with the fact that their average between particles in very different states (different shells) is relatively small. The coupling between unlike particles in different shells is then expected to be weak compared to the like-particle interaction within a shell, giving $(L_\pi L_\nu S_\pi S_\nu)$ coupling. Since two-thirds of the known μ_I correspond to neutron excess greater than ten, one may tentatively ascribe the observed regularity to this effect. The frequent occurrence of negative spin-orbit coupling (making $I=L-\frac{1}{2}$) is also plausibly ascribed to a remnant of shell structure in actual nuclei.

V

Since the Hartree model has more meaning for the lighter nuclei,[10a] its shell structure might be expected to make the moments of a few light nuclei much simpler than the more general case considered above. The nucleus $_{19}K^{39}$ seems to be quite simple. Its position on Fig. 1 ($I=3/2$, $\mu_I=0.36$) indicates that it has the sign of spin-orbit coupling[4] corresponding to an almost-closed shell. This is explicable on the basis of a zero-order (fictitious!) potential[10a] somewhat narrower toward the bottom than a harmonic oscillator potential (as is reasonable for so light a nucleus), making[14] the order of single-particle states $1s$, $2p$, $2s$, $3d$, $3p$. We have then the configuration $(3d^9\,{}^2D)_\pi(3d^{10}\,{}^1S)_\nu$, ${}^2D_{3/2}$. The two additional neutrons in the isotopic nucleus $_{19}K^{41}$ would be $3p^2$ with ${}^1S_0$ lowest,[5a] leaving the ground state unaltered except for the admixture of new higher states. The lowest of these admixed states is $({}^2D)_\pi(3p^2\,{}^1D)_\nu\,{}^2D_{3/2}$, which would reduce g_L (by polluting L with neutrons) and hence would reduce the total magnetic moment, as is observed: for $_{19}K^{41}$ one has $\mu_I=0.20$. (It would also reduce the doublet splitting slightly, but this has not yet been observed.) The other new state of interest is $({}^2D)_\pi(3p^2\,{}^3P)_\nu\,{}^2D_{3/2}$, which would tend to increase μ_I, but only slightly since it is quite high and is only admixed by unlike-particle spin coupling. It may be regretted that the interesting isotopic pairs Cu, Re, and Tl, each having $\mu_I\sim$(mass) quite exactly,[15] may not be treated so simply.

Discussion with Dr. Feenberg has been appreciated.

[14] Compare the term orders for square, parabolic (reference 2(d), page 173) and Coulomb potentials.

[15] Schüler and Korsching, Zeits. f. Physik **105**, 168, 495 (1937).

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The First Spark Spectrum of Manganese

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The analysis of the Mn II spectrum has been extended to include a classification of over seven hundred lines arising from combinations between terms belonging to the quintet and septet systems. From four members of the $3d^5({}^6S)nf\,{}^7f$ series an ionization potential of 126,147 wave numbers has been calculated by means of a Ritz formula. Pictures have been taken and measurements made covering the range from approximately 800A to 6000A. A hollow cathode discharge was used as a source, with each of the three gases, helium, argon and neon, as conducting media.

HISTORY

It was in the manganese spectra, arc and first spark, that Catalan first noted groups of lines of a more complicated structure than could be attributed to triplet-triplet combinations.[1] Among the enhanced lines he called attention to the groups which were later identified independently by Russell[2] and by Black and Duffendack[3] as being $3d^54s\,{}^7S-3d^54p\,{}^7P$, $3d^54s\,{}^5S-3d^54p\,{}^5P$, $3d^6\,{}^5D-3d^54p\,{}^5P$ and $3d^54p\,{}^7P-3d^54d\,{}^7D$, all based on the ${}^6S$ ion. Intersystem lines were found

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[1] Catalan, Phil. Trans. Roy. Soc. **A223**, 127 (1922).

[2] Russell, Astrophys. J. **66**, 233 (1927).

[3] Black and Duffendack, Science **66**, 402 (1927).

connecting the septet and quintet systems. Russell added the second member of the ^7S series, and Catalan[4] later located the corresponding ^5S. This completed the analysis as far as it had been carried until the present investigation was undertaken.

