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NRL Report 6085

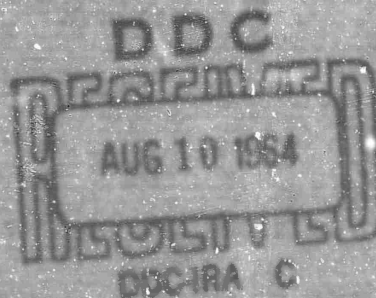
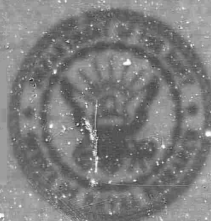
# Coulomb Approximation Oscillator Strengths of Spectral Lines from Light and Medium Elements

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## CONTENTS

Abstract	ii
Problem Statement	ii
Authorization	ii
SUMMARY	1
TABLE OF ABSORPTION OSCILLATOR STRENGTHS $f_{J'J}$ FOR VISIBLE LINES FROM THE COULOMB APPROXIMATION	3
TABLE OF ABSORPTION OSCILLATOR STRENGTHS $f_{J'J}$ FOR ULTRAVIOLET LINES FROM THE COULOMB APPROXIMATION	19

## ABSTRACT

This report contains a comprehensive table of absorption oscillator strengths for many spectral lines from various ionization stages of most elements between, and including, Li and Ca which have been calculated with the Coulomb approximation for the radial matrix elements, assuming LS-coupling. An average accuracy of 30 percent is suggested for visible lines emitted from neutral atoms. For ultraviolet lines, larger errors must be expected, with the accuracy improving as the degree of ionization increases. Absorption oscillator strengths for the lines in many of the strongest multiplets of the various spectra have also been included in the table. The lines and multiplets are arranged as in the multiplet tables for visible and ultraviolet lines by C. Moore (NBS Technical Note 36, and NBS Circular 488, Washington:U.S. Govt. Printing Office).

## PROBLEM STATUS

This is a final report on one phase of the problem of quantitative spectroscopy in a plasma. Work on other phases of the problem continues.

## AUTHORIZATION

NRL Problem H01-11  
Projects RR002-10-45-5054,  
NSF GP-1376, and NASA R-9

Manuscript submitted February 28, 1964.

## COULOMB APPROXIMATION OSCILLATOR STRENGTHS OF SPECTRAL LINES FROM LIGHT AND MEDIUM ELEMENTS

### SUMMARY

This report contains, in tabulated form, the results of extensive machine calculations of absorption oscillator strengths for spectral lines from two (except helium) and more electron systems. (For helium the Hartree-Fock results<sup>†</sup> should be used, and for the members of the one-electron sequence the exact hydrogen oscillator strengths are to be used.) The calculations are based on Coulomb approximation radial matrix elements obtained according to Bates and Damgaard.<sup>‡</sup> Effective quantum numbers were calculated from the empirical energy values, and relative line and multiplet strengths were calculated from Rohrlich's formulas<sup>\*\*</sup> using the table of Racah coefficients from Simon, et al.<sup>††</sup> Bates and Damgaard's table for the  $f$ -function was replaced by their analytical expression, but their tables for the  $d$ -functions were used in the original form, except that it was necessary to extrapolate in quite a number of cases. This extrapolation is especially critical for vacuum ultraviolet lines of neutral atoms.

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\*The IBM-7090 code was prepared by Mr. W.G. Hall and Mrs. J. Beiman at the National Bureau of Standards.

†E. Trefftz, A. Schiüter, K.H. Dettmar, and K. Jörgens, *Z. Astrophysik* 44:1 (1957).

‡H.A. Bethe and E.E. Salpeter, "Quantum Mechanics of One and Two Electron Systems," Berlin:Springer and New York:Academic Press (1957).

§D.R. Bates and A. Damgaard, *Phil. Trans. Roy. Soc. (London)*, A242:101 (1949).

¶C.E. Moore, "Atomic Energy Levels," NBS Circular 467, Vol. I, Washington:U.S. Govt. Printing Office (1949).

\*\*F. Rohrlich, *Astrophys. J.* 129:441 (1959).

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TABLE OF ABSORPTION OSCILLATOR STRENGTHS  $f_{j,j'}$  FOR VISIBLE LINES FROM THE COULOMB APPROXIMATION

Wavelength [ $\text{\AA}$ ] <sup>1</sup>	$E^2$	J-J'	$f_{j,j'}$	Wavelength [ $\text{\AA}$ ] <sup>2</sup>	$E^2$	J-J'	$f_{j,j'}$	Wavelength [ $\text{\AA}$ ] <sup>3</sup>	$E^2$	J-J'	$f_{j,j'}$
L I 6707.7 (1)	1.84	1/2-3/2	0.498	Be II 5270.8 (3)	14.25	3/2-1/2	0.135	C I 4771.7 (6)	10.04	2-2	0.00468
6707.9	1.84	1/2-1/2	0.249	5270.3	14.25	1/2-1/2	0.135	4766.6	10.04	1-1	0.00149
3232.6 (2)	3.82	1/2-3/2	0.00346	4361.0 (4)	14.74	3/2-5/2	0.467	4775.9	10.04	2-1	0.00146
3232.6	3.82	1/2-1/2	0.00173	4361.0	14.74	3/2-3/2	0.0519	4770.0	10.04	1-0	0.00188
8126.5 (3)	3.36	3/2-1/2	0.110	4360.7	14.74	1/2-3/2	0.519	4762.4	10.04	1-2	0.00266
8126.5	3.36	1/2-1/2	0.110	3261.8 (5)	15.72	3/2-1/2	0.0216	4762.4	10.04	0-1	0.00604
6103.6 (4)	3.86	3/2-5/2	0.582	4673.5 (6)	14.75	5/2-7/2	0.967	4065.1 (7)	10.49	2-3	0.000046
6103.6	3.86	3/2-3/2	0.0646	4673.5	14.75	5/2-5/2	0.0483	4064.2	10.49	1-2	0.000142
6103.6	3.86	1/2-3/2	0.646	4673.5	14.75	3/2-5/2	1.015	9405.8 (9)	8.96	0-1	0.000320
4971.9 (5)	4.32	3/2-1/2	0.0125	B II 4122.0 (2)	21.59	2-3	0.808	8335.2 (10)	9.13	1-2	0.616
4971.9	4.32	1/2-1/2	0.0125	4122.0	21.59	2-2	0.101	5380.2 (11)	9.95	1-0	0.00514
4603.0 (6)	4.52	3/2-5/2	0.109	4122.0	21.59	1-2	0.910	5052.1 (12)	10.09	1-1	0.0162
4603.0	4.52	3/2-3/2	0.0122	4122.0	21.59	3-4	0.835	4932.0 (13)	10.15	1-2	0.00764
4603.0	4.52	1/2-3/2	0.112	4122.0	21.59	3-3	0.0722	4371.3 (14)	10.47	1-0	0.00286
L I I 5484.6 (1)	61.02	1-2	0.170	4122.0	21.59	3-2	0.00206	4269.0 (16)	10.54	1-2	0.00318
5484.6	61.02	1-1	0.102	B III 4243.6 (1)	32.89	3/2-5/2	0.451	4231.4 (17)	10.57	1-0	0.00207
5484.6	61.02	1-0	0.0340	4243.6	32.89	3/2-3/2	0.0501	11330.4 (19)	9.59	1-2	0.647
3684.1 (2)	71.83	1-2	0.105	4243.6	32.89	1/2-3/2	0.500	10548.0 (20)	9.67	1-1	0.107
3684.1	71.83	1-1	0.0628	4487.5 (2)	32.89	5/2-7/2	0.846	6828.5 (21)	10.31	1-2	0.00610
3684.1	71.83	1-0	0.0209	4487.5	32.89	5/2-5/2	0.0423	6587.8 (22)	10.37	1-1	0.0161
4156.3 (3)	71.95	0-1	0.267	4487.5	32.89	3/2-5/2	0.888	11894.9 (23)	9.65	3-2	0.139
4881.3 (4)	71.60	2-1	0.0851	C I 10691.4 (1)	8.61	2-3	0.432	11894.9	9.64	2-1	0.105
4881.3	71.60	1-1	0.0851	10683.2	8.61	1-2	0.385	11880.4	9.64	1-0	0.0776
4881.3	71.60	0-1	0.0851	10685.4	8.60	0-1	0.512	11849.3	9.65	2-2	0.0346
4325.7 (5)	71.92	2-3	0.426	10729.6	8.61	2-2	0.0768	11863.0	9.64	1-1	0.0580
4325.7	71.92	2-2	0.0761	10707.4	8.60	1-1	0.128	11754.0 (24)	9.66	3-4	0.702
4325.7	71.92	2-1	0.00508	10754.1	8.60	2-1	0.00511	11747.5	9.66	2-3	0.677
4325.7	71.92	1-2	0.381	9658.5 (2)	8.73	2-1	0.113	11801.8	9.66	1-2	0.761
4325.7	71.92	1-1	0.127	9620.9	8.73	1-1	0.113	11667.1 (25)	9.67	3-3	0.0605
4325.7	71.92	0-1	0.508	9603.1	8.73	0-1	0.113	11631.6	9.67	3-3	0.122
Be I 3321.3 (1)	6.43	2-1	0.0342	9094.9 (3)	8.81	2-2	0.265	11609.9	9.67	2-2	0.095
3321.1	6.43	1-1	0.0342	9078.3	8.81	1-1	0.0882	11677.0	9.67	1-1	0.103
3321.0	6.43	0-1	0.0342	9111.9	8.81	2-1	0.0882	11638.6	9.67	3-2	0.0153
8254.1 (2)	6.75	1-0	0.130	9088.6	8.81	1-0	0.118	11619.0	9.67	2-1	0.0206
4572.7 (3)	7.95	1-2	0.191	9061.5	8.81	1-2	0.147	11602.9	9.67	2-3	0.0214
4572.7	7.95	1-0	0.00869	9062.5	8.81	0-1	0.353	7118.5 (26)	10.34	1-2	0.0144
4407.9 (4)	8.05	1-0	0.00869	5041.7 (4)	9.90	2-3	0.00782	11667.1 (29)	9.79	1-2	0.533
3813.4 (5)	8.49	1-2	0.0837	5039.1	9.90	1-2	0.00752	11636.0	9.79	1-1	0.320
3736.3 (6)	8.56	1-0	0.00267	5039.1	9.90	0-1	0.0105	12614.8 (30)	9.79	2-2	0.183
3515.5 (7)	8.77	1-2	0.0409	4826.7 (5)	10.01	2-1	0.000688	12565.0	9.79	1-1	0.0610
3130.4 (1)	3.94	1/2-3/2	0.333	4817.3	10.01	1-1	0.000716	12602.6	9.79	2-1	0.0610
3131.1	3.94	1/2-1/2	0.166	4812.8	10.01	0-1	0.000729	12565.0	9.79	1-0	0.0813
3274.6 (2)	14.66	1/2-3/2	0.0460					12551.0	9.79	1-2	0.102
3274.6	14.66	1/2-1/2	0.0230					8018.0 (31)	10.35	0-1	0.00254

1) The number in parentheses is the multiplet number.  
 2) Excitation potential of the upper level of the line [in Volts].  
 3) Total angular momentum quantum number of lower and upper levels.

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Wavelength [ $\text{\AA}$ ]	$E^{\circ}$	J-J <sup>o</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^{\circ}$	J-J <sup>o</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^{\circ}$	J-J <sup>o</sup>	$f_{J,J}$
C I 7850.0 (32)	10.38	0 - 1	0.00652	C II 6733.6 (21)	24.26	3/2-1/2	0.0219	C II 3876.1 (33)	27.35	3/2-5/2	0.773
C II 6578.0 (2)	16.26	1/2-3/2	0.553	6733.6	24.27	5/2-7/2	0.0167	3880.6	27.35	9/2-9/2	0.0501
6582.9	17.26	1/2-1/2	0.276	6726.8	24.27	3/2-5/2	0.0306	3879.6	27.35	7/2-7/2	0.0819
7236.2 (3)	16.97	3/2-5/2	0.530	5856.1 (22)	24.55	7/2-5/2	0.00719	3878.2	27.35	5/2-5/2	0.0829
7231.1	17.97	1/2-3/2	0.589	5836.3	24.55	5/2-3/2	0.00504	5478.6 (34)	26.52	7/2-7/2	0.0191
3920.7 (4)	19.41	3/2-1/2	0.134	5823.1	24.55	3/2-1/2	0.00301	5044.8 (35)	26.71	7/2-5/2	0.0457
3919.0	19.41	1/2-1/2	0.134	5843.8	24.55	5/2-5/2	0.00216	5047.2	26.71	5/2-3/2	0.0321
5890.0 (5)	20.06	5/2-3/2	0.105	5827.8	24.55	3/2-3/2	0.00385	4076.0 (36)	27.30	7/2-9/2	0.713
5891.7	20.06	3/2-1/2	0.0878	5817.9	24.55	1/2-1/2	0.00602	4074.5	27.30	5/2-7/2	0.652
4267.3 (6)	20.86	5/2-7/2	0.894	3589.7 (23)	25.88	7/2-5/2	0.107	4074.9	27.30	1/2-3/2	0.797
4267.0	20.86	3/2-5/2	0.939	3590.9	25.87	5/2-3/2	0.0752	3980.4 (37)	27.37	7/2-7/2	0.0819
3361.1 (7)	21.64	5/2-3/2	0.0123	3590.9	25.87	3/2-1/2	0.0449	3973.8	27.37	5/2-5/2	0.0548
3361.8	21.64	3/2-1/2	0.0703	3585.0	25.88	5/2-5/2	0.0319	3969.4	27.37	3/2-3/2	0.0380
2992.6 (8)	22.09	3/2-5/2	0.169	3587.7	25.87	3/2-3/2	0.0572	3978.9	27.37	5/2-7/2	0.182
5536.0 (10)	21.64	1/2-3/2	0.0564	3488.9	25.87	1/2-1/2	0.0896	3972.4	27.37	5/2-7/2	0.633
5536.0	21.64	1/2-1/2	0.0286	341.8	25.88	3/2-5/2	0.00531	3968.6	27.37	3/2-5/2	0.633
5336.7 (11)	22.38	3/2-1/2	0.0306	3585.8	25.87	1/2-3/2	0.0178	4411.5 (39)	27.37	1/2-3/2	0.0474
6783.8 (14)	22.44	5/2-7/2	0.340	6098.6 (24)	24.50	3/2-3/2	0.463	4411.2	27.29	5/2-7/2	0.819
6779.7	22.44	3/2-5/2	0.267	6095.4	24.50	1/2-3/2	0.514	4296.1 (42)	27.37	3/2-5/2	0.860
6780.3	22.44	1/2-3/2	0.212	6102.6	24.50	3/2-3/2	0.0514	4286.0	27.38	3/2-3/2	0.0931
6800.5	22.44	5/2-5/2	0.0762	4964.9 (25)	24.96	3/2-3/2	0.187	3049.4 (43)	28.54	5/2-5/2	0.144
6791.5	22.43	3/2-3/2	0.135	4954.2	24.96	1/2-1/2	0.150	5907.4 (44)	26.64	5/2-3/2	0.0559
6787.1	22.43	1/2-1/2	0.212	4959.5	24.96	3/2-1/2	0.0374	5914.9	26.64	3/2-3/2	0.0561
6812.2	22.43	5/2-3/2	0.00845	4959.5	24.96	1/2-3/2	0.0747	5919.6	26.64	1/2-3/2	0.0562
6798.0	22.43	3/2-1/2	0.0211	7063.4 (26)	24.55	3/2-5/2	0.314	4374.3 (45)	27.37	5/2-7/2	0.762
5662.5 (15)	22.80	5/2-3/2	0.104	7052.9	24.55	3/2-3/2	0.210	4372.5	27.37	3/2-5/2	0.599
5648.1	22.80	3/2-3/2	0.104	7045.8	24.55	3/2-1/2	0.105	4371.6	27.37	1/2-3/2	0.475
5640.5	22.80	1/2-3/2	0.104	4009.9 (27)	25.88	3/2-5/2	0.0705	4368.1	27.37	1/2-1/2	0.476
5145.2 (16)	23.02	5/2-5/2	0.239	4017.3	25.87	3/2-3/2	0.0473	3059.2 (47)	28.58	5/2-7/2	0.136
5137.3	23.02	3/2-3/2	0.0456	4021.1 (28)	25.88	3/2-1/2	0.0236	4727.2 (48)	27.29	7/2-7/2	0.0781
5151.1	23.02	1/2-1/2	0.0569	4317.4	25.88	5/2-5/2	0.115	4618.9 (50)	27.36	5/2-5/2	0.0770
5143.5	23.02	5/2-3/2	0.102	4322.0	25.87	3/2-3/2	0.0220	5118.6 (51)	27.36	5/2-7/2	0.923
5133.3	23.02	3/2-5/2	0.154	4325.9	25.87	5/2-3/2	0.0495	5114.1	27.37	3/2-5/2	0.970
5133.0	23.02	1/2-3/2	0.285	4313.5	25.88	3/2-5/2	0.0689	4647.4 (1)	27.38	1/2-3/2	1.076
6115.2 (19)	24.02	3/2-1/2	0.126	4318.9	25.87	1/2-3/2	0.0737	4650.2	32.05	1 - 2	0.423
7119.5 (20)	24.17	7/2-9/2	0.404	3039.7 (29)	27.34	3/2-5/2	0.137	4651.4	32.05	1 - 1	0.253
7115.1	24.17	5/2-7/2	0.369	5257.4 (30)	26.52	9/2-7/2	0.0801	5696.0 (2)	32.05	1 - 0	0.0845
7112.4	24.17	3/2-5/2	0.362	5259.6	26.52	7/2-5/2	0.0689	6744.2 (3)	39.88	2 - 3	0.254
7112.4	24.17	1/2-3/2	0.452	5259.6	26.51	5/2-3/2	0.0601	6730.7	39.87	1 - 2	0.227
7133.5	24.17	7/2-7/2	0.0461	5259.6	26.51	3/2-1/2	0.0564	6727.1	39.87	0 - 1	0.303
7125.5	24.17	5/2-5/2	0.0786	5249.4	26.52	7/2-7/2	0.0114	5272.6 (4)	40.39	2 - 1	0.0809
7119.5	24.17	3/2-3/2	0.0903	5253.6	26.52	5/2-5/2	0.0195	5253.6	40.39	1 - 1	0.0802
6750.2 (21)	24.27	7/2-7/2	0.0749	3952.1 (32)	27.30	9/2-9/2	0.0632	5244.5	40.39	0 - 1	0.0803
6738.4	24.27	5/2-5/2	0.0504	3948.2	27.30	7/2-7/2	0.0525	4663.9 (5)	40.69	2 - 2	0.205
6730.8	24.27	3/2-3/2	0.0350	3946.4	27.30	3/2-5/2	0.0138	4673.9	40.69	2 - 1	0.0683
6726.8	24.26	1/2-1/2	0.0436	3945.1	27.30	5/2-7/2	0.0123	4663.5	40.69	1 - 0	0.0911
6754.8	24.27	7/2-5/2	0.0125	3876.4 (33)	27.35	7/2-9/2	0.688	4325.7 (7)	41.12	1 - 2	0.506
6742.1	24.27	5/2-3/2	0.0204	3876.7	27.35	5/2-7/2	0.690	3170.2 (8)	42.37	0 - 1	0.147

