scattering data would indicate KBr would be a very good substance for using in further investigations. If a monochromatized beam of x-rays were used the complicating factor due to the $\alpha_1\alpha_2$ radiations would be eliminated, at the expense of the intensity of the incident beam, however.

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First Spark Spectrum of Neodymium—Preliminary Classification and Zeeman Effect Data

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Classification by means of the combination principle of 367 lines of Nd II as arising from 30 lower and 57 upper levels has been checked by Zeeman effect measurements at fields up to 87,180 oersteds, and by other data from the M.I.T.-W.P.A. wave-length project. Quantum numbers have been assigned to those levels which have approximate LS coupling, and g values of all known levels have been determined. The lowest term is $4f^4(^5I)6s-a^6I$. All of the low terms found arise from $4f^46s$ and $4f^45d$, while all identified upper terms are believed to arise from $4f^46p$. The strongest lines in the spectrum belong to the sextet and quartet super-multiplets arising from the transition $4f^4(^5I)6p-6s$, but these show perturbations which give rise to important intensity anomalies which affect the selection of *raies ultimes*. Curves are given which show the variation, in the progression La II, Ce II, Pr II, and Nd II, of the binding of terms arising from the configurations f^ns, f^np, f^nd and, where known, f^{n+1}.

NEODYMIUM ($Z=60$) is third in order of the 14 elements in the Periodic Table called the "rare earths." It gives rise to extremely complex spectra, the normal atom being characterized, according to the Bohr-Stoner theory, by six outer electrons of which several are f electrons. No previous known attempt at classification of any of the Nd spectra has met with success, and only by making extensive Zeeman effect studies at high magnetic fields, and by using new determinations of the wave-lengths of lines between 2000 and 11,000A from the neodymium arc, have we succeeded in determining the basic regularities in Nd II.

Some 2700 intense lines of neodymium are listed in the *M.I.T. Wavelength Tables*,[1] while the M.I.T.-W.P.A. card catalog contains a total of 6000 lines believed to arise from this element. Most of these lines can readily be ascribed to the normal atom or the first or second stages of ionization, on the basis of King's[2] studies with the electric furnace. In the present paper 367 Nd II lines are classified as arising from 30 lower and 57 upper levels, to the majority of which quantum numbers have been assigned. Zeeman effect data are included for such of the lines as show resolvable patterns at fields up to 87,180 oersteds. These data suffice to determine the Landé splitting-factors (g values) of all terms.

The only Zeeman determinations on Nd lines which we were able to find in the literature were those of Van de Vliet,[3] who reported the separations of a large number of unresolved triplets and resolved patterns for 16 Nd II lines. Van de Vliet used magnetic fields of 38,500 oersteds. Since we had available fields more than twice as strong in

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[1] *M.I.T. Wavelength Tables* (John Wiley & Sons, New York, 1939).

[2] A. S. King, Astrophys. J. **78**, 9 (1933).

[3] H. J. Van de Vliet, Thesis Amsterdam (1939).

TABLE I. Classified lines of Nd II.

