003	97684.835
3	1020.6990	97972.080
	Si III	
5	1436.160	69630.14
10	1435.772	69648.93
5	1367.047	73150.37
8	1361.596	73443.23
15	967.944	103311.8
5	939.097	106485.2
15	823.409	121446.4
10	653.334	153061.1
6	652.219	153322.8
2	651.672	153451.4
15	566.613	176487.2
5	466.131	214532.2
	Si IV	
30	818.128	122230.2
15	815.053	122691.4
5	749.939	133344.1
5	560.980	178259.4
3	559.533	178720.6
10	516.344	193669.3
5	515.118	194130.4
10	458.155	218266.9
20	457.815	218428.7
3	361.659	276503.7
6	361.560	276579.0
	S I	
100	1914.6981	52227.55
200	1900.2865	52623.64
150	1826.2449	54757.17
175	1820.3421	54934.73
200	1807.3110	55330.81
5	1782.2624	56108.46
175	1666.6876	59999.25
40	1487.1503	67242.70
25	1485.6219	67311.88
20	1483.2337	67420.26
70	1483.0392	67429.10
15	1481.7133	67489.44
30	1481.6635	67491.71
6	1474.5706	67816.35
20	1474.3785	67825.19
100	1473.9942	67842.87
18	1473.0187	67887.80
50	1472.9708	67890.01
20	1448.2302	69049.80
20	1436.9674	69591.00
15	1433.3104	69768.56
50	1433.2787	69770.10
7	1425.2191	70164.65
12	1425.1878	70166.19
80	1425.0300	70173.96
15	1412.8734	70777.75
20	1409.3378	70955.31
15	1401.5142	71351.40
500	1396.1136	71627.41
250	1392.5893	71808.68
150	1389.1544	71986.24
450	1388.4357	72023.50
200	1385.5109	72175.54
250	1381.5527	72382.33
30	1326.6432	75378.22
40	1323.516	75556.32
18	1316.6183	75952.16
30	1316.5423	75956.54
6	1313.2493	76147.00
14	1310.1940	76324.58
13	1305.8834	76576.52
11	1303.4295	76720.68
10	1303.1105	76739.46
10	1302.8633	76754.02
15	1302.3370	76785.04
8	1296.1738	77150.15
16	1295.6526	77181.18
5	1280.0991	78118.95
15	1270.7821	78691.70
5	1269.2086	78789.26
8	1262.8596	79185.37
	Cl I	
250	1396.5267	71606.22
400	1389.9569	71944.68
500	1389.6928	71958.35
400	1379.5278	72488.57
50	1373.1163	72827.04
250	1363.4471	73343.51
100	1351.6568	73983.28
200	1347.2397	74225.84
60	1335.7257	74865.67
20	1201.3527	83239.50
25	1188.7743	84120.26
6	1188.7515	84121.87
60	1179.2927	84796.59
15	1167.1479	85678.94
3	1145.3941	87306.19
8	1144.2909	87390.37
6	1135.3310	88080.04
6	1133.9341	88188.55
5	1132.8528	88272.72
8	1110.2948	90066.17
10	1107.5282	90291.16

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}
	Cl I—Continued			Cl II—Continued			Cl II—Continued	
4	1101.9362	90749.36	10	869.0127	115073.12	20	684.8623	146014.75
6	1101.3381	90798.64	30	868.5774	115130.79	30	682.0516	146616.47
4	1099.5230	90948.53	20	864.6198	115657.77	14	671.8436	148844.17
4	1098.0682	91069.02	100	851.6917	117413.38	6	667.4825	149816.66
6	1097.3692	91127.03	4	850.7509	117543.22	14	666.1465	150117.13
5	1096.8098	91173.51	140	841.4191	118846.84	10	666.0502	150138.83
8	1095.7971	91257.77	160	839.6001	119104.32	10	666.0246	150144.60
7	1095.6619	91269.03	120	839.2972	119147.31	4	665.5316	150255.83
7	1095.1483	91311.83	40	834.7223	119800.32	10	665.2295	150324.06
8	1094.7686	91343.50	60	834.6463	119811.23	8	665.1679	150337.98
5	1092.4366	91538.50	20	834.4229	119843.31	20	664.7199	150439.30
4	1092.1287	91564.30	16	829.8029	120510.54	20	663.6432	150683.38
5	1090.9815	91660.58	4	802.8911	124549.89	40	663.0723	150813.12
4	1090.7386	91680.99	20	797.8455	125337.55	20	662.1637	151020.06
7	1090.2706	91720.35	80	795.3537	125730.22	26	661.8394	151094.06
5	1085.3035	92140.13	80	793.4574	126030.71	6	661.6588	151135.30
4	1085.1709	92151.38	100	793.3424	126048.98	20	659.8107	151558.62
4	1084.6671	92194.19	60	792.2628	126220.74	3	657.9335	151991.04
3	1079.8821	92602.70	16	789.0997	126726.70	14	655.1427	152638.50
1	1041.1480	96047.83	60	788.9860	126744.96	10	653.8556	152938.97
3	1040.3475	96121.73	100	788.7408	126784.36	20	650.8935	153634.96
2	1038.7779	96266.97	100	787.5805	126971.15	4	643.2069	155470.97
3	1037.5871	96377.46	40	777.5623	128607.06	8	639.4578	156382.48
3	1035.2148	96598.31	12	774.7916	129066.96	18	638.2909	156668.38
1	1031.5070	96945.54	16	754.5869	132522.84	14	637.0691	156968.84
2	1031.3486	96960.43	12	753.6251	132691.97	20	636.6244	157078.49
1	1028.6162	97217.98	2	747.5649	133767.65	16	635.8802	157262.33
1	1027.3386	97338.89	4	738.9117	135334.17	8	634.6222	157574.06
2	1025.5528	97508.38	30	730.9424	136809.69	10	634.2568	157664.84
1	1022.4143	97807.71	24	729.5235	137075.78	8	631.8314	158270.07
3	1013.6635	98652.06	30	729.3406	137110.15	14	626.7339	159557.35
2	1002.3464	99765.91	50	728.9513	137183.38	7	623.0617	160497.75
	Cl II		20	725.6570	137806.15	9	621.1369	160995.10
100	1079.0796	92671.57	40	725.2717	137879.36	16	620.2958	161213.41
100	1075.2293	93003.42	24	719.2703	139029.79	12	619.9798	161295.58
120	1071.7667	93303.89	3	717.5327	139366.47	14	618.0539	161798.19
180	1071.0358	93367.56	24	717.1519	139440.47	10	617.6293	161909.42
60	1067.9442	93637.85	26	715.5874	139745.33	4	617.3161	161991.56
120	1063.8311	93999.88	26	714.0521	140045.80	2	616.4631	162215.71
5	990.5327	100955.78	2	712.9584	140260.64	3	615.3233	162516.19
40	961.4997	104004.19	28	712.6792	140315.59	10	599.2056	166887.63
10	932.9780	107183.66	12	710.5210	140741.79	2	598.4179	167107.30
24	926.9588	107879.66	18	709.1616	141011.58	2	598.3026	167139.50
2	924.3022	108189.72	28	707.4581	141351.13	6	594.4756	168215.48
7	914.8574	109306.65	5	701.0721	142638.68	4	593.2888	168551.98
36	895.9539	111612.88	5	698.4482	143174.54	6	590.8491	169247.95
40	893.5483	111913.37	24	696.1386	143649.56	5	589.9001	169520.23
10	889.8173	112382.62	30	693.5947	144176.42	4	588.8564	169820.69
40	888.0256	112609.37	7	692.7820	144345.55	7	588.7857	169841.08
10	874.2790	114379.96	16	690.9645	144725.24	4	588.0413	170056.08
20	872.8505	114567.16	14	688.1424	145318.76	4	587.1616	170310.86
10	872.1338	114661.30	30	687.6575	145421.23	3	587.0041	170356.56

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}
	Cl II—Continued	
2	586.4528	170516.71
8	586.3828	170537.06
10	586.2442	170577.38
6	584.8829	170974.40
6	584.7718	171006.88
5	575.4019	173791.57
16	574.4088	174092.04
10	574.2946	174126.66
6	572.0083	174822.64
8	571.9033	174854.74
4	569.8349	175489.43
5	566.8002	176429.01
5	565.8366	176729.47
6	565.7376	176760.39
4	564.9716	177000.05
4	564.7775	177060.88
5	564.5782	177123.38
5	563.6169	177425.48
4	562.6651	177725.61
6	562.5662	177756.86
6	562.3684	177819.38
2	562.2867	177845.22
4	561.5930	178064.90
6	559.5279	178722.10
5	559.4065	178760.88
7	559.3057	178793.10
2	540.9047	184875.45
2	540.0270	185175.93
4	538.3083	185767.15
	Ar I	
50	1066.6599	93750.60
100	1048.2199	95399.83
15	894.3102	111818.03
18	879.9466	113643.26
18	876.0577	114147.73
15	869.7541	114975.02
18	866.8000	115366.87
10	842.8051	118651.39
10	835.0021	119760.17
15	834.3918	119847.76
12	826.3649	121011.92
12	825.3460	121161.31
8	820.1235	121932.85
7	816.4640	122479.38
12	816.2320	122514.19
	Ar II	
2	1981.3883	50469.663
4	1976.7653	50587.696
4	1974.4621	50646.705
4	1962.1611	50964.215
2	1946.7947	51366.484
	Ar II—Continued	
2	1933.6936	51714.501
2	1932.2301	51753.670
4	1919.1985	52105.084
8	1888.7827	52944.153
8	1886.3860	53011.421
8	1877.5231	53261.662
4	1868.6600	53514.283
8	1606.9260	62230.620
15	1604.0815	62340.971
8	1603.0743	62380.141
8	1600.1327	62494.817
2	1598.7212	62549.994
4	1578.8121	63338.758
4	1575.8155	63459.207
2	1562.4422	64002.368
4	1559.0712	64140.754
75	932.0537	107289.95
100	919.7810	108721.53
6	762.2001	131199.15
2	761.5791	131306.12
7	754.8240	132481.21
7	748.1982	133654.42
12	745.3222	134170.15
15	744.9248	134241.74
15	740.2692	135086.00
2	737.4537	135601.73
12	730.9297	136812.06
18	725.5485	137826.76
30	723.3606	138243.64
15	718.0899	139258.34
9	704.5238	141939.85
9	698.7745	143107.68
6	697.9419	143278.40
5	697.4890	143371.43
6	693.3019	144237.30
5	691.0373	144709.98
6	686.4884	145668.88
15	679.4006	147188.56
10	679.2184	147228.05
10	677.9518	147503.12
12	676.2425	147875.94
8	672.8563	148620.14
30	671.8513	148842.47
20	670.9455	149043.41
15	666.0109	150147.70
10	664.5623	150474.99
18	661.8690	151087.31
10	612.3716	163299.55
10	602.8585	165876.40
12	597.7001	167307.98
10	583.4371	171398.07
	Ar II—Continued	
12	580.2632	172335.60
9	578.6044	172829.65
9	578.1072	172978.31
10	576.7364	173389.43
12	573.3620	174409.89
9	572.0136	174821.01
9	560.2233	178500.26
12	556.8170	179592.22
3	555.7660	179931.84
2	553.1263	180790.54
4	550.4810	181659.31
7	548.7808	182222.12
4	547.9961	182483.06
12	547.4606	182661.55
9	547.1651	182760.21
8	546.1768	183090.89
9	543.7305	183914.64
15	543.2033	184093.13
10	542.9124	184191.79
2	541.3020	184739.75
5	537.1396	186171.33
9	530.4954	188503.05
7	526.4969	189934.63
9	524.6804	190592.23
9	522.7925	191280.48
10	519.3270	192556.91
5	518.9089	192712.06
7	514.3100	194435.26
2	503.6504	198550.44
2	502.1630	199138.53
2	501.1897	199525.24
5	492.4083	203083.50
8	489.1954	204417.31
4	488.9615	204515.08
9	488.7927	204585.72
10	487.2272	205243.05
2	479.2178	208673.39
4	477.1049	209597.50
6	475.9056	210125.73
	Ca II	
20	1850.691	54033.88
10	1843.088	54256.77
30	1840.061	54346.03
20	1838.008	54406.72
2	1814.647	55107.13
18	1814.495	55111.76
10	1807.337	55330.02
8	1698.183	58886.48
4	1691.779	59109.37
9	1680.051	59522.01
5	1673.860	59742.14