Apparatus and Observations

A Schuler tube, similar in design to that used by A. G. Shenstone for the production of the Cu II spectrum[5] has proved quite satisfactory as a source for the manganese ion. The lines obtained are extremely sharp. The degree of excitation of the once ionized atom can be controlled to a considerable extent by the use of different noble gases; and, provided helium or neon is used, lines originating in high energy levels, which are either extremely diffuse or absent entirely in the spark, are here present with considerable intensity.

Since helium alone of the noble gases has an ionization potential sufficient to excite the complete Mn II spectrum, it was used to cover the complete range of wave-lengths from 800A to 6200A. Pictures of certain regions were also taken with argon and with neon in the tube, and wherever feasible, arc and spark pictures were also obtained.

In the region above 2250A the Princeton 21-foot concave grating (ruled by Professor R. W. Wood) was used. For wave-lengths between 2000A and 2400A only the strongest lines were obtainable with reasonable exposures with this grating, so supplementary measurements were made from plates taken on an Hilger E1 quartz prism instrument. Through the kindness of Professor J. C. Boyce, the author was permitted to use the two-meter normal incidence vacuum spectrograph of the Carnegie Institution of Washington, which is located in the Spectroscopy Laboratory of the Massachusetts Institute of Technology.[6] The plates taken with this spectrograph extended the observations to about 800A. Later the vacuum region was retaken on the two meter spectrograph at Princeton with neon and argon in the tube instead of helium.

[4] Catalan, An. Soc. Espan. **26**, 67 (1928).
[5] Shenstone, Phil. Trans. Roy. Soc. **235**, 195 (1936).
[6] Compton and Boyce, Rev. Sci. Inst. **5**, 218 (1934).

The Analysis

Positions of the low configurations

To the closed shell completed in argon, one must add six electrons to obtain the structure of once-ionized manganese. The possible low electron configurations are thus $3d^6$, $3d^54s$, and $3d^44s^2$. Series limits of Mn I determine the relative positions of the high multiplicity terms of $3d^6$ and $3d^54s$—the former limit being predicted higher by about 14,300 wave numbers.[2] From the height of $3d^44s$ above $3d^5$ in Mn III,[7] and from homologous terms of the neighboring first spark spectra, the $3d^44s^2$ configuration should be found rather high in the spectrum—between 55,000 and 60,000 wave numbers above the normal state. The positions (centers of gravity) of the lowest terms of these configurations are actually

$$3d^54s\ ^7S-0$$
$$3d^6\ ^5D-14550$$
$$3d^44s^2\ ^5D-55364.$$

Details of the configurations

$3d^54s$.—Consider the possible terms in the doubly ionized atom which form limits of the first spark spectrum. Because of Pauli's exclusion principle, $3d^5$ can give rise to only one sextet, ^6S, but there are many allowable quartet terms.

Upon the addition of a $4s$ electron one obtains $^{7,5}S$ from the sextet, the septet being the normal state. Based upon each quartet are metastable quintet and triplet terms. The arc spectra of Mn and Cr indicate that the lowest of these should be ^5G, ^5P, and ^5D. These have been located in Mn II and their term values (centers of gravity) compare with the corresponding terms of Mn I and Cr I as follows:

$3d^54s$	Mn II	$3d^54s^2$	Mn I	$3d^54s$	Cr I
^5G	27571.3	^4G	25278.4	^5G	20521.3
^5P	29911.6	^4P	27230.4	^5P	21846.3
^5D	32828.3	^4D	30397.0	^5D	24292.1

The remaining quintet term of this configuration is ^5F. This has not been found, probably because of its weak inter-limit combinations.

$3d^6$ and $3d^44s^2$.—The only quintet terms possible from these configurations are the ^5D terms previously mentioned.

[7] Gilroy, Phys. Rev. **38**, 2217 (1931).

$3d^54p$.—The expected $^{7,5}P$ terms, based upon ^6S, are those found earlier by other investigators.

Associated with each of the even terms ^5G, ^5P, and ^5D should be a triad of odd ones. It is thought that all of these nine terms have been located; however, there is some doubt as to whether those assigned to $3d^5(^4P)4p\,^5D$ and ^5S have been correctly named. The assignment is here made difficult because these levels undoubtedly mix characteristics with those of $3d^5(4G)4p\,^5F$. All three terms occur quite close together and are the only terms that have been found which show strong transitions which involve a change in L other than ± 1 or 0. The z^5F combines with a^5P, and the terms designated as z^5S and z^5D both combine with ^5G terms. Of the levels with the same j values in the three terms, the ones with the lowest j values are closest together. One might then expect that the transfer of characteristics would be greatest in these cases. This is borne out by the fact that the strongest combinations in the anomalous multiplets are between levels of low j values, while the intensities in the proper multiplets drop off more rapidly than might ordinarily be expected. The intensities of the lines in the a^5P-z^5D and a^5P-z^5S multiplets are not at all what would be predicted by theory. However, if one calculates the sums of the intensities for these two multiplets and compares them with the sums of the actual intensities of the lines to the a^5P term the agreement is quite good considering that only visual estimates of the lines have been made.