λ	Int.	Combination	Type	Sep.	p	n	g_1	g_2
8643.48	2	$a^6H_{2\frac12}-z^6H^\circ_{2\frac12}$	—	—	—	—	—	—
7982.090	4	$a^6G_{1\frac12}-z^6H^\circ_{2\frac12}$	—	—	—	—	—	—
7825.20	2	$b^6I_{8\frac12}-25,235$	—	—	—	—	—	—
7796.42	2	$b^6I_{6\frac12}-z^6H^\circ_{5\frac12}$	—	—	—	—	—	—
7792.24	2	$b^6I_{5\frac12}-z^6H^\circ_{4\frac12}$	5	55	—	1290	1.05	1.00
7766.86	2	$b^6I_{4\frac12}-z^6H^\circ_{3\frac12}$	—	—	(0)	800	0.8	0.8
7603.75	2	$b^6I_{3\frac12}-1^\circ_{4\frac12}$	5	302	—	1842	0.482	0.784
7587.66	2	$a^6H_{2\frac12}-z^6I^\circ_{3\frac12}$	5	308	(150)	1520	0.444	0.752
7513.77	5	$b^6I_{3\frac12}-20,830$	6	214	(751)	588	0.479	0 693
7432.20	2	$b^6I_{4\frac12}-21,871$	—	—	—	—	—	—
7288.56	10	$b^6I_{3\frac12}-z^6H^\circ_{2\frac12}$	5	170	(84)	920	0.493	0.321
7285.29	10	$a^6H_{2\frac12}-6^\circ_{3\frac12}$	5	390	(190)	1828	0.459	0.849
7261.64	2	$(b^6I_{3\frac12}-z^6H^\circ_{3\frac12})$ $(b^6I_{4\frac12}-z^6H^\circ_{4\frac12})$	—	—	—	—	—	—
7243.23	2	$b^6I_{5\frac12}-z^6H^\circ_{5\frac12}$	7b	—	(0)	1090	1.09	1.09
6968.35	5	$b^6I_{3\frac12}-21,871$	—	—	—	—	—	—
6816.02	10	$a^6K_{4\frac12}-1^\circ_{4\frac12}$	6	238	(1076)	—	(0.552)	0.790
6782.50	2	$b^6I_{4\frac12}-z^6H^\circ_{5\frac12}$	—	—	—	—	—	—
6780.61	5	$b^6I_{6\frac12}-13^\circ_{5\frac12}$	—	—	—	—	—	—
6765.786	2	$b^6I_{5\frac12}-z^6I^\circ_{5\frac12}$	—	—	—	—	—	—
6743.57	1	$a^6K_{4\frac12}-20,830$	—	—	—	—	—	—
6725.26	2	$b^6I_{3\frac12}-3^\circ_{3\frac12}$	—	—	—	—	—	—
6681.12	2	$b^6I_{5\frac12}-10^\circ_{4\frac12}$	—	—	—	—	—	—
6671.117	2	$b^6I_{8\frac12}-24^\circ_{7\frac12}$	—	—	—	—	—	—
6669.647	3	$b^6I_{4\frac12}-7^\circ_{4\frac12}$	—	—	—	—	—	—
6553.070	8	$a^6K_{5\frac12}-z^6H^\circ_{4\frac12}$	—	138	—	—	(0.842)	0.980
6539.937	10w	$a^6K_{4\frac12}-z^6H^\circ_{3\frac12}$	4	276	(130)	−414	0.550	0.826
6523.151	10	$b^6I_{3\frac12}-z^6I^\circ_{3\frac12}$	6	273	(952)	—	0.489	0.762
6504.463	10	$a^6H_{2\frac12}-y^6I^\circ_{3\frac12}$	5	363	(182)	1731	0.458	0.821
6483.445	5h	$a^6L_{6\frac12}-2^\circ_{5\frac12}$	—	—	—	—	—	—
6476.201	3	$b^6I_{4\frac12}-8^\circ_{5\frac12}$	—	160	(79)	—	(0.840)	1.000
6464 99	4	$a^6H_{2\frac12}-25,138$	—	—	—	—	—	—
6439.86	3	$a^6K_{5\frac12}-4^\circ_{4\frac12}$	—	—	—	—	—	—
6394.80	4	$b^6I_{4\frac12}-9^\circ_{4\frac12}$	6	133	(598)	—	(0.840)	0.973
6385.196	100l	$b^6I_{5\frac12}-25,014?$	—	—	—	—	—	—
6365.554	15	$b^6I_{3\frac12}-z^6K^\circ_{4\frac12}$	5	293	(144)	1810	0.489	0.782
6362.093	10	$b^6I_{4\frac12}-z^6I^\circ_{5\frac12}$	5	175	—	1802	0.841	1.016
6358.391	2	$b^6I_{5\frac12}-13^\circ_{5\frac12}$	—	—	—	—	—	—
6341.507	15	$a^6K_{6\frac12}-5^\circ_{5\frac12}$	—	—	—	—	—	—
6300.970	5	$a^6K_{4\frac12}-21,871$	—	—	—	—	—	—
6298.418	20	$b^6I_{3\frac12}-6^\circ_{3\frac12}$	6	362	(1269)	665	0.485	0.847
6287.207	5	$b^6I_{4\frac12}-10^\circ_{4\frac12}$	6	(56)	(249)	—	(0.840)	0.896
6284.726	3	$a^6K_{6\frac12}-8^\circ_{5\frac12}$	7b	—	(0)	1060	(1.015)	1.007
6264.34	5	$b^6I_{8\frac12}-z^6K^\circ_{8\frac12}$	—	—	—	—	—	—
6257.834	25	$a^6L_{5\frac12}-1^\circ_{4\frac12}$	—	168	—	—	(0.620)	0.788
6243.349	4	$b^6I_{3\frac12}-z^6I^\circ_{4\frac12}$	5	454	(237)	—	0.484	0.938
6238.499	20	$b^6I_{4\frac12}-z^6K^\circ_{5\frac12}$	5	80	(40)	1245	(0.840)	0.92
6183.907	20	$b^6I_{5\frac12}-z^6K^\circ_{6\frac12}$	7b	—	(0)	1039	1.039	1.039
6170.486	30	$a^6H_{2\frac12}-y^6H^\circ_{2\frac12}$	6	188	(467)	545	0.454	0.642
6150.431	10	$b^6I_{5\frac12}-15^\circ_{5\frac12}$	—	—	—	—	—	—
6133.964	5	$a^6K_{5\frac12}-z^6K^\circ_{4\frac12}$	5	—	—	1140	(0.842)	0.776
6108.410	20	$a^6H_{2\frac12}-26,041$	—	—	—	—	—	—
6106.75	2	$b^6I_{7\frac12}-27,744$	—	—	—	—	—	—
6094.98	2	$b^6I_{4\frac12}-12^\circ_{5\frac12}$	—	—	—	—	—	—
6082.96	2	$b^6I_{6\frac12}-21^\circ_{5\frac12}$	—	—	—	—	—	—
6077.39	2	$a^6K_{4\frac12}-4^\circ_{4\frac12}$	6	450	(2028)	770	0.550	1.000
6051.875	4	$b^6I_{5\frac12}-17^\circ_{4\frac12}$	5	60	—	1343	(1.034)	0.964
6048.44	2w	$b^6I_{3\frac12}-9^\circ_{4\frac12}$	—	—	—	—	—	—
6034.239	20	$b^6I_{8\frac12}-29.027$	6	81	(678)	—	1.281	1.200
6031.266	25	$b^6I_{6\frac12}-z^6K^\circ_{7\frac12}$	7b	—	(0)	1086	1.141	(1.133)
6000.564	2	$b^6I_{4\frac12}-13^\circ_{5\frac12}$	—	—	—	—	—	—
5989.341	15	$a^6K_{4\frac12}-5^\circ_{5\frac12}$	—	—	—	—	—	—
5942.063	2	$b^6I_{5\frac12}-26,182$	6	(9)	(48)	1024	1.029	1.020
5934.747	10	$a^6K_{4\frac12}-z^6I^\circ_{3\frac12}$	4	201	(105)	0	(0.552)	0.753
5932.140	3	$b^6I_{5\frac12}-18^\circ_{6\frac12}$	5	—	—	1497	(1.034)	1.105
5924.313	2	$b^6I_{4\frac12}-14^\circ_{3\frac12}$	—	—	—	—	—	—
5918.035	2	$a^6K_{6\frac12}-12^\circ_{5\frac12}$	—	—	—	—	—	—
5909.874	10	$b^6I_{5\frac12}-y^6I^\circ_{5\frac12}$	7b	—	(0)	1031	1.031	1.031
5906.646	6	$a^6K_{5\frac12}-8^\circ_{5\frac12}$	6	164	(897)	929	0.844	1.008
5900.430	5	$b^6I_{3\frac12}-11^\circ_{3\frac12}$	6	465	(1627)	710	0.480	0.945
5891.528	20	$b^6I_{4\frac12}-y^6I^\circ_{4\frac12}$	6	188	—	937	0.843	1.031
5890.503	5	$b^6I_{6\frac12}-22^\circ_{6\frac12}$	—	—	—	—	—	—
5865.057	15	$b^6I_{7\frac12}-z^6K^\circ_{8\frac12}$	4	—	(0)	1036	1.227	(1.202)
5842.391	25	$b^6I_{6\frac12}-y^6I^\circ_{6\frac12}$	6	(18)	(116)	1150	1.141	1.159
5835.89	2	$a^6K_{6\frac12}-13^\circ_{5\frac12}$	—	—	—	—	—	—
5825.872	25	$a^6G_{1\frac12}-y^6H^\circ_{2\frac12}$	5	634	(316)	1598	0.009	0.643
5811.572	15	$a^6K_{5\frac12}-z^6I^\circ_{5\frac12}$	6	173	(948)	928	0.844	1.017
5804.020	100	$a^6K_{4\frac12}-z^6K^\circ_{4\frac12}$	6	225	(1014)	666	0.553	0.778
5770.500	20	$a^6G_{1\frac12}-26,041$	—	—	—	—	—	—
5761.695	10	$b^6I_{4\frac12}-16^\circ_{4\frac12}$	6	142	(639)	915	0.842	0.984
5748.154	4	$a^6K_{4\frac12}-6^\circ_{3\frac12}$	4	294	(150)	−462	0.566	0.860
5744.766	25	$a^6K_{6\frac12}-15^\circ_{5\frac12}$	—	—	—	—	—	—
5744.138	8	$a^6K_{4\frac12}-7^\circ_{4\frac12}$	—	—	—	—	—	—
5743.196	20wh	$b^6I_{6\frac12}-27,744$	6	(62)	(405)	—	(1.144)	1.082
5740.862	35	$b^6I_{5\frac12}-21^\circ_{5\frac12}$	6	—	(20)	1023	1.03	1.02
5726.825	25	$b^6I_{4\frac12}-17^\circ_{4\frac12}$	6	116	(526)	903	0.847	0.963
5718.120	35	$b^6I_{7\frac12}-y^6I^\circ_{7\frac12}$	6	68	(508)	—	1.229	(1.161)
5708.280	60	$a^6K_{5\frac12}-z^6K^\circ_{5\frac12}$	6	70	(387)	—	(0.842)	0.912
5706.206	40	$b^6I_{3\frac12}-y^6I^\circ_{3\frac12}$	6	337	—	663	0.490	0.827
5702.244	25	$a^6K_{4\frac12}-z^6I^\circ_{4\frac12}$	6	387	(1742)	760	0.553	0.940
5698.927	10	$b^6I_{8\frac12}-z^6K^\circ_{9\frac12}$	4	—	(0)	1110	1.286	(1.267)
5688.525	150	$a^6K_{6\frac12}-z^6K^\circ_{6\frac12}$	6	(16)	(107)	1027	1.019	1.035
5675.76	6	$b^6I_{3\frac12}-25,138$	6	703	(2460)	837	0.477	1.180
5668.868	15	$a^6K_{9\frac12}-29,027$	5	—	(0)	1679	1.253	(1.203)
5645.240	2	$a^6L_{6\frac12}-5^\circ_{5\frac12}$	—	—	—	—	—	—
5632.15	1	$a^6L_{5\frac12}-z^6H^\circ_{4\frac12}$	—	—	—	—	—	—
5625.722	10	$b^6I_{3\frac12}-14^\circ_{3\frac12}$	6	552	(1929)	760	0.483	1.035
5620.6	—	$b^6I_{8\frac12}-y^6I^\circ_{8\frac12}$	6	63	(525)	—	1.278	1.215
5614.303	10	$b^6I_{4\frac12}-19^\circ_{4\frac12}$	6	208	(930)	944	0.839	1.047
5603.651	5	$a^4I_{5\frac12}-2^\circ_{5\frac12}$	6	89	(491)	—	0.975	0.886
5599.48	1	$b^6I_{4\frac12}-y^6I^\circ_{5\frac12}$	—	—	—	—	—	—
5594.425	150	$a^6K_{7\frac12}-z^6K^\circ_{7\frac12}$	6	(11)	(79)	1133	1.127	1.138
5581.601	3	$a^6K_{5\frac12}-12^\circ_{5\frac12}$	6	128	(707)	904	0.843	0.971
5548.474	10	$a^6L_{5\frac12}-4^\circ_{4\frac12}$	4	383	(188)	−1367	0.617	1.000
5539.26	10	$a^6K_{4\frac12}-9^\circ_{1\frac12}$	—	—	—	—	—	—
5533.396	15	$b^6I_{5\frac12}-23^\circ_{4\frac12}$	—	—	—	—	—	—
5526.143	5	$b^6I_{5\frac12}-y^6I^\circ_{6\frac12}$	5	131	(66)	—	1 035	1.166
5508.398	15	$a^6K_{5\frac12}-13^\circ_{5\frac12}$	6	146	(798)	912	0.840	0.986
5487.026	2	$b^6I_{4\frac12}-20^\circ_{3\frac12}$	4	136½	(71)	361	0.840	0.976
5485.699	20	$a^6K_{8\frac12}-z^6K^\circ_{8\frac12}$	7b	—	(0)	1203	1.203	1.203
5483.09	2h	$a^6K_{6\frac12}-26,182$	7b	—	(0)	1009	(1.015)	1.016
5474.734	3	$a^6K_{6\frac12}-18^\circ_{6\frac12}$	6	88½	(581)	1054	1.012	1.101
5473.083	6	$a^6K_{7\frac12}-22^\circ_{6\frac12}$	5	—	(0)	1360	1.122	(1.087)
5455.815	30	$a^6K_{6\frac12}-y^6I^\circ_{5\frac12}$	4	—	(0)	957	(1.015)	1.026
5447.556	8	$b^6I_{4\frac12}-21^\circ_{5\frac12}$	5	173	—	—	(0.840)	1.013
5447.556	8	$b^6I_{3\frac12}-y^6H^\circ_{2\frac12}$	4	161	—	—	0.480	0.642
5442.274	25	$a^6L_{6\frac12}-8^\circ_{5\frac12}$	4	152	(74)	0	0.852	1.004
5432.360	3	$a^6K_{7\frac12}-24^\circ_{7\frac12}$	6	(10)	(80)	1110	1.11	1.11
5431.526	25	$a^6K_{7\frac12}-y^6I^\circ_{6\frac12}$	—	—	—	—	—	—
5421.559	15	$a^6K_{4\frac12}-z^6K^\circ_{5\frac12}?$	—	—	—	—	—	—
5416.381	15	$a^6K_{5\frac12}-y^6I^\circ_{4\frac12}$	4	187	(91)	0	0.843	1.030
5414.819	3	$a^6K_{4\frac12}-11^\circ_{3\frac12}$	4	392	(196)	−824	0.551	0.943
5399.109	2	$b^6I_{3\frac12}-26,041$	—	—	—	—	—	—
5371.935	20	$a^6K_{9\frac12}-z^6K^\circ_{9\frac12}$	7b	—	(0)	1255	1.243	(1.267)
5361.474	25	$a^6L_{6\frac12}-z^6I^\circ_{5\frac12}$	4	161½	(82)	−31	0.852	1.014
5361.174	3	$a^4I_{6\frac12}-z^6H^\circ_{5\frac12}$	—	—	—	—	—	—
5356.976	15	$a^6K_{8\frac12}-y^6I^\circ_{7\frac12}$	5	60	(30)	1515	1.204	(1.161)
5345.709	6	$a^6K_{7\frac12}-27,744$	5	—	(0)	1360	(1.127)	1.091
5336.552	8	$a^6L_{5\frac12}-23,171$	4	460	(232)	−1458	0.617	1.077
5319.818	60	$a^6L_{5\frac12}-z^6K^\circ_{4\frac12}$	4	159	(79)	−80	0.620	0.779
5311.461	15	$a^6K_{6\frac12}-21^\circ_{5\frac12}$	7b	—	(0)	996	(1.015)	1.019
5308.42	2	$a^6K_{8\frac12}-29,027$	7b	—	(0)	1220	1.22	1.22
5306.472	4	$a^6K_{5\frac12}-16^\circ_{4\frac12}$	4	138	(70)	220	0.843	0.981
5302.279	12	$a^6K_{9\frac12}-y^6I^\circ_{8\frac12}$	5	—	(0)	1530	1.253	(1.220)
5293.168	60	$a^6L_{7\frac12}-z^6K^\circ_{6\frac12}$	4	—	(0)	837	(0.998)	1.023
5276.879	10	$a^6K_{5\frac12}-17^\circ_{4\frac12}$	4	114½	(57)	323	0.840	0.954
5273.431	25	$a^6L_{6\frac12}-z^6K^\circ_{5\frac12}$	4	61	(29)	519	0.841	0.902
5255.510	50	$a^4I_{4\frac12}-1^\circ_{4\frac12}$	6	(31)	(141)	772	0.757	0.788