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}
	Ca II—Continued	
15	1651.9909	60533.02
30	1649.8579	60611.28
18	1644.4428	60810.87
10	1643.7979	60834.73
2	1642.8033	60871.56
15	1554.6415	64323.51
10	1553.1761	64384.20
9	1433.7493	69747.20
6	1432.5028	69807.89
6	1342.5536	74484.92
12	1341.8901	74521.75
	Sc IV	
6	481.434	207713.0
3	478.611	208937.8
4	477.765	209307.8
3	476.206	209993.1
4	475.785	210179.1
5	474.673	210671.4
4	474.531	210734.3
3	474.248	210860.1
4	474.114	210919.8
5	472.995	211418.8
5	471.789	211959.1
5	470.251	212652.5
3	467.392	213953.0
3	466.963	214149.5
5	466.194	214502.9
5	465.482	214831.1
4	463.663	215673.8
6	462.567	216185.0
3	461.812	216538.4
3	445.748	224341.8
4	444.623	224909.8
6	442.262	226110.3
7	441.495	226503.2
7	441.189	226660.2
5	438.980	227800.6
9	438.786	227901.3
3	438.481	228060.3
5	436.138	229285.0
5	434.398	230203.7
5	431.780	231599.7
4	426.691	234361.4
4	425.524	235004.5
3	422.627	236615.0
5	422.023	236953.7
3	421.328	237344.6
6	420.806	237638.9
5	420.503	237810.2
4	420.125	238024.4
5	420.004	238092.9
6	419.525	238364.7
5	418.808	238772.7
4	416.448	240125.9
7	415.968	240403.0
5	412.969	242148.8
4	410.080	243854.6
10	371.159	269426.5
15	299.0385	334405.1
15	296.3108	337483.5
15	289.8505	345005.4
5	223.4026	447622.4
8	220.2776	453972.7
5	217.1897	460426.9
5	215.3051	464457.2
3	195.4536	511630.3
	V V	
13	484.511	206393.7
15	483.007	207036.3
8	481.557	207659.9
7	313.3757	319105.8
8	312.3950	320107.6
3	296.7249	337012.5
9	286.8383	348628.5
8	285.9796	349675.3
5	284.5806	351394.3
3	284.4951	351499.9
9	252.4396	396134.4
10	251.6550	397369.4
2	240.9339	415051.6
9	239.4845	417563.6
8	239.4069	417698.9
	Mn II	
2	1934.789	51685.23
2	1932.595	51743.89
30	1931.412	51775.60
4	1928.124	51863.88
5	1926.946	51895.59
50	1926.578	51905.51
30	1925.512	51934.25
20	1923.339	51992.91
20	1923.067	52000.26
80	1921.248	52049.49
10	1920.014	52082.96
30	1919.648	52092.88
3	1918.911	52112.90
20	1918.640	52120.25
100	1915.097	52216.67
20	1914.683	52227.97
30	1911.408	52317.45
6	1909.824	52360.84
20	1907.838	52415.34
3	1898.135	52683.30
10	1897.475	52701.61
3	1809.969	55249.56
3	1807.328	55330.29
2	1803.417	55450.28
4	1799.800	55561.74
3	1793.751	55749.11
4	1788.781	55903.98
2	1776.054	56304.58
5	1775.199	56331.72
5	1774.206	56363.24
3	1772.344	56422.44
8	1768.583	56542.43
5	1766.495	56609.29
10	1760.667	56796.66
10	1743.338	57361.22
20	1741.977	57406.03
5	1741.638	57417.20
4	1741.514	57421.31
20	1740.144	57466.52
10	1738.344	57526.02
30	1737.925	57539.87
40	1734.488	57653.89
50	1733.548	57685.16
30	1732.700	57713.39
20	1726.464	57921.85
2	1385.893	72155.62
2	1382.304	72342.99
3	1377.945	72571.81
2	1291.577	77424.70
2	1290.925	77463.84
2	1201.118	83255.79
2	1199.391	83375.63
4	1197.184	83529.33
3	1164.208	85895.30
4	1163.326	85960.46
5	1162.015	86057.44
	Cu II	
30	1989.8554	50254.907
50	1979.9565	50506.161
15	1977.0270	50580.998
15	1970.4946	50748.681
20	1957.5176	51085.108
5	1952.5758	51214.400
10	1946.4929	51374.450
25	1944.5970	51424.538
25	1929.7510	51820.157
5	1922.1425	52025.278
5	1920.6718	52065.117
5	1790.6603	55845.322
15	1753.2811	57035.921

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}
	Cu II—Continued			Cu II—Continued			Cu II—Continued	
10	1736.5514	57585.396	25	1533.9865	65189.624	30	1458.0016	68587.029
15	1717.7214	58216.660	30	1532.1306	65268.589	10	1457.1759	68625.897
10	1672.7757	59780.878	50	1531.8559	65280.290	20	1452.2935	68856.607
30	1663.0020	60132.218	5	1526.9276	65490.992	25	1450.3035	68951.083
20	1660.0009	60240.930	15	1525.7645	65540.916	20	1449.0580	69010.350
20	1656.3219	60374.739	20	1524.8601	65579.785	20	1445.9835	69157.083
25	1649.4575	60625.993	10	1523.7413	65627.938	10	1443.5419	69274.052
10	1636.6050	61102.099	15	1522.5768	65678.130	15	1442.1386	69341.463
25	1630.2681	61339.605	20	1520.5396	65766.128	15	1436.2359	69626.447
40	1622.4278	61636.023	60	1519.8371	65796.527	10	1435.3155	69671.092
60	1621.4256	61674.120	50	1519.4918	65811.476	25	1434.9037	69691.087
20	1617.9154	61807.930	10	1517.9300	65879.191	15	1434.7699	69697.588
10	1611.1181	62068.697	20	1517.6310	65892.168	10	1433.8404	69742.770
15	1610.2964	62100.368	10	1517.1599	65912.629	40	1430.2428	69918.197
25	1608.6393	62164.338	50	1514.4924	66028.723	15	1428.3580	70010.459
40	1606.8341	62234.178	10	1514.2339	66039.997	20	1427.8290	70036.396
30	1605.2813	62294.377	20	1513.3659	66077.873	10	1427.5912	70048.066
20	1604.8475	62311.218	20	1512.4646	66117.251	25	1421.7589	70335.411
40	1602.3880	62406.859	20	1512.1739	66129.962	5	1421.3737	70354.474
15	1602.2729	62411.341	35	1510.5058	66202.988	25	1418.4265	70500.655
40	1598.4023	62562.472	30	1508.6323	66285.205	10	1414.8980	70676.475
60	1593.5556	62752.752	25	1508.1846	66304.882	15	1407.1689	71064.675
40	1590.1649	62886.561	20	1505.3878	66428.067	15	1402.7770	71287.166
50	1583.6823	63143.976	25	1504.7571	66455.908	10	1398.6419	71497.932
10	1582.8458	63177.349	15	1503.3682	66517.306	10	1393.1275	71780.941
40	1581.9953	63211.314	10	1501.3363	66607.329	3	1375.5019	72700.733
30	1580.6257	63266.087	10	1499.5132	66688.310	20	1371.8399	72894.805
15	1580.0250	63290.139	35	1496.6867	66814.250	2	1370.5600	72962.877
30	1579.4918	63311.504	25	1495.4298	66870.408	25	1367.9509	73102.04
10	1569.4155	63717.989	25	1493.3665	66962.797	5	1363.5031	73340.502
10	1569.2123	63726.239	30	1492.8343	66986.671	20	1362.5997	73389.125
40	1566.4148	63840.049	10	1492.6817	66993.521	5	1359.9362	73532.863
40	1565.9243	63860.048	10	1492.1525	67017.278	20	1359.0091	73583.023
30	1558.3447	64170.656	75	1488.8311	67166.787	30	1358.7730	73595.81
20	1557.5867	64201.883	20	1485.3277	67325.212	15	1355.3053	73784.116
50	1555.7030	64279.621	20	1481.5438	67497.160	25	1351.8366	73973.436
40	1555.1344	64303.122	15	1476.0593	67747.955	15	1350.5938	74041.509
25	1553.8962	64354.364	20	1474.9348	67799.607	3	1340.9141	74575.995
50	1552.6464	64406.163	25	1473.9785	67843.596	5	1332.2228	75062.520
30	1551.3890	64458.365	15	1473.5299	67864.247	5	1331.8907	75081.237
30	1550.6533	64488.949	20	1472.3950	67916.56	5	1328.4129	75277.798
10	1547.9582	64601.227	40	1470.6974	67994.953	10	1326.3954	75392.301
40	1544.6771	64738.449	15	1469.6928	68041.428	3	1325.5135	75442.462
75	1541.7032	64863.328	5	1466.7284	68178.949	6	1323.7943	75540.439
30	1540.5883	64910.267	10	1466.5240	68188.449	3	1323.2042	75574.127
30	1540.3887	64918.681	20	1466.0702	68209.556	6	1322.6326	75606.786
20	1540.2394	64924.974	15	1465.5408	68234.199	5	1321.7962	75654.627
10	1538.4795	64999.241	40	1463.8381	68313.565	10	1320.6858	75718.237
50	1537.5590	65038.154	20	1463.7515	68317.609	30	1314.3366	76084.013
15	1535.5238	65124.356	15	1461.5539	68420.329	15	1314.1495	76094.845
25	1535.0023	65146.481	25	1459.4117	68520.760	15	1309.4633	76367.165

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}
	Cu II—Continued			Cu II—Continued			Cu II—Continued	
30	1308.2971	76435.238	80	1044.7435	95717.277	40	896.9762	111485.683
5	1305.5608	76595.437	80	1044.5188	95737.865	60	896.7588	111512.709
10	1299.2678	76966.424	60	1039.5821	96192.499	40	894.2274	111828.383
15	1298.3949	77018.172	60	1039.3477	96214.193	80	893.6777	111897.162
15	1287.4683	77671.815	60	1036.4695	96481.371	50	892.4144	112055.566
8	1284.8712	77828.813	8	1035.1628	96603.165	60	890.5669	112288.026
15	1282.4547	77975.462	10	1033.5677	96752.249	60	886.9434	112746.761
8	1281.4616	78035.894	8	1031.7662	96921.181	10	886.5111	112801.746
5	1280.2682	78108.632	20	1030.2633	97062.571	25	885.8472	112886.291
30	1275.5717	78396.219	10	1029.7508	97110.876	8	884.4346	113066.579
3	1274.4651	78464.291	25	1028.3279	97245.243	10	884.1332	113105.130
3	1274.0708	78488.574	50	1027.8311	97292.249	50	878.6986	113804.668
8	1272.0417	78613.775	5	1022.1021	97837.580	15	877.8471	113915.059
2	1271.3178	78658.536	15	1020.1076	98028.878	20	877.5548	113952.996
10	1266.3101	78969.599	15	1019.6545	98072.431	25	877.0121	114023.507
15	1265.5062	79019.760	50	1018.7073	98163.621	20	876.7227	114061.150
3	1262.9249	79181.275	15	1018.0642	98225.630	15	873.2629	114513.052
5	1253.1809	79796.942	15	1017.9980	98232.018	8	871.0676	114801.659
10	1250.0483	79996.909	25	1012.5971	98755.957	8	870.5389	114871.374
5	1248.7916	80077.410	30	1010.2690	98983.542	25	869.3360	115030.317
2	1241.9641	80517.628	30	1008.7284	99134.713	10	869.0641	115066.309
2	1205.9029	82925.419	30	1008.5688	99150.396	8	867.7336	115242.742
2	1201.6258	83220.583	30	1004.0554	99596.102	5	866.4427	115414.439
5	1157.0206	86428.884	8	1001.0130	99898.807	40	865.3902	115554.815
30	1144.8556	87347.261	8	998.3060	100169.685	40	861.9936	116010.144
20	1142.6405	87516.587	25	992.9532	100709.685	25	858.4869	116484.015
5	1123.2260	89029.275	10	987.6570	101249.728	10	855.7002	116863.357
15	1119.9470	89289.943	25	977.5674	102294.741	5	855.4762	116893.964
5	1105.1765	90483.288	10	976.5532	102400.978	3	852.9061	117246.195
25	1097.0529	91153.308	20	974.7589	102589.467	25	851.3027	117467.032
30	1094.4025	91374.059	25	968.0416	103301.34	2	850.7480	117543.617
5	1091.2916	91634.538	20	960.4135	104121.82	3	849.3594	117735.786
20	1088.3953	91878.379	40	958.1542	104367.339	15	848.8075	117812.341
5	1086.1102	92071.685	25	956.2903	104570.757	5	844.9122	118355.499
30	1073.7454	93131.951	20	954.3830	104779.737	3	844.6128	118397.445
15	1070.3112	93430.770	50	945.9648	105712.177	30	826.9961	120919.56
50	1069.1954	93528.271	40	945.8769	105722.007	20	813.8834	122867.73
20	1066.1343	93796.813	60	945.5249	105671.357	15	810.9984	123304.81
20	1065.7821	93827.807	60	943.3348	106006.903	3	806.5472	123985.307
60	1063.0052	94072.919	10	939.5232	106436.966	10	797.4552	125398.892
60	1060.6343	94283.210	60	935.8977	106849.280	8	779.2949	128321.121
60	1059.0960	94420.144	20	935.3434	106912.606	25	736.0319	135863.67
40	1058.7988	94446.649	40	935.2325	106925.280	20	735.5203	135958.18
60	1056.9546	94611.442	50	924.2386	108197.173	15	724.4887	138028.38
40	1055.7968	94715.191	20	922.4161	108410.947	10	718.1787	139241.12
60	1054.6901	94814.582	60	922.0190	108457.64	10	709.3129	140981.50
20	1052.1747	95041.249	80	914.2133	109383.663	2	685.3968	145900.89
10	1050.4028	95201.578	15	910.5185	109827.535	8	685.1406	145955.44
10	1050.1536	95224.169	40	906.1134	110361.459	2	675.6020	148016.15
50	1049.7554	95260.288	60	901.0731	110978.785		Zn I	
20	1049.3640	95295.815	15	897.7932	111384.223	10	1632.0013	61274.46

