

The First Spectrum of Barium, Ba I

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The analysis of the Ba I spectrum is presented. Although a monograph based on homogeneous observations is needed, this paper has been prepared from existing references, to present unpublished analysis by the senior author and, also, because Ba I is important in the history of atomic spectra. The first regularities attributed to two excited electrons were found in Ba I as well as in Ca I and Sr I.

Three tables are included: A complete term list; a complete line list containing all observed and all classified lines; a table giving the estimated intensities of the observed combinations. There are approximately 390 classified lines.

The limit, derived from well-established series, is 42032.4 K, giving an ionization potential of 5.210 volts.

The Ba I spectrum occupies an important position in the history of atomic spectra. Although regular series terms were reported by Saunders, Paschen-Götze, and Fowler (1920 to 1922) [1]² the first regularities attributed to two excited electrons were found in Ba I, as well as in Ca I and Sr I, in 1925 [2].

Shenstone and Russell suggested some revisions in the early analysis and discussed the perturbed series of Ba I in 1932 [3]. They adopted as the ionization limit, i. e., the absolute value of the ground state, the value 42032.4 K, giving an ionization potential 5.210 volts.

Although the spectrum has been studied thoroughly, a monograph based on a complete homogeneous line list is needed. In view of the fact that this does not appear to be forthcoming, a complete line list and multiplet array have been prepared from the existing literature references, and from unpublished analysis by the senior author. Uniform notation has been adopted, and the decimals of all energy levels have been revised. Sullivan and Burns (table 2, ref. C) improved the values of a number of energy levels from their interferometric measurements of selected lines. Starting with these three-place values, the rest were revised from a study of all observed combinations.

The complete term list is given in table 1, which is self-explanatory. The terms are listed in the following order:

(1) Terms due to the equivalent electron pairs $6s^2$, $6p^2$, and $5d^2$ so far as known.

(2) The regular series of triplet and singlet terms having as limit the ground term in Ba II $6s^2S_{0\frac{1}{2}}$, given in the order of the running electrons ns , np , nd , and nf .

(3) The triplet and singlet terms produced by two excited electrons, having as limit the term $5d^2D$ in Ba II, arranged in the same order of running electrons. The designations for these terms have primes attached to the running electrons to denote the higher limit term in Ba II.

B. E. Moore observed the Zeeman effect in Ba I in 1908 [4] and, so far as is known to the present authors, his work has never been superseded. His measurements of $\Delta\lambda/\lambda^2$ have been divided by the correction factor 1.09, a factor adopted to reduce them to the theoretical Landé patterns for a very few well-known lines. For unresolved patterns the formulas for blends given by Shenstone and Blair [5] have been used to determine observed g -values. The results obtained from Moore's observations are as follows:

Desig.	Obs. g	Desig.	Obs. g	Desig.	Obs. g	Desig.	Obs. g
$6p^2\ ^3P_2$	1.56	$5d\ ^3D_3$	1.38	$4f\ ^3F_4^o$	1.48	$6p'\ ^3P_2^o$	1.52
$\ ^3P_1$	1.53	$\ ^3D_2$	1.18	$\ ^3F_3^o$	1.09	$\ ^3P_1^o$	1.52
$6p^2\ ^1D_2$	1.21	$\ ^3D_1$	0.53	$\ ^3F_2^o$	0.69	$6p'\ ^1P_1^o$	1.02
$6p\ ^3P_2^o$	1.52	$6d\ ^3D_3$	1.32	$4f\ ^1F_3^o$	0.99	$6p'\ ^3D_3^o$	1.32
$\ ^3P_1^o$	1.45	$\ ^3D_2$	1.11:			$\ ^3D_2^o$	1.16
$6p\ ^1P_1^o$	1.02	$5d\ ^1D_2$	1.00			$\ ^3D_1^o$	0.54
$7p\ ^1P_1^o$	1.07					$6p'\ ^1F_3^o$	1.09
						$6d'\ ^1F_3^o$	1.50

Table 2 contains all of the observed and classified lines of Ba I. The letter in column 1 indicates the literature reference from which the wavelength in column 2 is quoted. The bibliography of these references is given at the end of this table. Two sets of intensities are quoted in column 3. The left-hand entry is from the reference source indicated in column 1, except for those in parentheses, which are arc intensities estimated by Exner and Haschek (ref. G). The intensities in parentheses are entered for the lines observed with the interferometer by Burns and Sullivan. The right-hand entries in column 3 are the arc intensity and temperature class estimated by A. S. King [6]. Brackets denote King's estimated intensity in the furnace spectrum, in cases where this spectrum gives better resolution than his arc spectrum. Column 4 contains the vacuum wave number in cm^{-1} , labeled K for kayser. It is followed by ΔK , the difference between the observed wave number and the wave number calculated from the energy levels. The last column gives the multiplet designation in the notation of table 1. There are approximately 390 classified lines in table 2.

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² Figures in brackets indicate the literature references at the end of this text.

TABLE 1. Ba I terms

Designation	Level	Interval	Designation	Level	Interval	Designation	Level	Interval
$6s^2\ ^1S_0$	0.00		$6s(2S)nd$ —continued			$5d(2S)np$		
$5d^2\ ^3P_2$	23918.94	438.93	10d 3D_3	39905.15	10.62	$6p'\ ^3P_2^o$	25956.549	252.409
3P_1	23480.01	270.90	3D_2	39894.53	2.34	$^3P_1^o$	25704.140	61.983
3P_0	23209.11		3D_1	39882.19		$^3P_0^o$	25642.157	
$5d^2\ ^1D_2$	23062.06		11d 3D_3	40382.68	2.36	$7p'\ ^3P_2^o$	37282.08	292.06
$6p^2\ ^3P_2$	35616.947	793.527	3D_2	40380.32		$^3P_1^o$	36990.016	82.01
3P_1	34823.420	329.522	3D_1			$^3P_0^o$	36908.01	
3P_0	34493.898		5d 1D_2	11395.382		$6p'\ ^1P_1^o$	28554.257	
$6p^2\ ^1D_2$	35344.423		6d 1D_2	30236.815		$7p'\ ^1P_1^o$	38499.852	
$6p^2\ ^1S_0$	34370.78		7d 1D_2	37434.956		$6p'\ ^3D_3^o$	24979.859	448.323
$6s(2S)ns$			8d 1D_2	38556.18		$^3D_2^o$	24531.536	339.479
			9d 1D_2	39334.94		$^3D_1^o$	24192.057	
			$6s(2S)nf$			$7p'\ ^3D_3^o$	37540.238	476.93
7s 3S_1	26160.284					$^3D_2^o$	37063.31	567.54
8s 3S_1	33905.349					$^3D_1^o$	36495.770	
9s 3S_1	37095.492		4f $^3F_4^o$	34630.809	14.126	$6p'\ ^1D_2^o$	23074.416	
10s 3S_1	38662.91		$^3F_3^o$	34616.683	13.881	$7p'\ ^1D_2^o$	37077.50	
11s 3S_1	39624.69		$^3F_2^o$	34602.802		$6p'\ ^3F_4^o$	23757.077	809.639
7s 1S_0	28230.08		5f $^3F_4^o$	37524.184	105.217	$^3F_3^o$	22947.438	882.777
8s 1S_0	37041.00		$^3F_3^o$	37418.967	24.042	$^3F_2^o$	22064.661	
9s 1S_0	38267.59		$^3F_2^o$	37394.925		$7p'\ ^3F_4^o$	37132.084	620.818
$6s(2S)np$			6f $^3F_4^o$	38825.265	6.847	$^3F_3^o$	36511.266	276.408
			$^3F_3^o$	38818.418	2.683	$^3F_2^o$	36234.858	
			$^3F_2^o$	38815.735		$6p'\ ^1F_3^o$	26816.293	
			7f $^3F_4^o$	39683.02	2.40	$7p'\ ^1F_3^o$	37739.95	
			$^3F_3^o$	39680.62	2.56			
			$^3F_2^o$	39678.06		$5d(2D)nd$		
			8f $^3F_4^o$	40244.02	2.65	6d' 3S_1	36446.583	
			$^3F_3^o$	40241.37	2.46	6d' 3P_2	38267.67	244.45
			$^3F_2^o$	40238.91		3P_1	38023.22	347.38
6p $^3P_2^o$	13514.738	878.122	9f $^3F_4^o$	40627.78	5.98	3P_0	37675.84	
$^3P_1^o$	12636.616	370.595	$^3F_3^o$	40621.80	7.64	6d' 1P_1	36902.55	
$^3P_0^o$	12266.021		$^3F_2^o$	40614.16		6d' 3D_3	36628.87	428.45
7p $^3P_2^o$	30987.277	171.715	10f $^3F_4^o$	40897.07	-1.62	3D_2	36200.423	266.598
$^3P_1^o$	30815.562	72.029	$^3F_3^o$	40898.69	3.42	3D_1	35933.825	
$^3P_0^o$	30743.533		$^3F_2^o$	40895.27		6d' 1D_2	37837.40	
6p $^1P_1^o$	18080.264		11f $^3F_4^o$	41096.50	-0.38	6d' 3F_4	37732.23	228.21
7p $^1P_1^o$	32547.076		$^3F_3^o$	41096.88	-3.37	3F_3	37504.02	415.18
8p $^1P_1^o$	35892.518		$^3F_2^o$	41100.25		3F_2	37088.844	
9p $^1P_1^o$	37774.50		12f $^3F_4^o$	41247.58	0.54	6d' 1F_3	36165.311	
10p $^1P_1^o$	39308.74		$^3F_3^o$	41247.04	-3.52	6d' 3G_5	36837.50	488.52
11p $^1P_1^o$	39984.75		$^3F_2^o$	41250.56		3G_4	36348.98	454.70
12p $^1P_1^o$	40421.23		13f $^3F_4^o$	41364.65	0.29	3G_3	35894.28	
			$^3F_3^o$	41364.36		6d' 1G_4	38177.10	
			14f $^3F_{4,3,2}^o$	41456.78		$5d(2D)4f?$		
$6s(2S)nd$			15f $^3F_{4,3,2}^o$	41530.05		4f' $^3F_4^o$		
5d 3D_3	9596.551	381.033	4f $^1F_3^o$	34736.423		$^3F_3^o$		
3D_2	9215.518	181.533	5f $^1F_3^o$	37282.175		$^3F_2^o$	39765.31	
3D_1	9033.985		6f $^1F_3^o$	38884.00		?	39905.45†	
6d 3D_3	30818.110	67.441	7f $^1F_3^o$	39705.11				
3D_2	30750.669	55.075	8f $^1F_3^o$	40257.63				
3D_1	30695.594		9f $^1F_3^o$	40614.15				
7d 3D_3	35785.302	23.091	$5d(2D)ns$					
3D_2	35762.211	52.903	7s' 3D_3	33526.41	582.81			
3D_1	35709.308		3D_2	32943.60	138.61			
8d 3D_3	37988.485	14.294	3D_1	32804.99				
3D_2	37974.191	12.272						
3D_1	37961.919							
9d 3D_3	39185.75	27.86						
3D_2	39157.89	17.19						
3D_1	39140.70		7s' 1D_2	33795.84				