TABLE I. Classified lines of Nd II.—*Continued.*

λ	Int.	Combination	Type	Sep.	p	n	g_1	g_2
5250.816	10	$a^6K_{4\frac{1}{2}}-y^6I^\circ_{3}$	4	268	(135)	−390	0.549	0.817
5249.585	60	$a^6L_{8\frac{1}{2}}-z^6K^\circ_{7\frac{1}{2}}$	4	—	(0)	915	1.107	(1.133)
5234.195	50	$a^6L_{5\frac{1}{2}}-z^6I^\circ_{4\frac{1}{2}}$	4	320	(160)	−814	0.620	0.940
5228.427	6	$a^4I_{5\frac{1}{2}}-z^6H^\circ_{4\frac{1}{2}}$	7*b*	—	(0)	977	0.977	0.977
5225.045	5	$a^6K_{4\frac{1}{2}}-25{,}138$	4	635	(317)	−1667	0.553	1.188
5212.365	30	$a^4I_{4\frac{1}{2}}-20{,}830$	5	—	(0)	942	(0.754)	0.700
5192.621	40	$a^6L_{9\frac{1}{2}}-z^6K^\circ_{8\frac{1}{2}}$	4	—	(0)	1058	1.187	(1.202)
5191.448	40	$a^4I_{4\frac{1}{2}}-2^\circ_{5\frac{1}{2}}$	5	131	(67)	1476	0.756	0.887
5182.603	8	$a^6K_{4\frac{1}{2}}-14^\circ_{3\frac{1}{2}}$	4	480	(238)	−1130	0.553	1.033
5181.165	5	$a^6K_{5\frac{1}{2}}-19^\circ_{4\frac{1}{2}}$	4	203	(101)	—	0.841	1.044
5167.923	5	$a^4I_{6\frac{1}{2}}-8^\circ_{5\frac{1}{2}}$	5	103	(52)	1676	1.115	1.012
5165.140	10	$a^6L_{6\frac{1}{2}}-12^\circ_{5\frac{1}{2}}$	4	117	(59)	206	0.850	0.967
5143.332	8	$a^6I_{5\frac{1}{2}}-2^\circ_{5\frac{1}{2}}$	6	136	(747)	958	1.024	0.888
5130.596	40	$a^6L_{10\frac{1}{2}}-z^6K^\circ_{9\frac{1}{2}}$	4	—	(0)	1050	1.247	(1.267)
5127.10	—	$a^6K_{6\frac{1}{2}}-y^6I^\circ_{6\frac{1}{2}}$	—	—	—	—	—	—
5119.58	2	$a^6L_{6\frac{1}{2}}-25{,}014$	—	—	—	—	—	—
5107.585	20	$a^6L_{7\frac{1}{2}}-18^\circ_{6\frac{1}{2}}$	4	99	(52)	362	1.001	1.100
5106.637	8	$a^6L_{8\frac{1}{2}}-24^\circ_{7\frac{1}{2}}$	7*b*	—	(0)	1073	1.107	(1.112)
5102.393	15	$a^6L_{6\frac{1}{2}}-13^\circ_{5\frac{1}{2}}$	4	135	—	112	0.852	0.987
5096.524	8	$a^6L_{5\frac{1}{2}}-9^\circ_{4\frac{1}{2}}$	4	352	(175)	−968	0.619	0.971
5092.797	20	$a^4I_{5\frac{1}{2}}-5^\circ_{5\frac{1}{2}}$	6	(7)	(39)	970	0.977	0.963
5089.837	10	$a^4I_{4\frac{1}{2}}-z^6H^\circ_{3\frac{1}{2}}$	4	69	—	507	0.749	0.818
5033.517	6	$a^6L_{9\frac{1}{2}}-29{,}027$	4	—	(0)	1065	(1.187)	1.202
5027.852	4	$a^6L_{5\frac{1}{2}}-10^\circ_{4\frac{1}{2}}$	4	278	(142)	−636	0.618	0.896
4972.67	2*h*	$a^4I_{5\frac{1}{2}}-23{,}171$	—	—	—	—	—	—
4970.922	5	$a^6I_{6\frac{1}{2}}-5^\circ_{5\frac{1}{2}}$	5	184	(92)	2171	1.154	0.970
4961.396	15	$a^6I_{8\frac{1}{2}}-25{,}235$	5	183	(93)	2650	1.291	1.108
4959.130	35	$a^6I_{4\frac{1}{2}}-1^\circ_{4\frac{1}{2}}$	6	(13)	(56)	795	0.802	0.788
4958.139	5	$a^4I_{5\frac{1}{2}}-z^6K^\circ_{4\frac{1}{2}}$	5	199	(103)	—	0.983	0.784
4943.901	10	$a^4I_{4\frac{1}{2}}-21{,}871$	5	115	(57)	1159	0.754	0.639
4942.961	5	$a^4I_{7\frac{1}{2}}-18^\circ_{6\frac{1}{2}}$	5	89	—	1770	1.192	1.103
4930.729	5	$a^6L_{7\frac{1}{2}}-z^6K^\circ_{7\frac{1}{2}}$	6	135	(999)	1077	1.001	1.136
4920.692	60	$a^6I_{4\frac{1}{2}}-20{,}830$	5	107	(53)	1175	0.802	0.695
4914.385	15	$a^4I_{5\frac{1}{2}}-7^\circ_{4\frac{1}{2}}$	4	—	(0)	835	(0.979)	1.011
4902.041	15	$a^6I_{4\frac{1}{2}}-2^\circ_{5\frac{1}{2}}$	—	82	—	—	(0.803)	0.885
4876.112	3	$a^4I_{6\frac{1}{2}}-25{,}014$	7*b*	—	(0)	1080	(1.109)	1.115
4867.839	6	$a^4I_{4\frac{1}{2}}-z^6H^\circ_{4\frac{1}{2}}?$	—	—	—	—	—	—
4859.030	60	$a^6I_{6\frac{1}{2}}-z^6H^\circ_{5\frac{1}{2}}$	5	88	(44)	1639	1.156	1.068
4835.982	15	$a^6I_{3\frac{1}{2}}-1^\circ_{4\frac{1}{2}}$	5	341	(170)	1983	0.447	0.788
4830.82	2*h*	$a^6L_{6\frac{1}{2}}-26{,}182$	—	—	—	—	—	—
4825.482	100	$a^6I_{5\frac{1}{2}}-z^6H^\circ_{4\frac{1}{2}}$	5	—	(0)	1216	(1.027)	0.985
4824.185	10	$a^4I_{6\frac{1}{2}}-25{,}235$	7*b*	—	(0)	1091	(1.109)	1.107
4820.336	40	$a^4I_{4\frac{1}{2}}-3^\circ_{3\frac{1}{2}}$	7*b*	—	(0)	759	0.759	0.759
4811.343	60	$a^6I_{4\frac{1}{2}}-z^6H^\circ_{3\frac{1}{2}}$	4	—	(0)	736	(0.803)	0.822
4809.45	2*h*	$a^6L_{6\frac{1}{2}}-y^6I^\circ_{5\frac{1}{2}}$	—	—	—	—	—	—
4805.103	6	$a^4I_{4\frac{1}{2}}-4^\circ_{4\frac{1}{2}}$	6	250	(1120)	—	0.761	1.011
4799.423	15	$a^6I_{3\frac{1}{2}}-20{,}830$	6	249	(870)	574	0.448	0.697
4797.157	30	$a^4I_{6\frac{1}{2}}-15^\circ_{5\frac{1}{2}}$	4	40	(20)	925	(1.109)	1.144
4763.865	20	$a^6I_{5\frac{1}{2}}-4^\circ_{4\frac{1}{2}}$	5	—	(0)	1080	(1.027)	1.01
4763.624	10	$a^4I_{5\frac{1}{2}}-9^\circ_{4\frac{1}{2}}$	7*b*	—	(0)	1059	(0.979)	0 961
4750.020	4	$a^4I_{4\frac{1}{2}}-5^\circ_{5\frac{1}{2}}$	—	—	—	—	—	—
4724.88	3	$a^6L_{8\frac{1}{2}}-29{,}027$	—	—	—	—	—	—
4715.589	30	$a^4I_{4\frac{1}{2}}-z^6I^\circ_{3\frac{1}{2}}$	7*b*	—	(0)	755	0.755	0.755
4709.714	30	$a^6I_{5\frac{1}{2}}-5^\circ_{5\frac{1}{2}}$	6	53	(292)	990	1.020	0.967
4706.542	50	$a^6I_{3\frac{1}{2}}-z^6H^\circ_{2\frac{1}{2}}$	5	138½	(70)	795	0.447	0.308
4703.576	20	$a^4I_{5\frac{1}{2}}-10^\circ_{4\frac{1}{2}}$	5	74	(30)	1314	0.983	0.909
4699.719	1	$a^6I_{6\frac{1}{2}}-8^\circ_{5\frac{1}{2}}$	—	—	—	—	—	—
4689.002	2	$a^6G_{1\frac{1}{2}}-30{,}037$	—	—	—	—	—	—
4680.734	50	$a^6I_{4\frac{1}{2}}-21{,}871$	5	164	(78)	1380	0.804	0.640
4676.262	2	$a^4I_{5\frac{1}{2}}-z^6K^\circ_{5\frac{1}{2}}$	—	—	—	—	—	—
4647.759	8	$a^4I_{4\frac{1}{2}}-z^6H^\circ_{5\frac{1}{2}}$	5	305	(150)	2447	0.766	1.071
4639.377	10	$a^6I_{6\frac{1}{2}}-z^6I^\circ_{5\frac{1}{2}}$	5	140	—	1930	1.145	1.005
4632.688	12	$a^4I_{4\frac{1}{2}}-z^6K^\circ_{4\frac{1}{2}}$	6	(20)	(88)	760	0.750	0.770
4612.473	12	$a^6I_{4\frac{1}{2}}-z^6H^\circ_{4\frac{1}{2}}$	6	174	(770)	888	0.800	0.974
4609.148	1	$a^6I_{5\frac{1}{2}}-z^6H^\circ_{5\frac{1}{2}}$	—	—	—	—	—	—
4607.381	25	$a^4I_{6\frac{1}{2}}-18^\circ_{6\frac{1}{2}}$	7*b*	—	(0)	1105	1.105	1.105
4602.242	10	$a^6I_{7\frac{1}{2}}-z^6K^\circ_{6\frac{1}{2}}$	—	—	—	—	—	—
4597.52	2*h*	$a^6L_{5\frac{1}{2}}-26{,}182$	—	—	—	—	—	—
4597.013	25	$a^4I_{4\frac{1}{2}}-6^\circ_{3\frac{1}{2}}$	4	89	—	438	0.747	0.836