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}	Intensity	Wavelength Å	Wave number cm^{-1}
	Zn I — Continued			Ge I—Continued			Ge I—Continued	
50	1589.5610	62910.45	200	1917.5924	52148.726	4	1702.3873	58741.040
4	1468.8451	68080.70	100	1912.4087	52290.079	8	1696.7160	58937.381
20	1457.5717	68607.26	50	1908.4342	52398.977	8	1695.8597	58967.142
2	1408.8079	70982.00	400	1904.7016	52501.663	4	1694.3424	59019.947
8	1404.1193	71219.02	10	1903.5620	52533.092	7	1691.8657	59106.347
	Zn II		100	1895.1969	52764.967	7	1691.6254	59114.742
8	1969.405	50776.75	8	1881.6470	53144.932	20	1691.0897	59133.470
10	1918.962	52111.51	10	1876.0104	53304.609	4	1690.9030	59139.997
3	1836.653	54446.87	200	1874.2565	53354.490	10	1690.0349	59170.377
8	1747.125	57236.89	70	1865.0525	53617.794	3	1685.2222	59339.357
2	1618.968	61767.76	9	1861.0946	53731.821	7	1681.3426	59476.279
5	1589.780	62901.80	50	1860.0865	53760.941	7	1675.5606	59681.519
10	1585.368	63076.84	80	1853.1336	53962.649	9	1674.2703	59727.511
10	1555.764	64277.10	20	1849.6355	54064.707	3	1671.0096	59844.059
8	1550.937	64477.15	20	1846.9578	54143.09	9	1670.6085	59858.429
5	1540.122	64929.93	70	1845.8723	54174.928	6	1667.8015	59959.174
20	1535.085	65142.98	15	1844.4102	54217.873	5	1665.2751	60050.138
15	1523.903	65620.99	70	1842.4099	54276.739	10	1663.5393	60112.797
12	1514.761	66017.02	70	1841.3275	54308.643	3	1662.9860	60132.797
15	1510.362	66209.29	70	1824.3023	54815.476	5	1661.3453	60192.184
30	1493.133	66973.27	15	1813.9087	55129.566	2	1660.7956	60212.104
12	1488.927	67162.45	4	1810.1006	55245.548	3	1658.3752	60299.986
70	1486.065	67291.81	50	1804.4523	55418.478	6	1651.9547	60534.346
30	1478.216	67649.12	40	1802.6246	55474.668	3	1651.5288	60549.958
40	1477.015	67704.12	50	1801.4323	55511.384	4	1650.2945	60595.245
15	1462.743	68364.71	40	1793.0711	55770.237	3	1647.5310	60696.886
10	1457.423	68614.28	40	1786.0686	55988.891	4	1643.1931	60857.120
50	1456.907	68638.56	50	1785.0461	56020.963	6	1639.7300	60985.650
70	1450.779	68928.48	40	1774.1755	56364.211	2	1635.2590	61152.392
70	1445.042	69202.14	30	1766.4330	56611.261	2	1630.1733	61343.172
50	1439.091	69488.32	25	1766.0648	56623.064	2	1624.1300	61571.426
15	1430.991	69881.64	30	1765.2843	56648.099		Ge II	
	Ge I		30	1764.1852	56683.391	20	1979.2736	50523.587
1000	1998.8870	50027.841	15	1759.2712	56841.718	2	1966.3173	50856.493
150	1997.8064	50054.899	40	1758.2792	56873.790	50	1938.8907	51575.884
100	1989.1174	50273.553	30	1750.0432	57141.446	50	1938.0076	51599.386
600	1988.2669	50295.059	20	1748.8572	57180.198	20	1649.1942	60635.671
300	1987.8493	50305.625	30	1746.0651	57271.633	10	1602.4864	62403.027
500	1970.8797	50738.765	15	1744.2546	57331.079	7	1581.0698	63248.315
200	1965.3830	50880.668	15	1744.0537	57337.683	50	1576.8548	63417.381
100	1963.3728	50932.761	25	1742.1951	57398.852	20	1538.0907	65105.671
500	1962.0133	50968.053	25	1739.1024	57500.926	10	1264.7096	79069.536
200	1955.1150	51147.886	30	1738.4791	57521.542	50	1261.9053	79245.249
100	1953.8018	51182.263	15	1738.1185	57533.475	50	1237.0589	80836.892
300	1944.7313	51420.986	10	1724.3082	57944.273	10	1075.0720	93017.026
150	1944.1163	51437.252	8	1720.7464	58114.315	2	1055.0261	94784.382
300	1938.3003	51591.592	10	1718.6883	58183.906	2	1017.0600	98322.614
300	1937.4825	51613.370	6	1718.4933	58190.510	10	1016.6377	98363.456
100	1934.0482	51705.020	40	1716.7845	58248.430	5	999.1011	100089.970
400	1929.8262	51818.137	15	1715.8356	58280.643	2	920.5537	108630.28
100	1923.4674	51989.443	10	1713.0806	58374.369	1	905.9771	110378.07

2.2.a. Vacuum Ultraviolet Linelist by Spectrum—Continued

Intensity	Wavelength Å	Wave number cm^{-1}
	Ge II—Continued	
1	875.4927	114221.40
1	862.2339	115977.81
	Kr I	
30	1235.838	80916.76
10	1164.867	85846.70
5	1030.023	97085.20
5	1003.550	99646.22
5	1001.061	99894.03
2	963.374	103801.8
2	953.404	104887.3
1	951.056	105146.3
2	946.535	105648.5
3	945.441	105770.7
1	928.711	107676.2
1	923.713	108258.8
	Rb II	
100	741.4562	134869.74
60	711.1868	140610.04
30	697.0488	143461.98
15	643.8784	155308.82
25	589.4192	169658.53
2	555.0364	180168.37
3	530.1729	188617.70
2	513.2661	194830.70
1	497.4296	201033.49
	Sr III	
75	562.752	177698.2
100	514.373	194411.5
40	507.033	197226.0
50	491.782	203342.0
75	437.237	228708.7
9	371.2114	269388.3
10	363.4916	275109.5
6	358.8008	278706.2
10	351.6203	284397.7
5	334.1088	299303.7
8	330.6636	302422.2
5	321.6105	310935.1
	Sr IV	
100	710.348	140776.2
200	664.434	150504.1
6	580.8645	178296.17
25	534.1859	187200.74
18	531.8467	188024.11
18	498.6804	200529.25
20	488.4160	204743.50
20	488.2599	204808.95
25	484.2049	206524.12
	Sr IV—Continued	
20	478.6113	208937.80
25	471.7580	211973.07
20	465.2331	214946.01
15	449.4736	222482.49
25	442.7302	225871.18
15	440.1472	227196.72
20	437.6558	228490.04
20	437.3417	228654.17
30	430.6439	232210.43
20	430.3576	232364.90
25	430.2118	232443.63
15	422.0751	236924.66
30	419.7836	238217.98
40	415.3243	240775.71
40	413.0647	242092.84
30	412.9304	242171.57
12	412.1026	242658.03
20	410.6711	243503.85
35	406.9426	245734.92
35	403.8494	247617.05
40	399.9252	250046.76
10	399.1958	250503.65
50	396.2185	252385.97
45	394.8951	253231.79
50	392.9989	254453.63
75	392.4324	254820.96
4	388.5834	257344.99
20	378.5275	264181.57
5	377.4154	264960.03
10	364.0494	274687.97
5	313.4738	319005.94
4	310.7067	321846.94
9	309.3077	323302.64
6	307.0226	325708.94
6	306.1795	326605.80
5	305.5119	327319.50
10	304.6589	328235.89
12	301.6691	331489.03
10	301.5910	331574.88
5	300.3830	332908.33
5	300.3254	332972.12
12	300.2727	333030.58
15	300.1237	333195.98
9	299.2723	334143.89
10	298.9823	334467.92
15	298.1187	335436.88
8	297.3237	336333.74
5	296.6941	337047.44
9	296.6027	337151.32
	Sr IV—Continued	
10	295.8897	337963.83
8	295.3501	338581.20
8	293.3046	340942.52
12	293.2161	341045.43
10	293.1653	341104.48
9	293.0687	341216.97
12	291.1881	343420.68
12	291.0897	343536.74
10	290.5323	344195.86
10	289.6795	345209.11
10	285.2983	350510.38
10	285.1680	350670.46
10	285.0364	350832.42
12	284.3115	351726.93
7	283.1669	353148.62
9	283.0739	353264.68
10	281.8157	354841.85
10	274.7384	363982.56
6	271.1892	368746.31
8	267.8618	373326.84
6	264.2188	378474.25
	Xe I	
40	1469.610	68045.26
20	1295.586	77185.16
10	1250.207	79986.76
10	1192.036	83890.07
8	1170.410	85440.13
4	1129.307	88549.88
4	1110.713	90032.25
5	1099.716	90932.54
2	1085.442	92128.40
2	1078.584	92714.20
1	1070.409	93422.22
3	1068.167	93618.35
	^{198}Hg I	
500	1849.4918	54068.906
3	1435.5031	69661.990
20	1402.6190	71295.198
25	1307.7509	76467.16
15	1301.0103	76863.340
50	1268.8247	78813.095
10	1259.2418	79412.86
40	1250.5637	79963.938
15	1235.8371	80916.81
25	1232.2293	81153.724
10	1222.3711	81808.22
20	1220.3672	81942.551
5	1213.9035	82378.87
10	1212.6478	82464.176

2.2.b. Vacuum Ultraviolet Linelist by Wavelength

The main purpose of the intensity figures is to aid the identification of the lines. Considerable efforts have been made to bring them on a reasonably uniform scale, but it should be remembered that they are usually based on visual estimates of plate blackening, uncorrected for plate sensitivity and spectrograph efficiency, and are thus consistent only over a limited wavelength range. Moreover, the relative intensities within the same spectrum depend to some extent upon the light source.