† $J=1$ or 2.

The intensities of the observed combinations in Ba I are recorded in table 3. This table is arranged in two sections: (1) the multiplets produced by transitions from the low even terms $6s^2\ ^1S$, $5d^2\ ^3P$, $5d^2\ ^1D$; $5d\ ^3D$, and $5d\ ^1D$ (more precisely $6s\ 5d\ ^3D$), to higher odd terms, the latter being given in the same order as in table 1; (2) multiplets representing transitions from $6p\ ^3P^o$ and $6p'\ ^3P^o$, $6p'\ ^3D^o$, $6p'\ ^3F^o$ to higher even terms as given in table 1. All observed combinations are reported in table 3 except the following four, which are omitted to save space:

Desig.	Int.
$6d\ ^3D_3-4f\ ^3F_4^o$	(20)
$6d\ ^1D-4f\ ^1F^o$	(20)
$7s\ ^3S-7p\ ^3P_2^o$	(40)
$7s\ ^3S-7p\ ^3P_1^o$	(15)

The intensities in table 3 are from column 3 of table 2. King's estimated arc intensity (or furnace intensity in brackets) and temperature class are entered when known. All intensities not by King are given in parentheses. For some lines no estimated intensity is available. In such cases, a "(—)" has been adopted to denote that the combination has been observed.

The present summary of our knowledge of the Ba I spectrum does not serve to replace the monograph

needed for this spectrum. Further observations of the Zeeman effect are desirable. With modern infrared detectors the long-wave region beyond the photographic range offers an attractive and worthwhile program. In particular, the even term $5d\ ^2\ ^3F$ remains to be found. The short-wave region likewise needs to be reobserved, and many of the early measurements throughout the spectrum could be improved.

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References

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TABLE 2. Observed and classified Ba I lines

Symbols in Intensity column

d, Double; *h*, hazy; *u*, diffuse; *n*, nebulous; *w*, wide; *H*, very hazy; *U*, very diffuse; *N*, very nebulous; *W*, very wide; *l*, shaded to longer waves; *v*, shaded to shorter waves; *r*, partial self-reversal; *R*, complete self-reversal.

Lit. ref.	I. A.	Intensity		K	ΔK o-c	Desig.	Lit. ref.	I. A.	Intensity		K	ΔK o-c	Desig.
		Ref.	King Arc T. C.						Ref.	King Arc T. C.			
A	30933.8	30	-----	3232	0	$5d\ ^3D_1-6p\ ^3P_0^o$	I. A.						
A	30686.9	20	-----	3258	-----	-----	B	11884.51	5h	-----	8412.01	-0.05	$6p'\ ^3D_2-7s'\ ^3D_2$
A	30468.5	15	-----	3281	-----	-----	B	11697.45	40h	-----	8546.53	-0.02	$6p'\ ^3D_2-7s'\ ^3D_3$
A	29790.6	35	-----	3356	-----	-----	B	11607.36	30h	-----	8612.86	-0.07	$6p'\ ^3D_2-7s'\ ^3D_1$
A	29223.9	50	-----	3421	0	$5d\ ^3D_2-6p\ ^3P_1^o$	B	11583.0	1h?	-----	8631.0	+0.1	$6p'\ ^3F_2-6d\ ^3D_1$
A	27751.1	30	-----	3602	-1	$5d\ ^3D_1-6p\ ^3P_1^o$	B	11423.46	20h	-----	8751.52	-0.02	$6p'\ ^3D_1-7s'\ ^3D_2$
A	26221.4	20	-----	3813	0	$6d\ ^3D_2-4f\ ^3F_2^o$	B	11403.92	2	-----	8766.51	-----	-----
A	25515.7	50	-----	3918	0	$5d\ ^3D_2-6p\ ^3P_2^o$	B	11373.88	5h	-----	8789.67	-0.09	$6p'\ ^3P_1-6p^2\ ^3P_0$
A	23255.3	30	-----	4299	0	$5d\ ^3D_2-6p\ ^3P_2^o$	B	11303.04	80	-----	8844.75	0.00	$5d\ ^3D_2-6p\ ^1P_1^o$
A	22313.4	20	-----	4480	-1	$5d\ ^3D_1-6p\ ^3P_2^o$	B	11274.77	10	-----	8866.93	+0.06	$6p'\ ^3P_2-6p^2\ ^3P_1$
A	22220.8	20	-----	4499	-1	$6d\ ^1D_2-4f\ ^1F_3^o$	B	11257.3	2H?	-----	8880.7	0.0	$6p'\ ^3P_1-7d\ ^1D_2$
A	21477.2	15	-----	4655	0	$7s\ ^3S_1-7p\ ^3P_1^o$	B	11118.3	1h?	-----	8991.7	-----	-----
A	20712.0	40	-----	4827	0	$7s\ ^3S_1-7p\ ^3P_2^o$	B	11114.42	50h	-----	8994.85	-0.02	$6p'\ ^3D_2-7s'\ ^3D_3$
A	19987.9	25	-----	5002	0	$6p\ ^1P_1-5d^2\ ^1D_2$	B	11075.7	3	-----	9026.3	0.0	$5d\ ^3D_1-6p\ ^1P_1^o$
A	19074.6	20	-----	5241	-1	$6p'\ ^1P_1-7s'\ ^1D_2$	B	11012.69	60hl	-----	9077.95	-0.04	$6p'\ ^1F_2-6d^2\ ^3G_3$
A	18204.1	15	-----	5492	0	$5d^2\ ^1D_2-6p'\ ^1P_1^o$	B	10962.65	20	-----	9119.39	+0.11	$6p'\ ^3P_1-6p^2\ ^3P_1$
A	17182.5?	5	-----	5818	+1	$6p'\ ^1P_1-6p^2\ ^1S_0$	B	10914.85	3	-----	9159.32	-----	-----
A	17064.8	10	-----	5858	-1	$6p\ ^1P_1-5d^2\ ^3P_2$	B	10888.65	30	-----	9181.36	+0.10	$6p'\ ^3P_0-6p^2\ ^3P_1$
A	15000.4	40	-----	6665	0	$5d\ ^1D_2-6p\ ^1P_1^o$	B	10791.25	40hl	-----	9264.23	-0.07	$6p'\ ^3D_2-7s'\ ^1D_2$
A	14325.4	25	-----	6979	-1	$6p'\ ^3P_2-6d\ ^3D_3$	B	10769.2	4h	-----	9283.2	+0.1	$6p'\ ^1P_1-6d^2\ ^1D_2$
A	14159.5	30	-----	7060	-8	$(5d^2\ ^3P_2-7p\ ^3P_2^o)$	B	10693.7	8hl	-----	9348.8	-0.2	$6p'\ ^1F_2-6d^2\ ^1F_3$
A	14077.9	40	-----	7101	0	$6p'\ ^3P_1-7s'\ ^3D_1$	B	10649.10	30h	-----	9387.90	+0.03	$6p'\ ^3P_2-6p^2\ ^1D_2$
A	13956.5	20	-----	7163	0	$6p'\ ^3P_0-7s'\ ^3D_1$	B	10540.10	8	-----	9484.97	-0.05	$5d^2\ ^1D_2-7p\ ^1P_1^o$
A	13810.5	40	-----	7239	-1	$6p'\ ^3P_1-7s'\ ^3D_2$	B	10487.3	2h	-----	9532.7	0.0	$6p'\ ^1F_2-6d^2\ ^3G_4$
A	13207.3	40	-----	7569	-1	$6p'\ ^3P_2-7s'\ ^3D_3$	B	10471.26	100	-----	9547.34	+0.02	$6p\ ^3P_2-5d^2\ ^1D_2$
A	12814.8	10	-----	7801	-2	$6p'\ ^3P_2-6d\ ^3D_2$	B	10409.7	3h	-----	9603.8	0.0	$6p'\ ^3D_1-7s'\ ^1D_2$
A	12554.3	30	-----	7963	-1	$6p'\ ^3D_2-7s'\ ^3D_2$	B	10370.35	10h	-----	9640.23	-0.05	$6p'\ ^3P_1-6p^2\ ^1D_2$
B	12083.60	1h	-----	8273.42	-0.03	$6p'\ ^3D_2-7s'\ ^3D_1$	B	10349.05	8hl	-----	9660.08	-0.32	$6p'\ ^3P_2-6p^2\ ^3P_2$
A	11978.2	15	-----	8346	-2	$6p'\ ^1P_1-6d^2\ ^1P_1$	B	10327.4	3	-----	9680.3	-----	-----