4594.447	10	$a^4I_{4\frac{1}{2}}-7^\circ_{4\frac{1}{2}}$	6	259	(1167)	883	0.753	1.012
4590.905	4	$a^4I_{5\frac{1}{2}}-12^\circ_{5\frac{1}{2}}$	7*b*	—	(0)	971	(0.979)	0.963
4569.849	8	$a^6I_{4\frac{1}{2}}-3^\circ_{3\frac{1}{2}}$	—	—	—	—	—	—
4567.606	20	$a^4I_{4\frac{1}{2}}-z^6I^\circ_{4\frac{1}{2}}$	6	183	(828)	848	0.757	0.940
4556.735	15	$a^6I_{5\frac{1}{2}}-7^\circ_{4\frac{1}{2}}$	7*b*	—	(0)	1046	(1.027)	1.023
4556.136	20	$a^6I_{4\frac{1}{2}}-4^\circ_{4\frac{1}{2}}$	6	199	(896)	890	0.806	1.005
4554.967	5	$a^4I_{5\frac{1}{2}}-25{,}014$	—	—	—	—	—	—
4552.275	2	$a^6L_{6\frac{1}{2}}-y^6I^\circ_{6\frac{1}{2}}$	—	—	—	—	—	—
4541.269	50	$a^4I_{5\frac{1}{2}}-13^\circ_{5\frac{1}{2}}$	6	(9)	(51)	983	0.974	0.992
4530.328	10	$a^6I_{5\frac{1}{2}}-z^6I^\circ_{4\frac{1}{2}}$	5	96	—	—	1.039	0.943
4506.582	50	$a^6I_{4\frac{1}{2}}-5^\circ_{5\frac{1}{2}}$	5	1626	(82)	1697	0.802	0.965
4505.75	8	$a^6I_{3\frac{1}{2}}-z^6H^\circ_{4\frac{1}{2}}$	—	—	—	—	—	—
4501.808	50	$a^4I_{4\frac{1}{2}}-8^\circ_{5\frac{1}{2}}$	5	250	(124)	2130	0.754	1.004
4491.644	6	$a^6I_{6\frac{1}{2}}-12^\circ_{5\frac{1}{2}}$	5	180	—	2150	1.16	0.98
4485.952	12	$a^4I_{5\frac{1}{2}}-15^\circ_{5\frac{1}{2}}$	6	173	(948)	1059	0.976	1.149
4475.566	12	$a^6I_{4\frac{1}{2}}-z^6I^\circ_{3\frac{1}{2}}$	5	—	(0)	937	(0.803)	0.765
4470.965	8*d*	$a^6I_{8\frac{1}{2}}-24^\circ_{7\frac{1}{2}}$	—	—	—	—	—	—
4465.601	20	$a^6I_{5\frac{1}{2}}-8^\circ_{5\frac{1}{2}}$	6	(15)	(80)	1000	1.01	0.99
4465.075	20	$a^6I_{3\frac{1}{2}}-3^\circ_{3\frac{1}{2}}$	6	308	(1066)	597	0.443	0.751
4462.985	60	$a^4I_{6\frac{1}{2}}-z^6K^\circ_{7\frac{1}{2}}$	5	—	(0)	1283	(1.109)	1.131
4462.407	30	$a^4I_{4\frac{1}{2}}-9^\circ_{4\frac{1}{2}}$	6	215	(968)	861	0.756	0.971
4457.179	5	$a^6I_{6\frac{1}{2}}-25{,}014$	—	—	—	—	—	—
4456.394	20	$a^4I_{7\frac{1}{2}}-z^6K^\circ_{8\frac{1}{2}}$	7*b*	—	(0)	1209	1.201	(1.202)
4451.978	50	$a^6I_{3\frac{1}{2}}-4^\circ_{4\frac{1}{2}}$	5	556	—	2948	0.445	1.001
4451.566	100	$a^4I_{5\frac{1}{2}}-z^6K^\circ_{6\frac{1}{2}}$	5	—	(0)	1328	(0.979)	1.033
4446.387	100	$a^4I_{4\frac{1}{2}}-z^6I^\circ_{5\frac{1}{2}}$	5	259	(129)	2184	0.757	1.016
4444.115	5	$a^6I_{6\frac{1}{2}}-13^\circ_{5\frac{1}{2}}$	—	150	(74)	—	(1.148)	0.998
4426.822	12	$a^6I_{5\frac{1}{2}}-9^\circ_{4\frac{1}{2}}$	5	—	(0)	1236	(1.027)	0.982
4414.432	12	$a^6I_{4\frac{1}{2}}-z^6H^\circ_{5\frac{1}{2}}$	5	253	(128)	2195	0.800	1.053
4413.784	5	$a^6I_{6\frac{1}{2}}-25{,}235$	—	—	—	—	—	—
4412.265	40	$a^6I_{4\frac{1}{2}}-23{,}171$	6	278	(1247)	—	0.804	1.082
4411.052	50	$a^6I_{5\frac{1}{2}}-z^6I^\circ_{5\frac{1}{2}}$	7*b*	(29)	(158)	1019	1.034	1.006
4400.828	50	$a^6I_{4\frac{1}{2}}-z^6K^\circ_{4\frac{1}{2}}$	6	(22)	(98)	794	0.805	0.783
4391.110	10	$a^6I_{6\frac{1}{2}}-15^\circ_{5\frac{1}{2}}$	7*b*	—	(0)	1159	(1.148)	1.146
4385.663	40	$a^4I_{4\frac{1}{2}}-z^6K^\circ_{5\frac{1}{2}}$	5	(161)	(80)	1645	0.759	0.920
4382.737	15	$a^4I_{5\frac{1}{2}}-17^\circ_{4\frac{1}{2}}$	5	—	(0)	1030	(0.979)	0.968
4381.290	10	$a^4I_{4\frac{1}{2}}-11^\circ_{3\frac{1}{2}}$	—	—	—	—	—	—
4375.039	30	$a^6I_{3\frac{1}{2}}-z^6I^\circ_{3\frac{1}{2}}$	6	309	(1083)	601	0.448	0.757
4374.923	20	$a^6I_{5\frac{1}{2}}-10^\circ_{4\frac{1}{2}}$	5	124	(62)	—	1.028	0.904
4371.069	10	$a^4I_{7\frac{1}{2}}-y^6I^\circ_{7\frac{1}{2}}$	6	(35)	(260)	—	1.196	(1.161)
4368.632	50	$a^6I_{4\frac{1}{2}}-6^\circ_{3\frac{1}{2}}$	4	—	(0)	677	(0.803)	0.839
4366.315	12*d*	$a^6I_{4\frac{1}{2}}-7^\circ_{4\frac{1}{2}}$	6	211	(947)	—	0.802	1.013
4359.244	15	$a^4I_{6\frac{1}{2}}-24^\circ_{7\frac{1}{2}}$	7*b*	—	(0)	1112	(1.109)	1 108
4358.699	15	$a^4I_{6\frac{1}{2}}-y^6I^\circ_{6\frac{1}{2}}$	7*b*	—	(0)	1140	(1.109)	1.171
4358.169	50	$a^6I_{6\frac{1}{2}}-z^6K^\circ_{6\frac{1}{2}}$	6	118	(764)	1092	1.150	1.032
4351.295	30	$a^6I_{5\frac{1}{2}}-z^6K^\circ_{5\frac{1}{2}}$	6	105	(575)	972	1.019	0.914
4342.071	20	$a^6I_{4\frac{1}{2}}-z^6I^\circ_{4\frac{1}{2}}$	6	136	(610)	867	0.800	0.936
4338.697	40	$a^4I_{7\frac{1}{2}}-29{,}027$	7*b*	—	(0)	1206	(1.199)	1.200
4325.766	100	$a^6I_{7\frac{1}{2}}-z^6K^\circ_{7\frac{1}{2}}$	6	96	(718)	1184	1.233	1.137
4324.89	2*h*	$a^4I_{5\frac{1}{2}}-26{,}182$	—	—	—	—	—	—
4319.54	15	$a^4I_{5\frac{1}{2}}-18^\circ_{6\frac{1}{2}}$	—	—	—	—	—	—
4316.518	5	$a^4I_{5\frac{1}{2}}-19^\circ_{4\frac{1}{2}}$	—	—	—	—	—	—
4314.511	20	$a^6I_{3\frac{1}{2}}-23{,}171$	5	635	(319)	3300	0.444	1.079
4310.506	20	$a^4I_{4\frac{1}{2}}-12^\circ_{5\frac{1}{2}}$	5	218	—	—	0.742	0 960
4307.778	5	$a^4I_{5\frac{1}{2}}-y^6I^\circ_{5\frac{1}{2}}$	6	(51)	(280)	—	(0.979)	1.030
4303.573	100	$a^6I_{3\frac{1}{2}}-z^6K^\circ_{4\frac{1}{2}}$	5	331	(165)	1936	0.447	0.778
4303.262	3	$a^4I_{6\frac{1}{2}}-27{,}744$	—	—	—	—	—	—
4291.892	3	$a^6K_{4\frac{1}{2}}-29{,}298$	—	—	—	—	—	—
4284.518	25	$a^6I_{8\frac{1}{2}}-z^6K^\circ_{8\frac{1}{2}}$	6	91	(767)	—	1.28	1.19
4282.570	10	$a^6I_{4\frac{1}{2}}-8^\circ_{5\frac{1}{2}}$	5	200	(88)	1908	0.802	1.002
4278.75	5	$a^4I_{4\frac{1}{2}}-25{,}014$	—	—	—	—	—	—
4277.279	20	$a^6I_{5\frac{1}{2}}-12^\circ_{5\frac{1}{2}}$	6	50	(250)	—	(1.027)	0.98
4272.789	15	$a^6I_{3\frac{1}{2}}-6^\circ_{3\frac{1}{2}}$	6	400	(1398)	646	0.445	0.845
4270.565	15	$a^6I_{3\frac{1}{2}}-7^\circ_{4\frac{1}{2}}$	5	561	—	—	0.451	1.012
4266.716	20	$a^4I_{4\frac{1}{2}}-13^\circ_{5\frac{1}{2}}$	5	233	—	—	0.750	0.983
4256.239	10	$a^4I_{4\frac{1}{2}}-25{,}138$	—	—	—	—	—	—
4247.367	50	$a^6I_{3\frac{1}{2}}-z^6I^\circ_{4\frac{1}{2}}$	5	491	(245)	2659	0.449	0.940
4246.879	10	$a^6I_{4\frac{1}{2}}-9^\circ_{4\frac{1}{2}}$	6	165	(740)	—	(0.803)	0.968
4234.196	20	$a^6I_{5\frac{1}{2}}-13^\circ_{5\frac{1}{2}}$	—	—	—	—	—	—