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
1998.8870	1000	Ge I	1952.5758	5	Cu II	1924.7537	5	Al II
1997.8064	150	Ge I	1949.6947	7	Ne II	1924.1654	7	Ne II
1994.0957	9	Ne II	1946.7947	2	Ar II	1923.4674	100	Ge I
1993.6212	2	C I	1946.4929	10	Cu II	1923.339	20	Mn II
1991.8537	10	Si I	1944.7313	300	Ge I	1923.067	20	Mn II
1990.5310	70	Al II	1944.5970	25	Cu II	1922.1425	5	Cu II
1989.8554	30	Cu II	1944.1163	150	Ge I	1921.248	80	Mn II
1989.1174	100	Ge I	1939.8749	7	Ne II	1920.6718	5	Cu II
1988.9937	200	Si I	1939.2606	22	Al II	1920.1812	8	Ne II
1988.2669	600	Ge I	1938.8907	50	Ge II	1920.014	10	Mn II
1987.8493	300	Ge I	1938.8269	20	Ne II	1919.648	30	Mn II
1986.3640	100	Si I	1938.3003	300	Ge I	1919.1985	4	Ar II
1984.4400	4	Si I	1938.0076	50	Ge II	1918.962	10	Zn II
1983.2330	60	Si I	1937.4825	300	Ge I	1918.911	3	Mn II
1981.3883	2	Ar II	1936.9066	15	Al II	1918.640	20	Mn II
1980.6185	60	Si I	1935.949	14	Al III	1917.5924	200	Ge I
1979.9565	50	Cu II	1935.863	1	Al III	1916.0818	50	Ne II
1979.2736	20	Ge II	1935.840	20	Al III	1915.097	100	Mn II
1979.2056	80	Si I	1934.789	2	Mn II	1914.6981	100	S I
1977.5978	80	Si I	1934.7129	15	Al II	1914.683	20	Mn II
1977.0270	15	Cu II	1934.5032	40	Al II	1912.4087	100	Ge I
1976.7653	4	Ar II	1934.0482	100	Ge I	1911.408	30	Mn II
1974.4621	4	Ar II	1933.6936	2	Ar II	1910.8252	8	Al II
1970.8797	500	Ge I	1933.5298	9	Ne II	1909.824	6	Mn II
1970.4946	15	Cu II	1932.595	2	Mn II	1908.4342	50	Ge I
1969.405	8	Zn II	1932.3768	20	Al II	1907.838	20	Mn II
1966.3173	2	Ge II	1932.2301	2	Ar II	1907.4940	20	Ne II
1965.3830	200	Ge I	1931.412	30	Mn II	1906.4987	6	Ne II
1963.3728	100	Ge I	1931.0481	15	Al II	1906.4082	2	Al II
1962.7634	5	Al II	1930.9056	100	C I	1904.7016	400	Ge I
1962.7349	7	Al II	1930.0345	30	Ne II	1904.6647	8	Si I
1962.6910	6	Al II	1929.9775	20	Al II	1904.5068	7	Ne II
1962.5904	7	Al II	1929.8262	400	Ge I	1903.5620	10	Ge I
1962.1611	4	Ar II	1929.7510	25	Cu II	1901.3377	80	Si I
1962.0133	500	Ge I	1928.7866	9	Ne II	1900.2865	200	S I
1957.5176	20	Cu II	1928.124	4	Mn II	1899.1943	2	Al II
1955.1150	200	Ge I	1926.946	5	Mn II	1898.135	3	Mn II
1954.9681	10	Si I	1926.578	50	Mn II	1897.475	10	Mn II
1954.0479	7	Ne II	1926.0291	6	Al II	1895.1969	100	Ge I
1953.8018	100	Ge I	1925.512	30	Mn II	1889.7120	10	Ne II

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
1888.7827	8	Ar II	1846.1118	40	Si I	1807.5851	2	Al II
1888.1064	10	Ne II	1845.9968	8	Ne II	1807.4168	7	Al II
1887.6928	9	Si I	1845.8723	70	Ge I	1807.337	10	Ca II
1886.3860	8	Ar II	1845.5203	40	Si I	1807.328	3	Mn II
1881.8538	6	Si I	1844.4102	15	Ge I	1807.3110	200	S I
1881.6889	7	Ne II	1843.9105	8	Ne II	1804.4523	50	Ge I
1881.6470	8	Ge I	1843.7700	40	Si I	1803.7301	7	Ne II
1877.5231	8	Ar II	1843.088	10	Ca II	1803.417	2	Mn II
1876.0104	10	Ge I	1842.4099	70	Ge I	1802.6246	40	Ge I
1875.8129	6	Si I	1842.3413	7	Ne II	1801.4323	50	Ge I
1874.8423	35	Si I	1841.4490	80	Si I	1799.800	4	Mn II
1874.2565	200	Ge I	1841.3275	70	Ge I	1799.1193	6	Si I
1873.1036	5	Si I	1841.1520	25	Si I	1798.2814	8	Ne II
1871.0970	7	Ne II	1840.061	30	Ca II	1796.5170	7	Ne II
1868.6600	4	Ar II	1838.0120	8	Si I	1793.751	3	Mn II
1865.0525	70	Ge I	1838.008	20	Ca II	1793.0711	40	Ge I
1862.7895	100	Al III	1836.9635	6	Al II	1790.6603	5	Cu II
1862.3111	100	Al II	1836.653	3	Zn II	1790.2548	5	Si I
1861.0946	9	Ge I	1836.5102	40	Si I	1788.781	4	Mn II
1860.0865	50	Ge I	1834.8077	25	Al II	1786.0686	40	Ge I
1859.9796	12	Al II	1833.9099	8	Ne II	1785.0461	50	Ge I
1859.3605	8	Ne II	1832.8374	40	Al II	1783.2315	5	Si I
1858.4108	8	Ne II	1829.8975	2	Si I	1782.2624	5	S I
1858.0262	70	Al II	1828.5876	60	Al II	1776.8241	30	Si I
1857.9530	7	Ne II	1827.9351	10	Mg I	1776.054	2	Mn II
1856.2741	3	Al II	1826.3996	100	B I	1775.199	5	Mn II
1856.0957	9	Al II	1826.2449	150	S I	1774.206	5	Mn II
1855.9286	30	Al II	1825.8961	50	B I	1774.1755	40	Ge I
1855.8054	9	Al II	1824.3023	70	Ge I	1772.344	3	Mn II
1854.7164	200	Al III	1822.4553	6	Si I	1772.2254	2	Si I
1853.1521	7	Si I	1820.3421	175	S I	1770.9223	60	Si I
1853.1336	80	Ge I	1818.3494	40	B I	1770.6295	25	Si I
1853.1147	9	Ne II	1817.9562	2	Si I	1769.7859	14	Si I
1852.4717	50	Si I	1817.8454	20	B I	1768.583	8	Mn II
1851.7829	14	Si I	1817.4517	3	Si II	1767.7308	40	Al II
1850.691	20	Ca II	1816.9290	30	Si II	1766.495	5	Mn II
1850.6719	80	Si I	1814.647	2	Ca II	1766.4330	30	Ge I
1849.6355	20	Ge I	1814.495	18	Ca II	1766.3541	10	Si I
1849.4918	500	Hg I	1814.0794	50	Si I	1766.0648	25	Ge I
1849.3784	9	Ne II	1813.9087	15	Ge I	1766.0627	20	Si I
1848.8229	7	Ne II	1810.1006	4	Ge I	1765.8981	7	Ne II
1848.7480	50	Si I	1809.969	3	Mn II	1765.8150	30	Al II
1848.1504	40	Si I	1809.1047	20	Si I	1765.6215	10	Si I
1847.4737	60	Si I	1808.4301	4	Si I	1765.3659	3	C I
1846.9578	20	Ge I	1808.0129	15	Si II	1765.2843	30	Ge I

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
1765.0296	18	Si I	1740.2988	4	Si I	1694.3424	4	Ge I
1764.1852	30	Ge I	1740.144	20	Mn II	1693.4681	12	Si I
1763.9521	70	Al II	1739.7382	5	Al II	1693.2934	25	Si I
1763.9089	8	C I	1739.1024	25	Ge I	1691.8657	7	Ge I
1763.8692	50	Al II	1738.7356	8	Ne II	1691.779	4	Ca II
1763.6607	16	Si I	1738.4791	30	Ge I	1691.6254	7	Ge I
1761.9751	30	Al II	1738.344	10	Mn II	1691.0897	20	Ge I
1760.8191	6	C II	1738.1185	15	Ge I	1690.9030	4	Ge I
1760.667	10	Mn II	1737.925	30	Mn II	1690.7889	12	Si I
1760.4735	2	C II	1737.6283	50	Mg II	1690.0349	10	Ge I
1760.3954	12	C II	1737.6124	6	Mg II	1689.2902	12	Si I
1760.1044	35	Al II	1736.5514	10	Cu II	1687.0923	4	Si I
1759.5832	2	Si I	1734.8523	30	Mg II	1686.8185	20	Si I
1759.2712	15	Ge I	1734.488	40	Mn II	1686.2505	10	Al II
1758.5549	8	Ne II	1733.548	50	Mn II	1685.2222	3	Ge I
1758.2792	40	Ge I	1732.700	30	Mn II	1683.4135	2	Mg I
1758.1060	7	Ne II	1730.6473	8	Ne II	1682.6734	14	Si I
1756.8363	8	Ne II	1726.464	20	Mn II	1681.8089	8	Al II
1753.4744	60	Mg II	1724.9838	90	Al II	1681.3426	7	Ge I
1753.2811	15	Cu II	1724.9519	50	Al II	1680.051	9	Ca II
1751.8270	50	C I	1724.3082	10	Ge I	1676.8207	3	Si I
1751.6980	8	Ne II	1721.2714	90	Al II	1675.5606	7	Ge I
1750.6637	30	Mg II	1721.2435	50	Al II	1675.2052	40	Si I
1750.6124	6	Al II	1720.7464	8	Ge I	1674.2703	9	Ge I
1750.0432	30	Ge I	1719.4400	80	Al II	1673.860	5	Ca II
1748.8572	20	Ge I	1718.6883	10	Ge I	1672.7757	10	Cu II
1747.7937	5	Mg I	1718.4933	6	Ge I	1672.5960	16	Si I
1747.4141	8	Si I	1717.7214	15	Cu II	1671.1169	8	Si I
1747.125	8	Zn II	1716.7845	40	Ge I	1671.0096	3	Ge I
1746.0651	30	Ge I	1715.8356	15	Ge I	1670.7867	150	Al II
1745.3475	5	Si I	1713.0806	10	Ge I	1670.6085	9	Ge I
1745.2603	20	N I	1707.0606	3	Mg I	1668.5204	14	Si I
1745.2485	40	N I	1704.4416	20	Si I	1668.4288	1	Mg I
1744.4164	8	Ne II	1702.8694	14	Si I	1667.8015	6	Ge I
1744.2546	15	Ge I	1702.3873	4	Ge I	1667.6288	14	Si I
1744.0537	15	Ge I	1700.6360	16	Si I	1666.6876	175	S I
1743.8941	4	Si I	1700.4194	18	Si I	1666.3762	12	Si I
1743.338	10	Mn II	1699.7162	2	Si I	1665.2751	5	Ge I
1742.8712	7	Ne II	1698.183	8	Ca II	1664.5111	7	Si I
1742.7309	100	N I	1697.9409	50	Si I	1663.5393	10	Ge I
1742.7192	20	N I	1696.7160	8	Ge I	1663.0324	16	B I
1742.1951	25	Ge I	1696.2065	40	Si I	1663.0020	30	Cu II
1741.977	20	Mn II	1695.8597	8	Ge I	1662.9860	3	Ge I
1741.638	5	Mn II	1695.5075	18	Si I	1662.6107	8	B I
1741.514	4	Mn II	1694.5989	8	Ne II	1661.4790	100	Be I