Wavelength [Å]	E <sup>0</sup>	J-J'	f <sub>J,J'</sub>	Wavelength [Å]	E <sup>0</sup>	J-J'	f <sub>J,J'</sub>	Wavelength [Å]	E <sup>0</sup>	J-J'	f <sub>J,J'</sub>
C III	4516.9 (9)	2 - 1	0.169	M I	8184.8 (2)	3/2-5/2	0.146	M I	6483.8 (21)	3/2-5/2	0.0260
	4516.0	1 - 1	0.169		8188.0	1/2-3/2	0.254		6481.7	1/2-3/2	0.0313
	4516.0	0 - 1	0.169		7468.3 (3)	5/2-3/2	0.116		6506.5	7/2-7/2	0.00352
	3609.6 (10)	2 - 3	0.257		7442.3	3/2-3/2	0.116		6499.5	5/2-5/2	0.00559
	42.64	0 - 1	0.308		7423.6	1/2-3/2	0.116		6491.3	3/2-3/2	0.00621
	42.64	3 - 2	0.0463		4253.5 (4)	5/2-7/2	0.00114		6468.3 (22)	7/2-7/2	0.00661
	42.48	2 - 2	0.0115		4254.7	3/2-5/2	0.000601		6468.3	5/2-5/2	0.00400
	42.48	2 - 1	0.0345		4254.7	5/2-5/2	0.00107		6457.9	7/2-5/2	0.00272
	42.48	1 - 1	0.0191		4223.0 (5)	3/2-1/2	0.000591		6441.7 (23)	5/2-1/2	0.00213
	42.48	1 - 0	0.0254		4230.4	5/2-3/2	0.000784		6420.5 (24)	5/2-5/2	0.00596
	42.84	3 - 4	0.531		4224.7	3/2-5/2	0.00114		5616.5 (24)	7/2-5/2	0.00182
	42.84	2 - 3	0.512		4214.7	1/2-3/2	0.00176		5623.2	5/2-3/2	0.00373
	42.84	1 - 2	0.443		4215.9	5/2-3/2	0.00301		5625.4	3/2-1/2	0.00214
	42.79	1 - 2	0.443		4151.5 (6)	3/2-3/2	0.00305		5560.4 (25)	7/2-9/2	0.00787
	42.67	3 - 3	0.0417		4143.4	1/2-3/2	0.00308		5564.4	5/2-7/2	0.00441
	41.67	2 - 2	0.0326		4137.6	3/2-3/2	0.00308		5545.1 (26)	5/2-7/2	0.00014 <sup>h</sup>
	41.67	1 - 1	0.0352		3992.8 (7)	3/2-5/2	0.502		12186.9 (27)	5/2-5/2	0.111
	41.97	3 - 2	0.00385		9386.8	1/2-3/2	0.556		12252.9	3/2-3/2	0.0213
	41.98	2 - 1	0.00290		9460.7	3/2-3/2	0.296		12288.0	5/2-3/2	0.0483
	41.98	1 - 0	0.00215		8629.2 (8)	1/2-1/2	0.237		12128.6	3/2-5/2	0.0710
	42.57	2 - 1	0.128		8994.0	3/2-1/2	0.0591		12203.4	1/2-3/2	0.133
	43.07	2 - 3	0.500		8655.9	1/2-3/2	0.0591		10539.0 (28)	5/2-7/2	0.554
G IV	4056.1 (24)	2 - 3	0.519		8567.7	1/2-3/2	0.118		10506.5	3/2-5/2	0.435
	5801.5 (1)	1/2-3/2	0.159		4935.0 (9)	3/2-1/2	0.00243		10548.0	5/2-5/2	0.125
	5812.1	1/2-1/2	0.0788		4914.9	1/2-1/2	0.00230		6945.2 (29)	5/2-5/2	0.0115
	3936.0 (2)	1/2-3/2	0.158		9060.6 (15)	1/2-3/2	0.581		6979.1	5/2-3/2	0.00483
	3936.0 (3)	3/2-1/2	0.176		9028.9	1/2-1/2	0.290		6926.9	3/2-5/2	0.00741
	5021.0	1/2-1/2	0.176		6008.5 (16)	1/2-3/2	0.0390		6752.4 (30)	5/2-7/2	0.0247
	4441.8 (4)	1/2-3/2	0.516		5999.5	1/2-1/2	0.0205		6758.6	3/2-5/2	0.0172
	4789.0 (5)	3/2-1/2	0.0586		11294.0 (17)	7/2-5/2	0.142		6723.1 (31)	5/2-5/2	0.00848
	4647.0 (6)	3/2-5/2	0.837		11313.8	5/2-3/2	0.101		6706.2	1/2-1/2	0.00169
	4665.0 (7)	5/2-3/2	0.0225		11229.5	3/2-1/2	0.0674		6741.3	3/2-5/2	0.00552
	6592.0 (10)	1/2-1/2	0.0858		11227.5	5/2-5/2	0.0423		5829.5 (32)	3/2-1/2	0.00420
	6592.0	1/2-3/2	0.172		10113.4 (18)	7/2-9/2	0.676		5841.0	5/2-5/2	0.00383
	4737.0 (12)	3/2-1/2	0.0174		10113.4	5/2-7/2	0.617		5816.5	3/2-3/2	0.00153
M I	8680.2 (1)	5/2-7/2	0.413		10113.4	3/2-5/2	0.603		5752.6 (33)	5/2-5/2	0.00246
	8683.4	3/2-5/2	0.324		10164.5	1/2-3/2	0.752		12186.9 (34)	3/2-3/2	0.00185
	8686.1	1/2-3/2	0.242		10147.3	7/2-7/2	0.0772		1295	5/2-5/2	0.465
	8718.8	5/2-5/2	0.0926		9862.5 (19)	5/2-7/2	0.117		12327.7	3/2-1/2	0.153
	8711.7	3/2-3/2	0.164		9821.8	7/2-7/2	0.0784		5747.4 (35)	5/2-7/2	0.00117
	8703.2	1/2-1/2	0.242		6645.0 (20)	5/2-5/2	0.0157		12467.8 (36)	3/2-5/2	0.738
	8747.4	5/2-3/2	0.0103		6653.4	5/2-3/2	0.0112		12461.2	5/2-5/2	0.0366
	8728.9	3/2-1/2	0.0256		6656.6	3/2-1/2	0.00666		12582.3	5/2-5/2	0.132
	8216.3 (2)	5/2-5/2	0.227		6622.5	5/2-3/2	0.00476		11997.7	3/2-3/2	0.127
	8210.6	3/2-3/2	0.0432		6637.0	3/2-3/2	0.00849		12107.4	5/2-3/2	0.00944
	8200.3	1/2-1/2	0.0508		6646.5	1/2-1/2	0.0133				
	8242.3	5/2-3/2	0.0971		6482.7 (21)	7/2-3/2	0.0355				
	8223.1	3/2-1/2	0.135		6484.9	5/2-7/2	0.0287				

NAVAL RESEARCH LABORATORY

6

Wavelength [ $\text{\AA}$ ] <sup>u</sup>	$E^v$	J-J' <sup>u</sup>	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ] <sup>u</sup>	$E^v$	J-J' <sup>u</sup>	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ] <sup>u</sup>	$E^v$	J-J' <sup>u</sup>	$f_{J,J'}$
N II 5679.6 (3)	20.58	2 - 3	0.357	N II 3615.9 (26)	24.26	1 - 0	0.0151	N II 6357.0 (46)	25.08	1 - 0	0.0536
5666.6	20.56	1 - 2	0.319	5941.7 (28)	23.15	2 - 3	0.424	6328.6	25.09	2 - 2	0.0239
5776.0	20.56	0 - 1	0.424	5931.8	23.14	1 - 2	0.378	6347.1	25.08	1 - 1	0.0401
5710.8	20.56	2 - 2	0.0634	5927.8	23.14	0 - 1	0.504	4241.8 (48)	26.06	3 - 4	0.762
5686.2	20.56	1 - 1	0.106	5924.4	23.14	2 - 2	0.0755	4237.0	26.05	2 - 3	0.737
5730.7	20.56	2 - 1	0.00421	5940.3	23.14	1 - 1	0.126	4236.9	26.05	1 - 2	0.829
5045.1 (4)	20.85	2 - 1	0.0974	5960.9	23.14	2 - 1	0.00502	4179.7 (50)	26.10	3 - 3	0.0906
5010.6	20.85	0 - 1	0.0979	5495.7 (29)	23.31	2 - 2	0.141	4173.5	26.10	2 - 2	0.0707
5002.7	21.07	1 - 1	0.0978	5480.1	23.32	1 - 1	0.0472	4156.8	26.11	1 - 1	0.0756
4630.5 (5)	21.06	2 - 2	0.239	5454.3	23.32	2 - 1	0.0471	4160.8	26.11	2 - 1	0.0151
4643.1	21.06	1 - 1	0.0798	5478.1	23.32	1 - 0	0.0631	4173.8	26.10	2 - 3	0.0158
4621.4	21.06	2 - 1	0.0796	5452.1	23.31	1 - 2	0.0784	7139.8 (52)	25.04	2 - 3	0.00355
4601.5	21.07	1 - 0	0.106	3838.4 (30)	24.28	0 - 2	0.189	7217.0	25.03	1 - 2	0.00321
4607.2	21.06	1 - 2	0.133	3847.4	24.27	2 - 2	0.114	7259.3	25.03	0 - 2	0.00431
6482.1 (8)	20.32	0 - 1	0.320	3856.1	24.27	1 - 1	0.0384	7188.7	25.03	2 - 2	0.00639
3995.0 (12)	21.51	1 - 1	0.220	3855.1	24.27	2 - 1	0.0386	6942.9 (53)	25.09	2 - 2	0.0457
3437.2 (13)	22.01	1 - 0	0.135	3829.8	24.26	1 - 0	0.0516	7003.0	25.08	2 - 2	0.0154
4447.0 (15)	23.10	1 - 2	0.587	3842.2	24.28	1 - 2	0.0631	6976.8	25.08	2 - 1	0.0153
3919.0 (17)	23.47	1 - 1	0.229	6610.6 (31)	23.37	0 - 1	0.153	7015.3	25.08	1 - 0	0.0206
3006.9 (18)	24.43	1 - 1	0.0732	6284.3 (32)	23.47	2 - 3	0.571	6967.6	25.09	1 - 2	0.0255
5005.1 (19)	23.04	3 - 4	0.557	4227.7 (33)	23.43	2 - 1	0.171	6812.3 (54)	25.08	0 - 1	0.0618
5001.5	23.03	2 - 3	0.537	5104.5 (34)	24.43	0 - 1	0.222	6836.2	25.13	2 - 1	0.0788
5025.7	23.02	1 - 2	0.603	3023.8 (35)	26.09	0 - 1	0.0967	4432.7 (55)	26.10	2 - 3	0.0792
5016.4	23.02	2 - 2	0.0669	6167.8 (36)	25.04	4 - 3	0.123	4442.0	26.10	2 - 3	0.816
5040.8	23.02	3 - 2	0.0478	6173.4	25.03	3 - 2	0.110	4433.5	26.11	1 - 2	0.730
4803.3 (20)	23.15	3 - 3	0.102	6170.2	25.03	3 - 2	0.104	4431.8	26.10	2 - 2	0.968
4788.1	23.14	2 - 2	0.0796	6136.9	25.04	3 - 3	0.0136	4428.0	26.11	1 - 1	0.244
4779.7	23.14	1 - 1	0.0860	6150.9	25.03	2 - 2	0.0192	6242.5 (57)	25.35	3 - 2	0.115
4810.3	23.14	3 - 2	0.0127	6114.6	25.03	2 - 3	0.00540	4530.4 (59)	26.10	3 - 4	0.909
4793.7	23.15	2 - 1	0.0172	4095.9 (38)	26.06	4 - 4	0.0671	6167.8 (60)	25.47	1 - 0	0.0591
4781.2	23.15	2 - 3	0.0179	4082.9	26.05	3 - 3	0.0600	4677.9 (62)	26.11	1 - 2	1.013
4774.2	23.14	2 - 2	0.0287	4076.8	26.05	2 - 2	0.0634	5535.4 (63)	27.61	3 - 4	0.336
4507.6 (21)	23.31	3 - 2	0.0835	4082.3	26.06	3 - 4	0.00373	5530.3	27.61	2 - 3	0.244
4477.7	23.32	2 - 1	0.00629	4073.1 (39)	26.05	2 - 3	0.00791	526.3	27.60	1 - 2	0.152
4460.0	23.32	1 - 0	0.00467	4043.5	26.08	3 - 4	0.763	5552.0	27.61	3 - 3	0.0869
4488.2	23.31	2 - 0	0.00209	4035.1	26.08	2 - 3	0.812	5543.5	27.60	2 - 2	0.152
4465.5	23.32	1 - 1	0.00350	4057.0	26.08	4 - 4	0.0397	5535.4	27.60	1 - 1	0.196
3328.8 (22)	24.28	3 - 2	0.111	4044.8	26.08	3 - 3	0.0509	5565.3	27.60	3 - 2	0.0124
3331.3	24.27	2 - 1	0.0840	6630.5 (41)	24.96	2 - 1	0.104	5552.5	27.60	2 - 1	0.0390
3330.3	24.26	1 - 0	0.0624	4176.2 (42)	26.05	2 - 3	0.818	5540.2	27.59	1 - 0	0.0868
3318.1	24.28	2 - 0	0.0275	6504.9 (45)	25.04	3 - 2	0.0298	5012.0 (64)	27.84	3 - 3	0.195
3324.6	24.27	1 - 1	0.0464	6533.0	25.03	2 - 2	0.0235	5005.1	27.84	2 - 2	0.0244
5007.3 (24)	23.31	1 - 2	0.439	6545.2	25.03	1 - 1	0.0254	4997.2	27.84	1 - 1	0.0732
4994.4	23.32	1 - 1	0.265	6545.2	25.03	3 - 2	0.00377	5023.1	27.84	3 - 2	0.0974
4987.4	23.32	1 - 0	0.0883	6492.0	25.04	2 - 3	0.00520	5011.2	27.84	2 - 1	0.132
3593.6 (26)	24.28	1 - 2	0.0739	6522.3 (46)	25.03	1 - 2	0.00843	4994.4	27.84	2 - 3	0.137
3609.1	24.27	1 - 1	0.0451	6340.7	25.09	3 - 2	0.0959	4991.2	27.84	1 - 2	0.220
				6357.0	25.08	2 - 1	0.0724	4145.8 (65)	28.36	3 - 2	0.118

Wavelength [ $\text{\AA}$ ]	$E^{\nu}$	J-J'	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ]	$E^{\nu}$	J-J'	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ]	$E^{\nu}$	J-J'	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ]	$E^{\nu}$	J-J'	$f_{J,J'}$
N II	4133.7 (65)	2 - 2	0.118	N II	4547.3 (3)	5/2-3/2	0.00710	N III	4535.1 (13)	3/2-3/2	0.304	N III	4535.1 (13)	3/2-3/2	0.304
	4124.1	1 - 2	0.118		4530.8	3/2-1/2	0.0178		4527.9	3/2-1/2	0.152		4527.9	3/2-1/2	0.152
	5175.9 (66)	3 - 4	0.446		3771.1 (4)	5/2-3/2	0.0874		6466.9 (14)	5/2-7/2	0.361		6466.9 (14)	5/2-7/2	0.361
	5173.4	2 - 3	0.399		3754.6	3/2-3/2	0.0877		6454.0	3/2-5/2	0.285		6454.0	3/2-5/2	0.285
	5172.3	1 - 2	0.388		3745.8	1/2-3/2	0.0878		6445.1	1/2-3/2	0.226		6445.1	1/2-3/2	0.226
	5172.3	0 - 1	0.581		3367.4 (5)	5/2-5/2	0.207		6478.7	5/2-5/2	0.0811		6478.7	5/2-5/2	0.0811
	5190.4	4 - 4	0.0692		3361.9	3/2-3/2	0.0395		6463.0	3/2-3/2	0.145		6463.0	3/2-3/2	0.145
	5185.0	3 - 3	0.125		3358.7	1/2-1/2	0.0494		6450.8	1/2-1/2	0.226		6450.8	1/2-1/2	0.226
	5185.0	2 - 2	0.166		3374.1	5/2-3/2	0.0887		6487.6	5/2-3/2	0.00900		6487.6	5/2-3/2	0.00900
	5199.5	4 - 3	0.00461		3365.8	3/2-1/2	0.123		6468.8	3/2-1/2	0.0226		6468.8	3/2-1/2	0.0226
	4860.4 (67)	4 - 3	0.00757		3354.3	3/2-5/2	0.134		5314.5 (15)	5/2-5/2	0.138		5314.5 (15)	5/2-5/2	0.138
	4718.4 (68)	4 - 4	0.0989		3333.8	1/2-3/2	0.247		5282.5	3/2-3/2	0.0265		5282.5	3/2-3/2	0.0265
	4709.5	3 - 3	0.0594		4200.0 (6)	3/2-5/2	0.398		5260.9	1/2-1/2	0.332		5260.9	1/2-1/2	0.332
	4702.6	2 - 2	0.297		4195.7	1/2-3/2	0.442		5298.9	5/2-3/2	0.0594		5298.9	5/2-3/2	0.0594
	4721.6	4 - 3	0.0198		4215.7	3/2-3/2	0.0440		5272.6	3/2-1/2	0.0829		5272.6	3/2-1/2	0.0829
	4712.1	3 - 2	0.0339		3355.5 (7)	3/2-1/2	0.112		5297.9	3/2-5/2	0.0850		5297.9	3/2-5/2	0.0850
	4704.3	2 - 1	0.0415		3342.8	1/2-1/2	0.113		5270.6	1/2-3/2	0.166		5270.6	1/2-3/2	0.166
	4698.6	1 - 0	0.0396		3938.5 (8)	3/2-5/2	0.335		4003.6 (16)	5/2-7/2	0.677		4003.6 (16)	5/2-7/2	0.677
	4706.4	3 - 4	0.0255		3934.4	1/2-3/2	0.372		3998.7	3/2-5/2	0.709		3998.7	3/2-5/2	0.709
	4700.1	2 - 3	0.0475		3942.8	3/2-3/2	0.0372		3478.7 (1)	1 - 2	0.350		3478.7 (1)	1 - 2	0.350
	4695.9	1 - 2	0.0693		4867.2 (9)	7/2-9/2	0.279		3483.0	1 - 1	0.210		3483.0	1 - 1	0.210
	5351.2 (69)	3 - 3	0.120		4861.3	5/2-7/2	0.255		3484.9	1 - 0	0.0699		3484.9	1 - 0	0.0699
	5327.5	2 - 2	0.0151		4658.7	3/2-5/2	0.250		6383.0 (2)	0 - 1	0.359		6383.0 (2)	0 - 1	0.359
	5313.4	1 - 1	0.0453		4858.7	1/2-5/2	0.312		4057.8 (3)	1 - 2	0.321		4057.8 (3)	1 - 2	0.321
	5340.2	3 - 2	0.0601		4884.1	7/2-7/2	0.0318		7123.1 (4)	2 - 3	0.136		7123.1 (4)	2 - 3	0.136
	5321.0	3 - 2	0.0814		4873.6	5/2-5/2	0.0542		7109.5	1 - 2	0.121		7109.5	1 - 2	0.121
	5338.7	2 - 1	0.0840		4873.6	3/2-3/2	0.0623		7103.3	0 - 1	0.162		7103.3	0 - 1	0.162
	5321.0	1 - 2	0.136		4896.7	7/2-5/2	0.00158		7127.2	2 - 2	0.0242		7127.2	2 - 2	0.0242
	5179.5 (70)	3 - 4	0.435		4881.8	5/2-3/2	0.00296		7111.3	1 - 1	0.0404		7111.3	1 - 1	0.0404
	5171.5	2 - 3	0.316		4348.4 (10)	7/2-7/2	0.0561		7129.0	2 - 1	0.00161		7129.0	2 - 1	0.00161
	5168.2	1 - 2	0.197		4335.5	5/2-5/2	0.0378		5245.0 (5)	2 - 3	0.200		5245.0 (5)	2 - 3	0.200
	5183.2	3 - 3	0.113		4328.2	3/2-3/2	0.0263		5236.0	2 - 2	0.179		5236.0	2 - 2	0.179
	5174.5	2 - 2	0.197		4323.9	1/2-1/2	0.0529		5281.0	2 - 2	0.0355		5281.0	2 - 2	0.0355
	5170.1	1 - 1	0.254		4333.7	7/2-5/2	0.00934		4528.0 (6)	2 - 1	0.0560		4528.0 (6)	2 - 1	0.0560
	5186.2	3 - 2	0.0161		4339.5	5/2-3/2	0.0153		4495.0	1 - 1	0.0564		4495.0	1 - 1	0.0564
	6888.7 (71)	2 - 3	0.282		4330.4	3/2-1/2	0.0164		4479.0	0 - 1	0.0565		4479.0	0 - 1	0.0565
	6870.8	30.15	0.202		4330.1	5/2-7/2	0.0175		3463.4 (7)	2 - 2	0.170		3463.4 (7)	2 - 2	0.170
	6857.6	30.16	0.202		4223.9	3/2-5/2	0.0236		3454.0	1 - 1	0.0567		3454.0	1 - 1	0.0567
N III	4097.3 (1)	30.33	0.122		4321.4	1/2-3/2	0.0329		61.01	1 - 1	0.0567		61.01	1 - 1	0.0567
	4103.4	30.33	0.484		3792.9 (11)	7/2-5/2	0.00333		61.01	2 - 1	0.0564		61.01	2 - 1	0.0564
	4640.6 (2)	32.99	0.242		3771.5	5/2-3/2	0.00375		61.03	1 - 0	0.0754		61.03	1 - 0	0.0754
	4634.2	32.99	0.428		3757.7	3/2-1/2	0.00224		61.03	1 - 2	0.0948		61.03	1 - 2	0.0948
	4641.9	32.99	0.0427		3779.2	5/2-5/2	0.00160		61.01	0 - 1	0.227		61.01	0 - 1	0.227
	4514.9 (3)	38.25	0.286		3762.6	1/2-1/2	0.00449		61.69	1 - 2	0.371		61.69	1 - 2	0.371
	4510.9	38.24	0.225		3752.7	3/2-3/2	0.00287		61.52	1 - 2	0.146		61.52	1 - 2	0.146
	4510.9	38.23	0.179		3770.4	5/2-5/2	0.00268		62.41	3 - 3	0.0345		62.41	3 - 3	0.0345
	4534.6	38.24	0.0641		3757.6	1/2-3/2	0.00897		4752.0 (11)	2 - 2	0.0271		4752.0 (11)	2 - 2	0.0271
	4523.6	38.23	0.114		4544.8 (12)	3/2-1/2	0.213		4762.0	3 - 2	0.00431		4762.0	3 - 2	0.00431
	4518.2	38.23	0.178		4546.4 (13)	3/2-5/2	0.227		4740.0	2 - 1	0.00584		4740.0	2 - 1	0.00584
									4723.0	2 - 3	0.00608		4723.0	2 - 3	0.00608