TABLE I. Classified lines of Nd II.—*Continued.*

λ	Int.	Combination	Type	Sep.	p	n	g_1	g_2
4232.378	40	$a^6I_{4\frac{1}{2}}-z^6I^\circ_{5\frac{1}{2}}$	5	210	(105)	1961	0.807	1.017
4228.200	15	$a^6I_{7\frac{1}{2}}-24^\circ_{7\frac{1}{2}}$	—	—	—	—	—	—
4228.025	12	$a^4I_{4\frac{1}{2}}-14^\circ_{3\frac{1}{2}}$	4	283	—	−241	0.749	1.032
4227.719	20	$a^6I_{7\frac{1}{2}}-y^6I^\circ_{6\frac{1}{2}}$	—	—	—	—	—	—
4220.258	10*d*	$a^6I_{6\frac{1}{2}}-y^6I^\circ_{5\frac{1}{2}}$	5	122	(57)	1811	1.147	1.025
4217 282	20	$a^4I_{5\frac{1}{2}}-21^\circ_{5\frac{1}{2}}$	6	(50)	(270)	—	—	—
4211.286	30	$a^4I_{4\frac{1}{2}}-y^6I^\circ_{4\frac{1}{2}}$	6	274	(1233)	897	0.753	1.027
4205.595	20	$a^6I_{8\frac{1}{2}}-y^6I^\circ_{7\frac{1}{2}}$	5	133	(68)	2291	1.293	1.160
4199.099	15	$a^6I_{4\frac{1}{2}}-10^\circ_{4\frac{1}{2}}$	6	93	(426)	—	0.799	0.892
4186.033	8	$a^6I_{5\frac{1}{2}}-15^\circ_{5\frac{1}{2}}$	6	128	(708)	—	1.02	1.15
4179.585	10	$a^6I_{5\frac{1}{2}}-y^6I^\circ_{4\frac{1}{2}}$	4	—	(0)	1004	(1.027)	1.033
4177.321	15	$a^6I_{4\frac{1}{2}}-z^6K^\circ_{5\frac{1}{2}}$	5	112	(57)	1418	0.803	0.915
4175.606	40	$a^6I_{8\frac{1}{2}}-29{,}027$	6	90	(764)	—	1.295	1.205
4173.379	12	$a^6I_{4\frac{1}{2}}-11^\circ_{3\frac{1}{2}}$	4	140	—	290	0.79	0.93
4156.265	5	$a^6I_{3\frac{1}{2}}-9^\circ_{4\frac{1}{2}}$	5	523	(256)	2800	0.443	0 966
4156.083	10	$a^6I_{5\frac{1}{2}}-z^6K^\circ_{6\frac{1}{2}}$	5	—	(0)	1063	(1.027)	1.032
4144.553	10	$a^4I_{4\frac{1}{2}}-16^\circ_{4\frac{1}{2}}$	6	224	(1010)	—	0.753	0.977
4133.361	15	$a^6I_{6\frac{1}{2}}-21^\circ_{5\frac{1}{2}}$	5	133	(68)	—	1.143	1.010
4126.475	1	$a^4I_{4\frac{1}{2}}-17^\circ_{4\frac{1}{2}}$	—	—	—	—	—	—
4123.881	40	$a^4I_{5\frac{1}{2}}-22^\circ_{6\frac{1}{2}}$	5	108	(53)	1681	0.981	1.089
4120.654	6	$a^4I_{7\frac{1}{2}}-y^6I^\circ_{8\frac{1}{2}}$	5	—	(0)	1326	1.204	(1.220)
4113 826	10*d*	$a^6I_{5\frac{1}{2}}-16^\circ_{4\frac{1}{2}}$	5	—	(0)	1173	(1.027)	0.984
4110.472	10	$a^6I_{3\frac{1}{2}}-10^\circ_{4\frac{1}{2}}$	5	452	(223)	2254	0.447	0.899
4109.455	30	$a^6I_{6\frac{1}{2}}-z^6K^\circ_{7\frac{1}{2}}$	5	—	(0)	1059	(1.148)	1.135
4109.073	15	$a^6I_{4\frac{1}{2}}-12^\circ_{5\frac{1}{2}}$	5	167	—	1722	0.802	0.969
4106.582	25	$a^4I_{6\frac{1}{2}}-y^6I^\circ_{7\frac{1}{2}}$	—	—	—	—	—	—
4104.227	10	$a^4I_{5\frac{1}{2}}-23^\circ_{4\frac{1}{2}}$	4	198	—	93	0.984	1.182
4100.240	10	$a^4I_{5\frac{1}{2}}-y^6I^\circ_{6\frac{1}{2}}$	—	185	—	—	(0.979)	1.164
4095.999	1	$a^6I_{5\frac{1}{2}}-17^\circ_{4\frac{1}{2}}$	—	—	—	—	—	—
4085.815	10	$a^6I_{3\frac{1}{2}}-11^\circ_{3\frac{1}{2}}$	6	496	(1746)	700	0.447	0.943
4080 227	20	$a^6I_{4\frac{1}{2}}-25{,}014$	5	317	(157)	2542	0.804	1.121
4075 272	12	$a^6I_{4\frac{1}{2}}-y^6I^\circ_{3\frac{1}{2}}$	4	—	(0)	763	(0.803)	0.814
4075.116	15	$a^4I_{4\frac{1}{2}}-26{,}182$	5	263	—	2199	0.752	1.015
4069.267	15	$a^6I_{4\frac{1}{2}}-13^\circ_{5\frac{1}{2}}$	5	184	(90)	1813	0.805	0.989
4067.727	2*h*	$a^4I_{4\frac{1}{2}}-19^\circ_{4\frac{1}{2}}$	6	291	(1307)	—	(0.754)	1.045
4061.085	40	$a^6I_{7\frac{1}{2}}-z^6K^\circ_{8\frac{1}{2}}$	4	—	(0)	976	1.232	(1.202)
4059.961	20	$a^4I_{4\frac{1}{2}}-y^6I^\circ_{5\frac{1}{2}}$	5	275	(135)	2269	0.757	1.032
4051.145	15	$a^4I_{5\frac{1}{2}}-27{,}744$	5	108	(51)	1683	0.981	1.089
4043.596	15	$a^6I_{6\frac{1}{2}}-22^\circ_{6\frac{1}{2}}$	6	(65)	(425)	—	(1.148)	1.083
4040.796	40	$a^6I_{5\frac{1}{2}}-18^\circ_{6\frac{1}{2}}$	5	76	—	1526	1.031	1.108
4038.124	15	$a^6I_{5\frac{1}{2}}-19^\circ_{4\frac{1}{2}}$	4	—	(0)	949	(1.027)	1.046
4034.012	4	$a^6I_{4\frac{1}{2}}-14^\circ_{3\frac{1}{2}}$	—	—	—	—	—	—
4030.470	20	$a^6I_{5\frac{1}{2}}-y^6I^\circ_{5\frac{1}{2}}$	7*b*	—	(0)	1026	1.026	1.026
4024.785	20	$a^6I_{4\frac{1}{2}}-15^\circ_{5\frac{1}{2}}$	5	346	(175)	2709	0.804	1.150
4021.330	12	$a^6I_{6\frac{1}{2}}-24^\circ_{7\frac{1}{2}}$	4	—	(0)	914	(1.148)	1.117
4020.872	15	$a^6I_{6\frac{1}{2}}-y^6I^\circ_{6\frac{1}{2}}$	6	(20)	(130)	1152	1.142	1.162
4018.826	15	$a^6I_{4\frac{1}{2}}-y^6I^\circ_{4\frac{1}{2}}$	6	225	(988)	926	0.804	1.029
4012.250	80	$a^6I_{8\frac{1}{2}}-z^6K^\circ_{9\frac{1}{2}}$	4	—	(0)	1036	(1.294)	1.267
4000.493	10*d*	$a^4I_{4\frac{1}{2}}-20^\circ_{3\frac{1}{2}}$	4	213	(107)	000	0.751	0.964
3991.743	60	$a^6I_{3\frac{1}{2}}-y^6I^\circ_{3\frac{1}{2}}$	6	372	(1309)	631	0.446	0.818
3990.103	40	$a^6I_{7\frac{1}{2}}-y^6I^\circ_{7\frac{1}{2}}$	6	(76)	(573)	—	(1.231)	1.155
3982.355	20	$a^4I_{5\frac{1}{2}}-28{,}170$	—	—	(0)	950	(0.98)	0.99
3979.479	40	$a^4I_{4\frac{1}{2}}-21^\circ_{5\frac{1}{2}}$	5	265	(131)	2225	0.755	1.020
3976.836	40	$a^6I_{3\frac{1}{2}}-25{,}138$	6	740	(2592)	816	0.445	1.185
3973.650	30	$a^6I_{6\frac{1}{2}}-27{,}744$	6	64	(417)	—	1.148	1.084
3973.269	40	$a^6I_{8\frac{1}{2}}-y^6I^\circ_{8\frac{1}{2}}$	6	(72)	(614)	—	(1.294)	1.222
3963.114	30	$a^6I_{7\frac{1}{2}}-29{,}027$	4	—	(0)	973	(1.231)	1.201
3958.001	30	$a^6I_{4\frac{1}{2}}-16^\circ_{4\frac{1}{2}}$	6	176	(797)	887	0.804	0.980
3952.195	30	$a^6I_{3\frac{1}{2}}-14^\circ_{3\frac{1}{2}}$	6	589	(2060)	—	0.448	1.037
3951.154	40	$a^6I_{5\frac{1}{2}}-21^\circ_{5\frac{1}{2}}$	7*b*	—	—	1020	(1.027)	1.013
3941.512	60	$a^6I_{4\frac{1}{2}}-17^\circ_{4\frac{1}{2}}$	6	154	(690)	722	0.802	0.956
3937.575	20	$a^6I_{3\frac{1}{2}}-y^6I^\circ_{4\frac{1}{2}}$	—	586	(293)	—	(0.447)	1.033
3894.627	20	$a^6I_{4\frac{1}{2}}-26.182$	5	215	(108)	1986	0.807	1.022
3887.866	25	$a^6I_{4\frac{1}{2}}-19^\circ_{4\frac{1}{2}}$	6	243	—	—	0.802	1.045
3880.779	—	$a^6I_{4\frac{1}{2}}-y^6I^\circ_{5\frac{1}{2}}$	5	226	(112)	2052	0.808	1.034
3869.045	20	$a^6I_{5\frac{1}{2}}-22^\circ_{6\frac{1}{2}}$	5	—	(0)	1400	(1.027)	1.084
3863.409	20	$a^6I_{3\frac{1}{2}}-y^6H^\circ_{2\frac{1}{2}}$	4	193	(95)	−56	0.448	0.641
3863.327	10	$a^6I_{3\frac{1}{2}}-17^\circ_{4\frac{1}{2}}$	5	510	(280)	2746	0.451	0.961
3851.748	8	$a^6I_{5\frac{1}{2}}-23^\circ_{4\frac{1}{2}}$	4	152	—	347	1.031	1 183
3848.233	10*d*	$a^6I_{5\frac{1}{2}}-y^6I^\circ_{6\frac{1}{2}}$	—	—	—	—	—	—
3838.981	20	$a^6I_{3\frac{1}{2}}-26{,}041$						
3826.416	10	$a^6I_{4\frac{1}{2}}-20^\circ_{3\frac{1}{2}}$	4	172	(82)	202	0.803	0.975
3811.774	8	$a^6I_{3\frac{1}{2}}-19^\circ_{4\frac{1}{2}}$	5	604	(302)	—	0.43	1.03
3811.073	10	$a^4I_{5\frac{1}{2}}-29{,}298$	5	—	—	1345	(0.979)	0.898
3807.227	15	$a^6I_{4\frac{1}{2}}-21^\circ_{5\frac{1}{2}}$	5	201	(107)	1920	0.803	1.004
3805.359	50	$a^6I_{6\frac{1}{2}}-y^6I^\circ_{7\frac{1}{2}}$	—	—	(0)	1169	(1.148)	1.151
3780.391	20*d*	$a^6I_{7\frac{1}{2}}-y^6I^\circ_{8\frac{1}{2}}$	—	—	(0)	1124	1.233	(1.220)
3769.644	100	$a^4I_{1\frac{1}{2}}-28{,}170$	6	263	(1182)	887	0.757	1.020
3752.679	10	$a^6I_{3\frac{1}{2}}-20^\circ_{3\frac{1}{2}}$	6	530	(1849)	714	0.450	0.980
3714.808	8*d*	$a^6I_{4\frac{1}{2}}-23^\circ_{4\frac{1}{2}}$	6	369	(1661)	995	0.800	1.169
3615.817	20	$a^4I_{4\frac{1}{2}}-29{,}298$	6	149	(672)	826	0.754	0.902
3614.673	8	$a^6I_{4\frac{1}{2}}-28{,}170$	6	214	(960)	—	0.803	1 017
3522.044	12	$a^4I_{5\frac{1}{2}}-25^\circ_{4\frac{1}{2}}$	4	—	(0)	683	(0.979)	1.045
3470.866	10	$a^4I_{4\frac{1}{2}}-30{,}453$	4	236	(114)	—	0.755	0.991
3354.621	10	$a^4I_{4\frac{1}{2}}-25^\circ_{4\frac{1}{2}}$	6	294	(1321)	—	0.74	1.04
3339 063	10	$a^6I_{4\frac{1}{2}}-30{,}453$	4	182	(90)	163	0.799	0.981
3334.471	15	$a^6I_{5\frac{1}{2}}-25^\circ_{4\frac{1}{2}}$	4	—	(0)	948	(1.027)	1.045
3328.270	15	$a^6I_{3\frac{1}{2}}-30{,}037$	4	353	(178)	−195	0.447	0.800
3282.777	8	$a^6I_{3\frac{1}{2}}-30{,}453$	6	547	—	—	0.448	0.995
3231.349	8	$a^6I_{4\frac{1}{2}}-25^\circ_{4\frac{1}{2}}$	6	246	(1106)	—	0.78	1.03