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
1661.3453	5	Ge I	1622.8806	18	Si I	1590.4768	4	Si I
1660.7956	2	Ge I	1622.4278	40	Cu II	1590.1649	40	Cu II
1660.4748	3	Si I	1621.4256	60	Cu II	1589.780	5	Zn II
1660.0009	20	Cu II	1620.4049	12	Si I	1589.5610	50	Zn I
1658.3752	3	Ge I	1619.5266	3	Si I	1589.1733	3	Si I
1658.1212	15	C I	1618.968	2	Zn II	1587.7620	3	Si I
1657.9068	12	C I	1618.3990	5	Al II	1586.7913	4	Si I
1657.3792	12	C I	1617.9154	20	Cu II	1586.1372	3	Si I
1657.0082	30	C I	1616.5794	14	Si I	1585.368	10	Zn II
1656.9283	12	C I	1615.9488	10	Si I	1584.3455	2	Si I
1656.3219	20	Cu II	1614.6309	5	Si I	1583.6823	50	Cu II
1656.2672	15	C I	1614.5665	6	Si I	1582.8458	10	Cu II
1653.3760	8	Si I	1611.8735	70	Al III	1581.9953	40	Cu II
1651.9909	15	Ca II	1611.8141	8	Al III	1581.0698	7	Ge II
1651.9547	6	Ge I	1611.1181	10	Cu II	1580.6257	30	Cu II
1651.5288	3	Ge I	1610.2964	15	Cu II	1580.3001	2	Si I
1651.0279	5	Si I	1608.9157	5	Si I	1580.0250	15	Cu II
1650.2945	4	Ge I	1608.6393	25	Cu II	1579.4918	30	Cu II
1649.8579	30	Ca II	1608.4379	3	C I	1578.8121	4	Ar II
1649.4575	25	Cu II	1606.9600	2	C I	1576.8548	50	Ge II
1649.1942	20	Ge II	1606.9260	8	Ar II	1575.8155	4	Ar II
1647.5310	3	Ge I	1606.8341	40	Cu II	1575.1268	2	Si I
1644.8089	10	Al II	1605.8370	4	Si I	1574.8435	6	Si I
1644.4428	18	Ca II	1605.7661	40	Al III	1573.8840	5	Si I
1644.2348	10	Al II	1605.2813	30	Cu II	1573.6350	2	Si I
1643.7979	10	Ca II	1604.8475	20	Cu II	1571.4058	2	Si I
1643.1931	4	Ge I	1604.0815	15	Ar II	1569.4155	10	Cu II
1642.8033	2	Ca II	1603.0743	8	Ar II	1569.3853	50	Al II
1639.7300	6	Ge I	1602.9715	6	C I	1569.2123	10	Cu II
1636.6050	10	Cu II	1602.4864	10	Ge II	1568.1963	2	Si I
1635.2590	2	Ge I	1602.3880	40	Cu II	1566.4148	40	Cu II
1633.9851	18	Si I	1602.2729	15	Cu II	1565.9243	40	Cu II
1633.3277	8	Si I	1600.1327	8	Ar II	1562.4422	2	Ar II
1633.2230	9	Si I	1598.7212	2	Ar II	1561.4384	40	C I
1632.0013	10	Zn I	1598.4023	40	Cu II	1561.3402	10	C I
1630.2681	25	Cu II	1597.9620	12	Si I	1560.7090	10	C I
1630.1733	2	Ge I	1596.0586	12	Al II	1560.6822	30	C I
1629.9477	20	Si I	1595.7552	6	Si I	1560.3092	15	C I
1627.7459	6	Si I	1594.9493	14	Si I	1559.0712	4	Ar II
1627.0498	4	Si I	1594.5655	14	Si I	1558.3447	30	Cu II
1625.7051	14	Si I	1593.5556	60	Cu II	1557.5867	20	Cu II
1625.6271	15	Al II	1592.4234	12	Si I	1555.764	10	Zn II
1625.5320	7	Si I	1592.0200	4	Si I	1555.7030	50	Cu II
1624.1300	2	Ge I	1591.1233	4	Si I	1555.1344	40	Cu II
1623.4971	2	Si I	1590.5763	3	Si I	1554.6415	15	Ca II

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
1553.8962	25	Cu II	1512.4646	20	Cu II	1474.9348	20	Cu II
1553.1761	10	Ca II	1512.1739	20	Cu II	1474.5706	6	S I
1552.6464	50	Cu II	1510.9812	4	C I	1474.3785	20	S I
1551.3890	30	Cu II	1510.5058	35	Cu II	1473.9942	100	S I
1550.937	8	Zn II	1510.362	15	Zn II	1473.9785	25	Cu II
1550.6533	30	Cu II	1508.6323	30	Cu II	1473.5299	15	Cu II
1547.9582	10	Cu II	1508.1846	25	Cu II	1473.0187	18	S I
1545.2485	2	C I	1505.3878	20	Cu II	1472.9708	50	S I
1544.6771	40	Cu II	1504.7571	25	Cu II	1472.3950	20	Cu II
1543.9594	3	C I	1503.3682	15	Cu II	1472.2317	2	C I
1542.1769	8	C I	1501.3363	10	Cu II	1470.6974	40	Cu II
1541.7032	75	Cu II	1499.5132	10	Cu II	1470.0940	3	C I
1541.5099	2	C I	1496.6867	35	Cu II	1469.6928	15	Cu II
1540.5883	30	Cu II	1495.4298	25	Cu II	1469.610	40	Xe I
1540.3887	30	Cu II	1494.6751	250	N I	1468.8451	4	Zn I
1540.2394	20	Cu II	1493.3665	25	Cu II	1468.4106	3	C I
1540.122	5	Zn II	1493.133	30	Zn II	1467.4024	12	C I
1539.8303	100	Al II	1492.8343	30	Cu II	1466.7284	5	Cu II
1538.4795	10	Cu II	1492.8195	50	N I	1466.5240	10	Cu II
1538.0907	20	Ge II	1492.7376	2	C I	1466.0702	20	Cu II
1537.5590	50	Cu II	1492.6817	10	Cu II	1465.5408	15	Cu II
1535.5238	15	Cu II	1492.6254	400	N I	1463.8381	40	Cu II
1535.085	20	Zn II	1492.1525	10	Cu II	1463.7515	20	Cu II
1535.0023	25	Cu II	1491.7647	30	Be I	1463.3367	20	C I
1533.9865	25	Cu II	1488.927	12	Zn II	1462.743	15	Zn II
1533.4318	100	Si II	1488.8311	75	Cu II	1461.5539	15	Cu II
1532.1306	30	Cu II	1487.1503	40	S I	1459.4117	25	Cu II
1531.8559	50	Cu II	1486.065	70	Zn II	1459.0314	10	C I
1526.9276	5	Cu II	1485.6219	25	S I	1458.0016	30	Cu II
1526.7071	50	Si II	1485.3277	20	Cu II	1457.5717	20	Zn I
1525.7645	15	Cu II	1483.5029	6	Ne II	1457.423	10	Zn II
1524.8601	20	Cu II	1483.2337	20	S I	1457.1759	10	Cu II
1523.903	15	Zn II	1483.0392	70	S I	1456.907	50	Zn II
1523.7413	10	Cu II	1482.8903	20	Mg II	1452.2935	20	Cu II
1522.5768	15	Cu II	1481.7631	15	C I	1450.779	70	Zn II
1520.5396	20	Cu II	1481.7133	15	S I	1450.3035	25	Cu II
1519.8371	60	Cu II	1481.6635	30	S I	1449.0580	20	Cu II
1519.4918	50	Cu II	1481.5438	20	Cu II	1448.2302	20	S I
1517.9300	10	Cu II	1480.8797	10	Mg II	1445.9835	20	Cu II
1517.6310	20	Cu II	1478.216	30	Zn II	1445.042	70	Zn II
1517.1599	10	Cu II	1478.0030	30	Mg II	1443.5419	10	Cu II
1514.761	12	Zn II	1477.015	40	Zn II	1442.1386	15	Cu II
1514.4924	50	Cu II	1476.0593	15	Cu II	1439.091	50	Zn II
1514.2339	10	Cu II	1475.9998	15	Mg II	1436.9674	20	S I
1513.3659	20	Cu II	1475.9603	8	Ne II	1436.2359	15	Cu II

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
1436.160	5	Si III	1396.1136	500	S I	1354.2886	10	C I
1435.772	10	Si III	1393.1275	10	Cu II	1351.8366	25	Cu II
1435.5031	3	Hg I	1392.5893	250	S I	1351.6568	100	Cl I
1435.3155	10	Cu II	1391.8544	7	Ne II	1350.5938	15	Cu II
1434.9037	25	Cu II	1391.7029	6	Ne II	1350.1782	80	Al II
1434.7699	15	Cu II	1389.9569	400	Cl I	1347.2397	200	Cl I
1433.8404	10	Cu II	1389.6928	500	Cl I	1342.5536	6	Ca II
1433.7493	9	Ca II	1389.1544	150	S I	1341.8901	12	Ca II
1433.3104	15	S I	1388.4901	5	Ne II	1340.9141	3	Cu II
1433.2787	50	S I	1388.4357	450	S I	1335.7257	60	Cl I
1432.5028	6	Ca II	1387.5158	8	Ne II	1335.7077	600	C II
1430.991	15	Zn II	1385.893	2	Mn II	1335.6627	90	C II
1430.2428	40	Cu II	1385.5109	200	S I	1334.5323	300	C II
1428.5822	9	Ne II	1384.1319	60	Al III	1332.2228	5	Cu II
1428.3580	15	Cu II	1382.304	2	Mn II	1331.8907	5	Cu II
1427.8290	20	Cu II	1381.5527	250	S I	1329.6005	4	C I
1427.5912	10	Cu II	1379.6696	30	Al III	1329.5775	10	C I
1426.1167	15	Be I	1379.5278	400	Cl I	1329.1233	2	C I
1425.2191	7	S I	1377.945	3	Mn II	1329.1004	4	C I
1425.1878	12	S I	1375.5019	3	Cu II	1329.0853	3	C I
1425.0300	80	S I	1373.1163	50	Cl I	1328.8333	3	C I
1423.5645	8	Ne II	1371.8399	20	Cu II	1328.4129	5	Cu II
1421.7589	25	Cu II	1371.2401	80	Al II	1326.6432	30	S I
1421.3737	5	Cu II	1370.5600	2	Cu II	1326.570	6	N I
1418.4265	25	Cu II	1369.4231	10	Mg II	1326.3954	10	Cu II
1418.3779	9	Ne II	1367.9509	25	Cu II	1325.5135	3	Cu II
1415.7144	7	Ne II	1367.7082	5	Mg II	1323.9955	2	C II
1414.8980	10	Cu II	1367.2565	20	Mg II	1323.9513	15	C II
1413.9570	7	Ne II	1367.047	5	Si III	1323.9059	10	C II
1412.8734	15	S I	1365.5442	10	Mg II	1323.8617	2	C II
1411.9483	30	N I	1364.1639	12	C I	1323.7943	6	Cu II
1411.932	20	N I	1363.5031	5	Cu II	1323.516	40	S I
1409.7467	6	Ne II	1363.4471	250	Cl I	1323.2042	3	Cu II
1409.3378	20	S I	1362.5997	20	Cu II	1322.6326	6	Cu II
1408.8079	2	Zn I	1362.461	100	B II	1321.7962	5	Cu II
1407.1689	15	Cu II	1361.596	8	Si III	1320.6858	10	Cu II
1405.3752	8	Ne II	1359.9362	5	Cu II	1319.675	12	N I
1404.1193	8	Zn I	1359.2753	4	C I	1319.001	6	N I
1403.6827	8	Ne II	1359.0091	20	Cu II	1316.6183	18	S I
1402.7770	15	Cu II	1358.7730	30	Cu II	1316.5423	30	S I
1402.6190	20	Hg I	1358.5123	10	O I	1315.9184	2	C I
1401.5142	15	S I	1357.6593	2	C I	1314.3366	30	Cu II
1399.5333	8	Ne II	1357.1345	6	C I	1314.1495	15	Cu II
1398.6419	10	Cu II	1355.5977	15	O I	1313.4648	3	C I
1396.5267	250	Cl I	1355.3053	15	Cu II	1313.2493	6	S I