## NAVAL RESEARCH LABORATORY

Wavelength [ $\text{\AA}$ ]	$E^v$	J-J <sup>v</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^v$	J-J <sup>v</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^v$	J-J <sup>v</sup>	$f_{J,J}$
M IV				O I				O I			
3714.0 (12)	63.14	3 - 2	0.00359	9262.7 (8)	12.03	2 - 1	0.0799	8221.8 (34)	13.99	3 - 3	0.268
3689.0	63.14	2 - 1	0.00271	9260.9	12.03	1 - 2	0.311	8230.0	13.99	2 - 2	0.209
3696.0	63.14	2 - 2	0.000901	9260.9	12.03	1 - 1	0.399	8233.0	13.99	1 - 1	0.226
4183.0 (14)	63.14	1 - 2	0.177	9260.9	12.03	1 - 0	0.177	8231.8	13.99	3 - 2	0.0335
4174.0	63.14	1 - 1	0.107	6456.0 (9)	12.61	3 - 2	0.0155	8227.6	13.99	2 - 1	0.0452
5846.0 (15)	63.14	2 - 2	0.0430	6454.5	12.61	2 - 2	0.0155	8230.0	13.99	2 - 3	0.0468
5794.0	63.14	1 - 1	0.0145	6453.6	12.61	1 - 2	0.0155	8235.3	13.99	1 - 2	0.0752
5728.0	63.14	2 - 1	0.0144	6158.2 (10)	12.70	3 - 4	0.0535	7947.6 (35)	14.04	3 - 4	0.399
5812.0	63.14	1 - 2	0.0240	6158.2	12.70	3 - 3	0.0139	7950.8	14.04	2 - 3	0.387
5073.0 (17)	64.12	2 - 1	0.00295	6158.2	12.70	3 - 2	0.00198	7952.2	14.04	1 - 2	0.435
4603.2 (1)	58.99	1/2-3/2	0.263	6156.8	12.70	2 - 3	0.0389	7943.2	14.04	3 - 3	0.0345
4619.4	58.98	1/2-1/2	0.131	6156.8	12.70	2 - 2	0.0243	7947.2	14.04	2 - 2	0.0483
3161.0 (2)	87.64	1/2-1/2	0.153	6156.8	12.70	2 - 1	0.00625	7939.5	14.04	3 - 2	0.000986
3161.0 (3)	87.64	3/2-1/2	0.153	6156.0	12.70	1 - 2	0.0243	8820.5 (37)	14.07	2 - 3	0.427
4335.0 (4)	90.49	1/2-1/2	0.106	6156.0	12.70	1 - 1	0.0313	7156.8 (38)	14.40	2 - 2	0.351
5273.0 (4)	90.30	1/2-1/2	0.196	5436.8 (11)	12.96	3 - 2	0.0139	9156.0 (41)	15.33	3 - 4	0.454
5273.0 (5)	90.30	3/2-1/2	0.196	5435.8	12.96	2 - 2	0.00515	6106.3 (43)	16.01	3 - 4	0.0359
4751.0 (6)	90.55	1/2-3/2	0.543	5435.2	12.96	1 - 2	0.00515	5995.3 (44)	16.04	3 - 2	0.00927
5067.0 (7)	90.49	3/2-1/2	0.0813	5330.7 (12)	13.01	3 - 4	0.0143	5991.9	16.05	2 - 1	0.00702
4933.0 (7)	90.56	3/2-5/2	0.828	5330.7	13.01	3 - 3	0.00370	5991.3	16.05	1 - 0	0.00523
4952.0 (8)	90.55	5/2-3/2	0.0395	5330.7	13.01	3 - 2	0.000528	5995.3	16.04	2 - 2	0.00232
6719.0 (11)	92.13	1/2-1/2	0.116	5329.6	13.01	2 - 3	0.0104	5993.2	16.05	1 - 1	0.00390
6719.0	92.13	1/2-3/2	0.232	5329.6	13.01	2 - 2	0.00648	9522.0 (45)	15.33	4 - 4	0.168
7330.0 (12)	92.17	1/2-3/2	0.610	5329.6	13.01	2 - 1	0.00167	9498.0 (47)	15.34	3 - 4	0.647
O I				5329.0	13.01	1 - 2	0.00649	6266.9 (48)	16.01	4 - 4	0.0116
7772.0 (1)	10.69	2 - 3	0.432	5329.0	13.01	1 - 1	0.00834	6256.8 (50)	16.01	3 - 4	0.0480
7774.2	10.69	2 - 2	0.309	5329.0	13.01	1 - 0	0.00371	6261.6	16.01	2 - 3	0.0505
7775.4	10.69	2 - 1	0.185	5020.1 (13)	13.15	3 - 2	0.00241	5410.8 (51)	16.32	4 - 4	0.00284
3947.3 (3)	12.23	2 - 3	0.00177	5019.3	13.15	2 - 2	0.00242	5404.9 (53)	16.32	3 - 4	0.0129
3947.5	12.23	2 - 2	0.00126	5018.8	13.15	1 - 2	0.00242	7476.5 (55)	15.71	2 - 3	0.440
3947.6	12.23	2 - 1	0.000751	7254.5 (20)	12.64	2 - 1	0.0160	7479.1	15.71	1 - 2	0.393
8446.4 (4)	10.94	1 - 2	0.553	7254.2	12.64	1 - 1	0.0160	7480.7	15.71	0 - 1	0.524
8446.8	10.94	1 - 1	0.332	7254.5	12.64	0 - 1	0.0160	7473.2	15.71	2 - 2	0.0787
8446.4	10.94	1 - 0	0.111	7002.2 (21)	12.70	2 - 3	0.0340	7477.2	15.71	1 - 1	0.131
4368.3 (5)	12.31	1 - 2	0.00413	7002.2	12.70	2 - 2	0.00606	7471.4	15.71	2 - 1	0.00524
4368.3	12.31	1 - 1	0.00248	7002.2	12.70	2 - 1	0.000404	9760.7 (56)	15.34	3 - 4	0.696
3692.4 (6)	12.82	1 - 2	0.000826	7001.9	12.70	1 - 2	0.0303	9677.4 (58)	15.35	3 - 3	0.181
3692.4	12.82	1 - 1	0.000305	7001.9	12.70	1 - 1	0.0101	6374.3 (59)	16.01	3 - 4	0.0452
3692.4	12.82	1 - 0	0.000183	7002.2 (22)	12.98	0 - 1	0.0404	6351.2 (61)	16.02	3 - 3	0.0133
11302.2 (7)	11.79	3 - 2	0.152	6046.3	12.98	2 - 1	0.00523	5492.8 (62)	16.32	3 - 4	0.0107
11297.5	11.79	2 - 2	0.152	6046.3	12.98	0 - 1	0.00523	7886.3 (64)	15.88	1 - 2	0.549
11295.0	11.79	1 - 2	0.152	5958.6 (23)	13.01	2 - 3	0.00633	4649.1 (1)	25.55	5/2-7/2	0.353
9266.0 (8)	12.03	3 - 4	0.685	5958.6	13.01	2 - 2	0.00113	4641.8	25.54	3/2-5/2	0.278
9266.0	12.03	3 - 3	0.178	5958.6	13.01	2 - 1	0.00075	4538.9	25.53	1/2-3/2	0.229
9262.7	12.03	3 - 2	0.0254	5958.5	13.01	1 - 2	0.00566	4676.2	25.51	5/2-5/2	0.0789
9262.7	12.03	2 - 3	0.497	5958.5	13.01	1 - 1	0.00189	4661.6	25.53	3/2-3/2	0.140
9262.7	12.03	2 - 2	0.311	5958.6	13.01	0 - 1	0.00754	4650.8	25.52	1/2-1/2	0.219

Wavelength [Å] <sup>W</sup>	E <sup>v</sup>	J-J <sup>v</sup>	f <sub>J,J</sub>	Wavelength [Å] <sup>W</sup>	E <sup>v</sup>	J-J <sup>v</sup>	f <sub>J,J</sub>	Wavelength [Å] <sup>W</sup>	E <sup>v</sup>	J-J <sup>v</sup>	f <sub>J,J</sub>			
O II	4696.4 (1)	25.53	5/2-3/2	0.00872	O II	3842.8 (12)	26.73	1/2-3/2	0.0645	C II	4906.9 (28)	28.71	3/2-3/2	0.255
	4673.8	25.52	3/2-1/2	0.0219		3134.8 (14)	25.49	7/2-5/2	0.115		4890.9	28.71	3/2-1/2	0.128
	4349.4 (2)	25.74	5/2-5/2	0.200		3134.4	25.47	5/2-3/2	0.0612		3739.9 (31)	28.71	3/2-5/2	0.0812
	4336.9	25.73	3/2-3/2	0.0381		3129.8	25.46	3/2-1/2	0.0487		3762.6	28.71	3/2-3/2	0.0550
	4325.8	25.72	1/2-1/2	0.0477		3122.6	25.46	5/2-5/2	0.0340		3777.6	28.71	3/2-1/2	0.0278
	4366.9	25.73	5/2-3/2	0.0854		3129.4	25.47	3/2-5/2	0.0615		5206.7 (32)	28.82	3/2-3/2	0.160
	4345.6	25.72	3/2-1/2	0.119		3134.3	29.45	1/2-1/2	0.0971		5160.0	28.83	1/2-1/2	0.130
	4319.6	25.74	3/2-5/2	0.129		3113.7	29.49	3/2-5/2	0.00563		5176.0	28.83	3/2-1/2	0.0223
	4317.1	25.73	1/2-3/2	0.239		3124.0	29.47	1/2-3/2	0.0191		5190.6	28.82	1/2-3/2	0.0643
	3749.5 (3)	26.19	5/2-3/2	0.111		4591.0 (15)	28.24	5/2-7/2	0.368		4943.1 (33)	28.94	3/2-5/2	0.558
	3727.3	26.19	3/2-3/2	0.111		4596.2	28.24	3/2-5/2	0.386		4941.1	28.94	1/2-3/2	0.618
	3712.8	25.18	1/2-3/2	0.111		4551.3 (16)	28.39	5/2-5/2	0.273		4955.8	28.94	3/2-3/2	0.0617
	6721.4 (4)	25.18	3/2-1/2	0.0625		4347.4	28.39	3/2-3/2	0.264		3803.1 (34)	29.69	3/2-3/2	0.130
	6640.9	25.18	1/2-1/2	0.0632		3912.0 (17)	28.71	5/2-3/2	0.196		3821.7	29.67	1/2-1/2	0.106
	4414.9 (5)	26.14	3/2-5/2	0.455		3919.3	28.70	3/2-1/2	0.163		3830.5	28.67	3/2-1/2	0.0266
	4417.0	26.11	1/2-3/2	0.503		3912.1	28.71	3/2-3/2	0.0326		3794.5	29.69	1/2-3/2	0.0519
	4452.4	26.11	3/2-3/2	0.0501		4169.2 (19)	28.70	5/2-5/2	0.145		4448.2	31.01	7/2-7/2	0.146
	3973.3 (6)	26.45	3/2-3/2	0.281		4140.7	28.71	3/2-3/2	0.0277		4443.1	31.01	5/2-5/2	0.144
	3954.4	26.44	1/2-1/2	0.225		4121.5	28.71	1/2-1/2	0.0348		4189.8	31.18	7/2-9/2	0.617
	3982.7	26.44	3/2-1/2	0.0560		4156.5	28.71	5/2-3/2	0.0623		4185.5	31.18	5/2-7/2	0.634
	3945.0	26.45	1/2-3/2	0.113		4129.3	28.71	3/2-1/2	0.0869		4113.8 (37)	31.24	7/2-5/2	0.0240
	3390.3 (9)	28.82	1/2-3/2	0.605		4152.3	28.70	3/2-5/2	0.0932		4110.2	31.24	5/2-3/2	0.126
	3377.2	28.83	1/2-1/2	0.304		4132.8	28.71	1/2-3/2	0.173		3273.5 (39)	32.01	7/2-5/2	0.117
	4075.9 (10)	28.98	7/2-9/2	0.605		4119.2 (20)	28.73	5/2-7/2	0.504		3271.0	32.01	5/2-3/2	0.117
	4072.2	28.57	5/2-7/2	0.552		4104.7	28.73	3/2-5/2	0.397		4699.2 (40)	31.01	5/2-7/2	0.392
	4069.9	28.56	3/2-5/2	0.539		4097.3	28.73	1/2-3/2	0.315		4703.2	31.01	3/2-5/2	0.411
	4065.6	28.55	1/2-3/2	0.673		4120.3	28.73	5/2-5/2	0.113		4698.5	31.01	5/2-5/2	0.0196
	4092.9	28.57	7/2-7/2	0.0688		4105.0	28.73	3/2-3/2	0.202		4327.5 (41)	31.24	5/2-5/2	0.269
	4085.1	28.56	5/2-5/2	0.117		4103.0	28.73	1/2-1/2	0.315		4331.9	31.24	5/2-3/2	0.260
	4078.9	28.55	3/2-3/2	0.134		4120.6	28.73	5/2-3/2	0.0126		4327.9	31.24	5/2-3/2	0.0193
	4106.0	28.56	7/2-5/2	0.00343		4110.8	28.73	3/2-1/2	0.0315		4327.9	31.24	5/2-3/2	0.0289
	4094.2	28.55	5/2-3/2	0.00636		3287.6 (23)	29.49	5/2-5/2	0.0893		4192.5 (42)	31.33	5/2-3/2	0.0772
	3926.6 (11)	25.70	7/2-5/2	0.00845		3295.1	29.47	3/2-3/2	0.0173		4196.7	31.33	3/2-1/2	0.0643
	3896.3	28.71	5/2-3/2	0.00595		3301.6	29.46	1/2-1/2	0.0218		4196.3	31.33	3/2-3/2	0.0129
	3872.5	28.70	3/2-1/2	0.00356		3305.2	29.47	5/2-3/2	0.0387		3407.4 (44)	32.01	5/2-5/2	0.128
	3907.5	28.71	5/2-5/2	0.00254		3306.6	29.46	3/2-1/2	0.0547		3407.4	32.01	5/2-3/2	0.00911
	3882.5	28.71	3/2-3/2	0.00454		3277.7	29.49	3/2-5/2	0.0570		3405.8	32.01	3/2-5/2	0.0137
	3864.1	28.71	1/2-1/2	0.00712		3290.1	29.47	1/2-3/2	0.108		3409.8	32.01	5/2-3/2	0.123
	3893.5	28.70	3/2-5/2	0.000424		4705.4 (25)	28.76	5/2-7/2	0.638		6895.3 (45)	30.37	9/2-7/2	0.147
	3874.1	28.71	1/2-3/2	0.00142		4699.2	28.74	3/2-5/2	0.666		6906.5	30.36	7/2-5/2	0.127
	3882.2 (12)	28.73	7/2-7/2	0.110		4741.7	28.74	5/2-5/2	0.0315		6910.8	30.35	5/2-3/2	0.110
	3864.5	28.73	5/2-5/2	0.0742		4396.0 (26)	28.94	5/2-5/2	0.122		6908.1	30.34	3/2-1/2	0.103
	3851.0	28.73	3/2-3/2	0.0515		4369.3	28.94	3/2-3/2	0.118		6847.0	30.37	7/2-7/2	0.0209
	3847.9	28.73	1/2-1/2	0.0644		4406.0	28.94	5/2-3/2	0.00863		6865.7	30.36	5/2-5/2	0.0358
	3863.2	28.73	7/2-5/2	0.0184		4359.4	28.94	3/2-5/2	0.0131		6885.1	30.35	5/2-3/2	0.0412
	3864.7	28.73	5/2-3/2	0.0300		3470.8 (27)	29.69	5/2-3/2	0.130		4107.1 (47)	31.57	5/2-7/2	0.000019
	3856.2	28.73	3/2-1/2	0.0322		3470.4	29.67	3/2-1/2	0.110		4097.3 (48)	31.58	7/2-9/2	0.738
	3863.5	28.73	5/2-7/2	0.0245		3448.0	29.69	3/2-3/2	0.0214		4095.6	31.57	5/2-7/2	0.740
	3850.8	28.73	3/2-5/2	0.0451		4524.6 (28)	28.70	3/2-5/2	0.381		4087.2	31.57	5/2-5/2	0.827