the Bitter electromagnet,[4] we prepared two sets of spectrograms of twenty plates each, containing exposures to an arc between electrodes of neodymium chloride in silver. Field strengths as determined from impurity lines were: set 58, 85,860 oersteds; set 64, 87,180 oersteds. The plates were obtained by using simultaneously several concave gratings of 35-foot radius, with the technique described in previous papers dealing with other elements,[5] and were measured on an automatic comparator.[6]

A quadratic array was first set up by the usual means, and was then extended by means of the interval sorter and interval recorder,[7] using the new wave numbers of Nd II lines obtained in the M.I.T.-W.P.A. wave-length program. This array was then checked and extended by use of the g values obtained from the Zeeman effect work. It was found that incorrect levels could be eliminated quickly when results obtained with both the combination principle and the Zeeman patterns were combined. In this way the intervals provided checks on patterns which had been improperly inter-

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[4] G. R. Harrison and F. Bitter, Phys. Rev. **57**, 15 (1940).

[5] G. R. Harrison and J Rand McNally, Jr., Phys. Rev. **58**, 703 (1940).

[6] G. R. Harrison, J. Opt. Soc. Am. **25**, 169 (1935); Rev. Sci. Inst. **9**, 15 (1938); G. R. Harrison and J. P. Molnar, J. Opt. Soc. Am. **30**, 343 (1940).

[7] G. R. Harrison, Rev. Sci. Inst. **4**, 581 (1933); J. Opt. Soc. Am. **28**, 290 (1938).

TABLE II.

Config. $4f^4(^5I)$ +	Term	Term Value cm^{-1}	*g* values *LS*	*g* values Obs.	No. Lines
Nd II—low even terms					
6*s*	$a^6I_{3\frac{1}{2}}$	0.00	0.444	0.447	24
6*s*	$a^6I_{4\frac{1}{2}}$	513.33	0.828	0.803	31
6*s*	$a^6I_{5\frac{1}{2}}$	1470.09	1.035	1.027	8
6*s*	$a^4I_{4\frac{1}{2}}$	1650.21	0.727	0.754	26
6*s*	$a^6I_{6\frac{1}{2}}$	2585.46	1.159	1.148	9
6*s*	$a^4I_{5\frac{1}{2}}$	3066.75	0.965	0.979	8
6*s*	$a^6I_{7\frac{1}{2}}$	3801.91	1.239	1.231	1
5*d*	$a^6L_{5\frac{1}{2}}$	4437.52	0.615	0.620	7
6*s*	$a^4I_{6\frac{1}{2}}$	4512.50	1.108	1.109	1
6*s*	$a^6I_{8\frac{1}{2}}$	5085.61	1.294	1.294	4
5*d*	$a^6L_{6\frac{1}{2}}$	5487.66	0.851	0.854	5
6*s*	$a^4I_{7\frac{1}{2}}$	5985.56	1.200	1.199	1
5*d*	$a^6K_{4\frac{1}{2}}$	6005.33	0.546	0.552	11
5*d*	$a^6L_{7\frac{1}{2}}$	6637.48	1.004	0.998	2
5*d*	$a^6K_{5\frac{1}{2}}$	6931.82	0.839	0.842	10
5*d*	$b^6I_{3\frac{1}{2}}$	7524.68	0.444	0.483	12
5*d*	$a^6L_{8\frac{1}{2}}$	7868.73	1.108	1.107	—
5*d*	$a^6K_{6\frac{1}{2}}$	7950.00	1.015	1.015	2
5*d*	$b^6I_{4\frac{1}{2}}$	8420.33	0.828	0.840	9
5*d*	$a^6G_{1\frac{1}{2}}$	8716.51	0.000	0.008	1
5*d*	$a^6K_{7\frac{1}{2}}$	9042.86	1.129	1.127	—
5*d*	$a^6L_{9\frac{1}{2}}$	9166.22	1.183	1.187	—
5*d*	$b^6I_{5\frac{1}{2}}$	9357.83	1.035	1.034	1
5*d*	$a^6H_{2\frac{1}{2}}$	9674.83	0.286	0.453	4
5*d*	$a^6K_{8\frac{1}{2}}$	10,194.70	1.207	1.205	—
5*d*	$b^6I_{6\frac{1}{2}}$	10,337.09	1.159	1.144	—
5*d*	$a^6L_{10\frac{1}{2}}$	10,516.70	1.233	1.247	—
5*d*	$b^6I_{7\frac{1}{2}}$	11,373.38	1.239	1.230	1
5*d*	$a^6K_{9\frac{1}{2}}$	11,392.07	1.263	1.250	—
5*d*	$b^6I_{8\frac{1}{2}}$	12,459.96	1.294	1.284	2