$3d^44sp$.—This configuration should give rise to a septet and a quintet triad based on ^6D and a quintet and triplet triad based on ^4D. Terms w^5F and w^5D have been allotted to the ^4D ion structure. Probably either w^5P or v^5P is the remaining member of this triad. It is suggested that the x^5P belongs to the group based on the sextet term. The separations of its levels are comparatively large as one would expect, and it falls in the right region. However, it exhibits two rather peculiar features. Its combinations with the b^5D are extremely weak and it shows marked enhancements when helium is used in the Schuler tube. Such enhancements do not occur with neighboring terms and cannot be explained as due to a metastable state of helium. Unfortunately, the normal state is the only low state with which septets may combine without intersystem combinations. Thus one would expect only the ^7P to be apparent. z^7P has been tentatively assigned to this configuration instead of $5p^7P$ since the latter shows combinations with $7s^7S$. Either assignment indicates a perturbation.

$3d^54d$.—The $^{7,5}D$ based on ^6S are known, and ^5I and ^5H based on ^4G have been found.

Series members and ionization potential

Certain higher members of the low terms discussed in the foregoing paragraphs have been found. These are listed below.

Configuration	Term	Total quantum number of excited electron.
$3d^5(^6S)ns$	^7S	$n=4, 5, 6, 7, 8, 9, 10.$
$3d^5(^6S)ns$	^5S	$n=4, 5, 6, 7, 8.$
$3d^5(^6S)np$	^7P	$n=4, 5.$
$3d^5(^6S)np$	^5P	$n=4, 5.$
$3d^5(^6S)nd$	^7D	$n=4, 5, 6, 7.$
$3d^5(^6S)nd$	^5D	$n=4, 5, 7.$
$3d^5(^6S)nf$	^7F	$n=4, 5, 6, 7.$
$3d^5(^6S)nf$	^5F	$n=4, 5, 6, 7, 8.$
$3d^5(^4G)ns$	^5G	$n=4, 5.$

The levels of the fourth member of the nd^5D series are slightly perturbed but otherwise show the correct characteristics for this assignment. $6f^5F$ is also slightly perturbed by t^5F.

The best value of the ionization potential can be obtained from the nf^7F series. These terms are fixed by combinations with $4d^7D$, which in turn depends upon $4p^7P$. All of the lines used to place these levels occur in the region above 2400A where the measurements are most reliable. The series shows no perturbations and the last member is within 9000 wave numbers of the limit. A Ritz formula adequately represents the series and gives an ionization potential of 126,147 wave numbers. This value is substantiated by a value of 126,148 obtained from the last five members of the ns^7S series.

Term Values

In Table I the values of the terms are listed. Their absolute values are given with respect to the normal state, $4s^7S$. Although the levels belonging to configurations $3d^54s$ and $3d^54p$ and based on quartet ion structures are consistent among themselves to within a few hundredths of a wave number, their absolute values with

TABLE I. *Absolute term values in the first spark spectrum of manganese with respect to the normal state. Column 1, discoverer (R, Russell; D, Duffendack and Black; C, Catalan; A, Curtis). Column 2, electron configuration. Column 3, term designation. Column 4, term value.*