## NAVAL RESEARCH LABORATORY

Wavelength [ $\text{\AA}$ ]	$E^{\nu}$	J-J' $\nu$	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ]	$E^{\nu}$	J-J' $\nu$	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ]	$E^{\nu}$	J-J' $\nu$	$f_{J,J'}$
4108.8 (48)	31.57	7/2-7/2	0.0880	3035.8 (72)	32.79	7/2-7/2	0.0152	3216.8 (107)	36.89	5/2-5/2	0.124
4096.2	31.57	5/2-5/2	0.0888	3039.5	32.79	5/2-7/2	0.00337	3216.1	36.89	5/2-5/2	0.124
4062.9 (50)	31.62	9/2-9/2	0.0646	3007.1 (74)	32.84	7/2-9/2	0.137	3759.9 (2)	36.32	2-3	0.311
4048.2	61.62	7/2-7/2	0.0535	3007.7	32.84	5/2-7/2	0.125	3754.7	36.29	1-2	0.277
4041.3	31.61	5/2-5/2	0.0483	3008.3	32.84	7/2-7/2	0.0156	3757.2	36.28	0-1	0.369
4033.2	31.61	5/2-3/2	0.0560	4342.0 (77)	31.58	7/2-9/2	0.851	3791.3	36.29	2-2	0.0550
4034.1	31.61	7/2-5/2	0.00944	4340.4	31.62	7/2-7/2	0.876	3774.0	36.28	1-1	0.0918
4046.2	31.62	7/2-9/2	0.00726	4312.1 (79)	31.62	7/2-7/2	0.0723	3811.0	36.28	2-1	0.00364
3371.9	32.24	9/2-7/2	0.0111	4315.4	31.62	7/2-5/2	0.00268	3340.7 (3)	36.73	2-1	0.0842
3375.8	32.23	7/2-5/2	0.00940	3458.0 (81)	32.33	7/2-5/2	0.120	3312.3	36.73	1-1	0.0847
3360.2	32.24	7/2-7/2	0.00159	3459.1 (83)	32.31	5/2-3/2	0.0110	3299.4	36.73	0-1	0.0850
3367.0	32.23	5/2-5/2	0.00267	3032.1 (85)	32.83	7/2-9/2	0.150	3047.1 (4)	37.09	2-2	0.210
3370.2	32.22	3/2-3/2	0.00304	3032.5	32.81	5/2-7/2	0.150	3055.4	37.07	1-1	0.0700
4303.8 (54)	31.57	5/2-7/2	0.757	5627.6 (85)	30.68	3/2-3/2	0.0470	3059.3	37.07	2-1	0.0696
4294.8	31.58	3/2-5/2	0.595	6678.2	30.68	1/2-3/2	0.0190	3043.0	37.06	1-0	0.0930
4281.4	31.58	5/2-5/2	0.170	6666.9	30.67	3/2-1/2	0.00950	3023.5	37.09	1-2	0.117
4282.8	31.59	3/2-3/2	0.300	4491.3 (86)	31.56	3/2-5/2	0.885	3024.6	37.07	0-1	0.281
4288.8	31.59	1/2-1/2	0.471	4489.5	31.58	1/2-3/2	0.982	5592.4 (5)	35.92	1-1	0.151
4276.7	31.59	3/2-1/2	0.0470	4707.8 (89)	31.56	5/2-5/2	0.105	2583.8 (6)	37.85	1-2	0.509
3013.4 (56)	32.79	5/2-7/2	0.129	4669.5	31.58	3/2-3/2	0.101	3265.5 (8)	40.10	3-4	0.418
4871.6 (57)	31.24	3/2-5/2	0.245	4609.4 (93)	31.62	5/2-7/2	0.849	3261.0	40.08	2-3	0.403
4861.0	31.24	1/2-3/2	0.272	4602.1	31.62	3/2-5/2	0.891	3267.3	40.05	1-2	0.451
4701.2 (58)	31.33	3/2-3/2	0.306	4613.1	31.62	5/2-5/2	0.0425	3281.6	40.05	3-3	0.0358
4691.5	31.33	1/2-1/2	0.245	4465.4 (91)	33.06	5/2-7/2	0.367	3305.8	40.05	3-2	0.0495
4701.8	31.33	3/2-1/2	0.0612	4467.9	33.06	5/2-5/2	0.275	3017.6 (10)	40.41	3-3	0.0809
4691.0	31.33	1/2-3/2	0.123	4469.3	33.06	5/2-3/2	0.183	3044.4	40.40	2-2	0.0633
4328.6 (61)	31.56	3/2-1/2	0.180	4060.6 (97)	34.05	7/2-9/2	0.667	2996.5	40.40	1-1	0.3684
4319.9	31.56	1/2-1/2	0.145	4061.0	34.05	5/2-7/2	0.686	2924.1	40.40	1-2	0.343
3735.9 (62)	32.01	3/2-5/2	0.161	4054.1 (98)	34.06	7/2-7/2	0.185	3132.9 (12)	40.67	1-2	0.207
3729.3	31.57	1/2-3/2	0.0912	4054.6	34.06	5/2-5/2	0.183	3121.7	40.69	1-1	0.0691
4334.3 (64)	31.58	5/2-5/2	0.0610	4024.0 (99)	34.08	5/2-3/2	0.110	3115.7	40.69	1-0	0.0691
4309.0	31.59	1/2-1/2	0.0526	4302.8 (100)	34.05	9/2-9/2	0.110	3715.1 (14)	40.41	2-3	0.325
4315.4	31.59	3/2-1/2	0.0263	4303.1	34.05	7/2-7/2	0.628	3707.2	40.40	0-1	0.290
4315.3	31.57	5/2-7/2	0.0203	4378.4 (102)	34.06	5/2-7/2	0.659	3702.6	40.40	0-1	0.386
4275.5 (67)	31.62	7/2-9/2	0.744	4343.4 (103)	34.08	5/2-5/2	0.254	3725.3	40.40	2-2	0.0577
4276.7	31.62	5/2-7/2	0.681	4342.8	34.08	3/2-3/2	0.254	3714.0	40.40	1-1	0.0964
4283.0	31.61	3/2-5/2	0.669	4488.1 (104)	34.08	5/2-5/2	0.589	3732.1	40.40	2-2	0.0577
4277.9	31.62	1/2-3/2	0.835	4487.7	34.08	1/2-3/2	0.654	3444.1 (15)	40.67	2-1	0.108
4281.1	31.61	7/2-7/2	0.0852	4843.3 (105)	34.10	1/2-3/2	0.694	3415.3	40.69	2-2	0.0362
4283.8	31.61	5/2-5/2	0.146	4843.3	34.10	1/2-1/2	0.350	3408.1	40.69	1-1	0.0361
3516.9 (69)	32.23	3/2-3/2	0.167	4146.1 (106)	36.03	7/2-9/2	0.602	3408.1	40.69	2-1	0.0485
3534.0	32.23	7/2-7/2	0.00233	4143.8	36.03	5/2-7/2	0.113	3408.1	40.69	1-0	0.0601
3495.4 (70)	32.26	7/2-5/2	0.00370	4142.2	36.03	5/2-5/2	0.225	3405.7	40.69	1-0	0.145
3506.0	32.25	5/2-5/2	0.00582	4145.9	36.03	7/2-7/2	0.172	5508.1 (16)	40.09	2-2	0.0510
3494.7	32.26	5/2-5/2	0.00588	4143.5	36.03	5/2-5/2	0.294	3961.6 (17)	40.96	2-3	0.454
3501.7	32.25	1/2-3/2	0.00256	4142.1	36.04	3/2-3/2	0.338				
	32.25	1/2-3/2	0.00140	3218.1 (107)	36.89	7/2-5/2	0.124				

Wavelength [ $\text{\AA}$ ] <sup>1</sup>	$f_{j,j}$	$J-J'$ <sup>2</sup>	$E^3$	Wavelength [ $\text{\AA}$ ] <sup>4</sup>	$E^3$	$J-J'$ <sup>2</sup>	$f_{j,j}$
0 III 2016.8 (18)	0.00571	2 - 1	41.08	0 III 3336.8 (28)	49.15	2 - 2	0.0117
528.1 (19)	0.429	0 - 1	41.08	3326.2	49.15	1 - 1	0.0352
3034.3 (20)	0.0582	1 - 1	45.15	3348.1	49.15	3 - 2	0.0466
3703.4 (21)	0.290	3 - 4	45.11	3332.5	49.15	2 - 1	0.0632
3698.7	0.210	2 - 3	45.10	3344.3	49.14	2 - 3	0.0652
3695.4	0.131	1 - 2	45.08	3330.4	49.15	1 - 2	0.105
3720.9	0.0748	3 - 3	45.10	3280.0 (29)	49.82	0 - 1	0.115
3712.5	0.131	2 - 2	45.08	3728.0 (30)	49.58	3 - 4	0.424
3704.7	0.168	1 - 1	45.08	3728.5	49.56	2 - 3	0.410
3734.8	0.106	3 - 2	45.08	3729.7	49.55	1 - 2	0.460
3722.0	0.0336	2 - 1	45.08	3216.0 (31)	50.11	3 - 3	0.0900
3709.5	0.0747	1 - 0	45.07	3207.1	50.10	2 - 2	0.0704
3351.0 (22)	0.168	3 - 3	45.46	3201.0	50.10	2 - 1	0.0762
3344.3	0.0210	2 - 2	45.45	4461.6 (33)	49.14	2 - 3	0.203
3336.8	0.0630	1 - 1	45.44	4447.8	45.15	2 - 2	0.146
3362.4	0.0835	3 - 2	45.45	4440.1	49.15	2 - 1	0.0878
3350.7	0.113	2 - 1	45.44	4555.3 (34)	49.42	2 - 2	0.0839
3333.0	0.118	2 - 3	45.46	3638.7 (35)	50.11	2 - 3	0.388
3330.4	0.189	1 - 2	45.46	3646.8	50.10	1 - 2	0.345
4081.1 (23)	0.328	2 - 3	46.27	3653.0	50.10	0 - 1	0.460
4073.9	0.293	1 - 2	46.25	3650.7	50.10	2 - 2	0.0691
3556.9 (24)	0.204	2 - 2	46.71	3650.2	50.10	2 - 1	0.115
3450.9 (25)	0.322	3 - 4	48.67	3649.2	50.10	2 - 1	0.00460
3448.1	0.289	2 - 3	48.66	3063.5 (1)	48.18	1/2-3/2	0.412
3446.7	0.280	1 - 2	48.66	3071.7	48.17	1/2-1/2	0.205
3447.2	0.420	4 - 4	48.67	3411.8 (2)	51.79	3/2-5/2	0.301
3466.2	0.0500	4 - 4	48.65	3403.6	51.79	1/2-3/2	0.336
3460.0	0.0899	3 - 3	48.66	3413.7	51.79	3/2-3/2	0.0335
3454.9	0.120	2 - 2	48.66	3385.6 (3)	57.84	5/2-7/2	0.243
3451.3	0.140	1 - 1	48.65	3481.3	57.81	3/2-5/2	0.191
3459.5	0.0738	4 - 4	48.65	3381.3	57.79	1/2-3/2	0.152
3088.0 (26)	0.0738	4 - 4	49.11	3409.8	57.81	5/2-5/2	0.0543
3083.7	0.0443	3 - 3	49.10	3396.8	57.79	3/2-3/2	0.0967
3075.2	0.0222	2 - 2	49.10	3390.4	57.78	1/2-1/2	0.151
3095.8	0.0147	4 - 3	49.10	3425.6	57.79	5/2-3/2	0.00600
3084.6	0.0253	3 - 2	49.10	3406.0	57.78	3/2-1/2	0.0151
3074.7	0.0310	2 - 1	49.10	3349.1 (4)	59.62	3/2-5/2	0.312
3068.1	0.0296	1 - 0	49.10	3348.1	59.59	1/2-3/2	0.346
3076.0	0.0190	3 - 4	49.11	3378.1	59.59	3/2-3/2	0.0344
3074.2	0.0355	2 - 3	49.10	3052.5 (5)	59.97	3/2-1/2	0.0784
3068.7	0.0518	1 - 2	49.10	3028.0	59.97	1/2-1/2	0.0788
3065.0	0.0889	0 - 1	49.10	3736.8 (6)	61.14	7/2-9/2	0.210
3385.0 (27)	0.319	3 - 4	49.11	3729.0	61.12	5/2-7/2	0.192
3382.7	0.231	2 - 3	49.10	3725.8	61.11	3/2-5/2	0.188
3394.3	0.0823	3 - 3	49.10	3725.8	61.12	1/2-3/2	0.235
3383.9	0.144	2 - 2	49.10	3758.5	61.12	7/2-7/2	0.0238
3376.8	0.186	1 - 1	49.10	3744.7	61.11	5/2-5/2	0.0407
3355.9 (28)	0.0929	3 - 3	49.14	3736.8	61.10	3/2-3/2	0.0468
				4774.4	61.11	7/2-5/2	0.00118
0 IV 3755.8 (6)	61.10	5/2-3/2		0 IV 3336.8 (28)	49.15	2 - 2	0.0117
3209.6 (7)	61.68	7/2-7/2		3326.2	49.15	1 - 1	0.0352
3194.8	61.67	5/2-5/2		3348.1	49.15	3 - 2	0.0466
3185.7	61.67	3/2-3/2		3332.5	49.15	2 - 1	0.0632
3180.7	61.66	1/2-1/2		3344.3	49.14	2 - 3	0.0652
3216.3	61.67	7/2-5/2		3330.4	49.15	1 - 2	0.105
3199.5	61.67	5/2-3/2		3280.0 (29)	49.82	0 - 1	0.115
3188.7	61.66	3/2-1/2		3728.0 (30)	49.58	3 - 4	0.424
3188.2	61.68	5/2-7/2		3728.5	49.56	2 - 3	0.410
3181.0	61.67	1/2-3/2		3729.7	49.55	1 - 2	0.460
3177.8	61.67	1/2-3/2		3216.0 (31)	50.11	3 - 3	0.0900
3375.5 (8)	62.20	3/2-5/2		3207.1	50.10	2 - 2	0.0704
3362.6	62.21	3/2-3/2		3201.0	50.10	2 - 1	0.0762
3354.3	62.22	3/2-1/2		4461.6 (33)	49.14	2 - 3	0.203
4798.3 (9)	61.68	5/2-7/2		4447.8	45.15	2 - 2	0.146
4783.4	61.67	3/2-5/2		4440.1	49.15	2 - 1	0.0878
4772.6	61.67	1/2-3/2		4555.3 (34)	49.42	2 - 2	0.0839
4813.1	61.67	5/2-5/2		3638.7 (35)	50.11	2 - 3	0.388
4794.2	61.67	3/2-3/2		3646.8	50.10	1 - 2	0.345
4779.1	61.66	1/2-1/2		3653.0	50.10	0 - 1	0.460
4823.9	61.67	5/2-3/2		3650.7	50.10	2 - 2	0.0691
4800.8	61.66	3/2-1/2		3650.2	50.10	2 - 1	0.115
3995.2 (10)	62.21	5/2-5/2		3649.2	50.10	2 - 1	0.00460
3956.8	62.21	3/2-3/2		3063.5 (1)	48.18	1/2-3/2	0.412
3930.6	62.22	1/2-1/2		3071.7	48.17	1/2-1/2	0.205
3977.1	62.21	5/2-5/2		3411.8 (2)	51.79	3/2-5/2	0.301
3945.3	62.22	3/2-1/2		3403.6	51.79	1/2-3/2	0.336
3974.7	62.20	3/2-5/2		3413.7	51.79	3/2-3/2	0.0335
3942.1	62.21	1/2-3/2		3385.6 (3)	57.84	5/2-7/2	0.243
3562.4	61.92	5/2-5/2		3481.3	57.81	3/2-5/2	0.191
3305.3	61.91	3/2-3/2		3381.3	57.79	1/2-3/2	0.152
3563.4 (12)	63.08	5/2-7/2		3409.8	57.81	5/2-5/2	0.0543
3560.4	63.05	3/2-5/2		3396.8	57.79	3/2-3/2	0.0967
3520.9 (13)	63.48	1/2-3/2		3390.4	57.78	1/2-1/2	0.151
3502.2	63.50	1/2-1/2		3425.6	57.79	5/2-3/2	0.00600
3489.8 (14)	67.57	3/2-5/2		3406.0	57.78	3/2-1/2	0.0151
3492.2	67.57	1/2-3/2		3349.1 (4)	59.62	3/2-5/2	0.312
4568.0 (15)	70.91	7/2-5/2		3348.1	59.59	1/2-3/2	0.346
4568.0	70.91	5/2-5/2		3378.1	59.59	3/2-3/2	0.0344
4568.0	70.91	5/2-3/2		3052.5 (5)	59.97	3/2-1/2	0.0784
5114.0 (1)	71.70	0 - 1		3028.0	59.97	1/2-1/2	0.0788
3144.7 (2)	75.63	1 - 2		3736.8 (6)	61.14	7/2-9/2	0.210
5600.0 (3)	74.13	2 - 3		3729.0	61.12	5/2-7/2	0.192
5582.0	74.12	1 - 2		3725.8	61.11	3/2-5/2	0.188
5573.0	74.12	0 - 1		3725.8	61.12	1/2-3/2	0.235
5606.0	74.12	2 - 2		3758.5	61.12	7/2-7/2	0.0238
5584.0	74.12	1 - 1		3744.7	61.11	5/2-5/2	0.0407
5608.0	74.12	2 - 1		3736.8	61.10	3/2-3/2	0.0468
4123.9 (4)	83.62	2 - 3		4774.4	61.11	7/2-5/2	0.00118