TABLE 2—Continued

Lit. Ref.	I. A.	Intensity		K	ΔK o-c	Desig.	Lit. Ref.	I. A.	Intensity		K	ΔK o-c	Desig.
		Ref.	King Arc T. C.						Ref.	King Arc T. C.			
B	10274.06	50h	-----	9730.59	+0.02	$6p' 1D_2-7s' 3D_1$	B	7865.29	1h	-----	12710.60	+0.11	$6p' 3D_1-6d' 1P_1$
B	10233.23	400h	-----	9769.41	+0.08	$6p' 3F_2-7s' 3D_3$	D	7863.45	10h	-----	12713.57	-----	-----
B	10188.24	50h	-----	9812.55	-0.03	$6p' 1F_3-6d' 3D_3$	C	7839.574	6u	-----	12752.292	-0.08	$6p' 3D_2-6d' 3F_4$
B	10172.1	3h	-----	9828.1	-0.7	$6p' 3P_2-7d' 3D_3$	D	7828.96	2	-----	12769.57	-----	-----
B	10146.9	5Hd?	-----	9852.5	-----	-----	B	7798.26	5h	-----	12819.85	-0.01	$6p' 1D_2-6d' 3G_3$
B	10129.70	10	-----	9869.25	+0.07	$6p' 1D_2-7s' 3D_2$	D	7783.55?	1	-----	12844.07	-----	-----
B	10115.2	5h	-----	9883.4	-----	-----	C	7780.479	400	10 I	12849.148	+0.005	$5d' 3D_2-6p' 3F_2$
B	10085.5	2h	-----	9912.5	-0.3	$6p' 3P_1-6p' 3P_2$	B	7775.37	10h	-----	12857.59	+0.05	$6p' 3D_2-6d' 1D_2$
B	10032.10	200	-----	9965.27	0.00	$6p' 3P_2-5d' 3P_1$	D	7770.26?	0	-----	12866.05	-----	-----
B	10001.08	300	-----	9996.18	+0.02	$6p' 3F_2-7s' 3D_2$	B	7766.80	10h	-----	12871.78	-0.01	$6p' 3F_2-6d' 3D_3$
B	9830.37	500h	-----	10169.77	-0.05	$6p' 1P_1-7s' 1S_0$	B	7751.68	40hv	-----	12896.88	+0.09	$6p' 3D_1-6d' 3F_2$
B	9821.60	3h	-----	10178.85	+0.21	$6p' 3D_1-6p' 1D_2$	B	7721.78	10h	-----	12946.82	-0.02	$6p' 3F_2-6d' 3G_3$
B	9792.91	5h	-----	10208.67	-0.09	$6p' 3P_2-6d' 3F_3$	B	7706.51	50hv	-----	12972.48	0.00	$6p' 3D_2-6d' 3F_3$
B	9772.62	6h	-----	10229.87	+0.19	$6p' 3P_1-6d' 3D_1$	C	7672.092	600	25r I	13030.673	-0.003	$5d' 3D_1-6p' 3F_2$
B	9759.35	2h	-----	10243.78	-0.09	$6p' 3P_2-6d' 3D_2$	D	7662.03	3	-----	13047.78	-----	-----
B	9713.75	60	-----	10291.86	+0.19	$6p' 3P_1-6d' 3D_1$	B	7642.91	200hl	4n III	13080.42	0.00	$6p' 3F_2-6d' 3G_5$
B	9704.42	20h	-----	10301.76	-0.02	$(6p' 3D_2-6p' 3P_1)$	B	7636.90	150hl	2n III	13090.72	-0.18	$6p' 1D_2-6d' 1F_3$
B	9658.8	10nl	-----	10350.4	-0.08	$6p' 3D_1-6p' 3P_0$	D	7616.55	1u	-----	13125.69	-0.32	$6p' 1D_2-6d' 3D_2$
B	9645.72	100h	-----	10364.45	-0.11	$6p' 3D_2-6p' 1D_2$	C	7610.479	50	2 IIIA	13136.167	+0.013	$5d' 1D_2-6p' 3D_2$
B	9608.88	300	-----	10404.19	-0.01	$6p' 3P_2-5d' 3P_2$	B	7575.22	2h	-----	13197.31	+0.07	$6p' 3D_2-6d' 1G_4$
B	9589.37	150	-----	10425.36	-0.08	$6p' 3P_1-5d' 1D_2$	B	7528.20	20h	-----	13252.84	-0.14	$6p' 3F_2-6d' 3D_2$
B	9530.30	10h	-----	10489.97	-0.06	$6p' 3P_2-6d' 3S_1$	B	7523.60	20h	-----	13279.73	-0.03	$6p' 3F_2-6p' 1D_2$
B	9524.70	60h	-----	10496.14	-0.14	$6p' 3P_1-6d' 3D_2$	B	7513.40	20h	-----	13287.85	+0.04	$6p' 3D_2-6d' 3D_2$
B	9455.92	100	-----	10572.49	0.00	$6p' 3P_2-6d' 3P_0$	C	7488.083	300	10 I	13305.89	+0.03	$6p' 3D_2-6d' 1D_2$
B	9450.05	15h	-----	10579.05	+0.08	$6p' 3F_2-7s' 3D_2$	B	7476.21	30h	-----	13350.882	-0.005	$5d' 3D_2-6p' 3F_2$
B	9414.6	4h	-----	10618.9	+0.2	$6p' 1F_3-7d' 1D_2$	B	7459.78	300hl	5n III	13372.08	-0.09	$6p' 1D_2-6d' 3S_1$
B	9403.53	10	-----	10631.39	+0.03	$6p' 3D_1-6p' 3P_1$	C	7457.53	100	5 II	13401.54	0.00	$6p' 3F_2-6d' 3G_4$
B	9398.8	6h	-----	10636.7	-0.4	$6p' 3D_3-6p' 3P_2$	B	7414.26	4hl	-----	13477.866	+0.001	$5d' 3D_2-6p' 1D_2$
B	9370.06	500	-----	10669.37	+0.09	$5d' 1D_2-6p' 3F_2$	B	7409.97	30hv	1 IV	13483.81	-0.06	$6p' 3D_2-6d' 3P_1$
B	9367.45	80h	-----	10672.34	+0.02	$6p' 3P_2-6d' 3D_3$	C	7392.411	400	30 II	13491.62	-0.000	$6p' 3P_1-7s' 3S_1$
B	9324.58	100h	-----	10721.40	-0.02	$6p' 1D_2-7s' 1D_2$	B	7375.59	50hl	2n III	13523.668	+0.000	$6p' 3D_2-6d' 3P_1$
B	9308.08	100	-----	10740.41	+0.08	$6p' 3F_2-7s' 3D_1$	B	7359.29	20	1 IIIA	13554.53	+0.05	$5d' 1D_2-6p' 3D_3$
B	9306.52	10	-----	10742.21	-0.23	$6p' 3P_1-6d' 3S_1$	B	7339.57	4h	-----	13584.53	+0.05	$5d' 1D_2-6p' 3D_3$
B	9253.08	15h	-----	10804.25	-0.18	$6p' 3P_2-6d' 3S_1$	B	7326.50	10h	-----	13621.03	-0.27	$5d' 3P_2-7p' 3D_2$