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
1311.9244	2	C I	1280.0991	5	S I	1248.7916	5	Cu II
1311.3629	10	C I	1279.8905	8	C I	1243.307	30	N I
1310.944	12	N I	1279.4978	2	C I	1243.178	50	N I
1310.6372	2	C I	1279.2287	4	C I	1241.9641	2	Cu II
1310.5403	18	N I	1279.0559	3	C I	1240.3947	25	Mg II
1310.1940	14	S I	1277.9539	2	C I	1239.9252	50	Mg II
1309.4633	15	Cu II	1277.7230	8	C I	1239.1674	6	Ne II
1309.4434	6	Mg II	1277.5497	30	C I	1237.0589	50	Ge II
1309.2766	15	Si II	1277.5131	3	C I	1235.838	30	Kr I
1308.2971	30	Cu II	1277.2824	20	C I	1235.8371	15	Hg I
1308.2807	10	Mg II	1277.2452	10	C I	1232.2293	25	Hg I
1307.8754	3	Mg II	1276.7499	4	C I	1230.168	20	B II
1307.7509	25	Hg I	1276.4823	2	C I	1229.8367	9	Ne II
1306.7139	5	Mg II	1275.5717	30	Cu II	1229.6873	7	Ne II
1306.0286	30	O I	1274.9841	3	C I	1228.790	4	N I
1305.8834	13	S I	1274.4651	3	Cu II	1225.369	4	N I
1305.5608	5	Cu II	1274.0708	3	Cu II	1225.0257	6	N I
1304.8576	90	O I	1272.0417	8	Cu II	1222.3711	10	Hg I
1304.3711	8	Si II	1271.3178	2	Cu II	1220.3672	20	Hg I
1303.4295	11	S I	1270.7821	15	S I	1217.6477	30	O I
1303.1105	10	S I	1269.2086	5	S I	1215.6701	100	H I
1302.8633	10	S I	1268.8247	50	Hg I	1215.3394	100	D I
1302.3370	15	S I	1266.6481	70	Al II	1213.9035	5	Hg I
1302.1685	150	O I	1266.4151	2	C I	1212.6478	10	Hg I
1301.0103	15	Hg I	1266.3101	10	Cu II	1211.9531	50	Al II
1299.2678	10	Cu II	1265.5062	15	Cu II	1211.8983	60	Al II
1298.3949	15	Cu II	1265.0022	8	Si II	1210.0817	50	Al II
1296.1738	8	S I	1264.7379	80	Si II	1209.1914	40	Al II
1295.6526	16	S I	1264.7096	10	Ge II	1208.3522	50	Al II
1295.586	20	Xe I	1262.9249	3	Cu II	1205.9029	2	Cu II
1291.577	2	Mn II	1262.8596	8	S I	1201.6258	2	Cu II
1290.925	2	Mn II	1261.9053	50	Ge II	1201.3527	20	Cl I
1289.9775	3	C I	1261.5520	10	C I	1201.118	2	Mn II
1288.4226	5	C I	1261.4258	5	C I	1200.7098	150	N I
1288.0370	2	C I	1261.1224	5	C I	1200.2233	350	N I
1287.4683	15	Cu II	1260.9963	3	C I	1199.5496	500	N I
1284.8712	8	Cu II	1260.9267	4	C I	1199.391	2	Mn II
1282.4547	15	Cu II	1260.7353	5	C I	1197.3941	4	Si II
1281.4616	8	Cu II	1260.4223	40	Si II	1197.184	4	Mn II
1280.8471	8	C I	1259.2418	10	Hg I	1194.6146	8	C I
1280.5971	6	C I	1258.8585	70	Al II	1194.5004	20	Si II
1280.4043	2	C I	1253.1809	5	Cu II	1194.4883	10	C I
1280.3330	20	C I	1250.5637	40	Hg I	1194.4056	6	C I
1280.2682	5	Cu II	1250.207	10	Xe I	1194.3010	4	C I
1280.1351	6	C I	1250.0483	10	Cu II	1194.2294	4	C I

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
1194.0636	10	C I	1145.3941	3	Cl I	1090.2706	7	Cl I
1193.9953	4	C I	1144.8556	30	Cu II	1088.3953	20	Cu II
1193.3933	10	C I	1144.2909	8	Cl I	1086.1102	5	Cu II
1193.2898	8	Si II	1142.9529	20	Al II	1085.701	150	N II
1193.2644	4	C I	1142.6405	20	Cu II	1085.546	30	N II
1193.2402	30	C I	1141.7445	2	C II	1085.529	2	N II
1192.4508	4	C I	1141.6246	4	C II	1085.442	2	Xe I
1192.2173	2	C I	1139.3317	4	C II	1085.3035	5	Cl I
1192.036	10	Xe I	1138.9358	2	C II	1085.1709	4	Cl I
1191.8111	50	Al II	1135.3310	6	Cl I	1084.6671	4	Cl I
1190.4160	4	Si II	1134.9803	300	N I	1084.580	80	N II
1190.0518	40	Al II	1134.4149	200	N I	1084.562	30	N II
1189.6308	20	C I	1134.1653	100	N I	1083.990	40	N II
1189.4470	15	C I	1133.9341	6	Cl I	1079.8821	3	Cl I
1189.2488	8	C I	1132.8528	5	Cl I	1079.0796	100	Cl II
1189.1854	30	Al II	1132.7256	3	Al II	1078.584	2	Xe I
1189.0651	6	C I	1129.307	4	Xe I	1075.2293	100	Cl II
1188.9926	15	C I	1123.2260	5	Cu II	1075.0720	10	Ge II
1188.8330	6	C I	1119.9470	15	Cu II	1073.7789	5	Ne II
1188.7743	25	Cl I	1110.713	4	Xe I	1073.7454	30	Cu II
1188.7515	6	Cl I	1110.2948	8	Cl I	1071.7667	120	Cl II
1179.3541	30	Al II	1107.5282	10	Cl I	1071.0358	180	Cl II
1179.2927	60	Cl I	1105.1765	5	Cu II	1070.409	1	Xe I
1177.6948	5	N I	1101.9362	4	Cl I	1070.3112	15	Cu II
1177.4371	40	Al II	1101.3381	6	Cl I	1069.1954	50	Cu II
1176.5098	9	N I	1100.3597	2	N I	1068.6488	7	Ne II
1170.410	8	Xe I	1099.716	5	Xe I	1068.167	3	Xe I
1168.5358	7	N I	1099.5230	4	Cl I	1067.9442	60	Cl II
1168.3344	2	N I	1098.2599	2	N I	1066.6599	50	Ar I
1167.4485	10	N I	1098.0951	2	N I	1066.1343	20	Cu II
1167.1479	15	Cl I	1098.0682	4	Cl I	1066.1332	10	C II
1164.867	10	Kr I	1097.3692	6	Cl I	1065.9199	2	C II
1164.3246	2	N I	1097.2372	5	N I	1065.8913	18	C II
1164.208	3	Mn II	1097.0529	25	Cu II	1065.7821	20	Cu II
1163.8836	3	N I	1096.8098	5	Cl I	1063.8311	120	Cl II
1163.326	4	Mn II	1095.7971	8	Cl I	1063.0052	60	Cu II
1162.015	5	Mn II	1095.6619	7	Cl I	1060.6343	60	Cu II
1158.9667	4	C I	1095.1483	7	Cl I	1059.0960	60	Cu II
1158.2103	10	Al II	1094.7686	8	Cl I	1058.7988	40	Cu II
1157.9095	15	C I	1094.4025	30	Cu II	1056.9546	60	Cu II
1157.4055	3	C I	1092.4366	5	Cl I	1056.6613	40	Al II
1157.0881	30	Al II	1092.1287	4	Cl I	1055.7968	40	Cu II
1157.0206	5	Cu II	1091.2916	5	Cu II	1055.2802	30	Al II
1156.5602	4	C I	1090.9815	5	Cl I	1055.0261	2	Ge II
1152.1512	50	O I	1090.7386	4	Cl I	1054.6901	60	Cu II

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
1054.6031	20	Al II	1023.7003	6	Si II	973.8852	6	O I
1052.1747	20	Cu II	1022.4143	1	Cl I	973.2342	20	O I
1050.4028	10	Cu II	1022.1021	5	Cu II	972.5368	7	H I
1050.1536	10	Cu II	1020.6990	3	Si II	972.2722	7	D I
1049.9233	50	Al II	1020.1076	15	Cu II	971.7381	30	O I
1049.7554	50	Cu II	1019.6545	15	Cu II	968.0416	25	Cu II
1049.3640	20	Cu II	1018.7073	50	Cu II	967.944	15	Si III
1048.5588	45	Al II	1018.0642	15	Cu II	965.0413	2	N I
1048.2199	100	Ar I	1017.9980	15	Cu II	964.6256	4	N I
1047.8893	35	Al II	1017.0600	2	Ge II	963.9903	6	N I
1044.7435	80	Cu II	1016.6377	10	Ge II	963.374	2	Kr I
1044.5188	80	Cu II	1013.6635	3	Cl I	961.4997	40	Cl II
1041.6876	10	O I	1012.5971	25	Cu II	960.4135	20	Cu II
1041.1480	1	Cl I	1010.2690	30	Cu II	958.1542	40	Cu II
1040.9425	30	O I	1008.7284	30	Cu II	956.2903	25	Cu II
1040.3475	3	Cl I	1008.5688	30	Cu II	955.9766	30	Al II
1039.5821	60	Cu II	1004.0554	30	Cu II	954.8466	25	Al II
1039.3477	60	Cu II	1003.550	5	Kr I	954.3830	20	Cu II
1039.2304	50	O I	1002.3464	2	Cl I	954.3050	30	Al II
1038.7779	2	Cl I	1001.061	5	Kr I	953.9699	6	N I
1037.5871	3	Cl I	1001.0130	8	Cu II	953.6549	4	N I
1037.0182	300	C II	999.4974	30	O I	953.4152	2	N I
1036.4695	60	Cu II	999.1011	5	Ge II	953.404	2	Kr I
1036.3367	150	C II	998.3060	8	Cu II	953.1822	25	Al II
1035.2148	3	Cl I	992.9532	25	Cu II	952.9413	2	O I
1035.1628	8	Cu II	990.8623	35	Al II	952.6301	15	Al II
1033.5677	10	Cu II	990.8010	15	O I	952.3178	6	O I
1031.7662	8	Cu II	990.5327	5	Cl II	951.056	1	Kr I
1031.5070	1	Cl I	990.2043	30	O I	950.8846	10	O I
1031.3486	2	Cl I	990.1269	12	O I	950.7327	4	O I
1030.2633	20	Cu II	989.6475	30	Al II	950.1121	12	O I
1030.023	5	Kr I	989.0525	20	Al II	949.7430	3	H I
1029.7508	10	Cu II	988.7734	60	O I	949.4847	3	D I
1028.6162	1	Cl I	988.6549	12	O I	948.6855	20	O I
1028.3279	25	Cu II	987.7772	35	Al II	946.7694	5	Mg II
1028.1571	10	O I	987.6570	10	Cu II	946.7032	10	Mg II
1027.8311	50	Cu II	986.5712	30	Al II	946.535	2	Kr I
1027.4307	30	O I	985.9802	20	Al II	945.9648	50	Cu II
1027.3386	1	Cl I	978.946	3	B II	945.8769	40	Cu II
1026.1133	10	Mg II	978.6170	4	O I	945.5249	60	Cu II
1025.9681	20	Mg II	977.9594	12	O I	945.441	3	Kr I
1025.7618	50	O I	977.5674	25	Cu II	943.3348	60	Cu II
1025.7223	20	H I	976.5532	10	Cu II	939.5232	10	Cu II
1025.5528	2	Cl I	976.4481	20	O I	939.2346	3	O I
1025.4433	20	D I	974.7589	20	Cu II	939.097	5	Si III