Wavelength [Å]	E <sup>2</sup>	J-J <sup>2</sup>	f <sub>J,J</sub>	Wavelength [Å]	E <sup>2</sup>	J-J <sup>2</sup>	f <sub>J,J</sub>	Wavelength [Å]	E <sup>2</sup>	J-J <sup>2</sup>	f <sub>J,J</sub>
Ne II 3503.6 (28)	54.73	1/2-1/2	0.302	Na I 4058.8 (53)	37.47	7/2-7/2	0.0819	Na I 5153.4 (8)	4.49	3/2-1/2	0.00418
3275.2 (29)	34.98	1/2-3/2	0.0986	4062.9	37.51	5/2-5/2	0.138	5146.8	4.49	1/2-1/2	0.00418
3542.9 (34)	54.71	3/2-5/2	0.449	4133.7	37.47	3/2-5/2	0.162	4982.8 (9)	4.57	3/2-5/2	0.0258
3565.8	34.69	3/2-3/2	0.297	4412.5 (55)	37.38	9/2-7/2	0.00218	4978.5	4.57	1/2-3/2	0.0288
3584.2 (36)	34.66	3/2-1/2	0.147	4514.8	37.39	7/2-5/2	0.00190	4751.8 (11)	4.69	3/2-1/2	0.00192
3442.1	34.81	3/2-5/2	0.0832	4535.5	37.40	3/2-1/2	0.00156	4747.9	4.69	1/2-1/2	0.00192
3597.9	34.86	3/2-5/2	0.0539	4517.8	37.38	7/2-7/2	0.000317	10745.9 (18)	4.33	1/2-5/2	0.0254
3829.8 (39)	34.60	3/2-5/2	0.576	4553.2	37.39	3/2-3/2	0.000625	10748.7	4.33	1/2-1/2	0.0126
3818.4	34.62	3/2-3/2	0.645	4565.5	37.39	3/2-5/2	0.000045	12679.0 (21)	4.57	3/2-5/2	0.160
3800.0	34.62	1/2-3/2	0.0646	4397.9 (56)	37.39	9/2-9/2	0.0699	10834.4 (22)	4.74	3/2-5/2	0.0541
3628.1 (41)	34.78	3/2-3/2	0.189	4375.5	37.47	7/2-7/2	0.0581				
3697.1	34.73	1/2-1/2	0.149	4385.0	37.51	5/2-5/2	0.0525	Mg I 5183.6 (2)	5.09	2 - 1	0.0721
3679.8	34.73	3/2-1/2	0.0373	4430.9	37.47	3/2-3/2	0.0616	5172.7	5.09	1 - 1	0.0719
3644.9	34.78	1/2-3/2	0.0757	4446.5	37.47	5/2-3/2	0.0103	5167.3	5.09	0 - 1	0.0717
3428.8 (42)	34.98	3/2-3/2	0.133	4502.5	37.39	7/2-9/2	0.00809	3638.3 (3)	5.92	2 - 3	0.361
3377.2	35.05	1/2-1/2	0.102	4442.7	37.47	5/2-7/2	0.0138	3832.3	5.92	1 - 2	0.321
3443.7	34.98	1/2-3/2	0.0534	4369.8	37.51	3/2-5/2	0.0152	3829.4	5.92	0 - 1	0.428
3229.5 (43)	37.70	7/2-9/2	0.654	4391.9 (57)	37.46	5/2-7/2	0.789	3838.3	5.92	2 - 2	0.0644
3224.8	37.70	5/2-7/2	0.673	4409.3	37.48	5/2-7/2	0.793	3832.3	5.92	1 - 1	0.107
3097.2 (44)	37.86	7/2-5/2	0.0259	4413.2	37.48	3/2-5/2	0.889	3336.7 (4)	6.40	2 - 1	0.00805
3092.9	37.86	5/2-5/2	0.00173	4428.5	37.48	5/2-5/2	0.0555	3332.2	6.40	1 - 1	0.00802
3411.4 (45)	37.72	3/2-3/2	0.325	4465.7	37.48	7/2-5/2	0.00262	3329.9	6.40	0 - 1	0.00803
3440.8	37.72	1/2-1/2	0.260	4616.0 (64)	37.36	5/2-7/2	0.795	3096.9 (5)	6.69	2 - 3	0.103
3413.1	37.72	3/2-1/2	0.0650	4574.5	37.39	3/2-5/2	0.622	3096.9	6.69	2 - 2	0.184
3439.0	37.72	1/2-2/2	0.130	4612.9	37.39	5/2-5/2	0.179	3096.9	6.69	2 - 1	0.00123
3536.1 (46)	37.81	3/2-2/2	0.0311	4562.1	37.39	3/2-3/2	0.316	3093.0	6.69	1 - 2	0.0920
3050.6 (48)	38.15	3/2-1/2	0.191	4498.9	37.40	1/2-1/2	0.489	3093.0	6.69	0 - 1	0.0307
3072.7	38.15	1/2-1/2	0.191	4600.1	37.39	5/2-3/2	0.0198	3091.1	6.69	0 - 1	0.123
3460.8 (49)	37.70	1/2-3/2	0.569	4544.1	37.40	3/2-1/2	0.0493	11828.8 (6)	5.37	1 - 0	0.165
3479.5	37.70	1/2-1/2	0.284	4511.4 (70)	37.51	3/2-5/2	0.888	8806.8 (7)	5.73	1 - 2	0.710
3542.3 (50)	37.72	5/2-3/2	0.0772	4511.3	37.46	1/2-5/2	0.987	5711.1 (8)	6.49	1 - 0	0.00883
3538.0	37.72	3/2-1/2	0.0644	4432.3 (74)	40.49	3/2-5/2	0.520	5528.4 (9)	6.56	1 - 2	0.00320
3539.9	37.72	3/2-5/2	0.0129	4431.7	40.49	1/2-5/2	0.578	4700.0 (10)	6.94	1 - 0	0.00267
3406.9 (51)	37.86	5/2-5/2	0.293	4429.6	40.49	3/2-5/2	0.520	4703.0 (11)	6.95	1 - 2	0.0135
3457.2	37.81	3/2-3/2	0.278	Na I 5890.0 (1)	2.10	1/2-3/2	0.624	4354.5 (13)	7.16	1 - 0	0.00121
3459.4	37.81	5/2-3/2	0.0206	5895.9	2.09	1/2-1/2	0.312	4351.9 (14)	7.16	1 - 2	0.00759
3404.8	37.86	3/2-5/2	0.0314	3302.3 (2)	3.74	1/2-3/2	0.00974	7657.6 (22)	6.70	1 - 2	0.0242
4219.8 (52)	37.38	7/2-7/2	0.0885	3302.9	3.74	1/2-1/2	0.00481	6318.2 (23)	7.04	1 - 2	0.00583
4231.6	37.39	5/2-5/2	0.0597	11403.6 (3)	3.18	3/2-1/2	0.163	6318.8	7.04	1 - 2	0.00583
4240.0	37.39	3/2-3/2	0.0415	11381.2	3.18	1/2-1/2	0.162	6318.8	7.04	1 - 1	0.00347
4242.2	37.40	1/2-1/2	0.0519	8194.8 (4)	3.60	3/2-5/2	0.753	6318.8	7.04	1 - 0	0.00116
4217.2	37.39	7/2-5/2	0.0148	8194.8	3.60	1/2-3/2	0.836	8923.8 (25)	6.75	0 - 1	0.0397
4220.9	37.39	5/2-5/2	0.0241	8194.8	3.60	3/2-3/2	0.836	12063.8 (26)	6.75	2 - 3	0.585
4224.6	37.39	3/2-1/2	0.0259	8194.8	3.60	1/2-3/2	0.836	8256.0 (27)	7.06	2 - 3	0.181
4250.7	37.39	3/2-5/2	0.0364	6160.7 (5)	4.10	3/2-1/2	0.0131	9213.0 (28)	7.23	2 - 3	0.0821
4257.8	37.39	1/2-3/2	0.0321	6154.2	4.10	1/2-1/2	0.0132	10966.1 (35)	7.03	2 - 3	0.112
4206.4 (53)	37.39	7/2-9/2	0.736	5688.2 (6)	4.27	3/2-5/2	0.0855	10966.1	7.03	2 - 2	0.0199
4080.5	37.51	3/2-5/2	0.636	5682.6	4.27	1/2-3/2	0.0952	10966.1	7.03	2 - 1	0.00133
4150.7	37.47	1/2-3/2	0.813	5688.2	4.27	3/2-3/2	0.00950	10961.2	7.03	1 - 2	0.0096

Wavelength [ $\text{\AA}$ ]	$E^2$	J-J <sup>2</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^2$	J-J <sup>2</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^2$	J-J <sup>2</sup>	$f_{J,J}$
Mg I 10961.2 (35)	7.03	1 - 1	0.0332	Al I 6696.0 (5)	4.97	1/2-3/2	0.0225	Al II 6231.8 (10)	15.00	1 - 2	0.860
10961.2	7.03	0 - 1	0.133	6698.6	4.97	1/2-1/2	0.0111	6226.2	15.00	0 - 1	1.146
9993.7 (36)	7.14	2 - 1	0.00674	5557.1 (6)	5.35	1/2-3/2	0.00479	3738.0 (11)	16.32	2 - 1	0.0269
9987.0	7.14	1 - 1	0.00675	5558.0	5.35	1/2-1/2	0.00234	3733.9	16.32	1 - 1	0.0265
9987.0	7.14	0 - 1	0.00675	11255.7 (8)	5.10	5/2-5/2	0.479	3732.0	16.32	0 - 1	0.0269
10812.8 (37)	7.06	1 - 2	0.185	11255.7	5.10	3/2-5/2	0.503	3655.0 (12)	16.40	2 - 3	0.0771
9415.5 (38)	7.23	1 - 2	0.0730	11253.8	5.10	5/2-7/2	0.160	3651.1	16.40	1 - 2	0.0691
Mg II 9217.4 (1)	9.96	1/2-3/2	0.914	8773.9 (9)	5.41	5/2-7/2	0.0801	3026.8 (13)	17.10	2 - 1	0.00935
9217.4	9.96	1/2-1/2	0.456	8773.9	5.41	3/2-5/2	0.168	3024.1	17.10	1 - 1	0.00935
9213.4 (2)	12.03	1/2-3/2	0.000628	8772.9	5.41	5/2-7/2	0.0756	322.8	17.10	0 - 1	0.00935
3613.8	12.03	1/2-1/2	0.000269	7836.2 (10)	5.58	5/2-7/2	0.00378	2538.2 (14)	17.14	2 - 3	0.0208
3615.6	12.03	1/2-1/2	0.178	7836.2	5.58	5/2-5/2	0.00378	2918.2	17.14	2 - 2	0.00371
10914.2 (3)	9.96	5/2-3/2	0.178	7835.3	5.58	3/2-5/2	0.0793	2918.2	17.14	2 - 1	0.000247
10914.2	9.96	3/2-1/2	0.149	10891.2 (12)	5.20	3/2-1/2	0.0200	2993.5	17.14	1 - 1	0.0187
4481.3 (4)	11.58	5/2-7/2	0.934	10891.2	5.20	3/2-5/2	0.0200	2993.5	17.14	1 - 1	0.00622
4481.3	11.58	5/2-5/2	0.0467	10782.5	5.21	1/2-1/2	0.0130	2994.3	17.14	0 - 1	0.0245
4481.1	11.58	3/2-5/2	0.981	10782.5	5.21	1/2-3/2	0.0144	6920.0 (15)	14.98	1 - 0	0.226
3848.2 (5)	12.03	5/2-3/2	0.00431	10782.5	5.21	3/2-5/2	0.00140	5593.2 (16)	15.41	1 - 2	0.847
3850.4	12.03	5/2-1/2	0.00355	10785.4	5.21	3/2-5/2	0.00190	3866.2 (17)	16.39	1 - 0	0.0276
3104.8 (6)	12.80	5/2-7/2	0.156	10786.8	5.21	1/2-3/2	0.00213	3703.2 (18)	16.53	1 - 2	0.131
3104.8	12.80	5/2-5/2	0.00781	8923.6 (14)	5.45	1/2-3/2	0.00649	3135.9 (19)	17.13	1 - 0	0.00968
3104.7	12.80	3/2-5/2	0.164	8923.6	5.45	3/2-1/2	0.00649	3088.5 (20)	17.19	1 - 2	0.0364
8238.4 (7)	11.45	3/2-1/2	0.263	8828.9	5.47	1/2-1/2	0.00651	7471.4 (21)	15.24	2 - 3	1.097
8217.8	11.45	1/2-1/2	0.263	7042.1 (3)	13.02	1 - 2	0.727	6335.7 (22)	15.54	2 - 1	0.0501
7896.4 (8)	11.52	3/2-5/2	1.112	7056.6	13.02	1 - 1	0.435	4026.5 (24)	16.66	2 - 1	0.00927
7896.4	11.52	3/2-3/2	0.124	7063.6	13.01	1 - 0	0.145	3428.9 (25)	17.19	2 - 3	0.000322
7877.1	11.52	1/2-3/2	1.234	8640.7 (4)	13.20	0 - 1	1.241	3074.7 (27)	17.60	2 - 3	0.00216
4434.0 (9)	12.74	3/2-1/2	0.0295	3275.8 (5)	15.54	0 - 1	0.00406	6696.4 (29)	16.67	1 - 2	0.00426
4428.0	12.74	1/2-1/2	0.0295	10076.3 (6)	13.02	3 - 2	0.144	6699.5	16.67	1 - 1	0.00244
4390.6 (10)	12.77	3/2-5/2	0.0694	10107.2	13.02	2 - 1	0.108	4398.4 (30)	17.29	1 - 0	0.000002
4390.6	12.77	3/2-3/2	0.00771	10122.5	13.01	1 - 0	0.0796	5388.5 (34)	17.27	0 - 1	0.0162
4384.6	12.77	1/2-3/2	0.0777	10077.3	13.02	2 - 2	0.0359	8354.4 (40)	16.47	3 - 4	0.671
3553.5 (11)	13.43	3/2-1/2	0.0102	10077.5	13.02	2 - 2	0.0359	8359.6	16.47	2 - 3	0.652
3549.6	13.43	1/2-1/2	0.0102	10108.0	13.02	1 - 1	0.0598	8363.5	16.47	1 - 2	0.736
3538.9 (12)	13.44	3/2-5/2	0.0166	10108.4	13.02	1 - 1	0.0598	8359.2	16.47	3 - 3	0.0582
3538.9	13.44	3/2-3/2	0.00184	3586.6 (7)	15.24	3 - 4	0.720	8363.3	16.47	2 - 2	0.0817
3535.0	13.44	1/2-3/2	0.0186	3587.1	15.24	2 - 3	0.697	5853.6 (41)	17.11	3 - 4	0.154
3175.8 (13)	13.84	3/2-1/2	0.00489	3587.5	15.24	1 - 2	0.785	5861.5	17.10	2 - 3	0.148
3172.8	13.84	1/2-1/2	0.00490	356.9	15.24	3 - 3	0.0623	5867.8	17.10	2 - 3	0.165
9633.0 (15)	12.80	3/2-5/2	0.804	3587.3	15.24	2 - 2	0.0872	6917.9 (75)	17.19	1 - 2	0.00470
6346.7 (16)	13.46	3/2-5/2	0.183	3587.2	15.24	3 - 2	0.00178	6915.2 (77)	17.60	2 - 3	0.156
5264.1 (17)	13.86	3/2-5/2	0.0726	3313.3 (8)	15.52	3 - 2	0.00291	7823.7 (90)	17.10	2 - 3	0.0462
Al I 3961.5 (1)	3.13	3/2-1/2	0.0513	3314.9	15.52	2 - 1	0.00216	7815.8	17.10	2 - 1	0.0387
3914.0	3.13	1/2-1/2	0.0598	3315.6	15.52	1 - 0	0.00159	7812.3	17.10	1 - 1	0.0387
3092.7 (3)	4.00	3/2-5/2	0.370	3313.5	15.52	2 - 2	0.000726	7631.3 (91)	17.14	2 - 3	0.106
3062.2	4.00	1/2-3/2	0.409	6837.1 (9)	14.83	2 - 1	0.238	7635.3	17.14	2 - 2	0.0190
3052.8	4.00	3/2-3/2	0.0411	6823.5	14.83	1 - 1	0.237	7635.3	17.14	2 - 2	0.0126
13123.4 (4)	4.07	1/2-3/2	0.810	6816.7	14.83	0 - 1	0.237	7627.9	17.14	2 - 1	0.0951
13150.7	4.07	1/2-1/2	0.404	6243.4 (10)	15.00	2 - 3	0.964				

Wavelength [ $\lambda^{\mu}$ ]	$E^{\nu}$	J-J <sup>μ</sup>	f <sub>J,J</sub>	Wavelength [ $\lambda^{\mu}$ ]	$E^{\nu}$	J-J <sup>μ</sup>	f <sub>J,J</sub>	Wavelength [ $\lambda^{\mu}$ ]	$E^{\nu}$	J-J <sup>μ</sup>	f <sub>J,J</sub>
Al II 7627.9 (91)	17.14	1 - 1	0.0317	SI I 10979.3 (5)	6.06	2 - 1	0.0971	SI I 6131.5 (30)	7.60	2 - 2	0.00022
7624.5	17.14	0 - 1	0.127	10786.9	6.05	1 - 0	0.129	6124.9	7.60	1 - 1	0.00028
6073.2 (92)	17.55	2 - 1	0.0135	3603.4	6.07	1 - 2	0.162	6131.9	7.60	2 - 3	0.00005
6068.5	17.55	1 - 1	0.0135	10651.0	6.06	0 - 1	0.388	6125.0	7.60	1 - 2	0.00009
6066.3	17.55	0 - 1	0.0136	10585.1 (6)	6.10	2 - 1	0.131	6142.2	7.60	3 - 2	0.00003
6066.4	17.55	0 - 1	0.0136	10371.2	6.10	1 - 1	0.130	6131.3	7.60	2 - 1	0.00005
6006.4 (93)	17.57	2 - 3	0.0255	10358.8	6.10	0 - 1	0.130	10844.0 (31)	6.98	1 - 2	0.484
6006.4	17.57	2 - 2	0.00455	5797.9 (9)	7.06	2 - 3	0.0149	8093.3 (34)	7.36	1 - 1	0.0151
6006.4	17.57	2 - 1	0.000303	5743.1	7.04	1 - 2	0.00887	7680.4 (36)	7.44	1 - 2	0.0924
6001.8	17.57	1 - 2	0.0229	5780.3	7.03	0 - 1	0.0107	6848.7 (37)	7.64	1 - 1	0.00390
6001.8	17.57	1 - 1	0.00763	5750.2	7.04	2 - 2	0.00153	6722.7 (38)	7.67	1 - 2	0.0376
5999.7	17.57	0 - 1	0.0306	5748.5 (10)	7.09	2 - 2	0.0141	11018.0 (39)	6.97	2 - 1	0.00423
5999.8	17.57	0 - 1	0.0306	5690.5	7.08	1 - 1	0.00380	9570.1 (42)	7.14	2 - 2	0.00243
7449.4 (98)	17.19	1 - 2	0.163	5754.3	7.08	2 - 1	0.00354	8752.2 (43)	7.26	2 - 3	0.231
6061.1 (99)	17.57	1 - 0	0.0143	5701.1	7.07	1 - 0	0.00473	8501.5 (47)	7.30	2 - 2	0.0148
5971.9 (100)	17.60	1 - 2	0.0440	5645.7	7.09	1 - 2	0.00832	7165.6 (48)	7.57	2 - 4	0.0113
Al III 3601.6 (1)	17.74	5/2-3/2	0.170	5665.6	7.03	0 - 1	0.0156	10727.2 (53)	7.11	3 - 4	0.260
3612.4	17.74	3/2-1/2	0.142	5622.2	7.10	2 - 1	0.00719	10694.1	7.09	2 - 3	0.278
3601.9	17.74	3/2-3/2	0.0284	5622.2	7.10	1 - 1	0.00755	10689.5	7.08	1 - 2	0.331
5696.5 (2)	17.74	1/2-3/2	0.844	10369.5 (13)	6.20	1 - 2	0.666	10882.7	7.09	3 - 3	0.0261
5722.7 (3)	17.73	1/2-1/2	0.420	5413.6 (14)	6.37	1 - 0	0.124	10784.3	7.08	2 - 2	0.0377
4529.2 (3)	20.47	3/2-5/2	1.147	5948.6 (16)	7.14	1 - 2	0.0404	893.0 (54)	7.35	3 - 2	0.0195
4512.5	20.47	1/2-3/2	1.275	5772.3 (17)	7.20	1 - 0	0.0130	8949.3	7.32	2 - 1	0.0147
4528.9	20.47	3/2-3/2	0.127	8417.9 (18)	7.06	3 - 3	0.000132	8925.6	7.31	1 - 0	0.0109
3713.1 (4)	21.07	1/2-1/2	0.229	8527.3	7.04	2 - 2	0.000042	8766.7	7.35	2 - 2	0.00481
3702.1	21.07	3/2-1/2	0.228	8398.0	7.06	2 - 3	0.000024	883.8	7.32	1 - 1	0.00814
4149.9 (5)	23.44	5/2-7/2	0.713	8514.6	7.04	1 - 2	0.000015	7943.9 (57)	7.51	3 - 4	0.0585
4150.1	23.44	3/2-5/2	0.748	8230.7 (19)	7.05	3 - 2	0.00104	7952.2	7.49	2 - 3	0.0705
4149.9	23.44	5/2-5/2	0.0356	8306.8	7.08	2 - 1	0.000563	7518.4	7.49	1 - 2	0.0847
4701.7 (6)	23.32	5/2-3/2	0.0175	8317.5	7.07	1 - 0	0.000377	8031.4	7.49	3 - 3	0.00651
4364.6 (9)	24.86	3/2-5/2	0.0353	8211.5	7.09	2 - 2	0.00261	7970.3	7.49	2 - 2	0.00956
4364.6	24.86	3/2-3/2	0.00392	7423.5 (23)	7.26	3 - 4	0.0868	733.0 (56)	7.63	3 - 2	0.00592
4357.2	24.86	1/2-3/2	0.0400	7409.1	7.26	2 - 3	0.0830	7285.9	7.63	2 - 2	0.00144
3287.4 (10)	25.79	3/2-5/2	0.00259	7405.9	7.26	1 - 2	0.0958	7005.8 (60)	7.72	3 - 4	0.0149
3287.4	25.79	3/2-3/2	0.00288	7424.6	7.26	3 - 3	0.00756	7003.6	7.70	2 - 3	0.0288
3283.1	25.79	1/2-5/2	0.00302	7415.4	7.26	2 - 2	0.0106	6576.5	7.70	1 - 2	0.0342
4903.7 (11)	25.83	3/2-5/2	0.177	7250.7 (25)	7.30	3 - 3	0.00151	7084.3	7.70	3 - 3	0.00266
3980.6 (12)	26.42	3/2-5/2	0.0757	7193.6	7.31	2 - 2	0.000327	10067.8 (64)	7.30	2 - 3	0.00159
5260.9 (13)	25.79	5/2-3/2	0.00774	7184.9	7.31	1 - 1	0.000336	10025.8	7.29	1 - 2	0.00106
SI I 3905.5 (3)	5.06	0 - 1	0.0557	7208.2	7.31	3 - 2	0.00058	9967.5	7.29	0 - 1	0.00587
12031.5 (4)	5.96	2 - 3	0.516	7193.9	7.31	2 - 1	0.000071	10155.9	7.29	2 - 2	0.000374
11924	5.94	1 - 2	0.457	7235.9	7.30	2 - 3	0.000252	10001.4	7.29	1 - 1	0.000188
11991.6	5.93	0 - 1	0.606	7184.5	7.31	1 - 2	0.000111	9689.4 (65)	7.35	2 - 2	0.0155
12270.5	5.93	2 - 2	0.0509	6254.3 (28)	7.57	3 - 4	0.0340	9784.2	7.32	1 - 1	0.00470
12103.5	5.93	1 - 1	0.151	6243.9	7.57	2 - 3	0.0327	5913.2	7.22	2 - 1	0.00463
12396.0	5.93	2 - 1	0.0601	6237.3	7.57	1 - 2	0.0365	5835.6	7.31	1 - 0	0.00605
10227.1 (5)	6.07	2 - 2	0.292	6255.0	7.57	3 - 3	0.00297	5570.1	7.35	1 - 2	0.00655
10745.4	6.06	1 - 1	0.0971	6244.1	7.57	2 - 2	0.00410	5758.1	7.32	0 - 1	0.0189
				6142.5 (30)	7.60	3 - 3	0.000022	9310.2 (66)	7.40	2 - 2	0.0153