B	9245.6	1h	-----	10813.0	+0.1	$6p' 3D_2-6p' 1D_2$	B	7326.50	10h	-----	13645.33	-0.01	$6p' 3D_2-6d' 3D_2$
B	9219.69	100	-----	10843.38	-0.01	$6p' 3P_1-5d' 3P_1$	D	7319.12	1u	-----	13659.08	-----	-----
B	9215.42	15h	-----	10848.40	0.00	$6p' 3F_2-7s' 1D_2$	B	7307.23	10h	-----	13681.31	-0.12	$6p' 3F_2-6d' 3D_3$
B	9189.57	60h	-----	10878.92	-0.02	$6p' 3F_2-7s' 3D_2$	C	7304.46	5h	-----	13686.50	-----	-----
B	9159.66	10h	-----	10914.44	+0.02	$6p' 3D_2-6d' 3G_3$	B	7280.298	1000	150r II	13731.924	+0.004	$5d' 3D_2-6p' 3F_2$
B	9133.29	15h	-----	10945.95	-0.05	$6p' 3P_2-6d' 1P_1$	B	7272.33	2h	-----	13746.97	+0.03	$6p' 3F_2-6d' 3F_3$
B	9101.7	3ln	-----	10983.9	-----	-----	E	7229.56	10h	-----	13828.29	+0.16	$6p' 1D_2-6d' 3P_3$
B	9097.8	2h	-----	10988.7	-----	-----	B	7228.84	200hl	25 III	13829.67	+0.05	$6p' 3F_2-6d' 3G_3$
B	9018.63	3h	-----	11085.12	-0.29	$6p' 3D_2-6p' 3P_2$	B	7213.56	10	1 IIIA	13858.97	+0.07	$5d' 3D_2-6p' 1D_2$
B	8975.6	2h	-----	11138.3	-0.6	$6p' 3P_2-9s' 3S_1$	B	7208.18	20h	1n III	13859.31	+0.15	$6p' 3F_2-6d' 3D_1$
B	8937.93	10h	-----	11185.20	-0.25	$6p' 3D_2-6d' 1F_3$	C	7195.235	200	80 III	13894.263	0.000	$6p' 3P_2-7s' 3S_1$
B	8927.41	7hl	-----	11198.39	-0.02	$6p' 3P_1-6d' 1P_1$	B	7153.54	80hv	5 III	13975.25	+0.10	$6p' 3F_2-6d' 3F_4$
B	8914.99	150	-----	11213.99	0.00	$6p' 3P_2-5d' 3P_1$	B	7133.16	4h	-----	14015.17	-0.27	$5d' 1D_2-7p' 1D_2$
B	8909.83	3h	-----	11220.48	-0.08	$6p' 3P_2-6d' 3D_2$	D	7129.56	2	-----	14022.24	-----	-----
B	8860.98	100	-----	11282.33	+0.01	$6p' 3P_1-5d' 3P_2$	B	7126.60	10h	-----	14028.08	-----	-----
B	8799.76	100h	-----	11360.83	+0.02	$6p' 1F_3-6d' 1G_4$	C	7120.329	800hv	200 II	14040.431	0.000	$5d' 3D_1-6p' 1D_2$
B	8793.36	3h	-----	11369.10	-0.02	$6p' 3D_2-6d' 3G_4$	D	7110.24	1u	-----	14060.35	-----	-----
B	8767.7	1h	-----	11402.4	+0.1	$6p' 3D_2-6d' 3D_1$	D	7097.99	1	-----	14084.61	-----	-----
B	8737.74	5h	-----	11441.47	-----	-----	B	7090.01	100hl	5n III	14100.47	-0.18	$6p' 3F_2-6d' 1F_3$
B	8710.82	3h	-----	11476.83	-----	-----	B	7072.38	1h	-----	14135.62	-0.14	$6p' 3F_2-6d' 3D_2$
D	8659.30	1	-----	11476.83	-----	-----	B	7069.43	3	-----	14141.52	+0.11	$6p' 3F_2-6d' 3F_4$
B	8654.07	60	-----	11545.11	-----	-----	C	7059.941	2000	400r II	14160.526	0.000	$5d' 3D_2-6p' 3F_4$
B	8593.48	4hl	-----	11552.09	+0.03	$5d' 1D_2-6p' 3F_2$	B	6986.79	5	-----	14308.78	+0.02	$5d' 1D_2-6p' 3P_1$
B	8581.98	50hl	-----	11633.54	-0.24	$6p' 3D_2-6d' 1F_3$	B	6961.63	2h	-----	14360.50	-0.04	$6p' 1D_2-7d' 1D_2$
D	8569.99	1r	-----	11649.13	+0.12	$6p' 3D_2-6d' 3D_3$	D	6951.35	1u	-----	14381.73	-0.19	$6p' 3F_2-6d' 3S_1$
B	8567.58	40hl	-----	11665.42	-----	-----	B	6932.92	2h	-----	14419.96	-0.06	$6p' 3F_2-6d' 1G_4$
B	8559.97	600h	-----	11668.70	-0.19	$6p' 3D_2-6d' 3D_2$	D	6874.16	1u	-----	14543.22	-----	-----
D	8542.37	1u	4 I	11679.08	+0.05	$5d' 1D_2-6p' 1D_2$	B	6867.85	100h	8n IV?	14556.59	+0.01	$6p' 3F_2-6d' 3F_3$
B	8521.96	3hl	-----	11703.14	-----	-----	C	6865.692	200	30 II	14561.164	-0.003	$5d' 1D_2-6p' 3P_2$
B	8514.23	30hl	-----	11731.17	-0.01	$6p' 3F_2-7s' 1D_2$	B	6771.85	60h	2n III	14762.95	-0.03	$6p' 1D_2-6d' 1D_2$
B	8414.58	4hp	-----	11741.82	+0.05	$6p' 3D_1-6d' 3D_1$	D	6769.60	2u	-----	14767.84	-----	-----
B	8350.76	2h	-----	11880.87	+0.12	$6p' 3P_2-6d' 1D_2$	B	6761.86	2h	-----	14784.76	-0.03	$6p' 3F_2-6d' 3F_4$
D	8328.82	3u	-----	11971.67	-0.03	$6p' 3P_1-6d' 3P_0$	B	6714.03	2h	-----	14890.08	+0.12	$6p' 3F_2-6d' 1D_2$
B	8325.38	20h	-----	12003.20	-----	-----	C	6693.842	600	70 I	14934.987	+0.002	$5d' 3D_2-6p' 3D_2$
D	8288.10	1u	-----	12008.27	-0.10	$6p' 3D_1-6d' 3D_2$	C	6675.271	50	80 I	14976.538	-0.001	$5d' 3D_2-6p' 3D_1$
B	8285.00	1hp	-----	12062.18	-----	-----	C	6654.102	50	10 III	15024.183	0.000	$6p' 3F_2-6d' 3F_2$
B	8264.01	3h	-----	12066.69	+0.02	$6p' 3P_2-6d' 3P_1$	F	6642.40	-----	1n IIIA	1505		