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
938.6249	2	O I	907.4115	2	Mg II	873.2629	15	Cu II
938.0200	6	O I	907.3752	4	Mg II	872.8505	20	Cl II
937.8405	5	O I	906.1134	40	Cu II	872.1338	10	Cl II
937.8035	2	H I	905.9771	1	Ge II	871.0676	8	Cu II
937.5484	2	D I	904.4801	60	C II	870.5389	8	Cu II
936.6295	10	O I	904.1416	300	C II	869.7541	15	Ar I
935.8977	60	Cu II	903.9616	120	C II	869.3360	25	Cu II
935.3434	20	Cu II	903.6235	60	C II	869.0641	10	Cu II
935.2752	20	Al II	901.0731	60	Cu II	869.0127	10	Cl II
935.2325	40	Cu II	897.7932	15	Cu II	868.5774	30	Cl II
935.1930	30	O I	896.9762	40	Cu II	867.7336	8	Cu II
935.0198	25	Al II	896.7588	60	Cu II	866.8000	18	Ar I
934.0150	20	Al II	895.9539	36	Cl II	866.4427	5	Cu II
933.9382	20	Al II	894.3102	15	Ar I	865.3902	40	Cu II
933.4077	10	Al II	894.2274	40	Cu II	864.6198	20	Cl II
932.9780	10	Cl II	893.896	4	Al III	864.069	3	B II
932.9385	5	Al II	893.6777	80	Cu II	862.2339	1	Ge II
932.4075	4	Al II	893.5483	40	Cl II	861.9936	40	Cu II
932.0537	75	Ar II	892.4144	50	Cu II	858.5590	40	C II
930.8862	3	O I	892.0242	2	Al III	858.4869	25	Cu II
930.7483	1	H I	890.5669	60	Cu II	858.0918	20	C II
930.4951	1	D I	889.8173	10	Cl II	856.7457	20	Al III
929.5168	5	O I	888.0256	40	Cl II	855.7002	10	Cu II
928.711	1	Kr I	886.9434	60	Cu II	855.4762	5	Cu II
926.9588	24	Cl II	886.5111	10	Cu II	855.0340	10	Al III
924.3022	2	Cl II	885.8472	25	Cu II	852.9061	3	Cu II
924.2386	50	Cu II	884.4346	8	Cu II	851.6917	100	Cl II
923.713	1	Kr I	884.1332	10	Cu II	851.3027	25	Cu II
922.4161	20	Cu II	882.8895	15	O I	850.7509	4	Cl II
922.0727	10	O I	879.9466	18	Ar I	850.7480	2	Cu II
922.0190	60	Cu II	879.5507	8	O I	849.3594	3	Cu II
922.0081	10	O I	879.1001	10	O I	848.8075	15	Cu II
921.3670	20	Al II	879.0194	6	O I	844.9122	5	Cu II
920.7160	10	Al II	878.9720	8	O I	844.6128	3	Cu II
920.5537	2	Ge II	878.6986	50	Cu II	842.8051	10	Ar I
920.3166	15	Al II	878.2007	10	O I	841.4191	140	Cl II
919.7810	100	Ar II	877.8787	30	O I	839.6001	160	Cl II
916.704	150	N II	877.8471	15	Cu II	839.2972	120	Cl II
916.015	60	N II	877.7983	10	O I	835.0021	10	Ar I
915.962	30	N II	877.5548	20	Cu II	834.7223	40	Cl II
915.612	30	N II	877.0121	25	Cu II	834.6463	60	Cl II
914.8574	7	Cl II	876.7227	20	Cu II	834.4229	20	Cl II
914.2133	80	Cu II	876.0577	18	Ar I	834.3918	15	Ar I
911.9457	5	Al II	875.4927	1	Ge II	829.8029	16	Cl II
910.5185	15	Cu II	874.2790	10	Cl II	826.9961	30	Cu II

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
826.3649	12	Ar I	754.5869	16	Cl II	704.5238	9	Ar II
825.3460	12	Ar I	753.6251	12	Cl II	701.0721	5	Cl II
823.409	15	Si III	749.939	5	Si IV	698.7745	9	Ar II
820.1235	8	Ar I	748.369	10	N II	698.4482	5	Cl II
818.128	30	Si IV	748.1982	7	Ar II	697.9419	6	Ar II
816.4640	7	Ar I	747.5649	2	Cl II	697.4890	5	Ar II
816.2320	12	Ar I	746.984	15	N II	697.0488	30	Rb II
815.053	15	Si IV	745.841	5	N II	696.2170	15	Al III
813.8834	20	Cu II	745.3222	12	Ar II	696.1386	24	Cl II
812.1594	5	O I	744.9248	15	Ar II	695.8289	30	Al III
812.0936	7	O I	743.7196	35	Ne I	693.947	15	B II
811.7064	4	O I	741.4562	100	Rb II	693.5947	30	Cl II
811.4968	5	O I	740.2692	15	Ar II	693.3019	6	Ar II
811.0512	20	O I	738.9117	4	Cl II	692.7820	7	Cl II
810.9984	15	Cu II	737.4537	2	Ar II	691.0373	5	Ar II
810.6650	7	O I	736.0319	25	Cu II	690.9645	16	Cl II
806.5472	3	Cu II	735.8963	100	Ne I	688.1424	14	Cl II
802.8911	4	Cl II	735.5203	20	Cu II	687.6575	30	Cl II
797.8455	20	Cl II	730.9424	30	Cl II	687.346	120	C II
797.4552	10	Cu II	730.9297	12	Ar II	687.0526	60	C II
795.3537	80	Cl II	729.5235	24	Cl II	686.4884	6	Ar II
793.4574	80	Cl II	729.3406	30	Cl II	685.3968	2	Cu II
793.3424	100	Cl II	728.9513	50	Cl II	685.1406	8	Cu II
792.9671	10	O I	726.9152	2	Al III	684.8623	20	Cl II
792.9381	9	O I	725.6826	1	Al III	682.0516	30	Cl II
792.5063	7	O I	725.6570	20	Cl II	679.4006	15	Ar II
792.2628	60	Cl II	725.5485	18	Ar II	679.2184	10	Ar II
792.2330	9	O I	725.2717	40	Cl II	677.9518	10	Ar II
791.9732	30	O I	724.4887	15	Cu II	676.2425	12	Ar II
791.5136	10	O I	723.3606	30	Ar II	675.6020	2	Cu II
789.0997	16	Cl II	719.2703	24	Cl II	672.8563	8	Ar II
788.9860	60	Cl II	718.1787	10	Cu II	672.001	5	N II
788.7408	100	Cl II	718.0899	15	Ar II	671.8513	30	Ar II
787.5805	100	Cl II	717.5327	3	Cl II	671.8436	14	Cl II
779.2949	8	Cu II	717.1519	24	Cl II	671.773	5	N II
777.5623	40	Cl II	715.5874	26	Cl II	671.630	3	N II
775.965	100	N II	714.0521	26	Cl II	671.411	4	N II
774.7916	12	Cl II	712.9584	2	Cl II	671.386	15	N II
770.6986	2	O I	712.6792	28	Cl II	671.016	5	N II
770.3464	3	O I	711.1868	60	Rb II	670.9455	20	Ar II
769.4083	8	O I	710.5210	12	Cl II	667.4825	6	Cl II
769.3528	3	O I	710.348	100	Sr IV	666.1465	14	Cl II
762.2001	6	Ar II	709.3129	10	Cu II	666.0502	10	Cl II
761.5791	2	Ar II	709.1616	18	Cl II	666.0246	10	Cl II
754.8240	7	Ar II	707.4581	28	Cl II	666.0109	15	Ar II

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
665.5316	4	Cl II	618.6717	15	Ne I	582.5982	2	Ne I
665.2295	10	Cl II	618.0539	14	Cl II	582.156	3	N II
665.1679	8	Cl II	617.6293	10	Cl II	580.8645	6	Sr IV
664.7199	20	Cl II	617.3161	4	Cl II	580.2632	12	Ar II
664.5623	10	Ar II	616.4631	2	Cl II	578.6044	9	Ar II
664.434	200	Sr IV	615.6283	15	Ne I	578.1072	9	Ar II
663.6432	20	Cl II	615.3233	3	Cl II	576.7364	10	Ar II
663.0723	40	Cl II	612.3716	10	Ar II	575.4019	5	Cl II
662.1637	20	Cl II	602.8585	10	Ar II	574.650	5	N II
661.8690	18	Ar II	602.7263	12	Ne I	574.4088	16	Cl II
661.8394	26	Cl II	600.0366	6	Ne I	574.2946	10	Cl II
661.6588	6	Cl II	599.2056	10	Cl II	574.2809	120	C III
660.286	25	N II	598.8908	3	Ne I	573.3620	12	Ar II
659.8107	20	Cl II	598.7056	7	Ne I	572.0136	9	Ar II
657.9335	3	Cl II	598.4179	2	Cl II	572.0083	6	Cl II
655.1427	14	Cl II	598.3026	2	Cl II	571.9033	8	Cl II
653.8556	10	Cl II	597.7001	12	Ar II	569.8349	4	Cl II
653.334	10	Si III	595.9200	10	Ne I	566.8002	5	Cl II
652.219	6	Si III	595.022	20	C II	566.613	15	Si III
651.672	2	Si III	594.8000	10	C II	565.8366	5	Cl II
650.8935	20	Cl II	594.4756	6	Cl II	565.7376	6	Cl II
645.178	30	N II	593.2888	4	Cl II	565.5280	10	C III
644.837	20	N II	591.8303	5	Ne I	564.9716	4	Cl II
644.634	10	N II	591.4117	1	He I	564.7775	4	Cl II
643.8784	15	Rb II	590.8491	6	Cl II	564.5782	5	Cl II
643.2069	4	Cl II	589.9114	3	Ne I	563.6169	5	Cl II
639.4578	8	Cl II	589.9001	5	Cl II	562.752	75	Sr III
638.2909	18	Cl II	589.4192	25	Rb II	562.6651	4	Cl II
637.0691	14	Cl II	589.1793	3	Ne I	562.5662	6	Cl II
636.6244	20	Cl II	588.8564	4	Cl II	562.3684	6	Cl II
636.2511	4	C II	588.7857	7	Cl II	562.2867	2	Cl II
635.9945	2	C II	588.0413	4	Cl II	561.5930	4	Cl II
635.8802	16	Cl II	587.2128	3	Ne I	560.980	5	Si IV
635.197	3	N II	587.1616	4	Cl II	560.4369	10	C II
634.6222	8	Cl II	587.0041	3	Cl II	560.4331	5	Al III
634.2568	10	Cl II	586.4528	2	Cl II	560.3173	10	Al III
631.8314	8	Cl II	586.3828	8	Cl II	560.2394	5	C II
629.7388	18	Ne I	586.3141	2	Ne I	560.2233	9	Ar II
626.8232	20	Ne I	586.2442	10	Cl II	559.533	3	Si IV
626.7339	14	Cl II	586.1955	5	B II	559.5279	6	Cl II
623.0617	7	Cl II	585.2473	2	Ne I	559.4065	5	Cl II
621.1369	9	Cl II	584.8829	6	Cl II	559.3057	7	Cl II
620.2958	16	Cl II	584.7718	6	Cl II	556.8170	12	Ar II
619.9798	12	Cl II	584.3340	100	He I	555.7660	3	Ar II
619.1024	12	Ne I	583.4371	10	Ar II	555.0364	2	Rb II