1	2	3	4	1	2	3	4	1	2	3	4
	Even Terms				Even Terms				Odd Terms		
C, R, D	$3d^5(^6S)4s$	$4s^7S_3$	0.00	A	$3d^5(^6S)9s$	$9s^7S_3$	117031.1	A	$3d^44s(^4D)4p$	w^5F_5	106893.8
"	$3d^5(^6S)4s$	$4s^5S_2$	9472.86	"	$3d^5(^6S)10s$	$10s^7S_3$	119185.6	"		w^5P_3	107172.8
"	$3d^6$	$3d^5D_4$	14325.64					"	$3d^5(^6S)5f$	$5f^7F_{6,5}$	108409.8
"	"	$3d^5D_3$	14593.62		Odd Terms			"	"	$5f^7F_4$	108410.1
"	"	$3d^5D_2$	14781.03					"	"	$5f^7F_3$	108410.2
"	"	$3d^5D_1$	14901.06	C, R, D	$3d^5(^6S)4p$	$4p^7P_2$	38366.07	"	"	$5f^7F_2$	108410.3
"	"	$3d^5D_0$	14959.68	"	"	$4p^7P_3$	38542.96	"	$3d^5(^6S)5f$	$5f^5F_1$	108435.6
A	$3d^5(^4G)4s$	a^5G_6	27546.90*	"	"	$4p^7P_4$	38806.53	"	"	$5f^5F_2$	108437.2
"	"	a^5G_5	27570.95*	"	$3d^5(^6S)4p$	$4p^5P_3$	43370.37	"	"	$5f^5F_3$	108439.0
"	"	a^5G_4	27583.30*	"	"	$4p^5P_2$	43484.50	"	"	$5f^5F_4$	108441.4
"	"	a^5G_3	27588.23*	"	"	$4p^5P_1$	43557.03	"	"	$5f^5F_5$	108443.0
"	"	a^5G_2	27589.03*	A	$3d^5(^4G)4p$	z^5G_2	64456.33*	"		v^5G_2	108485.4
"	$3d^5(^4P)4s$	a^5P_3	29889.31*	"	"	z^5G_3	64473.13*	"		v^5G_3	108503.0
"	"	a^5P_2	29919.22*	"	"	z^5G_4	64493.83*	"		v^5G_4	108524.7
"	"	a^5P_1	29951.12*	"	"	z^5G_5	64518.57*	"		v^5G_5	108550.7
"	$3d^5(^4D)4s$	a^5D_4	32787.60*	"	"	z^5G_6	64549.72*	"		v^5G_6	108587.9
"	"	a^5D_0	32818.10*	"	$3d^5(^4G)4p$	z^5H_3	65482.66*	"		v^5P_1	108726.4
"	"	a^5D_1	32836.40*	"	"	z^5H_4	65565.68*	"		v^5P_2	108974.7
"	"	a^5D_3	32856.95*	"	"	z^5H_5	65658.30*	"		v^5F_1	108994.0
"	"	a^5D_2	32858.84*	"	"	z^5H_6	65754.61*	"		v^5F_2	109045.7
"	$3d^44s^2$	b^5D_0	54846.0	"	"	z^5H_7	65846.61*	"		v^5F_3	109122.4
"	"	b^5D_1	54938.1	"	$3d^5(^4G)4p$	z^5F_5	66542.26*	"		w^5D_0	109167.7
"	"	b^5D_2	55115.8	"	"	z^5F_4	66643.01*	"		v^5F_4	109221.1
"	"	b^5D_3	55371.3	"	"	z^5F_1	66644.78*	"		w^5D_1	109235.3
"	"	b^5D_4	55696.5	"	"	z^5F_2	66676.56*	"		v^5F_5	109327.1