TABLE 2—Continued

Lit. Ref.	I. A.	Intensity		K	ΔK o-c	Desig.	Lit. Ref.	I. A.	Intensity		K	ΔK o-c	Desig.
		Ref.	King Arc T. C.						Ref.	King Arc T. C.			
D	6174.54	4	-----	16191.06	-----	-----	H	4724.742	(3)	3 III	21159.26	+0.04	6p $^2P_{1/2}^-$ 7s' 1D_2
D	6140.39	5	-----	16281.11	-----	-----	C	4700.427	(3)	20 III	21268.729	-0.004	6p $^2P_{1/2}^-$ 8s 3S_1
H	6129.335	3u	3 III	16310.47	-0.05	6p $^1P_{1/2}^-$ 6p 2S_0	F	4699.108	(3)	15NIII	21274.68	0.00	6p $^1P_{1/2}^-$ 9d 1D_2
C	6110.784	(100R)	300r II	16359.994	-0.004	5d 3D_3 6p $^3P_2^0$	I	4698.10	2h	-----	21279.25	-----	-----
C	6086.4	1u	-----	16425.53	+0.09	5d $^3P_1^-$ 39905 0	C	4691.617	(8)	35 II	21308.667	-0.015	6p $^3P_2^-$ 6p 2P_1
C	6083.402	(5R)	5 IIIA	16433.632	-0.002	6p $^1P_{1/2}^-$ 6p 2P_0	J	4674.97	-----	-----	21384.52	-----	-----
C	6063.117	(50R)	200 II	16488.612	-0.010	5d 3D_2 6p 3P_1	C	4673.619	(3)	30 II	21390.727	+0.001	5d 3D_3 7p $^3P_2^0$
D	6035.52	1u	-----	16563.99	-----	-----	I	4670.75	1h	-----	21403.85	-----	-----
C	6019.470	(50)	100 II	16608.170	-0.002	5d 3D_1 6p $^3P_0^0$	I	4668.56	1h	-----	21413.89	-----	-----
C	5997.088	(50)	100 II	16670.153	-0.002	5d 3D_1 6p 3P_1	G	4662.8	1u	10NIV?	21440.34	-----	-----
G	5985.2	1u	-----	16703.25	0.00	5d 1D_2 39765 0	G	4651.8	1u	5NIV?	21491.04	-----	-----
H	5978.496	2	4 IIIA	16721.98	-0.10	6p $^3P_1^-$ 6d 1D_2	H	4642.038	2r	4NIV?	21536.23	-----	-----
H	5971.699	50	100 II	16741.027	-0.004	5d 3D_2 6p $^3P_2^0$	H	4636.333	3r	15NIV?	21562.73	-----	-----
H	5964.787	2	5 III	16760.42	-----	-----	J	4629.63	-----	-----	21593.95	-----	-----
H	5962.445	2	2 IIIA	16767.00	-----	-----	C	4628.328	(3)	25n III	21600.044	0.000	5d 3D_2 7p 3P_1
D	5935.43	1u	-----	16843.31	-0.08	5d 1D_2 39905 0	I	4624.21	1h	-----	21619.26	-----	-----
C	5927.7	1u	-----	16865.28	-----	-----	C	4619.924	(3)	20n III	21639.336	+0.008	6p $^3P_0^-$ 8s 3S_1
C	5907.639	(10)	15 IIIA	16922.558	-0.006	5d 3D_1 6p $^3P_2^0$	J	4606.38	-----	-----	21702.94	-----	-----
G	5859.29	1	-----	17062.19	-----	-----	C	4604.982	(1)	8n IIIA	21709.548	0.000	5d 3D_1 7p 3P_0
G	5849.28	1	-----	17091.38	-----	-----	H	4599.751	6R	30 III	21734.22	+0.06	6p $^3P_1^-$ 6p 2S_0
C	5826.277	(100)	150 II	17158.874	-0.001	5d 1D_2 6p 3P_1	J	4593.16	-----	-----	21765.40	-----	-----
C	5819.831	(3)	5 IIIA	17180.831	-0.025	6p $^3P_2^-$ 6d 3D_1	C	4591.824	(2)	10n III	21771.758	-0.001	5d 3D_2 7p $^3P_2^0$
C	5818.25	1	-----	17182.53	-----	-----	J	4591.07	-----	-----	21775.31	-----	-----
C	5805.685	(10)	20 II	17219.734	-0.008	5d 3D_2 6p $^1F_3^0$	C	4589.754	(2)	8n IIIA	21781.577	0.000	5d 3D_1 7p 3P_1
C	5800.229	(100)	100 III	17235.932	+0.001	6p $^3P_2^-$ 6d 3D_2	C	4579.639	(15)	80 II	21829.695	0.000	6p $^3P_2^-$ 6p 2D_2
C	5784.105	2u	4 III	17283.97	-0.19	6p $^1P_{1/2}^-$ 6p 2D_2	C	4573.854	(10)	40 II	21857.293	+0.011	6p $^3P_1^-$ 6p 2P_0
C	5777.622	(500)	400r II	17303.372	0.000	6p $^3P_2^-$ 6d 3D_3	I	4562.75	1	-----	21910.47	-----	-----
C	5720.712	1	-----	17475.49	-----	-----	C	4523.171	(10)	60n II	22102.206	-0.003	6p $^3P_2^-$ 6p 2P_2
H	5718.364	1	-----	17482.67	-----	-----	K	4512.89	1	-----	22152.54	-----	-----
H	5715.953	1	-----	17490.04	-----	-----	C	4505.924	(10)	40 II	22186.803	-0.001	6p $^3P_1^-$ 6p 2P_1
H	5713.554	2	4 nIII	17497.39	-----	-----	K	4504.36	1n	-----	22194.49	-0.08	6p $^3P_2^-$ 7d 3D_1
H	5709.546	1	2 nIII	17509.67	-----	-----	C	4493.637	(6)	50n III	22247.469	-0.004	6p $^3P_2^-$ 7d 3D_2
H	5706.042	1	-----	17520.42	-----	-----	C	4488.977	(8)	60n III	22270.564	0.000	6p $^3P_2^-$ 7d 3D_3
H	5704.820	1	-----	17524.17	-----	-----	C	4467.093	(3)	12 III	22379.664	+0.12	6p $^3P_2^-$ 6d' 3G_3
C	5680.184	-----	10 IIIA	17600.192	-0.007	6p $^3P_1^-$ 6d' 1D_2	K	4459.18	(0)	-----	22419.36	+0.27	6p $^3P_2^-$ 6d' 3D_1
C	5679.997	-----	2 IIIA	17600.771	-0.004	5d 3D_2 6p $^1F_3^0$	C	4451.894	(10)	40 II	22557.403	+0.004	6p $^3P_0^-$ 6p 2P_1
I	5664.3	1h	-----	17649.53	+0.49	6p $^1P_{1/2}^-$ 7d 2D_1	K	4430.33	(1)	-----	22565.35	-----	-----
G	5641.1	1u	-----	17722.12	-----	-----	C	4413.664	(2)	8 III	22650.573	0.000	6p $^3P_2^-$ 6d' 1F_3
H	5628.938	1U	-----	17760.41	-----	-----	H	4406.846	4r	15 III	22685.59	-0.09	6p $^3P_2^-$ 6d' 2D_2
H	5625.701	1U	-----	17770.63	+0.08	5d $^2P_1^-$ 12f $^2F_2^0$	C	4402.539	(20)	60 II	22707.808	+0.001	6p $^3P_1^-$ 6p 2D_2
G	5620.4	1u	20n IV?	17787.39	-----	-----	I	4375.88	1H	-----	22846.13	-----	-----
G	5620.0	1u	4t IV?	17788.66	-----	-----	C	4359.527	(2)	5 III	22931.845	0.000	6p $^3P_2^-$ 6d' 3S_1
H	5619.099	1U	-----	17791.51	-----	-----	C	4350.328	(15)	80 II	22980.334	+0.003	6p $^3P_1^-$ 6p 2P_2
G	5618.7	1u	-----	17792.77	-----	-----	C	4332.914	(3)	10n III	23072.692	0.000	6p $^3P_1^-$ 7d 3D_1
H	5593.297	3	3 III	17873.58	+0.02	6p $^1P_{1/2}^-$ 6d' 3D_1	H	4325.152	3	10 III	23114.07	-0.06	6p $^3P_2^-$ 6d' 3D_3
G	5546.1	2u	-----	18025.68	-----	-----	C	4323.620	-----	-----	23122.286	-----	-----
F	5535.86	7	-----	18059.02	+0.04	6p $^3P_1^-$ 6d' 3D_1	C	4323.001	(3v)	20n III	23125.597	+0.002	6p $^3P_1^-$ 7d 3D_2
C	5535.484	(100R)	1000R I	18060.264	0.000	6s' 1S_0 6p 1P_1	I	4305.15	1	-----	23221.46	+0.16	5d 1D_2 4f $^3F_3^0$
C	5519.047	(50)	200 II	18114.052	-0.001	6p $^3P_1^-$ 6d' 3D_2	C	4291.158	(5)	12 III	23297.201	-0.008	6p $^3P_1^-$ 6d' 3D_1
H	5473.689	2u	3 IIIA	18264.14	-----	-----	I	4284.90	1	-----	23331.20	-0.36	5d 3D_2 7p 1P_1
H	5437.393	2u	4 IIIA	18386.06	-0.26	6p $^1P_{1/2}^-$ 6d' 3S_1	C	4283.098	(20)	100 II	23341.041	0.000	5d 1D_2 4f $^1F_3^0$
C	5424.551	(50r)	100 II	18429.597	+0.024	6p $^3P_0^-$ 6d' 2D_1	I	4278.83	0+	-----	23364.50	-----	-----
H	5416.344	1U	-----	18457.51	-----	-----	C	4264.418	(2)	15n IIIA	23443.286	-0.001	6p $^3P_0^-$ 7d 3D_1
H	5404.920	1U	5 nIII	18496.52	-----	-----	I	4252.4	1	-----	23509.51	-----	-----
I	5393.25	1hR	-----	18536.54	-----	-----	C	4242.606	(4)	10 III	23563.807	0.000	6p $^3P_1^-$ 6d' 2D_2
G	5389.6	1u	-----	18549.10	-----	-----	C	4239.557	(2)	10n III	23580.754	0.000	6p $^3P_2^-$ 9s 3S_1
G	5381.0	1u	-----	18578.75	-----	-----	C	4223.962	(5)	12 III	23667.813	+0.009	6p $^3P_2^-$ 6d' 3D_1
K	5378.85	(1)	-----	18586.17	-----	-----	H	4179.372	2r	8n IIIA	23920.30	+0.08	6p $^3P_2^-$ 7d 3D_2
H	5365.383	1u	-----	18632.82	-----	-----	E	4134.383	(1)	-----	24180.58	+0.02	6p $^3P_2^-$ 6d' 2S_1
H	5349.621	1U	-----	18687.72	-----	-----	C	4132.427	(5)	20 I	24192.054	+0.01	6s' 2S_0 6p 2P_1
H	5308.952	1U	4 IV?	18830.87	-----	-----	E	4110.23	2	2 III	24322.67	+0.18	6p $^3P_2^-$ 6d' 1D_2
H	5305.758	2u	4 IV?	18842.20	-0.09	6p $^1P_{1/2}^-$ 6d' 1P_1	H	4087.371	1U	8n IIIA	24458.70	-0.75	6p $^3P_2^-$ 8d 3D_2
H	5302.808	3u	6 IV?	18852.69	-----	-----	H	4085.322	1U	-----	24470.97	-----	-----
H	5294.130	2u	-----	18883.59	-----	-----	C	4084.862	(1u)	30n III	24473.747	0.000	6p $^3P_2^-$ 8d 3D_3
H	5290.945	1U	-----	18894.49	-----	-----	G	4080.9	1u	6n III	24497.5	+0.4	5d 1D_2 8p 1P_1
H	5279.619	1U	-----	18935.49	-----	-----	E	4057.833	1Pb?	-----	24636.74	+0.21	6p $^3P_2^-$ 6d' 1P_1
H	5277.625	1U	3 IV?	18942.64	-----	-----	E	4038.797	0	-----	24752.85	-0.08	6p $^3P_2^-$ 6d' 3P_2
H	5267.033	4u	20 IV?	18980.74	0.00	6p $^1P_{1/2}^-$ 8s 1S_0	E	4031.415	0h	-----	24798.18	-0.16	6p $^3P_1^-$ 7d 1D_2
H	5265.566	1u	-----	18986.03	-----	-----	G	4026.40	1r	2n IV?	24829.06	-0.41	6p $^3P_0^-$ 9s 3S_1
H	5253.807	1U	-----	19028.52	-0.06	6p $^1P_{1/2}^-$ 6d' $^2F_2^0$	G	3997.90	1	3 III	25006.06	-0.19	5d 3D_3 4f $^3F_2^0$
E	5177.322	(2u)	2 IV?	19309.63	-----	-----	C	3995.656	(5)	30 III	25020.131	-0.001	5d 3D_3 4f $^3F_3^0$
H	5175.619	3u	5 IV?	19315.98	-----	-----	C						