Wavelength [ $\text{\AA}$ ]	$E^\circ$	J-J <sup>2</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^\circ$	J-J <sup>2</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^\circ$	J-J <sup>2</sup>	$f_{J,J}$			
SI I	7.41	2 - 1	0.00616	SI II	6347.1 (2)	10.03	1/2-3/2	0.820	SI IV	3145.6 (2)	30.86	1/2-3/2	1.197	
5238.6 (66)	7.41	1 - 0	0.00870	6371.4	10.02	1/2-1/2	0.409	3762.4 (3)	34.14	5/2-3/2	0.295	5/2-3/2	0.295	
5103.4	7.40	1 - 2	0.00594	4130.9 (3)	12.78	5/2-7/2	0.869	3773.1	34.15	3/2-1/2	0.247	3/2-1/2	0.247	
9208.6	7.41	0 - 1	0.0253	4130.9	12.78	5/2-5/2	0.0435	4328.2 (4)	37.00	3/2-1/2	0.296	3/2-1/2	0.296	
9103.4	7.60	1 - 2	0.000001	4128.1	12.78	3/2-5/2	0.912	4314.2	37.00	1/2-1/2	0.293	1/2-1/2	0.293	
8070.6 (67)	7.58	2 - 2	0.00261	5979.0 (4)	12.09	3/2-1/2	0.215	4212.4 (5)	38.92	3/2-5/2	0.610	3/2-5/2	0.610	
8036.2	7.63	2 - 2	0.00523	5957.6	12.09	1/2-1/2	0.212							
7912.6 (68)	7.63	2 - 2	0.00314	5056.0 (5)	12.47	3/2-5/2	0.888	A II	4401.0 (1)	19.14	7/2-5/2	0.0305	7/2-5/2	0.0305
7858.4 (65)	7.35	1 - 2	0.0116	5041.1	12.47	1/2-3/2	0.978	4371.4	19.18	5/2-3/2	0.0216	5/2-3/2	0.0216	
9491.9 (71)	7.40	1 - 2	0.0419	5056.4	12.47	3/2-3/2	0.0987	4332.1	19.22	3/2-1/2	0.0130	3/2-1/2	0.0130	
9421.8	7.41	1 - 1	0.0305	3339.8 (6)	13.73	3/2-1/2	0.0253	4431.0	19.14	5/2-5/2	0.00924	5/2-5/2	0.00924	
9493.4	7.41	1 - 0	0.0109	3333.2	13.73	1/2-1/2	0.0252	4400.1	19.18	3/2-3/2	0.0166	3/2-3/2	0.0166	
8046.8 (73)	7.63	1 - 2	0.00403	3210.0 (7)	13.87	3/2-5/2	0.108	4352.2	19.22	1/2-1/2	0.0261	1/2-1/2	0.0261	
7992.2 (75)	7.77	1 - 2	0.00189	3210.0	13.87	3/2-3/2	0.0120	4460.6	19.14	3/2-5/2	0.00155	3/2-5/2	0.00155	
7455.5	7.75	1 - 1	0.00872	3203.9	13.87	1/2-3/2	0.120	4425.9	19.18	1/2-3/2	0.00521	1/2-3/2	0.00521	
11468.5 (76)	7.26	4 - 4	0.0388	3026.2 (1)	21.63	3 - 2	0.143	4013.9 (2)	19.41	7/2-7/2	0.00869	7/2-7/2	0.00869	
11202.0	7.26	2 - 2	0.0352	3093.4	21.62	1 - 1	0.108	3968.4	19.46	5/2-5/2	0.00588	5/2-5/2	0.00588	
11308.5	7.26	3 - 2	0.00321	3096.8	21.62	1 - 0	0.0797	3914.8	19.53	3/2-3/2	0.00411	3/2-3/2	0.00411	
11290.0	7.26	3 - 4	0.00322	3086.4	21.63	2 - 2	0.0598	3891.4	19.56	1/2-1/2	0.00145	1/2-1/2	0.00145	
11187.7	7.26	2 - 3	0.00437	3093.6	21.62	1 - 2	0.0597	3944.3	19.46	7/2-5/2	0.00237	7/2-5/2	0.00237	
10982.3 (77)	7.29	3 - 4	0.341	3086.6	21.63	1 - 2	0.00398	3892.0	19.53	5/2-3/2	0.00256	5/2-3/2	0.00256	
10885.2	7.29	2 - 3	0.356	4552.7 (2)	21.63	1 - 2	0.691	3875.3	19.56	3/2-1/2	0.00195	3/2-1/2	0.00195	
10855.2	7.29	3 - 3	0.0228	4567.9	21.62	1 - 1	0.413	4038.8	19.41	5/2-7/2	0.00361	5/2-7/2	0.00361	
10984.2 (79)	7.29	4 - 4	0.0126	4574.8	21.62	1 - 0	0.138	3992.1	19.46	3/2-5/2	0.00517	3/2-5/2	0.00517	
8899.0	7.57	3 - 3	0.0111	5735.8 (4)	21.79	0 - 1	1.097	3931.2	19.53	1/2-3/2	0.221	1/2-3/2	0.221	
8729.0	7.57	2 - 2	0.0117	3006.6 (5)	24.88	2 - 3	1.038	4806.1 (6)	19.14	5/2-5/2	0.0418	5/2-5/2	0.0418	
8899.5	7.57	4 - 3	0.000844	3806.6	24.88	2 - 2	0.185	4933.2	19.18	3/2-3/2	0.0524	3/2-3/2	0.0524	
8751.3	7.57	3 - 2	0.00105	3806.6	24.88	2 - 1	0.0124	4972.2	19.22	1/2-1/2	0.0960	1/2-1/2	0.0960	
8790.9	7.57	3 - 4	0.00106	3796.1	24.88	1 - 2	0.927	4755.9	19.18	5/2-3/2	0.133	5/2-3/2	0.133	
8728.4	7.57	2 - 3	0.00146	3796.1	24.88	1 - 1	0.309	4847.9	19.22	3/2-1/2	0.139	3/2-1/2	0.139	
8596.0 (80)	7.60	3 - 4	0.0886	3751.4	24.88	0 - 1	1.236	5009.4	19.14	3/2-5/2	0.257	3/2-5/2	0.257	
8536.4	7.60	2 - 3	0.0927	3241.7 (6)	25.44	2 - 1	0.214	5062.1 (7)	19.41	1/2-7/2	0.464	1/2-7/2	0.464	
8597.0	7.60	3 - 3	0.00592	3234.0	25.44	1 - 1	0.213	4348.1	19.46	3/2-5/2	0.365	3/2-5/2	0.365	
7850.5 (81)	7.74	3 - 2	0.000494	3230.6	25.44	0 - 1	0.212	4426.0	19.53	1/2-3/2	0.293	1/2-3/2	0.293	
7800.0	7.74	2 - 2	0.00549	3590.5 (7)	25.22	1 - 2	1.250	4430.2	19.53	5/2-5/2	0.106	5/2-5/2	0.106	
11607.4 (82)	7.26	2 - 1	0.000834	3185.2 (8)	25.66	1 - 0	0.151	4266.5	19.46	3/2-3/2	0.189	3/2-3/2	0.189	
11485.7 (83)	7.27	2 - 3	0.0499	3126.3 (11)	30.62	2 - 2	0.0456	4331.3	19.56	1/2-1/2	0.296	1/2-1/2	0.296	
10582.7 (84)	7.36	2 - 1	0.0210	3147.4	30.62	2 - 1	0.0153	4379.7	19.56	5/2-3/2	0.0120	5/2-3/2	0.0120	
9886.9 (85)	7.44	2 - 2	0.0170	3255.7 (12)	30.62	3 - 2	0.113	4178.4	19.53	3/2-1/2	0.0299	3/2-1/2	0.0299	
8899.0 (86)	7.58	2 - 3	0.0172	3275.3	30.60	2 - 1	0.0849	4282.9	19.56	3/2-1/2	0.131	3/2-1/2	0.131	
8590.3 (88)	7.64	2 - 1	0.00748	3275.3	30.59	1 - 0	0.0629	3729.3 (10)	19.88	5/2-3/2	0.150	5/2-3/2	0.150	
11611.5 (90)	7.30	2 - 3	0.359	3253.4	30.62	2 - 2	0.0282	3850.6	19.88	3/2-3/2	0.129	3/2-3/2	0.129	
11592.0	7.31	1 - 2	0.294	4683.0 (13)	30.62	2 - 2	0.312	3928.6	19.68	1/2-5/2	0.509	1/2-5/2	0.509	
11640.0	7.31	0 - 1	0.397	4665.9	30.60	1 - 1	0.104	4795.9 (14)	19.68	1/2-3/2	0.569	1/2-3/2	0.569	
11502.9	7.31	2 - 2	0.0576	4683.0	30.59	1 - 0	0.138	4965.1	19.68	3/2-3/2	0.0583	3/2-3/2	0.0583	
11592.0	7.31	1 - 1	0.0981	4008.1 (1)	36.50	0 - 1	0.417	4726.9	19.78	1/2-3/2	0.302	1/2-3/2	0.302	
9009.0 (91)	7.60	2 - 3	0.0922	4116.1	26.97	1/2-3/2	0.770	4545.1 (15)	19.78	3/2-3/2	0.302	3/2-3/2	0.302	
9084.1	7.60	1 - 2	0.0636	3165.7 (2)	30.86	3/2-5/2	1.075	4889.1	19.72	1/2-1/2	0.231	1/2-1/2	0.231	
9009.0	7.60	2 - 2	0.0164					4657.9	19.72	3/2-1/2	0.0591	3/2-1/2	0.0591	

Wavelength [Å]	$E^2$	J-J <sup>3</sup>	$f_{J,J}$	Wavelength [Å]	$E^2$	J-J <sup>3</sup>	$f_{J,J}$
A II 4764.9 (15)	19.78	1/2-3/2	0.118	A II 3169.7 (47)	23.07	3/2-5/2	0.0851
4376.0 (17)	19.89	3/2-1/2	0.125	3249.8	23.02	1/2-3/2	0.168
4379.4	19.89	1/2-1/2	0.123	4103.9 (52)	22.42	7/2-5/2	0.164
6643.8 (20)	19.41	9/2-7/2	0.0609	4072.4	22.50	5/2-3/2	0.110
6684.4	19.46	7/2-5/2	0.0535	4033.8	22.59	3/2-1/2	0.0515
6638.2	19.53	5/2-3/2	0.0476	4179.3	22.42	3/2-5/2	0.0563
6639.7	19.56	3/2-1/2	0.0452	4156.1	22.50	5/2-3/2	0.0869
6886.6	19.41	7/2-7/2	0.00878	4076.6	22.59	1/2-1/2	0.126
6863.5	19.46	5/2-5/2	0.0153	4267.5	22.42	3/2-5/2	0.00878
6756.6	19.53	3/2-3/2	0.0179	4201.6	22.50	1/2-3/2	0.0277
7077.0	19.41	5/2-7/2	0.000588	3780.8 (51)	22.67	7/2-7/2	0.131
6990.2	19.46	3/2-5/2	0.00126	3826.8	22.69	5/2-5/2	0.0883
6608.6 (24)	19.68	1/2-3/2	0.00194	3872.2	22.71	3/2-5/2	0.0615
7284.3	19.68	3/2-3/2	0.000196	3880.3	22.74	1/2-1/2	0.0767
6861.3 (25)	19.78	3/2-3/2	0.0247	3763.5	22.69	7/2-5/2	0.0217
6666.4	19.72	1/2-1/2	0.0191	3799.4	22.71	5/2-5/2	0.0355
6437.6	19.78	1/2-3/2	0.00971	3841.5	22.74	3/2-1/2	0.0382
6483.1 (27)	19.89	3/2-1/2	0.0405	3844.8	22.67	5/2-7/2	0.0293
6103.6	19.89	1/2-1/2	0.0397	3900.6	22.69	3/2-5/2	0.0541
4609.6 (31)	21.05	5/2-7/2	0.444	3911.6	22.71	1/2-5/2	0.0772
4637.3	21.04	3/2-5/2	0.466	3582.4 (56)	22.85	7/2-9/2	0.641
4589.9	21.04	3/2-5/2	0.466	3576.6	22.92	5/2-7/2	0.641
4637.3	21.04	5/2-5/2	0.0221	3582.4	22.97	3/2-5/2	0.617
4277.6 (32)	21.26	5/2-3/2	0.214	3521.6	22.97	7/2-7/2	0.762
4131.7	21.33	3/2-1/2	0.0359	3521.6	22.92	7/2-7/2	0.0790
4072.0 (33)	21.41	5/2-5/2	0.349	3520.3	22.97	5/2-5/2	0.132
4042.9	21.40	3/2-3/2	0.337	3520.3	22.97	5/2-5/2	0.132
4079.6	21.40	5/2-3/2	0.0249	3548.5	23.00	3/2-5/2	0.151
4035.5	21.41	3/2-5/2	0.0375	3466.3	22.97	7/2-5/2	0.00381
3765.3 (42)	22.42	5/2-5/2	0.0972	3471.3	23.00	5/2-3/2	0.00706
3720.4	22.50	3/2-3/2	0.0173	3371.0 (57)	23.07	7/2-5/2	0.00821
3669.6	22.59	1/2-1/2	0.0197	3471.6	23.02	5/2-3/2	0.00610
3678.3	22.50	5/2-3/2	0.0378	3569.9	22.98	3/2-1/2	0.00380
3622.2	22.59	3/2-1/2	0.0477	3421.5	23.02	5/2-5/2	0.00251
3809.5	22.42	3/2-5/2	0.0641	3532.2	23.02	3/2-3/2	0.00474
3770.5	22.50	1/2-3/2	0.111	3603.5	22.98	1/2-1/2	0.00766
3491.5 (44)	22.67	5/2-7/2	0.585	3480.5	23.07	3/2-5/2	0.00427
3514.4	22.69	3/2-5/2	0.461	3565.0	22.60	5/2-3/2	0.152
3535.3	22.71	1/2-3/2	0.366	4103.9 (64)	22.70	3/2-1/2	0.118
3476.7	22.69	5/2-5/2	0.131	4218.7	22.60	3/2-5/2	0.0267
3491.2	22.71	3/2-3/2	0.232	3559.5 (70)	23.06	5/2-7/2	0.703
3509.8	22.74	1/2-1/2	0.362	3545.6	23.16	3/2-5/2	0.705
3454.1	22.71	5/2-3/2	0.0144	3464.1	23.16	5/2-5/2	0.0326
3466.3	22.74	3/2-1/2	0.0359	3137.7 (71)	23.53	5/2-3/2	0.00456
3139.0 (47)	23.07	5/2-5/2	0.130	3273.4	23.45	3/2-1/2	0.00501
3212.5	23.02	3/2-3/2	0.0265	3204.3	23.53	3/2-3/2	0.00873
3281.7	22.98	1/2-1/2	0.0347	3000.5 (72)	23.79	3/2-3/2	0.0368
3181.1	23.02	5/2-3/2	0.0588	3014.5	23.77	3/2-5/2	0.00436
3243.7	22.98	3/2-1/2	0.0454	4374.9 (77)	22.60	3/2-5/2	0.145
A II 4129.7 (77)	22.70	1/2-1/2	0.0971	A II 3376.5 (109)	24.71	7/2-7/2	0.166
4222.7	22.70	3/2-1/2	0.0255	3350.9	24.72	5/2-5/2	0.162
4275.2	22.60	1/2-3/2	0.0547	3365.5	24.72	7/2-5/2	0.00610
3293.7 (83)	23.53	3/2-3/2	0.117	3361.7	24.71	5/2-7/2	0.00817
3307.2	23.45	1/2-1/2	0.102	4227.0 (113)	24.18	3/2-5/2	0.154
3366.6	23.45	3/2-1/2	0.0265	4337.1	24.18	1/2-3/2	0.178
3236.8	23.53	1/2-3/2	0.0448	4226.7	24.18	3/2-3/2	0.0171
4866.0 (85)	22.42	3/2-5/2	0.106	3600.2 (115)	24.69	3/2-3/2	0.347
4721.6	22.50	3/2-5/2	0.0666	3754.1	24.62	1/2-1/2	0.293
4564.4	22.59	3/2-1/2	0.0308	3671.0	24.62	3/2-1/2	0.0721
3868.5 (90)	23.07	3/2-5/2	0.476	3680.1	24.69	1/2-3/2	0.142
3932.6	23.02	3/2-3/2	0.166	3630.9 (116)	24.65	3/2-5/2	0.0335
3979.4	22.98	3/2-1/2	0.122	3660.4	24.65	3/2-3/2	0.0801
4543.9 (95)	22.60	1/2-3/2	0.397	3026.8 (120)	25.34	3/2-1/2	0.0845
3388.5 (96)	23.53	1/2-3/2	0.224	3083.0	25.34	1/2-1/2	0.173
3465.8	23.45	1/2-1/2	0.224	4448.9 (127)	24.18	5/2-5/2	0.166
4052.9 (101)	23.74	1/2-1/2	0.374	4438.5	24.18	3/2-3/2	0.0124
3946.1 (105)	24.18	7/2-5/2	0.151	4440.1	24.18	5/2-3/2	0.0185
3925.7	24.18	5/2-3/2	0.139	3830.4 (128)	24.62	3/2-1/2	0.0744
3545.8	24.52	5/2-9/2	0.723	3753.5	24.69	3/2-3/2	0.0144
3562.2	24.52	7/2-7/2	0.742	3803.2 (129)	24.65	5/2-5/2	0.320
3429.6 (107)	24.65	5/2-5/2	0.0241	3819.0	24.63	3/2-3/2	0.331
3414.5	24.65	5/2-5/2	0.00170				