R	$3d^5(^6S)5s$	$5s^7S_3$	74559.91	"	"	z^5F_3	66686.45*	"		w^5D_2	109343.7
C	$3d^5(^6S)5s$	$5s^5S_2$	76374.56	"	$3d^5(^4P)4p$	z^5D_1	66893.79*	"		v^5P_3	109378.9
C, R, D	$3d^5(^6S)4d$	$4d^7D_1$	79540.76	"	"	z^5D_2	66901.14*	"		w^5D_3	109476.3
"	"	$4d^7D_2$	79544.51	"	$3d^5(^4P)4p$	z^5S_2?	66929.22*	"		w^5D_4	109607.8
"	"	$4d^7D_3$	79550.28	"	$3d^5(^4P)4p$	z^5D_3	67008.93*	"	$3d^44s(^4D)4p$	v^5D_0	109958.0
"	"	$4d^7D_4$	79558.38	"	"	z^5D_4	67295.16*	"	"	v^5D_1	109994.3
"	"	$4d^7D_5$	79561.10	"	$3d^5(^4P)4p$	z^5P_3	68284.38*	"	"	v^5D_2	110068.5
A	$3d^5(^6S)4d$	$4d^5D_4$	82136.30	"	"	z^5P_2	68417.34*	"	"	v^5D_3	110204.9
"	"	$4d^5D_3$	82144.34	"	"	z^5P_1	68496.37*	"	"	v^5D_4	110428.7
"	"	$4d^5D_2$	82151.07	"	$3d^5(^4D)4p$	y^5F_1	70150.39*	"		v^5H_3	110547.5
"	"	$4d^5D_1$	82155.72	"	"	y^5F_2	70231.07*	"		v^5H_4	110602.0
"	"	$4d^5D_0$	82158.16	"	"	y^5F_3	70342.58*	"		v^5H_5	110692.2
"	$3d^5(^6S)6s$	$6s^7S_3$	97728.0	"	"	y^5F_4	70497.44*	"		v^5H_6	110795.0
"	$3d^5(^6S)6s$	$6s^5S_2$	98410.1	"	"	y^5F_5	70657.18*	"		v^5H_7	110926.0
"	$3d^5(^6S)5d$	$5d^7D_2$	99892.5	"	$3d^5(^4D)4p$	y^5P_1	71263.92*	"		u^5F_1	111017.5
"	"	$5d^7D_3$	99894.8	"	"	y^5P_2	71323.15*	"		u^5F_2	111060.5
"	"	$5d^7D_4$	99898.6	"	"	y^5P_3	71390.14*	"		u^5F_3	111115.4
"	"	$5d^7D_5$	99903.1	"	$3d^5(^4D)4p$	y^5D_4	72010.75*	"		u^5F_4	111159.2
"	"	$5d^5D_4$	100682.3	"	"	y^5D_3	72247.38*	"		u^5F_5	111160.5
"	"	$5d^5D_3$	100688.1	"	"	y^5D_2	72306.81*	"		u^5P_1	111162.3
"	"	$5d^5D_2$	100692.6	"	"	y^5D_1	72320.62*	"		u^5P_2	111178.8
"	"	$5d^5D_1$	100695.3	"	"	y^5D_0	72322.07*	"		u^5P_3	111212.8
"	$3d^5(^4G)5s$	e^5G_6	101467.58*	"	$3d^44s(^6D)4p$?	z^7P_2	83255.1	"		u^5G_4	113181.7
"	"	e^5G_5	101489.31*	"	"	z^7P_3	83375.9	"		u^5G_5	113250.8
"	"	e^5G_4	101499.03*	"	"	z^7P_4	83529.6	"		u^5G_6	113323.0
"	"	e^5G_2	101499.84*	"	$3d^5(^6S)5p$?	$5p^7P_2$	85895.1	"		t^5F_3	113641.4