TABLE 2—Continued

Lit. Ref.	I. A.	Intensity		K	ΔK o-c	Desig.	Lit. Ref.	I. A.	Intensity		K	ΔK o-c	Desig.
		Ref.	King Arc T. C.						Ref.	King Arc T. C.			
C	3894.345	1h	-----	25671.013	+3.08	5d 1D ₂ -7p' 3D ₂	F	3426.453	-----	4n III?	29176.33	-----	-----
H	3892.653	2u	20 III	25682.14	+0.02	6p 3P ₂ -9d 3D ₃	F	3421.476	-----	[30n] III	29218.77	{ 0.00	5d 1D ₂ -9f 1F ₃
I	3890.57	0	-----	25695.89	-0.01	5d 1D ₂ -7p' 1D ₂	F	3421.008	-----	[25] III	29222.77	+0.90	5d 3D ₃ -6f 3F ₃
C	3889.326	(8)	20 II	25704.140	0.000	6s ² 1S ₀ -6p' 3P ₁	C	3420.316	(8r)	[70R] III	29228.714	0.000	5d 3D ₃ -6f 3F ₃
E	3881.319	2	-----	25757.14	-0.06	6p 3P ₀ -6d' 3P ₁	F	3413.835	-----	3n III	29284.17	-0.16	5d 3D ₂ -7p' 1P ₁
H	3861.905	2u	15 III	25886.62	-0.08	5d 1D ₂ -7p' 3P ₂	F	3377.391	-----	[20] III	29600.15	-0.07	5d 3D ₂ -6f 3F ₂
I	3841.15	1h	-----	26026.49	-0.17	5d 1D ₂ -5f 1F ₃	C	3377.081	(5r)	[60R] III	29602.900	0.000	5d 3D ₂ -6f 3F ₂
I	3828.93	-----	-----	26109.55	+0.20	6p 3P ₁ -10s 3S ₁	C	3356.800	(4r)	80N III	29781.750	0.000	5d 3D ₁ -6f 3F ₂
H	3794.771	5v	15 III	26344.57	-0.40	6p 3P ₂ -11s 3S ₁	F	3323.058	-----	[10] III	30084.11	+0.04	5d 3D ₃ -7f 3F ₃
J	3790.27	0	-----	26375.85	0.00	5d 1D ₂ -7p' 1F ₃	F	3322.797	-----	[50r] III	30086.47	0.00	5d 3D ₃ -7f 3F ₃
I	3789.72	-nl	-----	26379.68	-0.11	6p 3P ₂ -10d 3D ₂	F	3315.753	-----	8n III	30150.39	-----	-----
I	3788.18	-----	-----	26390.41	+0.56	5d 1D ₂ -9p 1P ₁ ?	G	3298.2	1r	-----	30310.84	-----	-----
I	3787.23	-----	-----	26390.41	0.00	5d 1D ₂ -9p 1P ₁ ?	F	3281.772	-----	[15] III	30462.56	+0.02	5d 3D ₂ -7f 3F ₂
I	3771.93	-----	-----	26397.03	+0.14	6p 3P ₂ -10s 3S ₁	F	3281.503	-----	[40r] III	30465.06	-0.04	5d 3D ₂ -7f 3F ₂
I	3769.48	-----	-----	26504.10	+0.02	6p 3P ₁ -10s 3S ₁	F	3272.405	-----	2n III	30549.76	-0.03	5d 3D ₂ -39765°
I	3767.4	0II	-----	26521.32	+0.05	6p 3P ₁ -9d 3D ₂	F	3270.115	-----	4n III	30571.15	-----	-----
I	3721.17	-----	-----	26535.96	-----	6p 3P ₁ -9d 3D ₂	F	3262.336	-----	[60P] III	30644.05	-0.03	5d 3D ₁ -7f 3F ₂
I	3720.85	-----	-----	26865.63	+0.05	6p 3P ₂ -11d 3D ₂	F	3261.961	-----	[50r] III	30647.57	+0.10	5d 3D ₂ -8f 3F ₂
I	3719.92	-----	-----	26867.94	0.00	6p 3P ₂ -11d 3D ₂	F	3253.067	-----	5n III	30731.36	+0.03	5d 3D ₂ -7f 39765°
I	3704.23	-----	-----	26874.65	-0.03	6p 3P ₀ -9d 3D ₁	J	3244.20	-----	-----	30815.35	-0.21	6s ² 1S ₀ -3p' 3P ₁
H	3701.716	2u	3 III	26988.48	+0.41	6p 3P ₀ -9d 3D ₁	F	3222.441	-----	[8] III	31023.42	+0.03	5d 3D ₂ -8f 3F ₂
K	3699.94	2	-----	27006.81	-----	6p 3P ₁ -11s 3S ₁	F	3222.188	-----	[40] III	31025.85	0.00	5d 3D ₂ -8f 3F ₂
H	3688.473	3r	-----	27019.78	+0.44	5d 3D ₂ -7p' 3F ₃	F	3221.630	-----	[30] III	31031.23	0.00	5d 3D ₂ -8f 3F ₂
C	3675.310	(1)	2 III	27103.78	-0.69	5d 1D ₂ -7p' 1P ₁	F	3203.700	-----	25N III	31204.89	-0.04	5d 3D ₁ -9f 3F ₄
I	3667.93	-----	-----	27200.873	0.000	5d 1D ₂ -7p' 1P ₁	F	3193.967	-----	[5] III	31296.98	-----	-----
I	3667.60	-----	-----	27255.57	+0.01	6p 3P ₁ -10d 3D ₁	F	3193.912	-----	[10] III	31300.52	0.00	5d 3D ₃ -10f 3F ₄
H	3664.598	1u	3 III	27258.02	+0.11	6p 3P ₁ -10d 3D ₁	F	3183.156	-----	[15] III	31398.35	-0.29	5d 3D ₂ -9f 3F ₂
C	3662.535	(3)	15 III	27280.35	+0.10	5d 3D ₂ -7p' 3D ₁	F	3173.69	-----	[30] III	31406.28	0.00	5d 3D ₂ -9f 3F ₂
C	3640.391	(3)	10 III	27295.748	-0.000	5d 3D ₂ -7p' 3D ₁	F	3173.69	-----	[15n] III	31499.95	0.00	5d 3D ₂ -11f 3F ₄
F	3639.715	-----	-----	27446.85	+0.09	5d 3D ₁ -7p' 3D ₁	F	3165.598	-----	[25] III	31580.47	+0.29	5d 3D ₁ -9f 3F ₄
F	3636.832	-----	-----	27488.62	+0.00	5d 3D ₃ -7p' 3D ₁	F	3158.046	-----	[12N] III	31651.03	0.00	5d 3D ₃ -12f 3F ₄
C	3630.640	(10)	40 III	27535.533	0.000	5d 3D ₃ -7p' 3D ₁	F	3158.046	-----	[12] III	31655.99	-----	-----
C	3610.957	-----	-----	27685.624	0.000	5d 3D ₃ -7p' 3D ₁	F	3155.336	-----	[10] III	31679.79	+0.04	5d 3D ₂ -10f 3F ₂
I	3603.40	-----	-----	27743.65	+0.09	5d 3D ₃ -7p' 3D ₁	I	3146.90	-----	[10] III	31683.17	0.00	5d 3D ₂ -10f 3F ₂
C	3599.402	(3)	15 III	27774.499	-0.05	6p 3P ₃ -11d 3D ₂	I	3137.80	-----	-----	31768.10	0.00	5d 3D ₃ -13f 3F ₄
C	3596.33	(1u)	-----	27798.19	-0.18	5d 3D ₂ -7p' 3P ₂	F	3137.70	-----	[8n] III	31860.23	0.00	5d 3D ₃ -13f 3F ₄
C	3593.204	(1)	15n III	27822.406	-0.010	5d 3D ₃ -5f 3F ₃	G	3135.72	-----	[10] III	31861.25	-0.04	5d 3D ₁ -10f 3F ₂
F	3589.950	-----	-----	27847.59	-0.20	5d 3D ₃ -5f 3F ₃	F	3132.602	-----	[8] III	31913.10	0.00	5d 3D ₃ -11f 3F ₂
F	3588.099	-----	-----	27861.96	-0.02	5d 3D ₂ -7p' 3D ₂	I	3130.6	-----	-----	31933.50	0.00	5d 3D ₃ -15f 3F ₀
C	3586.549	(2)	10 III	27874.031	0.00	5d 3D ₂ -7p' 1D ₂	I	3121.02	-----	-----	32031.52	0.00	5d 3D ₂ -12f 3F ₃
C	3579.665	(20r)	80n III	27927.633	0.000	5d 3D ₁ -7p' 3P ₂	F	3119.202	-----	3N III	32050.19	-----	-----
F	3577.615	-----	-----	27943.60	-0.09	5d 3D ₁ -7p' 3P ₂	F	3117.638	-----	[3n] III	32066.27	0.00	5d 3D ₁ -11f 3F ₂
F	3576.036	-----	-----	27955.94	-0.09	5d 3D ₃ -7p' 3D ₁	F	3117.34	-----	[3n] III	32069.33	-----	-----
I	3571.8	1h	-----	27989.10	0.00	5d 3D ₁ -7p' 3P ₂	I	3109.63	-----	-----	32148.84	0.00	5d 3D ₂ -13f 3F ₃
F	3566.660	-----	-----	28029.43	+0.10	5d 3D ₁ -7p' 3D ₂	I	3108.21	-----	10n III	32163.53	-----	-----
F	3561.942	-----	-----	28066.56	-0.10	5d 3D ₂ -5f 1F ₃	I	3103.1	-----	-----	32216.49	-0.09	5d 3D ₁ -12f 3F ₂
I	3552.3	1h	-----	28142.74	0.00	5d 3D ₂ -5f 1F ₃	C	3071.583	(20)	100R III	32547.076	0.000	6s ² 1S ₀ -7p 1P ₁
C	3547.680	(3)	20n III	28179.415	+0.008	5d 3D ₂ -5f 1F ₃	C	2785.276	(2)	15 IV	35892.518	0.000	6s ² 1S ₀ -8p 1P ₁
C	3544.655	(20r)	80n III	28203.462	+0.013	5d 3D ₂ -5f 1F ₃	H	2739.243	4	3 IV	36495.64	-0.13	6s ² 1S ₀ -7p' 3Df
I	3540.72	1	-----	28234.77	-----	5d 3D ₂ -5f 1F ₃	C	2702.632	(2)	8 IV	36990.016	0.000	6s ² 1S ₀ -7p' 3P ₁
F	3531.345	-----	-----	28309.73	0.00	5d 1D ₂ -7f 1F ₃	I	2646.50	1h	-----	37774.50	0.00	6s ² 1S ₀ -9p 1P ₁
C	3529.480	(3)	15 III	28324.720	0.000	5d 1D ₂ -7f 1F ₃	C	2596.637	(1)	8n IV	38499.852	0.000	6s ² 1S ₀ -7p' 1P ₁
C	3524.973	(20r)	80n III	28360.935	-0.005	5d 3D ₁ -5f 3F ₃	I	2543.2	-----	-----	38564.25	-----	-----
K	3523.92	0n	-----	28369.38	-0.55	5d 3D ₁ -39765°?	I	2500.2	-----	-----	39308.74	0.00	6s ² 1S ₀ -10p 1P ₁
C	3501.107	(50)	200P II	28554.257	0.000	6s ² 1S ₀ -6p' 1P ₁	I	2473.20	0h	-----	39984.75	0.00	6s ² 1S ₀ -11p 1P ₁
F	3463.741	-----	-----	28862.25	0.00	5d 1D ₂ -8f 1F ₃	H	2373.109	3	-----	40421.23	0.00	6s ² 1S ₀ -12p 1P ₁
F	3427.85	-----	-----	29164.44	0.00	5d 1D ₂ -8f 1F ₃	H	2216.577	2	-----	42125.95	-----	-----
							H	2214.639	2	-----	45100.56	-----	-----
											45140.02	-----	-----