## NAVAL RESEARCH LABORATORY

Wavelength [ $\text{\AA}$ ]	$E^{\circ}$	J-J <sup>o</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^{\circ}$	J-J <sup>o</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^{\circ}$	J-J <sup>o</sup>	$f_{J,J}$	
A II	3825.7 (129)	5/2-3/2	0.0231	Ca I	4425.4 (4)	0 - 1	0.300	Ca I	6343.3 (53)	3 - 4	0.406	
	3796.6	3/2-5/2	0.0343		4455.9	2 - 2	0.0457		6318.1	2 - 3	0.434	
	3737.9 (131)	5/2-7/2	0.508		4435.7	1 - 1	0.0755		5757.7 (54)	4 - 4	0.0269	
	3718.2	3/2-5/2	0.529		4456.6	2 - 1	0.00305		5735.7	3 - 3	0.0259	
	3724.5	5/2-5/2	0.0252		3973.7 (6)	0 - 1	0.00928		5718.0	2 - 2	0.0281	
	6985.7 (137)	3/2-3/2	0.0294		3957.1	1 - 1	0.00918		5761.9	4 - 3	0.00196	
K I	7664.9 (1)	1/2-3/2	0.655		3948.9	0 - 1	0.00914		5746.8	3 - 2	0.00256	
	7699.0	1/2-1/2	0.326		3630.7	2 - 3	0.0666		5731.7 (54)	3 - 4	0.00243	
	4044.1 (3)	1/2-3/2	0.0101		3624.1	1 - 2	0.0887	Ca II	5707.0	2 - 3	0.00335	
	4047.2	1/2-1/2	0.00473		3644.8	0 - 1	0.0134		3933.7 (1)	1/2-3/2	0.663	
	3446.4 (4)	1/2-3/2	0.00180		3631.0	2 - 2	0.0222		3968.5	3.11	1/2-1/2	0.329
	3447.4	1/2-1/2	0.00838		3645.0	1 - 1	0.0222		8542.1 (2)	5/2-3/2	0.0485	
	12523.0 (5)	3/2-1/2	0.167		3645.0 (10)	2 - 1	0.00895		8662.1	3/2-1/2	0.0399	
	12434.3	1/2-1/2	0.166		3474.8	2 - 1	0.00313		8498.0	3/2-3/2	0.00809	
	11772.7 (6)	3/2-5/2	0.751		3468.5	1 - 1	0.00310		3706.0	1/2-1/2	0.153	
	11689.8	2.66	0.836		3361.9 (11)	0 - 1	0.00308		3179.3 (4)	3/2-5/2	0.809	
	11769.4	2.66	0.835		3350.2	2 - 3	0.0350		3158.9	1/2-1/2	0.894	
	6964.7 (7)	3/2-3/2	0.0835		3344.5	1 - 2	0.0312		3181.3	3/2-3/2	0.990	
	6964.2	3.38	0.00009		3362.1	0 - 1	0.0416		11836.4 (5)	1/2-3/2	0.978	
	3336.3	3.38	0.00050		3350.4	2 - 2	0.00627		11947.0	1/2-1/2	0.485	
	6964.2	3.38	0.00001		3362.3	1 - 1	0.0104		4472.1 (6)	1/2-1/2	0.485	
	11022.3 (9)	3/2-5/2	0.184		3328.1 (12)	2 - 1	0.00418		4479.3	1/2-3/2	0.00122	
	9595.6 (10)	5/2-7/2	0.0706		3274.7	2 - 1	0.00148		4722.6 (7)	5/2-7/2	0.000861	
	9595.6	3.94	0.00353		3269.1	1 - 1	0.00147		4722.6	5/2-5/2	0.00043	
	9597.8	3.94	0.0741		6169.6 (20)	0 - 1	0.00146		4718.2	3/2-5/2	0.000971	
K III	3322.4 (1)	29.32	0.212		6169.1	3 - 2	0.000680		3758.4 (8)	5/2-7/2	0.00127	
	3420.8	29.37	0.0998		6166.4	2 - 1	0.000528		3758.4	10.30	5/2-5/2	0.00063
	3278.8	29.37	0.0921		6161.3	1 - 0	0.000396		3755.6	10.30	3/2-5/2	0.00128
	3468.3	29.32	0.132		6163.2	2 - 2	0.000171		3347.0 (9)	10.71	5/2-7/2	0.00219
	3513.9	29.37	0.244		6156.1	1 - 2	0.000019		3347.0	10.71	5/2-5/2	0.000110
	2992.2 (2)	29.73	0.451		4585.9 (23)	3 - 4	0.0812		9933.3 (12)	8.73	3/2-1/2	0.284
	3052.1	29.81	0.354		4581.4	2 - 3	0.0791		9856.7	8.73	1/2-1/2	0.281
	3056.8	29.90	0.283		4578.6	1 - 2	0.0894		8250.2 (13)	8.98	3/2-5/2	0.932
	3289.1 (4)	30.01	0.492		4585.9	3 - 3	0.00700		8203.2	8.98	1/2-3/2	1.028
	3421.8	30.05	0.534		4098.5 (25)	3 - 4	0.0189		8256.1	8.98	3/2-3/2	0.104
	3202.0 (5)	30.12	0.281		4094.9	2 - 3	0.0184		5307.3 (14)	9.81	1/2-1/2	0.0325
	3209.3	30.29	0.229		4092.6	1 - 2	0.0208		5285.3	9.81	1/2-1/2	0.0325
	3364.2	30.12	0.109		4878.1 (35)	2 - 3	0.225		5020.0 (15)	9.94	3/2-5/2	0.133
					4355.1 (37)	2 - 3	0.0832		5001.5	9.94	1/2-3/2	0.148
Ca I	4226.7 (2)	2.92	1.833		10313.9 (43)	1 - 0	0.142		5021.1	9.94	3/2-3/2	0.0148
	6162.2 (3)	3.89	0.0780		7326.1 (44)	1 - 2	0.622		4220.1	10.41	3/2-1/2	0.0114
	6122.2	3.89	0.0770		5513.0 (48)	1 - 0	0.00372		4206.2	10.41	1/2-1/2	0.0114
	6102.7	3.89	0.0765		5188.2 (49)	1 - 0	0.0323		4109.8 (17)	10.49	3/2-5/2	0.0445
	4454.8 (4)	4.66	0.255		4847.3 (50)	1 - 2	0.00302		4097.1	10.49	1/2-3/2	0.0498
	4435.0	4.66	0.226		4685.3 (51)	1 - 2	0.00549		4110.3	10.49	3/2-3/2	0.00493

TABLE OF ABSORPTION OSCILLATOR STRENGTHS  $f_{j,j'}$  FOR ULTRAVIOLET LINES FROM THE COULOMB APPROXIMATION

Wavelength [ $\text{\AA}$ ]	$E^a$	J-J'	$f_{j,j'}$	Wavelength [ $\text{\AA}$ ]	$E^a$	J-J'	$f_{j,j'}$	Wavelength [ $\text{\AA}$ ]	$E^a$	J-J'	$f_{j,j'}$	
<b>Li I</b>	2741.2 (1)	1/2-3/2	0.00304	<b>C I</b>	1280.3 (5)	2-2	0.00214	<b>C III</b>	459.6 (6)	33.33	2-3	0.351
2741.2	4.50	1/2-1/2	0.00192	1280.3	9.64	1-1	0.00072	459.6	33.33	2-2	0.0626	
2562.3 (2)	4.82	1/2-3/2	0.00122	1280.9	9.64	2-1	0.00072	459.5	33.33	1-2	0.313	
2562.3	4.82	1/2-1/2	0.000611	1280.6	9.64	1-0	0.00097	459.5	33.33	1-1	0.104	
<b>Li II</b>	61.95 (1)	0-1	0.431	1279.9	9.65	1-2	0.00119	459.5	33.33	0-1	0.417	
178.0 (2)	69.35	0-1	0.102	1280.2 (7)	9.64	0-1	0.00290	371.7 (7)	39.67	2-3	0.0996	
171.6 (3)	71.95	0-1	0.0402	1277.6 (7)	9.67	2-3	0.0142	371.7	39.67	1-2	0.0890	
2674.4 (4)	73.10	1-2	0.0344	1277.3	9.67	1-2	0.0124	371.7	39.66	0-1	0.119	
2674.4	73.10	1-1	0.0206	1277.2	9.67	0-1	0.0162	371.8	39.67	2-2	0.0178	
2674.4	73.10	1-0	0.00687	1277.8	9.67	2-2	0.0025	650.5 (10)	30.51	1-0	0.0529	
<b>Be I</b>	2348.6 (1)	5.25	1.593	1261.6 (9)	9.79	2-2	0.0358	574.3 (11)	34.13	1-2	0.517	
2494.7 (3)	7.66	2-3	0.133	1261.0	9.79	1-1	0.0125	1548.2 (1)	7.97	1/2-3/2	0.190	
2494.7	7.66	2-2	0.0238	1261.1	9.79	1-2	0.0200	1550.8	7.96	1/2-1/2	0.0948	
2494.6	7.66	1-2	0.119	1260.7	9.79	0-1	0.0300	312.4 (2)	39.51	1/2-3/2	0.135	
2494.6	7.66	1-1	0.0396	1189.7 (14)	10.38	2-2	0.0092	312.5	39.51	1/2-1/2	0.0677	
2494.5	7.66	0-1	0.158	1189.1	10.38	1-1	0.0033	244.9 (3)	50.41	1/2-3/2	0.0398	
<b>Be II</b>	1036.3 (1)	11.91	0.0560	1189.9	10.38	2-1	0.0033	244.9	50.41	1/2-1/2	0.0199	
842.1 (2)	14.66	1/2-3/2	0.0208	1188.6	10.38	0-1	0.0130	222.8 (4)	55.41	1/2-3/2	0.0175	
842.1	14.66	1/2-1/2	0.0104	858.6 (4)	14.39	3/2-1/2	0.0250	222.8	55.41	1/2-1/2	0.00876	
1776.3 (3)	10.89	3/2-1/2	0.0641	858.1	14.39	1/2-1/2	0.0229	419.7 (6)	37.39	3/2-1/2	0.0394	
1512.5 (4)	12.10	3/2-5/2	0.0641	657.4 (5)	17.97	3/2-5/2	0.157	419.5	37.39	1/2-1/2	0.0393	
1512.5	12.10	3/2-3/2	0.576	687.1	17.97	1/2-3/2	0.174	384.2 (7)	40.11	3/2-5/2	0.594	
1512.3 (5)	12.10	1/2-3/2	0.640	806.6 (8)	20.62	5/2-5/2	0.0142	384.0	40.11	1/2-3/2	0.659	
1197.2 (6)	14.25	3/2-1/2	0.0100	806.7	20.61	3/2-3/2	0.00272	297.0 (8)	45.55	3/2-1/2	0.00772	
2453.9 (6)	15.92	1/2-3/2	0.0204	806.8	20.61	1/2-1/2	0.00341	296.9	49.55	1/2-1/2	0.00771	
2453.9	15.92	1/2-1/2	0.0102	806.6	20.61	5/2-3/2	0.00613	289.2 (9)	50.66	3/2-5/2	0.108	
2728.8 (7)	16.63	3/2-5/2	0.0529	806.4	20.62	3/2-1/2	0.00852	285.1	50.66	1/2-3/2	0.0599	
<b>B I</b>	2497.7 (1)	4.94	0.0222	806.6	20.61	1/2-3/2	0.00915	259.5 (10)	55.54	3/2-5/2	0.0344	
2496.8	4.94	1/2-1/2	0.0221	651.3 (9)	24.27	5/2-7/2	0.104	259.5	55.54	1/2-3/2	0.0383	
1826.4 (3)	6.76	3/2-5/2	0.0118	651.3	24.27	3/2-5/2	0.0822	2698.7 (12)	54.98	3/2-1/2	0.149	
1825.9	6.76	1/2-3/2	0.0131	651.2	24.27	1/2-3/2	0.0653	2697.7	54.98	1/2-1/2	0.148	
<b>B II</b>	1362.5 (1)	9.06	1.368	651.3	24.27	3/2-3/2	0.0418	2595.1 (13)	55.41	3/2-1/2	0.0452	
694.0 (2)	17.79	0-1	0.125	651.2	24.26	1/2-1/2	0.0654	2524.4 (14)	55.54	3/2-5/2	0.995	
<b>C I</b>	1657.0 (2)	7.46	0.0175	2747.3 (15)	20.75	3/2-5/2	0.0791	1199.6 (1)	10.29	3/2-5/2	0.00242	
1657.4	7.45	1-1	0.0059	2746.5	20.75	1/2-3/2	0.0877	1200.2	10.29	3/2-3/2	0.00162	
1658.1	7.45	2-1	0.0059	977.0 (1)	12.64	0-1	1.078	1200.7	10.28	3/2-1/2	0.000815	
1657.9	7.45	1-0	0.0079	386.2 (2)	31.97	0-1	0.255	563.9 (3)	12.81	3/2-5/2	0.000200	
1656.3 (2)	7.46	1-2	0.0097	310.2 (3)	39.80	0-1	0.162	964.6	12.80	3/2-3/2	0.000200	
1656.9	7.45	0-1	0.0234	538.3 (5)	29.39	2-1	0.0307	965.1	12.79	3/2-1/2	0.000102	
				538.2	29.39	1-1	0.0506	1492.6 (4)	10.64	5/2-3/2	0.00450	
				538.1	29.39	0-1	0.0306	1492.6	10.64	3/2-3/2	0.000751	
								1494.7	10.63	3/2-1/2	0.00382	
								1243.2 (5)	12.50	5/2-5/2	0.00106	
								1243.2	12.30	3/2-5/2	0.000114	
								1243.3	12.50	5/2-3/2	0.000076	
								1243.3	12.50	3/2-3/2	0.00102	

1/ The number in parentheses is the multiplet number.  
 2/ Excitation potential of the upper level of the line [in Volts].  
 3/ Total angular momentum quantum number of lower and upper levels.

wavelength [ $\text{\AA}$ ]	$\bar{\nu}$	J-J'	$f_{J,J'}$	wavelength [ $\text{\AA}$ ]	$\bar{\nu}$	J-J'	$f_{J,J'}$	wavelength [ $\text{\AA}$ ]	$\bar{\nu}$	J-J'	$f_{J,J'}$
N I	1167.4 (6)	5/2-7/2	0.00851	N II	2522.3 (15)	2 - 3	0.0255	N III	1855.3 (24)	3/2-5/2	0.933
1168.5	12.94	5/2-5/2	0.000804	2520.9	25.56	1 - 2	0.0233	2583.6 (25)	42.51	3/2-3/2	0.153
1168.5	12.94	3/2-5/2	0.0169	2520.3	25.95	0 - 1	0.0318	2572.6	42.31	1/2-1/2	0.123
1163.9 (7)	12.98	5/2-5/2	0.000301	2496.5 (20)	26.01	2 - 2	0.00440	1508.1 (27)	47.77	5/2-7/2	0.799
1163.9	12.98	5/2-5/2	0.000332	2490.4	26.02	1 - 1	0.00135	1908.1	47.77	3/2-5/2	0.839
1164.3	12.98	5/2-3/2	0.000019	2799.2 (21)	25.52	2 - 2	0.0184	2453.9 (28)	46.52	5/2-7/2	0.00176
1164.3	12.98	3/2-3/2	0.000140	2795.8 (22)	26.06	2 - 3	0.0366	2462.6	46.52	3/2-5/2	0.00140
1742.7 (9)	10.64	3/2-3/2	0.00092	2461.3 (23)	26.52	2 - 1	0.0209	2468.4	46.52	1/2-3/2	0.00112
1742.7	10.64	1/2-3/2	0.00397	452.2 (4)	27.32	3/2-1/2	0.0230	1920.5 (25)	47.93	5/2-7/2	0.755
1745.2	10.63	5/2-1/2	0.00201	451.9	27.32	1/2-1/2	0.0249	1921.5	47.94	3/2-5/2	0.594
1745.2	10.63	1/2-1/2	0.00804	374.4 (5)	32.99	3/2-5/2	0.253	1920.9	47.94	1/2-3/2	0.471
1411.9 (10)	12.30	1/2-3/2	0.0139	374.2	32.99	1/2-5/2	0.281	2064.0 (30)	47.93	7/2-9/2	0.899
1326.6 (11)	12.87	3/2-3/2	0.00127	314.9 (7)	35.23	3/2-5/2	0.0915	2063.5	47.92	5/2-7/2	0.926
1326.6	12.87	1/2-3/2	0.000507	314.7	39.23	1/2-3/2	0.102	2063.5	47.92	7/2-7/2	0.0258
1328.0	12.86	3/2-1/2	0.000259	314.9	31.23	5/2-5/2	0.0102	765.1 (1)	16.13	0 - 1	0.880
1328.0	12.86	1/2-1/2	0.00104	334.1 (9)	35.52	5/2-5/2	0.0306	247.2 (2)	45.98	0 - 1	0.354
1319.7 (12)	12.91	5/2-3/2	0.000561	334.1	35.50	3/2-3/2	0.00585	322.7 (4)	46.57	2 - 1	0.0280
1319.7	12.91	1/2-3/2	0.000224	334.1	35.50	1/2-1/2	0.00733	322.6	46.57	1 - 1	0.0279
1319.0	12.92	3/2-1/2	0.000136	334.3	35.50	5/2-3/2	0.0132	322.5	46.57	0 - 1	0.0279
1310.6 (13)	12.98	3/2-5/2	0.0111	433.9	35.52	5/2-5/2	0.0196	283.6 (5)	51.85	2 - 3	0.399
1311.0	12.98	3/2-3/2	0.00117	434.0	35.50	1/2-3/2	0.0365	283.5	51.85	1 - 2	0.356
1311.0	12.98	1/2-3/2	0.0117	362.9 (10)	41.09	5/2-7/2	0.333	225.0 (6)	51.85	0 - 1	0.475
N II	671.4 (3)	2 - 2	0.0233	362.9	41.09	3/2-5/2	0.263	225.1	63.13	2 - 3	0.100
671.6	18.39	1 - 1	0.00785	362.8	41.09	1/2-5/2	0.269	225.1	63.13	1 - 2	0.0893
672.0	18.35	2 - 1	0.00785	363.0	41.09	5/2-5/2	0.0751	387.4 (9)	48.00	0 - 1	0.0430
671.8	18.38	1 - 0	0.0105	362.9	41.09	3/2-3/2	0.134	335.1 (10)	52.98	1 - 2	0.548
671.0	18.40	0 - 1	0.0129	362.8	41.08	1/2-1/2	0.209	345.1 (13)	57.46	2 - 2	0.0457
671.4	18.39	0 - 1	0.0313	358.6 (11)	41.51	5/2-5/2	0.0845	345.1	57.44	1 - 1	0.0153
533.7 (5)	23.15	2 - 3	0.113	358.4	41.51	3/2-3/2	0.0161	303.1 (14)	62.41	2 - 3	0.626
533.6	23.14	1 - 2	0.101	358.3	41.52	1/2-1/2	0.0200	303.0	62.41	1 - 2	0.559
533.5	23.14	0 - 1	0.135	358.5	41.52	5/2-3/2	0.0362	303.2	62.40	0 - 1	0.746
533.8	23.14	2 - 2	0.0203	358.4	41.52	3/2-1/2	0.0501	303.1	62.40	1 - 1	0.186
533.6	23.14	1 - 1	0.0339	358.5	41.51	3/2-5/2	0.0543	257.8 (15)	63.14	2 - 2	0.167
529.9 (6)	23.31	2 - 2	0.0259	358.3	41.51	1/2-3/2	0.100	297.6	63.14	1 - 1	0.0555
529.5	23.32	1 - 1	0.00851	509.6 (14)	36.70	5/2-3/2	0.0585	297.6	63.14	1 - 1	0.0740
529.4	23.32	2 - 1	0.00853	509.9	36.68	3/2-1/2	0.0491	297.6	63.14	1 - 0	0.0542
529.6	23.31	1 - 2	0.0144	428.2 (15)	41.30	5/2-5/2	0.102	351.9 (16)	56.40	2 - 1	0.0542
529.5	23.32	0 - 1	0.0340	428.2	41.30	3/2-3/2	0.0983	323.2 (17)	61.52	2 - 2	0.173
529.5	23.32	2 - 1	0.0452	418.7 (16)	41.96	5/2-7/2	0.472	315.1 (18)	62.50	2 - 3	0.875
747.0 (8)	18.42	2 - 2	0.0358	418.9	41.94	3/2-5/2	0.498	1236.8 (1)	9.97	1/2-3/2	0.157
582.2 (10)	23.10	2 - 2	0.145	472.4 (18)	42.31	1/2-3/2	0.439	1242.8	9.53	1/2-1/2	0.0780
574.7 (11)	23.37	2 - 3	0.145	472.2	42.31	1/2-1/2	0.227	203.3 (2)	58.99	1/2-3/2	0.156
635.2 (13)	23.47	0 - 1	0.210	274.0 (21)	32.99	3/2-5/2	0.397	208.3	58.98	1/2-1/2	0.0784
1886.8 (14)	24.96	1 - 1	0.0167	274.1	32.99	1/2-3/2	0.442	162.6 (3)	75.54	1/2-3/2	0.0146
2206.1 (15)	25.92	1 - 2	0.00679	1805.5 (22)	37.17	3/2-1/2	0.111	162.6	75.54	1/2-1/2	0.0223
2317.0 (16)	25.90	3 - 4	0.0180	1804.3	37.17	1/2-1/2	0.110	266.4 (4)	56.31	3/2-1/2	0.0321
2316.5	25.89	2 - 3	0.0190	2247.9 (23)	38.48	5/2-3/2	0.0532	266.2	56.31	1/2-1/2	0.0320
2316.7	25.88	1 - 2	0.0227	2248.9	38.48	3/2-1/2	0.0445	247.7 (5)	59.80	3/2-5/2	0.591