"	"	e^5G_3	101501.30*	"	"	$5p^7P_3$	85960.6	"		t^5F_2	113645.0
"	$3d^5(^4G)4d$	e^5H_3	106157.4	"	"	$5p^7P_4$	86057.4	"		t^5F_1	113645.5
"	"	e^5H_4	106164.2	"	$3d^5(^6S)5p$	$5p^5P_3$	86897.7	"		t^5F_4	113646.7
"	"	e^5H_7	106167.7	"	"	$5p^5P_2$	86936.9	"		t^5F_5	113658.0
"	"	e^5H_5	106168.9	"	"	$5p^5P_1$	86960.8	"	$3d^5(^6S)6f$	$6f^7F_6$	113840.0
"	"	e^5H_6	106169.9	"	$3d^44s(^6D)4p$?	x^5P_1	88839.6	"	"	$6f^7F_5$	113840.1
"	$3d^5(^4G)4d$	e^5I_8	106508.1	"	"	x^5P_2	89078.9	"	"	$6f^7F_4$	113840.2
"	"	e^5I_4	106512.1	"	"	x^5P_3	89428.8	"	"	$6f^7F_3$	113840.3
"	"	e^5I_5	106519.1	"	$3d^5(^6S)4f$	$4f^7F_6$	98423.5	"	$3d^5(^6S)6f$	$6f^5F_1$	114024.5
"	"	e^5I_7	106519.8	"	"	$4f^7F_5$	98423.7	"	"	$6f^5F_2$	114025.5
"	"	e^5I_6	106522.5	"	"	$4f^7F_4$	98423.8	"	"	$6f^5F_3$	114026.4
"	$3d^5(^6S)7s$	$7s^7S_3$	108126.2	"	"	$4f^7F_3$	98424.0	"	"	$6f^5F_5$	114027.8
"	$3d^5(^6S)7s$	$7s^5S_2$	108447.6	"	"	$4f^7F_2$	98424.1	"	"	$6f^5F_4$	114026.9
"	$3d^5(^6S)6d$	$6d^7D_3$	109242.3	"	$3d^5(^6S)4f$	$4f^5F_1$	98461.76	"	$3d^5(^6S)7f$	$7f^7F_6$	117112.9
"	"	$6d^7D_4$	109244.4	"	"	$4f^5F_2$	98462.34	"	"	$7f^7F_5$	117113.0
"	"	$6d^7D_5$	109248.2	"	"	$4f^5F_3$	98463.16	"		$7f^7F_{4,3}$	117113.1
"	$3d^5(^6S)8s$	$8s^7S_3$	113697.0	"	"	$4f^5F_4$	98464.14	"	$3d^5(^6S)7f$	$7f^5F_5$	117148.3
"	$3d^5(^6S)8s$	$8s^5S_2$	113895.2	"	"	$4f^5F_5$	98465.15	"	"	$7f^5F_4$	117137.8
"	$3d^5(^6S)7d$	$7d^7D$	114347.0	"	$3d^44s(^4D)4p$	w^5F_1	106265.3	"		s^5F_1	117164.7
"	$3d^5(^6S)7d$	$7d^5D_4$	114932.2	"	"	w^5F_2	106373.7	"		s^5F_2	117231.7
"	"	$7d^5D_3$	114943.9	"		w^5P_1	106479.2	"		s^5F_3	117314.6
"	"	$7d^5D_2$	114951.9	"	$3d_44s(^4D)4p$	w^5F_3	106525.8	"		s^5F_4	117399.3
"	"	$7d^5D_1$	114956.5	"	"	w^5F_4	106707.3	"		s^5F_5	117483.2
"	"	$7d^5D_0$	114958.1	"		w^5P_2	106750.0	"	$3d^5(^6S)8f$	$8f^5F$	119253.