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TABLE 3. Intensities of Ba I combinations

	$6s^2 1S_0$	$5d^2 3P_2$	$5d^2 3P_1$	$5d^2 3P_0$	$5d^2 1D_2$	$5d 3D_3$	$5d 3D_2$	$5d 3D_1$	$5d 1D_2$		$6s^2 1S_0$	$5d^2 3P_2$	$5d^2 3P_1$	$5d^2 3P_0$	$5d^2 1D_2$	$5d 3D_3$	$5d 3D_2$	$5d 3D_1$	$5d 1D_2$
$6p 3P_2$	-----	(300)	(200)	-----	(100)	(50)	(30)	(20)	-----	$13f 3F_4$	-----	-----	-----	-----	(-)	-----	-----	-----	-----
$3P_1$	3 IA	(100)	(100)	-----	(150)	-----	(50)	(30)	-----	$3F_3$	-----	-----	-----	-----	(-)	-----	-----	-----	-----
$3P_0$	-----	(150)	(150)	-----	-----	-----	-----	(30)	-----	$3F_2$	-----	-----	-----	-----	-----	-----	-----	-----	-----
$7p 3P_2$	-----	-----	-----	-----	-----	30 II	10n III	-----	-----	$14f 3F^{\circ}$	-----	-----	-----	-----	(-)	-----	-----	-----	-----
$3P_1$	(-)	-----	-----	-----	-----	-----	25n III	-----	-----	$15f 3F^{\circ}$	-----	-----	-----	-----	(-)	-----	-----	-----	-----
$3P_0$	-----	-----	-----	-----	-----	-----	-----	8n IIIA	-----	-----	-----	-----	-----	-----	(-)	-----	-----	-----	-----
$6p 1P_1$	1000R I	(10)	-----	-----	(25)	-----	(80)	(3)	(40)	$4f 1F^{\circ}$	-----	-----	-----	-----	-----	4 III	-----	100 II	-----
$7p 1P_1$	100R III	-----	-----	-----	(8)	-----	(1)	-----	40 II	$5f 1F^{\circ}$	-----	-----	-----	-----	15n III*	10 III*	-----	15 III*	-----
$8p 1P_1$	15 IV	-----	-----	-----	-----	-----	-----	-----	6n III	$6f 1F^{\circ}$	-----	-----	-----	-----	-----	-----	-----	40N III	-----
$9p 1P_1$	(1h)	-----	-----	-----	-----	-----	-----	-----	(-) <i>nl</i> *	$7f 1F^{\circ}$	-----	-----	-----	-----	-----	-----	-----	30N III	-----
$10p 1P_1$	(-)	-----	-----	-----	-----	-----	-----	-----	-----	$8f 1F^{\circ}$	-----	-----	-----	-----	-----	-----	-----	[40] III	-----
$11p 1P_1$	(-)	-----	-----	-----	-----	-----	-----	-----	-----	$9f 1F^{\circ}$	-----	-----	-----	-----	-----	-----	-----	[30n] III	-----
$12p 1P_1$	(0h)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$4f 3F_4$	-----	-----	-----	-----	-----	80 II	-----	-----	-----	$6p' 3P_2$	-----	-----	-----	-----	300r II	100 II	15 IIIA	30 II	-----
$3F_3$	-----	-----	-----	-----	-----	30 III	-----	-----	(1)	$3P_1$	20 II	-----	-----	-----	-----	200 II	100 II	100 II	(5)
$3F_2$	-----	-----	-----	-----	-----	3 III	20 III	40 II	-----	$3P_0$	-----	-----	-----	-----	-----	-----	100 II	-----	-----
$5f 3F_4$	-----	-----	-----	-----	-----	80n III	-----	-----	-----	$7p' 3P_2$	-----	-----	-----	-----	-----	15n III*	10 III*	-----	15 III*
$3F_3$	-----	-----	-----	-----	-----	15n III	80n III	80n III	-----	$3P_1$	8 IV	-----	-----	-----	-----	15 III	10 III	10 III	2 III
$3F_2$	-----	-----	-----	-----	-----	(1u)	20n III	-----	-----	$3P_0$	-----	-----	-----	-----	-----	-----	10 III	-----	-----
$6f 3F_4$	-----	-----	-----	-----	-----	[70R] III	-----	-----	-----	$6p' 1P_1$	200R II	-----	-----	(15)	-----	(1)	-----	150 II	-----
$3F_3$	-----	-----	-----	-----	-----	[25] III	[60R] III	80N III	-----	$7p' 1P_1$	8n IV	-----	-----	-----	-----	3n III	-----	20N III	-----
$3F_2$	-----	-----	-----	-----	-----	[50r] III	[40r] III	-----	-----	$6p' 3D_3$	-----	-----	-----	-----	300r II	150 I	-----	-----	-----
$7f 3F_4$	-----	-----	-----	-----	-----	[10] III	[60R] III	-----	-----	$3D_2$	-----	-----	-----	-----	70 I	250 I	125 I	-----	1 IIIA
$3F_3$	-----	-----	-----	-----	-----	[50r] III	[40r] III	[60R] III	-----	$3D_1$	20 I	-----	-----	-----	-----	80 I	200 I	-----	2 IIIA
$3F_2$	-----	-----	-----	-----	-----	[10] III	[60R] III	-----	-----	$7p' 3D_3$	-----	(4h)	-----	-----	30 III	15 III	-----	-----	(1h)*
$8f 3F_4$	-----	-----	-----	-----	-----	[50r] III	[40] III	25N III	-----	$3D_2$	-----	-----	-----	-----	2 III	3 IIIA	10 III	-----	-----
$3F_3$	-----	-----	-----	-----	-----	[40] III	[8] III	-----	-----	$3D_1$	3 IV	-----	-----	-----	3 III	3 III	10 III	-----	2 III
$3F_2$	-----	-----	-----	-----	-----	[8] III	-----	-----	-----	$6p' 1D_2$	-----	-----	-----	-----	5 II	1 IIIA	200 II	4 I	-----
$9f 3F_4$	-----	-----	-----	-----	-----	[30] III	-----	-----	-----	$7p' 1D_2$	-----	-----	-----	-----	-----	10 III	-----	20 III	-----
$3F_3$	-----	-----	-----	-----	-----	[30] III	[15] III	[25] III	-----	$6p' 3F_4$	-----	-----	-----	-----	400r II	-----	-----	-----	-----
$3F_2$	-----	-----	-----	-----	-----	[15] III	[10] III	[10] III	-----	$3F_3$	-----	-----	-----	-----	10 I	150r II	-----	-----	(60)
$10f 3F_4$	-----	-----	-----	-----	-----	[10] III	[10] III	[10] III	-----	$3F_2$	-----	-----	-----	-----	(10)	10 I	25r I	-----	(500)
$3F_3$	-----	-----	-----	-----	-----	[10] III	[10] III	[10] III	-----	$3F_1$	-----	-----	-----	-----	-----	-----	-----	-----	-----
$3F_2$	-----	-----	-----	-----	-----	[15n] III	-----	-----	-----	$7p' 3F_4$	-----	-----	-----	-----	40 III	-----	-----	-----	(2n)
$11f 3F_4$	-----	-----	-----	-----	-----	[8n] III	-----	-----	-----	$3F_3$	-----	-----	-----	-----	-----	15 III	-----	-----	-----
$3F_3$	-----	-----	-----	-----	-----	[8n] III	-----	-----	-----	$3F_2$	-----	-----	-----	-----	-----	(2)	2 III	-----	-----
$3F_2$	-----	-----	-----	-----	-----	[3n] III	-----	-----	-----	$6p' 1F_3$	-----	-----	-----	-----	20 II	2 IIIA	-----	200 II	-----
$12f 3F_4$	-----	-----	-----	-----	-----	[12N] III	-----	-----	-----	$7p' 1F_3$	-----	-----	-----	-----	-----	-----	-----	-----	15 III
$3F_3$	-----	-----	-----	-----	-----	(-)	-----	-----	-----	39765_3	-----	-----	-----	-----	-----	2n III	5n III	-----	(0n)
$3F_2$	-----	-----	(1U)	-----	-----	(-)	-----	(-)	-----	$39905_{1,2}$	-----	-----	(1u)	(1u)	-----	-----	-----	-----	-----