Term or *J* value	Term Value	*g* values *LS*	*g* values Obs.	No. Lines
Nd II—middle odd terms				
$1^\circ_{4\frac{1}{2}}$	20,672.55		0.788	4
$_{3\frac{1}{2}}$	20,830.03		0.696	3
$2^\circ_{5\frac{1}{2}}$	20,907.33		0.888	4
$z^6H^\circ_{2\frac{1}{2}}$	21,241.11	0.285	0.309	2
$z^6H^\circ_{3\frac{1}{2}}$	21,291.76	0.825	0.826	3
$_{3\frac{1}{2}}$	21,871.53		0.639	2
$z^6H^\circ_{4\frac{1}{2}}$	22,187.63	1.071	0.979	2
$3^\circ_{3\frac{1}{2}}$	22,389.86		0.755	1
$4^\circ_{4\frac{1}{2}}$	22,455.63		1.003	5
$5^\circ_{5\frac{1}{2}}$	22,696.91		0.965	3
$z^6I^\circ_{3\frac{1}{2}}$	22,850.54	0.444	0.755	4
$z^6H^\circ_{5\frac{1}{2}}$	23,159.99	1.203	1.058	3
$_{4\frac{1}{2}}$	23,171.07		1.081	3
Nd II—middle odd terms—*Continued*				
$z^6K^\circ_{4\frac{1}{2}}$	23,230.00	0.545	0.778	5
$6^\circ_{3\frac{1}{2}}$	23,397.39		0.845	5
$7^\circ_{4\frac{1}{2}}$	23,409.53		1.012	3
$z^6I^\circ_{4\frac{1}{2}}$	23,537.38	0.828	0.938	6
$8^\circ_{5\frac{1}{2}}$	23,857.27		1.004	7
$9^\circ_{4\frac{1}{2}}$	24,053.36		0.970	5
$z^6I^\circ_{5\frac{1}{2}}$	24,134.08	1.035	1.014	6
$10^\circ_{4\frac{1}{2}}$	24,321.27		0.899	5
$z^6K^\circ_{5\frac{1}{2}}$	24,445.35	0.839	0.917	5
$11^\circ_{3\frac{1}{2}}$	24,467.98		0.946	3
$12^\circ_{5\frac{1}{2}}$	24,842.87		0.970	5
$_{5\frac{1}{2}}$	25,014.91		1.120	1
$y^6I^\circ_{3\frac{1}{2}}$	25,044.65	0.444	0.820	3
$13^\circ_{5\frac{1}{2}}$	25,080.86		0.988	5
$_{3\frac{1}{2}}$	25,138.56		1.187	3
$_{7\frac{1}{2}}$	25,235.62		1.110	1
$14^\circ_{3\frac{1}{2}}$	25,295.26		1.035	4
$15^\circ_{5\frac{1}{2}}$	25,352.37		1.152	3
$y^6I^\circ_{4\frac{1}{2}}$	25,389.21	0.828	1.029	6
$z^6K^\circ_{6\frac{1}{2}}$	25,524.47	1.015	1.030	1
$16^\circ_{4\frac{1}{2}}$	25,771.50		0.980	4
$y^6H^\circ_{2\frac{1}{2}}$	25,876.57	0.286	0.642	4
$17^\circ_{4\frac{1}{2}}$	25,877.18		0.957	4
$_{2\frac{1}{2}}$	26,041.19		—	—
$_{5\frac{1}{2}}$	26,182.49		1.018	2
$18^\circ_{6\frac{1}{2}}$	26,210.75		1.104	4
$19^\circ_{4\frac{1}{2}}$	26,227.09		1.047	5
$y^6I^\circ_{5\frac{1}{2}}$	26,274.08	1.035	1.028	3
$20^\circ_{3\frac{1}{2}}$	26,640.07		0.976	4
$21^\circ_{5\frac{1}{2}}$	26,772.06		1.013	4
$z^6K^\circ_{7\frac{1}{2}}$	26,912.73	1.129	1.133	2
$22^\circ_{6\frac{1}{2}}$	27,308.97		1.087	1
$23^\circ_{4\frac{1}{2}}$	27,425.05		1.177	3
$24^\circ_{7\frac{1}{2}}$	27,445.91		1.112	—
$y^6I^\circ_{6\frac{1}{2}}$	27,448.70	1.159	1.166	2
$_{6\frac{1}{2}}$	27,744.17		1.086	2
$_{4\frac{1}{2}}$	28,170.45		1.017	2
$z^6K^\circ_{8\frac{1}{2}}$	28,418.90	1.207	1.202	1
$y^6I^\circ_{7\frac{1}{2}}$	28,856.78	1.239	1.161	2
$_{8\frac{1}{2}}$	29,027.49		1.203	2
$_{4\frac{1}{2}}$	29,298.60		0.902	1
$z^6K^\circ_{9\frac{1}{2}}$	30,002.26	1.263	1.267	—
$_{2\frac{1}{2}}$	30,037.04		0.800	1
$y^6I^\circ_{8\frac{1}{2}}$	30,246.67	1.294	1.220	1
$_{3\frac{1}{2}}$	30,453.25		0.990	3
$25^\circ_{4\frac{1}{2}}$	31,451.24		1.048	2

preted because of faint or overlapped components, while the *g* values checked on accidental coincidences of intervals.

RESULTS

Table I contains the lines of Nd II which we have thus far been able to classify. The first two columns contain the wave-length and arc intensity of the line as given in the *M.I.T. Wavelength Tables*, followed by the lower and upper terms from which the line is believed to arise. The fourth column contains the type of Zeeman pattern observed for the line in accordance with the notation described elsewhere.[8] The fifth column, marked "Sep.", contains the fundamental observed separation between lines of the pattern, which is equal to the difference in *g* values of the lower and upper levels, in terms of 1000 for the normal Lorenz separation. The columns marked *p* and *n* contain the displacements from the zero position of the strongest parallel and perpendicularly-polarized components, respectively, expressed in the same units

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[8] G. R. Harrison, W. E. Albertson, and N. Hosford, J. Opt. Soc. Am. **31**, 439 (1941).

as column 5. The last two columns contain g values for the lower and upper levels, respectively, as calculated from the observed data. Lines for which no Zeeman data are entered were too weak to observe, or produced incompletely resolved or badly overlapped patterns. Values enclosed in parentheses were assumed from final averages for the level involved, and were then used to calculate a g value for the other level producing the line.

The levels found in the classification are listed in Table II. The first column lists the electron which, added to the configuration $4f^4(^5I)$ of Nd III, is believed responsible for the levels the designations of which are given in column 2, and value in cm^{-1} in column 3. In that part of the table containing the middle odd terms configuration assignments are not given, and in cases where exact term assignments are not known only the inner quantum number J is given. The columns headed *g values* contain respectively the theoretical g values for LS coupling and the g values observed. The final column gives the number of resolved patterns used in arriving at the average measured value of g given in the preceding column.

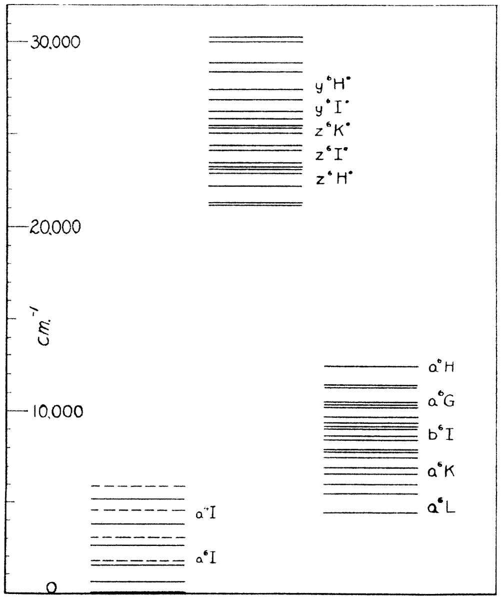

FIG. 1. Identified levels in Nd II to which complete quantum assignments have been made. The strongest lines in the spectrum are those arising from transitions between the upper group of levels and the two lower groups.

LOW CONFIGURATIONS OF SINGLY IONIZED NEODYMIUM

The neutral neodymium atom contains 60 electrons, of which 54 are in closed shells, while 6 are expected to be in the $4f$, $5d$, $6s$, and $6p$ shells. Following the normal order of binding, one might expect the lowest configuration of Nd I to be $4f^45d6s^2$, leading perhaps to a normal configuration in Nd II of $4f^35d6s^2$, $4f^46s^2$, or $4f^35d6s$. Instead, the trend observed in Ce II[8] and Pr II[9] is found to continue and $4f^46s$ is lowest, with $4f^45d$ only slightly higher, both combining strongly with $4f^46p$. The terms expected from these configurations are as follows:

$$f^4s:\ {}^{6,4}(SDFGI)\quad {}^{4,2}(P_3D_2F_4G_3H_4L_2K_2LM)$$

$${}^{2}(S_2D_4FG_4H_2I_3KL_2N)$$

$$f^4p:\ {}^{6,4}(P_2D_2F_3G_2H_2IK)$$

$${}^{4,2}(S_3P_5D_9F_9G_{11}H_9I_8K_5L_4M_2N)$$

$${}^{2}(P_6D_5F_9G_7H_9I_6K_6L_3M_3NO)$$

$$f^4d:\ {}^{6,4}(SP_2D_4F_3G_4H_3I_2KL)$$

$${}^{4,2}(S_5P_9D_{12}F_9G_{11}H_{11}I_8K_6L_6M_4N_2O)$$

$${}^{2}(S_4P_5D_{11}F_{11}G_{14}H_{11}I_{12}K_8L_7M_4N_3OQ).$$

A diagram showing the energy levels of Nd II completely identified thus far is given in Fig. 1. All the low even terms found originate from the $4f^4(^5I)$ term of Nd III by addition of an s or a d electron, while most, if not all, of the upper terms found are believed to rise from addition of a p electron to the same parent configuration.