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
553.1263	2	Ar II	516.344	10	Si IV	474.248	3	Sc IV
550.4810	4	Ar II	515.6165	5	He I	474.114	4	Sc IV
549.5700	2	C II	515.118	5	Si IV	472.995	5	Sc IV
549.5110	10	C II	514.373	100	Sr III	471.789	5	Sc IV
549.3785	4	C II	514.3100	7	Ar II	471.7580	25	Sr IV
549.3195	2	C II	513.849	1	N II	470.251	5	Sc IV
548.7808	7	Ar II	513.2661	2	Rb II	467.392	3	Sc IV
547.9961	4	Ar II	512.0982	3	He I	466.963	3	Sc IV
547.4606	12	Ar II	511.5225	40	C III	466.194	5	Sc IV
547.1651	9	Ar II	511.1907	2	Al III	466.131	5	Si III
546.1768	8	Ar II	511.1384	4	Al III	465.482	5	Sc IV
543.7305	9	Ar II	510.758	2	N II	465.2331	20	Sr IV
543.2033	15	Ar II	509.9979	2	He I	463.663	4	Sc IV
542.9124	10	Ar II	508.6431	1	He I	462.567	6	Sc IV
541.3020	2	Ar II	507.033	40	Sr III	462.3908	50	Ne II
540.9047	2	Cl II	503.6504	2	Ar II	461.812	3	Sc IV
540.0270	2	Cl II	502.1630	2	Ar II	460.7284	100	Ne II
538.3120	200	C III	501.1897	2	Ar II	460.0487	15	C III
538.3083	4	Cl II	498.6804	18	Sr IV	458.155	10	Si IV
538.1487	120	C III	497.4296	1	Rb II	457.815	20	Si IV
538.0801	40	C III	492.6500	10	C III	456.8962	9	Ne II
537.1396	5	Ar II	492.4083	5	Ar II	456.3485	12	Ne II
537.0296	25	He I	491.782	50	Sr III	455.2730	20	Ne II
535.2885	40	C III	489.1954	8	Ar II	454.6540	15	Ne II
534.1859	25	Sr IV	488.9615	4	Ar II	450.7338	25	C III
533.815	3	N II	488.7927	9	Ar II	449.4736	15	Sr IV
533.729	8	N II	488.4160	20	Sr IV	447.8146	18	Ne II
533.650	3	N II	488.2599	20	Sr IV	446.5902	25	Ne II
533.581	5	N II	487.2272	10	Ar II	446.2552	30	Ne II
533.511	3	N II	484.511	13	V V	445.748	3	Sc IV
531.8467	18	Sr IV	484.2049	25	Sr IV	445.0393	20	Ne II
530.4954	9	Ar II	483.007	15	V V	444.623	4	Sc IV
530.1729	3	Rb II	481.557	8	V V	442.7302	25	Sr IV
529.867	5	N II	481.434	6	Sc IV	442.262	6	Sc IV
529.722	2	N II	479.2178	2	Ar II	441.495	7	Sc IV
529.637	2	N II	478.6113	20	Sr IV	441.189	7	Sc IV
529.491	1	N II	478.611	3	Sc IV	440.1472	15	Sr IV
529.413	2	N II	477.765	4	Sc IV	438.980	5	Sc IV
529.355	2	N II	477.6246	1	C III	438.786	9	Sc IV
526.4969	7	Ar II	477.1049	4	Ar II	438.481	3	Sc IV
524.6804	9	Ar II	476.206	3	Sc IV	437.6558	20	Sr IV
522.7925	9	Ar II	475.9056	6	Ar II	437.3417	20	Sr IV
522.2128	10	He I	475.785	4	Sc IV	437.237	75	Sr III
519.3270	10	Ar II	474.673	5	Sc IV	436.138	5	Sc IV
518.9089	5	Ar II	474.531	4	Sc IV	434.398	5	Sc IV

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
433.3391	15	C III	371.2114	9	Sr III	305.5119	5	Sr IV
431.780	5	Sc IV	371.159	10	Sc IV	304.6589	10	Sr IV
430.6439	30	Sr IV	364.0494	10	Sr IV	303.7822	100	He II
430.3576	20	Sr IV	363.8598	5	C III	301.6691	12	Sr IV
430.2118	25	Sr IV	363.7852	3	C III	301.5910	10	Sr IV
426.691	4	Sc IV	363.7538	1	C III	300.3830	5	Sr IV
425.524	4	Sc IV	363.4916	10	Sr III	300.3254	5	Sr IV
422.627	3	Sc IV	362.4544	6	Ne II	300.2727	12	Sr IV
422.0751	15	Sr IV	361.659	3	Si IV	300.1237	15	Sr IV
422.023	5	Sc IV	361.560	6	Si IV	299.2723	9	Sr IV
421.328	3	Sc IV	361.4321	9	Ne II	299.0385	15	Sc IV
420.806	6	Sc IV	358.8008	6	Sr III	298.9823	10	Sr IV
420.503	5	Sc IV	357.5346	4	Ne II	298.1187	15	Sr IV
420.125	4	Sc IV	356.8762	2	Ne II	297.3237	8	Sr IV
420.004	5	Sc IV	356.8001	5	Ne II	296.7249	3	V V
419.7836	30	Sr IV	356.5398	3	Ne II	296.6941	5	Sr IV
419.525	6	Sc IV	356.4399	3	Ne II	296.6027	9	Sr IV
418.808	5	Sc IV	356.1288	4	Ne II	296.3108	15	Sc IV
416.448	4	Sc IV	355.9480	4	Ne II	295.8897	10	Sr IV
415.968	7	Sc IV	355.6550	4	Ne II	295.3501	8	Sr IV
415.3243	40	Sr IV	354.9620	6	Ne II	293.3046	8	Sr IV
413.0647	40	Sr IV	353.9297	3	Ne II	293.2161	12	Sr IV
412.969	5	Sc IV	353.2145	5	Ne II	293.1653	10	Sr IV
412.9304	30	Sr IV	352.9549	9	Ne II	293.0687	9	Sr IV
412.1026	12	Sr IV	352.2436	3	Ne II	291.3261	4	C III
411.9577	1	C III	351.6203	10	Sr III	291.1881	12	Sr IV
410.6711	20	Sr IV	334.1088	5	Sr III	291.0897	12	Sr IV
410.080	4	Sc IV	330.7887	2	Ne II	290.5323	10	Sr IV
407.1377	12	Ne II	330.6636	8	Sr III	289.8505	15	Sc IV
406.9426	35	Sr IV	327.6210	2	Ne II	289.6795	10	Sr IV
405.8538	15	Ne II	327.2605	3	Ne II	286.8383	9	V V
403.8494	35	Sr IV	326.7856	5	Ne II	285.9796	8	V V
399.9252	40	Sr IV	326.5376	4	Ne II	285.8335	8	O IV
399.1958	10	Sr IV	324.5686	2	Ne II	285.7103	4	O IV
396.2185	50	Sr IV	322.5741	16	C III	285.2983	10	Sr IV
394.8951	45	Sr IV	321.6105	5	Sr III	285.1680	10	Sr IV
392.9989	50	Sr IV	320.2926	2	He I	285.0364	10	Sr IV
392.4324	75	Sr IV	313.4738	5	Sr IV	284.5806	5	V V
389.0898	10	C III	313.3757	7	V V	284.4951	3	V V
389.0045	6	C III	312.3950	8	V V	284.3115	12	Sr IV
388.9687	2	C III	310.7067	4	Sr IV	283.1669	7	Sr IV
388.5834	4	Sr IV	310.1697	10	C III	283.0739	9	Sr IV
386.2028	300	C III	309.3077	9	Sr IV	281.8157	10	Sr IV
378.5275	20	Sr IV	307.0226	6	Sr IV	279.9330	120	O IV
377.4154	5	Sr IV	306.1795	6	Sr IV	279.6309	60	O IV

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
274.7384	10	Sr IV	214.2046	1	O IV	182.2421	15	Mg III
272.4493	20	Na III	214.1516	5	O IV	181.3441	14	Mg IV
272.0717	20	Na III	214.0277	2	O IV	181.2756	2	O IV
271.1892	6	Sr IV	213.9747	1	O IV	181.1497	1	O IV
268.6251	50	Na III	207.9957	5	Na III	180.7947	20	Mg IV
267.8713	50	Na III	207.8847	7	Na III	180.6144	25	Mg IV
267.8618	8	Sr IV	207.7956	100	O V	180.0693	12	Mg IV
267.6428	70	Na III	207.4593	6	Na III	178.0144	25	Li II
266.8945	25	Na III	207.2959	10	Na III	172.3099	20	Mg IV
264.2188	6	Sr IV	207.2386	9	O IV	172.1689	250	O V
260.5560	30	O IV	207.1826	5	O IV	171.8997	4	Mg III
260.5465	2	O IV	206.8729	6	Na III	171.6551	25	Mg IV
260.3889	45	O IV	203.3240	8	Na III	171.5758	10	Li II
256.3170	20	He II	203.2819	8	Na III	171.3941	15	Mg III
252.4396	9	V V	203.0527	8	Na III	170.8041	15	Mg III
251.6550	10	V V	203.0437	2	O IV	170.2194	8	O V
251.3725	30	Na III	202.8847	1	O IV	169.7427	6	Mg III
243.0266	7	He II	202.7607	8	Na III	169.1416	7	Mg III
240.9339	2	V V	202.4910	8	Na III	168.7430	5	Li II
239.4845	9	V V	202.3906	15	O V	168.0084	2	O V
239.4069	8	V V	202.3316	5	O V	167.9892	10	O V
238.5792	60	O IV	202.2805	5	O V	166.2351	5	O V
238.5697	540	O IV	202.2216	3	O V	166.1504	3	O V
238.3598	300	O IV	202.1825	6	Na III	166.1128	1	O V
237.3307	3	He II	202.1580	4	O V	164.7087	3	O V
234.3472	2	He II	202.1485	6	Na III	164.6569	8	O V
234.2644	80	Mg III	199.2793	100	Li II	164.6256	2	O V
232.5842	1	He II	196.0525	5	Na III	164.5887	2	O V
231.7336	100	Mg III	196.0063	15	O IV	164.5739	3	O V
223.4026	5	Sc IV	195.8596	8	O IV	164.1766	1	O V
220.3527	450	O V	195.5285	6	Na III	160.8023	11	Mg IV
220.2776	8	Sc IV	195.4536	3	Sc IV	160.2283	14	Mg IV
217.1897	5	Sc IV	194.5919	30	O V	156.2269	2	O V
217.1111	3	Na III	193.0058	4	O V	153.9516	2	O V
216.1177	12	Na III	192.9111	75	O V	151.5468	15	O V
215.8592	12	Na III	192.9035	425	O V	151.4774	9	O V
215.4814	8	Na III	192.7979	300	O V	151.4470	3	O V
215.3051	5	Sc IV	192.7501	100	O V	148.1186	10	Mg IV
215.2448	50	O V	188.5296	10	Mg III	147.8854	9	Mg IV
215.1028	30	O V	187.1966	20	Mg III	147.7487	11	Mg IV
215.0790	8	Na III	186.5143	20	Mg III	147.6314	8	Mg IV
215.0455	8	Na III	185.7450	50	O V	147.5352	17	Mg IV
215.0398	10	O V	184.1927	4	Mg IV	147.4973	4	Mg IV
214.5868	8	Na III	183.4399	11	Mg IV	147.3201	10	Mg IV
214.2300	7	Na III	182.9720	12	Mg III	147.2538	11	Mg IV

2.2.b. Vacuum Ultraviolet Linelist by Wavelength—Continued

Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum	Wavelength Å	Intensity	Spectrum
147.0518	11	Mg IV	105.4679	3	Li III	26.9898	7	C VI
147.0063	11	Mg IV	104.1421	2	Li III	26.3573	3	C VI
146.9526	20	Mg IV	103.3586	1	Li III	26.0260	2	C VI
146.8381	10	Mg IV	100.2552	100	Be III	25.8303	1	C VI
146.5264	11	Mg IV	88.3088	25	Be III	24.7810	100	N VII
140.9635	11	Mg IV	84.7545	10	Be III	21.8040	25	O VII
140.9142	8	Mg IV	83.2001	5	Be III	21.6020	100	O VII
140.8658	11	Mg IV	75.9277	100	Be IV	20.9098	20	N VII
140.5574	11	Mg IV	64.0648	20	Be IV	19.8258	7	N VII
140.5222	11	Mg IV	60.7431	7	Be IV	19.3613	3	N VII
140.4732	11	Mg IV	60.3145	100	B IV	19.1179	2	N VII
140.4251	10	Mg IV	59.3195	3	Be IV	18.9741	1	N VII
140.1719	17	Mg IV	58.5739	2	Be IV	18.9689	100	O VIII
140.1186	10	Mg IV	58.1333	1	Be IV	18.6285	25	O VII
139.9903	7	Mg IV	52.6807	25	B IV	17.7685	10	O VII
139.0289	8	O V	50.4342	10	B IV	17.3962	5	O VII
138.3915	8	Mg IV	49.4555	5	B IV	16.0059	20	O VIII
138.2617	10	Mg IV	48.5874	100	B V	15.1762	7	O VIII
138.1090	5	O V	40.9964	20	B V	14.8206	3	O VIII
138.0511	3	O V	40.7306	5	C V	14.6343	2	O VIII
138.0255	1	O V	40.2679	100	C V	14.5243	1	O VIII
137.9661	6	Mg IV	38.8709	7	B V			
135.5232	8	O V	37.9599	3	B V			
134.9977	100	Li III	37.4828	2	B V			
133.1967	9	Mg IV	37.2008	1	B V			
132.5123	3	Mg IV	34.9729	25	C V			
132.1238	5	Mg IV	33.7360	100	C VI			
124.6159	4	O V	33.4264	10	C V			
113.9051	20	Li III	32.7545	5	C V			
107.9990	7	Li III	28.4656	20	C VI			