Wavelength [ $\text{\AA}$ ]	$E^2$	J-J <sup>2</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^2$	J-J <sup>2</sup>	$f_{J,J}$	Wavelength [ $\text{\AA}$ ]	$E^2$	J-J <sup>2</sup>	$f_{J,J}$
N V	247.6 (5)	1/2-3/2	0.656	O II	517.9 (16)	1/2-1/2	0.0155	O III	260.6 (9)	3/2-5/2	0.614
	186.2 (6)	3/2-5/2	0.109		515.5 (17)	3/2-5/2	0.0468	O V	625.7 (1)	0 - 1	0.738
	186.1	1/2-3/2	0.121		515.6	3/2-3/2	0.00530		171.2 (2)	0 - 1	0.424
O I	1302.2 (2)	2 - 1	0.000031		515.6	1/2-3/2	0.0530		215.2 (4)	2 - 1	0.0258
	1304.9	1 - 1	0.000018	O III	2733.3 (20)	1/2-3/2	0.0444		215.1	1 - 1	0.0258
	1306.0	0 - 1	0.000040		2747.5	1/2-1/2	0.0231		215.0	0 - 1	0.0257
	1039.2 (3)	2 - 1	0.000004		574.1 (1)	2 - 2	0.0210		192.9 (5)	2 - 3	0.429
	1040.9	1 - 1	0.000002		374.2	1 - 1	0.00542		192.8	1 - 2	0.482
	1041.7	0 - 1	0.000005		374.4	2 - 1	0.00945		192.8	0 - 1	0.510
	1025.8 (4)	2 - 3	0.0468		374.5	1 - 0	0.0126		248.5 (9)	1 - 0	0.0669
	1025.8	2 - 2	0.00836		373.8	1 - 2	0.0155		220.4 (10)	1 - 2	0.567
	1025.8	2 - 1	0.000558		374.0	0 - 1	0.0376		203.9 (13)	2 - 3	0.665
	1027.4	1 - 2	0.0406		305.8 (5)	2 - 3	0.229		203.8	1 - 2	0.594
	1027.4	1 - 1	0.0135		305.7	1 - 2	0.205		203.8	0 - 1	0.792
	1028.2	0 - 1	0.0533		305.6	0 - 1	0.273		216.0 (15)	2 - 2	0.180
	988.8 (5)	2 - 3	0.00581		305.6	2 - 2	0.0410		207.8 (16)	2 - 3	0.853
	990.2	1 - 2	0.00517		305.7	1 - 1	0.0684		1031.9 (1)	1/2-3/2	0.133
	990.8	0 - 1	0.00688		305.7	2 - 1	0.0273		1037.6	1/2-1/2	0.0659
	1152.1 (6)	2 - 2	0.00633		303.5	2 - 2	0.0609		150.1 (2)	1/2-3/2	0.175
	999.5 (7)	2 - 1	0.00333		303.7	1 - 1	0.0201		150.1	1/2-1/2	0.0878
	1217.6 (9)	0 - 1	0.00625		303.5	2 - 1	0.0202		184.1 (3)	3/2-1/2	0.0289
O II	539.1 (2)	3/2-5/2	0.0142		303.6	1 - 0	0.0267		183.9	1/2-1/2	0.0288
	539.5	3/2-5/2	0.00960		303.4	1 - 2	0.0338		173.1 (4)	3/2-5/2	0.595
	539.9	3/2-1/2	0.00483		303.6	0 - 1	0.0804		172.9	1/2-3/2	0.661
	430.2 (3)	3/2-5/2	0.0380		303.4	2 - 1	0.0393		129.9 (5)	3/2-5/2	0.109
	430.2	3/2-5/2	0.0244		303.4	2 - 2	0.0713		129.8	1/2-5/2	0.121
	430.2	3/2-1/2	0.0118		33.71	2 - 3	0.281		446.3 (3)	3/2-3/2	0.0145
	616.3 (5)	5/2-5/2	0.0210		32.0 (11)	0 - 1	0.0561		446.6	1/2-1/2	0.0113
	617.1	3/2-1/2	0.0177		435.0 (14)	0 - 1	0.384		445.0 (3)	3/2-1/2	0.00279
	616.4	3/2-3/2	0.00350		345.3 (15)	1 - 2	0.509		447.8	1/2-3/2	0.00590
	555.1 (6)	5/2-5/2	0.0142		298.8 (18)	1 - 0	0.123		405.9 (4)	3/2-5/2	0.00581
	555.1	5/2-5/2	0.00102		2455.0 (19)	2 - 1	0.0552		405.9	3/2-3/2	0.00646
	555.1	5/2-5/2	0.00153		2597.7 (20)	2 - 1	0.0556		407.1	1/2-3/2	0.00659
	555.1 (8)	5/2-7/2	0.0606		2605.4	3 - 2	0.0868		363.4 (5)	3/2-1/2	0.000539
	485.5	5/2-5/2	0.0670		2558.1 (21)	2 - 2	0.107		362.5	1/2-1/2	0.000552
	484.0 (9)	5/2-3/2	0.000644		2586.1 (22)	2 - 2	0.107		356.8 (6)	3/2-5/2	0.00446
	483.8	3/2-1/2	0.000514		2674.6	1 - 2	0.107		357.5	1/2-3/2	0.00382
	481.6 (10)	5/2-5/2	0.00580		2665.7	1 - 2	0.379		356.5	3/2-3/2	0.000350
	481.8	3/2-3/2	0.00574		2655.5 (23)	1 - 1	0.229		2953.7 (8)	5/2-3/2	0.109
	672.9 (12)	3/2-3/2	0.0241		2683.7	1 - 0	0.0764		3011.7	3/2-3/2	0.108
	672.9	1/2-3/2	0.00963		279.9 (4)	3/2-1/2	0.0243		2792.1 (10)	5/2-5/2	0.0811
	673.8	3/2-1/2	0.00487		279.6	1/2-1/2	0.0242		2780.1	3/2-3/2	0.0150
	600.6 (14)	1/2-3/2	0.0195		238.6 (5)	3/2-5/2	0.322		2770.1	1/2-1/2	0.0183
	518.2 (16)	3/2-3/2	0.0200		238.4	1/2-3/2	0.357		313.0 (2)	2 - 1	0.0209
	518.2	1/2-3/2	0.00799		233.6 (7)	5/2-7/2	0.426		313.7	1 - 1	0.0211
	517.9	3/2-1/2	0.00387		233.5	3/2-5/2	0.336		313.5	0 - 1	0.0212
					233.5	1/2-3/2	0.266		283.2 (3)	2 - 3	0.0176
					260.4 (9)	1/2-1/2	0.267		283.7	1 - 2	0.0158
					63.08	5/2-7/2	0.582				



NAVAL RESEARCH LABORATORY

Wavelength [ $\text{\AA}$ ] <sup>1</sup>	$E^2$	J-J' <sup>2</sup>	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ] <sup>3</sup>	$E^2$	J-J' <sup>2</sup>	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ] <sup>4</sup>	$E^2$	J-J' <sup>2</sup>	$f_{J,J'}$	Wavelength [ $\text{\AA}$ ] <sup>5</sup>	$E^2$	J-J' <sup>2</sup>	$f_{J,J'}$
S1 I 1693.5 (21)	7.32	2 - 1	0.000412	S1 III 1113.2 (5)	17.63	2 - 3	0.666	A III 637.5 (3)	19.37	2 - 2	0.0909				
1690.8	7.31	1 - 0	0.000578	1113.2	17.63	2 - 2	0.119	641.4	19.39	1 - 1	0.152				
1682.7	7.35	1 - 2	0.000497	1113.2	17.63	2 - 1	0.00793	636.8	19.39	2 - 1	0.00607				
1687.1	7.22	0 - 1	0.00162	1110.0	17.65	1 - 2	0.595	553.5 (4)	22.30	2 - 1	0.0470				
1623.3 (28)	7.63	2 - 2	0.000220	1110.0	17.65	1 - 1	0.198	556.9	22.30	1 - 1	0.0480				
1625.6	7.60	1 - 1	0.000177	1108.4	17.64	0 - 1	0.793	558.3	22.30	0 - 1	0.0485				
1625.5	7.70	2 - 1	0.000179	997.4 (6)	18.92	2 - 1	0.0790	1669.7 (6)	25.28	4 - 3	0.0544				
1627.0	7.70	1 - 0	0.000267	994.8	18.92	1 - 1	0.0784	1673.4	25.26	3 - 2	0.0364				
1619.5	7.63	1 - 2	0.000120	993.5	18.92	0 - 1	0.0782	1675.6	25.25	2 - 1	0.0191				
281.6 (43)	5.06	2 - 1	0.0551	2541.8 (8)	15.09	1 - 2	0.351	1514.4 (7)	25.82	3 - 2	0.0707				
245.2 (45)	5.85	2 - 2	0.106	1312.6 (10)	19.64	1 - 0	0.129	1515.6	25.82	2 - 1	0.0530				
212.1 (48)	6.59	2 - 3	0.105	1312.6 (10)	19.64	1 - 0	0.129	2484.1 (8)	27.98	4 - 4	0.0274				
2123.0 (49)	6.59	2 - 1	0.00121	1402.7 (1)	8.86	1/2-3/2	0.506	2508.9	27.96	3 - 3	0.0247				
2058.1 (52)	6.77	2 - 1	0.00600	457.7 (2)	26.97	1/2-3/2	0.251	2533.9	27.94	2 - 2	0.0262				
1901.3 (57)	7.27	2 - 3	0.0177	457.7 (2)	26.97	1/2-1/2	0.0198	2724.8 (9)	27.83	3 - 3	0.0470				
1874.9 (62)	7.36	2 - 1	0.00164	1128.3 (3)	19.80	3/2-5/2	0.723	2678.4	27.79	2 - 2	0.0363				
1814.0 (68)	7.58	2 - 3	0.00123	1122.5	19.80	1/2-3/2	0.805	2631.9	27.80	1 - 1	0.0388				
1799.1 (71)	7.64	2 - 1	0.000447	818.1 (4)	23.95	3/2-1/2	0.109	2345.2 (10)	28.56	3 - 2	0.0315				
2631.3 (83)	6.59	0 - 1	0.252	815.1	23.95	1/2-1/2	0.108	2282.2	28.56	2 - 1	0.0251				
2532.4 (86)	6.77	0 - 1	0.0111	723.4 (4)	17.07	3/2-3/2	0.0410	2242.3	28.61	1 - 0	0.0168				
2259.6 (90)	7.36	0 - 1	0.00332	725.5	17.19	1/2-1/2	0.0280	2809.4 (4)	35.50	5/2-7/2	0.412				
2150.4 (95)	7.64	0 - 1	0.00121	718.1	17.19	1/2-1/2	0.00747	2789.0	35.40	3/2-5/2	0.324				
S1 II 1533.4 (2)	8.09	3/2-1/2	0.0650	730.9	17.07	1/2-3/2	0.0154	2776.3	35.33	1/2-3/2	0.257				
1526.7	8.09	1/2-1/2	0.0643	671.9 (6)	18.37	3/2-5/2	0.0223	2640.3 (5)	35.78	5/2-5/2	0.231				
1265.0 (4)	9.80	3/2-5/2	0.515	679.4	18.35	1/2-3/2	0.0238	2608.1	35.71	5/2-3/2	0.0441				
1260.7	9.79	1/2-3/2	0.570	672.8	18.35	3/2-3/2	0.00252	2757.9 (6)	37.58	5/2-7/2	0.419				
993.1 (6)	12.47	3/2-5/2	0.0873	661.9 (8)	18.65	3/2-5/2	0.786	2784.5	37.54	5/2-5/2	0.436				
990.3	12.47	1/2-3/2	0.0976	670.9	18.58	1/2-3/2	0.869	463.9 (4)	26.86	2 - 2	0.241				
1350.1 (7)	14.62	5/2-5/2	0.0634	664.6	18.58	3/2-3/2	0.0862	459.7	26.95	1 - 1	0.0808				
1350.6	14.60	3/2-3/2	0.0122	597.7 (9)	20.65	3/2-1/2	0.00296	462.4	26.95	2 - 1	0.0806				
1352.7	14.58	3/2-1/2	0.0277	580.3 (10)	21.27	3/2-5/2	0.161	461.2	26.86	1 - 2	0.134				
1346.9	14.62	3/2-5/2	0.0405	583.4	21.34	1/2-3/2	0.181	449.1 (5)	27.74	2 - 3	0.852				
1348.6	14.60	1/2-3/2	0.0761	578.6	21.34	3/2-3/2	0.0180	446.9	27.72	1 - 2	0.761				
2604.4 (15)	12.82	1/2-1/2	0.00114	573.4 (11)	21.53	3/2-3/2	0.198	446.0	27.62	0 - 1	1.014				
2606.1	12.82	1/2-1/2	0.000489	576.7	21.53	1/2-1/2	0.160	338.0 (6)	36.77	2 - 2	0.0779				
2505.7 (17)	14.04	5/2-7/2	0.158	572.0	21.58	1/2-1/2	0.160	350.9 (8)	37.20	2 - 1	0.112				
2505.7	14.04	5/2-5/2	0.00788	578.1	21.58	3/2-1/2	0.0398	K III 520.6 (2)	23.71	3/2-5/2	0.880				
2904.3	14.04	3/2-5/2	0.166	578.1 (12)	21.53	1/2-3/2	0.0796	529.8	23.57	1/2-3/2	0.961				
2502.0 (18)	14.73	5/2-7/2	0.0537	519.3 (12)	23.77	3/2-5/2	0.00102	523.8	23.57	3/2-3/2	0.0961				
2502.0	14.73	5/2-5/2	0.00269	522.8	23.79	1/2-3/2	0.00156	470.1 (4)	26.26	3/2-3/2	0.0642				
2501.0	14.73	3/2-5/2	0.0565	650.2 (2)	17.89	2 - 3	0.401	471.6	26.45	1/2-1/2	0.0444				
2726.7 (19)	14.56	3/2-1/2	0.00885	690.2	17.89	2 - 2	0.0716	466.8	26.45	3/2-1/2	0.0118				
2722.3	14.56	1/2-1/2	0.00885	650.2	17.89	2 - 1	0.00477	474.9	26.26	1/2-5/2	0.0242				
2682.3	14.63	3/2-5/2	0.0326	695.5	17.89	1 - 2	0.357	444.3 (5)	27.78	3/2-5/2	0.0355				
2682.3	14.63	3/2-3/2	0.00363	655.5	17.89	1 - 1	0.119	448.6	27.79	1/2-3/2	0.0371				
2678.0	14.63	1/2-3/2	0.0366	637.3 (3)	19.37	2 - 3	0.509	413.8 (6)	29.83	5/2-1/2	0.00714				
S1 III 1206.5 (2)	10.23	0 - 1	1.280	641.8	19.37	1 - 2	0.454	2992.2 (7)	29.73	5/2-7/2	0.451				
566.5 (3)	21.79	0 - 1	0.0159	643.3	19.35	0 - 1	0.606	3052.1	29.81	3/2-5/2	0.354				

## NAVAL RESEARCH LABORATORY

Wavelength [ $\text{\AA}$ ] <sup>W</sup>	E <sup>2</sup>	J-J' <sup>3</sup>	f <sub>J',J</sub>	Wavelength [ $\text{\AA}$ ] <sup>W</sup>	E <sup>2</sup>	J-J' <sup>3</sup>	f <sub>J',J</sub>	Wavelength [ $\text{\AA}$ ] <sup>W</sup>	E <sup>2</sup>	J-J' <sup>3</sup>	f <sub>J',J</sub>
K III 3056.8 (7)	29.90	1/2-3/2	0.283	Ca II 2131.4 (3)	7.48	5/2-3/2	0.000178	Ca II 1433.1 (7)	10.30	3/2-5/2	0.0377
2938.5	29.81	5/2-5/2	0.103	2132.3	7.47	3/2-1/2	0.000132	2208.6 (8)	8.73	3/2-1/2	0.0194
2986.2	29.90	3/2-3/2	0.183	2128.7	7.48	3/2-3/2	0.000031	2197.8	8.73	1/2-1/2	0.0193
2550.0 (8)	30.45	5/2-3/2	0.130	1840.2 (4)	8.40	5/2-7/2	0.0852	2112.8 (9)	8.98	3/2-5/2	0.103
2635.1	30.45	3/2-3/2	0.128	1840.2	8.40	5/2-5/2	0.0426	2105.2	8.98	1/2-5/2	0.115
2689.9	30.45	1/2-3/2	0.127	1838.1	8.40	3/2-5/2	0.0884	2113.2	8.98	3/2-3/2	0.0114
Ca I 2398.6 (5)	5.15	0 - 1	0.0276	1555.1 (6)	9.63	5/2-7/2	0.0362	1851.1 (10)	9.81	3/2-1/2	0.00676
2275.5 (6)	5.42	0 - 1	0.0690	1555.1	9.63	5/2-5/2	0.00181	1843.6	9.81	1/2-1/2	0.00675
Ca II 1650.0 (1)	7.48	1/2-3/2	0.000229	1553.5	9.63	5/2-5/2	0.0377	1815.0 (11)	9.94	3/2-5/2	0.0325
1652.0	7.47	1/2-1/2	0.000047	1434.3 (7)	10.30	5/2-7/2	0.0362	1807.7	9.94	1/2-3/2	0.0362
				1434.3	10.30	5/2-5/2	0.00181				