Table III gives the wave-lengths, estimated arc intensities and temperature classes of identified lines of the fundamental enlarged $s-p$ supermultiplet. Most of the lines in this array check within a few hundredths of a wave number with their calculated values, testifying to the validity of the assignments and the consistency of the wave-length determinations.

The *raies ultimes* of neodymium are usually given as 4303.573A, 3951.154A, and 4177.321A in decreasing intensity. We classify these lines as $a^6I_{3\frac{1}{2}}-z^6K^\circ{}_{4\frac{1}{2}}$, $a^6I_{5\frac{1}{2}}-21^\circ{}_{5\frac{1}{2}}$, and $a^6I_{4\frac{1}{2}}-zK^\circ{}_{5\frac{1}{2}}$. One would expect $a^6I_{8\frac{1}{2}}-z^6K^\circ{}_{9\frac{1}{2}}$ to be the strongest line in the spectrum and hence the true *raie ultime*,

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[9] N. Rosen, G. R. Harrison, and J. R. McNally, Jr., Phys. Rev. **60**, 722 (1941).

TABLE III. Principal supermultiplet of Nd II, (incomplete).*

	$a^6I_{8\frac{1}{2}}$	$a^6I_{7\frac{1}{2}}$	$a^6I_{6\frac{1}{2}}$	$a^6I_{5\frac{1}{2}}$	$a^6I_{4\frac{1}{2}}$	$a^6I_{3\frac{1}{2}}$	$a^4I_{7\frac{1}{2}}$	$a^4I_{6\frac{1}{2}}$	$a^4I_{5\frac{1}{2}}$	$a^4I_{4\frac{1}{2}}$
$z^6K^\circ_{9\frac{1}{2}}$	4012.250 80 III	x	x	x	x	x	x	x	x	x
$z^6K^\circ_{8\frac{1}{2}}$	4284.518 25 IV	4061.085 40 III	x	x	x	x	4456.394 20 IV	x	x	x
$z^6K^\circ_{7\frac{1}{2}}$	—	4325.766 100 IV	4109.455 30 III	x	x	x	—	4462.985 60 IV	x	x
$z^6K^\circ_{6\frac{1}{2}}$	x	4602.242 10 V	4358.169 50 III	4156.083 10 III	x	x	—	—	4451.566 100 III	x
$z^6K^\circ_{5\frac{1}{2}}$	x	x	—	4351.295 30 III	4177.321 15 III	x	x	—	4676.262 2	4385.663 40 III
$z^6K^\circ_{4\frac{1}{2}}$	x	x	x	—	4400.828 50 III	4303.573 100 III	x	x	4958.139 5 V	4632.688 12 V
$y^6I^\circ_{8\frac{1}{2}}$	3973.269 40 IV	3780.391 20*d* IV	x	x	x	x	4120.654 6 IV	x	x	x
$y^6I^\circ_{7\frac{1}{2}}$	4205.595 20 IV	3996.100 40 IV	3805.359 50 III	x	x	x	4371.069 10	4106.582 25 IV	x	x
$y^6I^\circ_{6\frac{1}{2}}$	x	4227.719 20 IV	4020.872 15 III	3848.233 10*d* IV	x	x	—	4358.699 15 IV	4100.240 10 IV	x
$y^6I^\circ_{5\frac{1}{2}}$	x	x	4220.258 10*d* IV	4030.470 20 IV	3880.779 30 IV	x	x	—	4307.778 5 IV	4059.961 20 IV
$y^6I^\circ_{4\frac{1}{2}}$	x	x	x	4179.585 10 IV	4018.826 15 IV	3937.826 20 IV	x	x	—	4211.286 30 IV
$y^6I^\circ_{3\frac{1}{2}}$	x	x	x	x	4075.272 12 IV	3991.743 60 III	x	x	x	—
$z^6H^\circ_{5\frac{1}{2}}$	x	x	4859.030 60 IV	4609.230 5*d*	4414.432 12 IV	x	x	5361.174 3 V	—	4647.759 8 IV
$z^6H^\circ_{4\frac{1}{2}}$	x	x	x	4825.482 100 IV	4612.473 12 IV	4505.741 8	x	x	5228.427 6 V	4867.839 6 V
$z^6H^\circ_{3\frac{1}{2}}$	x	x	x	x	4811.343 60 IV	—	x	x	x	5089.837 10 IV
$z^6H^\circ_{2\frac{1}{2}}$	x	x	x	x	x	4706.542 50 IV	x	x	x	x

* x indicates line forbidden by selection principle for J; lines not found are indicated by —

but this line, at 4012.250A, though given in our list at intensity 80 and stronger than the two weaker *raies ultimes*, is not usually included in lists of sensitive lines. Intensity anomalies which are similar in character to those found in Pr II[9] will be noted in Table III. The whole matter of the most sensitive lines of Nd and Pr needs re-examination, and exact intensity measurements on these important lines would be well worth making.

Figure 2 shows the shift in binding of levels originating from the configurations f^ns, f^np, and f^nd for the progression La II, Ce II, Pr II, and Nd II; and from f^{n+1} for the first two elements. The lowest f^ns level is taken as zero in each case. This appears to be the actual lowest level of the spectrum except in the case of La II[10] where Russell and Meggers find $5d^2$ and $5d6s$ levels still lower.

No attempt has been made to locate accurately the centers of gravity of the configurations in Fig. 2, but it is obvious that the differences $p-s$ and $p-d$ remain approximately constant through-

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[10] H. N. Russell and W. F. Meggers, Bur. Stand. J. Research 9, 625 (1932).

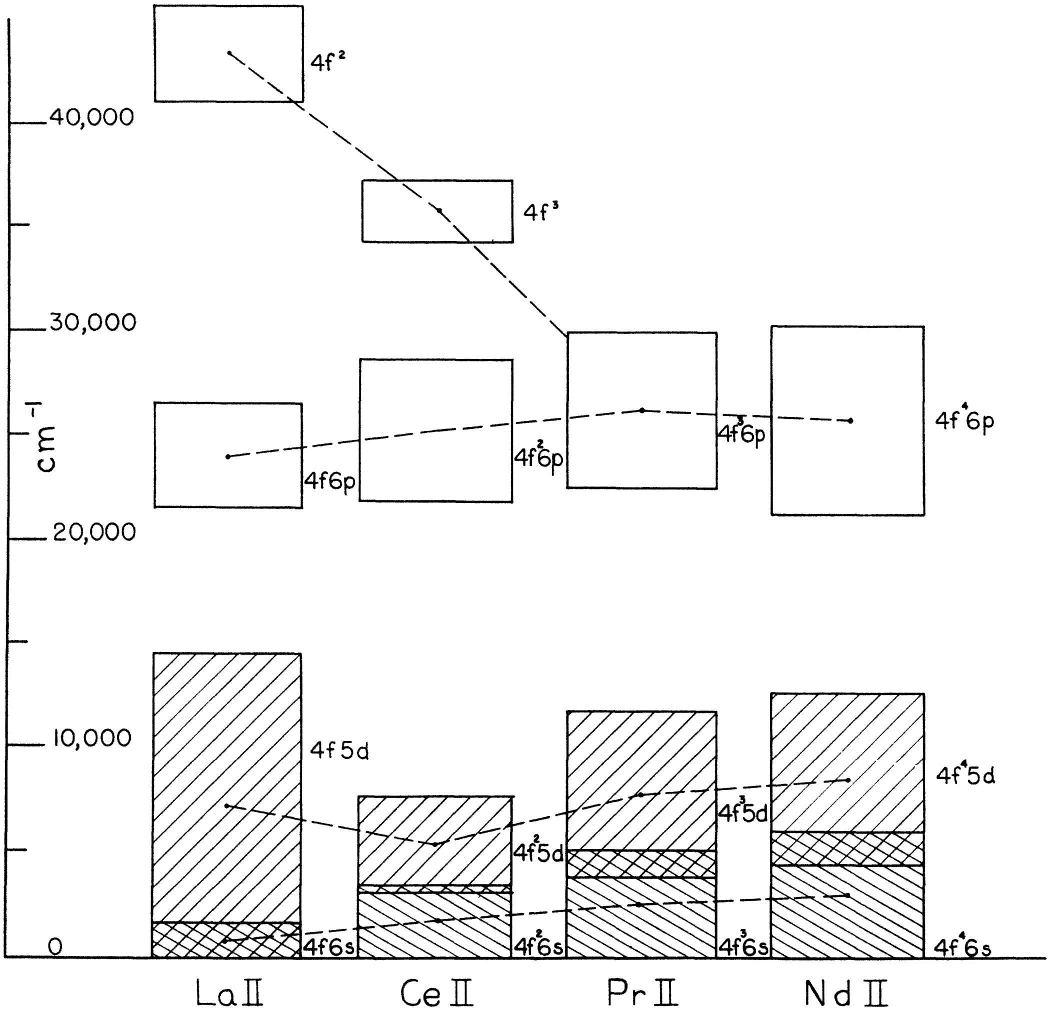

FIG. 2. Variation in the positions of levels due to homologous configurations through the progression La II, Ce II, Pr II, and Nd II, with the lowest level of f^ns set at zero.

out the progression. The f^{n+1} configuration, on the other hand, becomes more closely bound in Ce II than in La II, and it appears that in Pr II many f^4 terms will be found in about the same location as the f^3p terms, while in Nd II they may lie even lower. Figure 2 shows clearly the origin of the great wealth of strong lines emitted by the four elements in and near the violet.

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Note added in proof: In every case in this paper the designations $y^6I^\circ_5$ and 21°_5 should be interchanged. This applies to Tables I, II, and III, and simplifies the explanation of the *raies ultimes* anomaly.