* Blend.

TABLE 3. Intensities of Ba I combinations—Continued

	$6p\ ^3P_2^{\ddagger}$	$6p\ ^3P_1^{\ddagger}$	$6p\ ^3P_0^{\ddagger}$	$6p\ ^1P_1^{\ddagger}$	$6p'\ ^3P_2^{\ddagger}$	$6p'\ ^3P_1^{\ddagger}$	$6p'\ ^3P_0^{\ddagger}$	$6p'\ ^1P_1^{\ddagger}$	$6p'\ ^3D_2^{\ddagger}$	$6p'\ ^3D_1^{\ddagger}$	$6p'\ ^1D_2^{\ddagger}$	$6p'\ ^3F_4^{\ddagger}$	$6p'\ ^3F_3^{\ddagger}$	$6p'\ ^3F_2^{\ddagger}$	$6p'\ ^1F_3^{\ddagger}$
$6p^2\ ^3P_2$	60n II	80 II	40 II	-----	(8hl)	(2h)	-----	-----	(6h)	(3h)	-----	-----	-----	-----	-----
3P_1	35 II	40 II	-----	-----	(10)	(20)	(30)	-----	-----	(m)	(10)	-----	-----	-----	-----
3P_0	-----	40 II	-----	5 IIIA	-----	(5h)	-----	-----	-----	(20h)	-----	-----	-----	-----	-----
$6p^2\ ^1D_2$	80 II	60 II	-----	4 III	(30h)	(10h)	-----	-----	(100h)	(1h)	(3h)	(30h)	-----	20h	-----
$6p^2\ ^1S_0$	-----	30 III	-----	3 III	-----	-----	(5)	-----	-----	-----	-----	-----	-----	-----	-----
$7s\ ^3S_1$	6 III	30 II	80 III	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$8s\ ^3S_1$	15 III	20 III	20n III	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$9s\ ^3S_1$	10n III	8n IIIA*	2n IV?	-----	(2h)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$10s\ ^3S_1$	4n III	(1h)	(-)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$11s\ ^3S_1$	(-)	(-)	(-)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$7s\ ^1S_0$	-----	(1)	-----	(500hl)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$8s\ ^1S_0$	-----	-----	-----	20 IV?	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$9s\ ^1S_0$	-----	-----	-----	8 III*	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$6d\ ^3D_3$	400r II	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	(30)	-----	-----	-----
3D_2	100 III	200 II	-----	(20hl)	-----	-----	-----	-----	-----	-----	-----	-----	(10)	-----	-----
3D_1	5 IIIA	(7)	100 II	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	(1h?)	-----
$7d\ ^3D_3$	60n III	-----	-----	-----	(3h)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_2	50n III	20n III	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_1	(1n)	10n III	15n IIIA	(1h)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$8d\ ^3D_3$	30N III	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_2	8n IIIA*	10N III	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_1	-----	5N III	(0)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$9d\ ^3D_3$	(1h)*	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_2	(0)	(-)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_1	-----	(-)	(-)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$10d\ ^3D_3$	(-)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_2	(-nl)*	(-)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_1	-----	(-)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$11d\ ^3D_3$	(-)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_2	(-)	(-)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3D_1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$6d\ ^1D_2$	4 IIIA	10 IIIA	-----	4 III?	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$7d\ ^1D_2$	8n IIIA	(0h)	-----	20n IV?	-----	-----	2H?	-----	-----	-----	(2h)	-----	-----	-----	(4h)
$8d\ ^1D_2$	(3u)	-----	-----	30N III	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$9d\ ^1D_2$	-----	-----	-----	15N III	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
$7s'\ ^3D_3$	(1)	-----	-----	-----	(40)	-----	-----	-----	(40h)	(50h)	-----	(400h)	(15h)	-----	-----
3D_2	-----	-----	-----	-----	(40)	-----	-----	-----	(30)	(5h)	(20h)	(10)	(300)	(60h)	-----
3D_1	-----	-----	-----	-----	(40)	(20)	-----	-----	-----	(1h)	(30h)	(50h)	(100)	-----	-----
$7s'\ ^1D_2$	(1)	3 III	-----	(1)	-----	-----	(20)	-----	-----	(40hl)	(3h)	(100h)	(15h)	(8hl)	(25)
$6d'\ ^3S_1$	5 III	-----	(1)	4 IIIA	(10h)	(10)	(15h)	-----	-----	-----	(3h)	(30h)	-----	(1u)	-----
$6d'\ ^3P_2$	(0)	2 III	-----	8 III*	(30hv)	(2h)	-----	-----	(20h)	-----	-----	-----	-----	-----	-----
3P_1	-----	-----	(2)	-----	(6hv)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3P_0	-----	-----	-----	-----	(2h)	(1h)	-----	-----	-----	(30hv) IV	-----	-----	-----	-----	-----
$6d'\ ^1P_1$	-----	(1)Pb?	4 IV?	(15h)	(7hl)	-----	(15)	-----	-----	-----	(1h)	(10h)	-----	-----	-----
$6d'\ ^3D_3$	10 III	-----	-----	-----	(80h)	-----	-----	-----	(50hl)	(3h)	-----	2n III	(10hl)	(10h)	(50h)
3D_2	15 III	10 III	-----	-----	(2h)	(60h)	-----	-----	(3h)	(40hl)	(20h)	(1u)	-----	(25h)	-----
3D_1	(0)	12 III	12 III	3 III	(6h)	(60)	-----	-----	(1h)	(30hl)	(30hl)	-----	-----	(1h)	1n III
$6d'\ ^1D_2$	2 III	-----	-----	5 IV?	(4hv)	-----	(4h)	(10h)	(3h)	(10h)	2n III	-----	(2h)	-----	-----
$6d'\ ^3F_4$	-----	-----	-----	-----	-----	-----	-----	-----	(60h)	-----	-----	5 III	(2h)	-----	-----
3F_3	-----	-----	-----	-----	-----	-----	-----	-----	(15hv)	(50hv)	-----	(2h)	(8n IV?)	-----	-----
3F_2	-----	-----	-----	(1u)	-----	-----	-----	-----	-----	(10hv)	(40hv)	-----	(3)	10 III	-----
$6d'\ ^1F_3$	8 III	-----	-----	-----	(5h)	-----	-----	(10h)	(4hl)	-----	2n III	-----	-----	5n III	(8hl)
$6d'\ ^3G_4$	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4n III	(3h)	-----	-----
3G_3	-----	-----	-----	-----	-----	-----	-----	-----	(3h)	-----	-----	-----	(5n III)	-----	(2h)
3G_2	-----	-----	-----	-----	-----	-----	-----	-----	(10h)	-----	(5h)	-----	(10h)	25 III	(60hl)
$6d'\ ^1G_4$	-----	-----	-----	-----	-----	-----	-----	-----	(2h)	-----	-----	(2h)	2 IIIA	-----	(100h)

*Blend.
mMasked.

WASHINGTON, February 18, 1955.