respect to $4s^7S$ may be incorrect by several tenths. This is because the only lines connecting this group with levels fixed accurately with respect to the normal state fall in the region below 2000A where measurements cannot be relied upon to better than a few tenths of a wave number. Levels of this type are listed to hundredths and followed by an asterisk.

CLASSIFIED LINES

Table IIA contains the classified lines from 2000A to 6200A. All lines were observed with the

TABLE IIA. *Classified lines from 2000A to 6200A. Lines whose wave-lengths are followed by an asterisk were photographed with a quartz prism instrument. Columns 1, 2, and 3, visual estimates of intensities in spark, helium Schuler tube, and arc. Column 4, wave-length in air. Column 5, wave number. Column 6, classification.*

1	2	3	4	5	6
	5		6131.917	16303.61	$4d^5D_0-4f^5F_1$
	5		6131.005	16306.04	$4d^5D_1-4f^5F_1$
	15		6130.794	16306.59	$4d^5D_1-4f^5F_2$
	10		6129.022	16311.31	$4d^5D_2-4f^5F_2$
	20		6128.725	16312.10	$4d^5D_2-4f^5F_3$
	10		6126.210	16318.80	$4d^5D_3-4f^5F_3$
	25		6125.855	16319.74	$4d^5D_3-4f^5F_4$
	8		6122.799	16327.89	$4d^5D_4-4f^5F_4$
	40		6122.438	16328.85	$4d^5D_4-4f^5F_5$
	30		5302.320	18854.44	$4d^7D_5-4f^7F_{6,5,4}$
	25		5299.278	18865.26	$4d^7D_4-4f^7F_{5,4,3}$
	20		5296.968	18873.49	$4d^7D_3-4f^7F_{4,3,2}$
	15		5295.292	18879.46	$4d^7D_2-4f^7F_{3,2,1}$
	10		5294.216	18883.30	$4d^7D_1-4f^7F_{2,1,0}$
	1		4652.816	21486.36	$5p^5P_1-7s^5S_2$
	2		4647.585	21510.55	$5p^5P_2-7s^5S_2$
	3		4639.150	21549.66	$5p^5P_3-7s^5S_2$
	5		4530.034	22068.72	$5p^7P_4-7s^7S_3$
	3		4510.210	22165.72	$5p^7P_3-7s^7S_3$
	2		4496.989	22230.89	$5p^7P_2-7s^7S_3$
	0		3804.476	26277.40	$4d^5D_0-5f^5F_1$
	0		3803.881	26281.51	$4d^5D_1-5f^5F_2$
	0		3802.958	26287.89	$4d^5D_2-5f^5F_3$
	3		3801.633	26297.05	$4d^5D_3-5f^5F_4$ blend?
	2		3800.240	26306.69	$4d^5D_4-5f^5F_5$
40	25	25	3497.536	28583.41	$3d^5D_1-4p^5P_2$
30	20	20	3496.814	28589.31	$3d^5D_2-4p^5P_3$
60	40	35	3495.831	28597.35	$3d^5D_0-4p^5P_1$
75	40	40	3488.676	28656.00	$3d^5D_1-4p^5P_1$
80	40	40	3482.905	28703.48	$3d^5D_2-4p^5P_2$
()	40	35	3474.124	28776.03	$3d^5D_2-4p^5P_1$
100					
()	50	50	3474.037	28776.75	$3d^5D_3-4p^5P_3$
	9		3466.336	28840.68	$4d^7D_5-5f^7F_{6,5,4}$
	8		3465.037	28851.41	$4d^7D_4-5f^7F_{5,4,3}$
	7		3464.043	28859.77	$4d^7D_3-5f^7F_{4,3,2}$
	6		3463.330	28865.71	$4d^7D_2-5f^7F_{3,2,1}$
	5		3462.878	28869.48	$4d^7D_1-5f^7F_{2,1,0}$
100	75	75	3460.312	28890.88	$3d^5D_3-4p^5P_2$
()					
	8	10	3460.039	28893.16	$4s^5S_2-4p^7P_2$
150	100	100	3441.983	29044.73	$3d^5D_4-4p^5P_3$
10	20	15	3438.978	29070.10	$4s^5S_2-4p^7P_3$
	0		3136.315	31875.35	$4d^5D_2-6f^5F_3$
	0		3135.507	31883.56	$4d^5D_3-6f^5F_4$
	1		3134.819	31890.56	$4d^5D_4-6f^5F_5$
4u	30	1	3046.266	32817.55	$4p^5P_1-5s^5S_2$
4u	40	1	3039.551	32890.06	$4p^5P_2-5s^5S_2$
4u	50	2	3029.041	33004.17	$4p^5P_3-5s^5S_2$
	1		2965.801	33707.89	$b^5D_3-x^5P_2$
	0		2963.633	33732.55	$b^5D_4-x^5P_3$
5	3	1	2961.694	33754.63	$a^5D_4-z^5F_5$
5	0	1	2958.944	33786.00	$a^5D_3-z^5F_4$, $a^5D_2-z^5F_1$
1	1	1?	2956.984	33808.39	$a^5D_1-z^5F_1$
4	0	0	2956.168	33817.73	$a^5D_2-z^5F_2$
2	0	0	2956.005	33819.59	$a^5D_3-z^5F_2$
1			2955.37	33826.9	$a^5D_0-z^5F_1$
6	3u	1	2955.110	33829.83	$a^5D_3-z^5F_3$ double?
0			2954.20	33840.2	$a^5D_1-z^5F_2$
3			2952.87	33855.5	$a^5D_4-z^5F_4$
200	75	75	2949.209	33897.52	$4s^5S_2-4p^5P_3$, $a^5D_4-z^5F_3$
150	60	60	2939.309	34011.68	$4s^5S_2-4p^5P_2$
1			2936.51	34044.1	$a^5D_3-z^5D_2$
1			2935.35	34057.6	$a^5D_1-z^5D_1$
3			2934.71	34065.0	$a^5D_1-z^5D_2$
1	0	0	2933.784	34075.73	$a^5D_0-z^5D_1$
100	50	50	2933.057	34084.18	$4s^5S_2-4p^5P_1$
1			2932.32	34092.6	$a^5D_1-z^5S_2$
5	1	1	2927.394	34150.11	$a^5D_2-z^5D_3$
4	0	0	2927.221	34152.13	$a^5D_3-z^5D_3$
	0		2923.630	34194.07	$z^5D_4-e^5G_5$
2	1		2921.320	34221.11	$a^5D_4-z^5D_3$ also ghost?
	4		2917.076	34270.90	$4d^7D_5-6f^7F_{6,5,4}$
	4		2916.155	34281.72	$4d^7D_4-6f^7F_{5,4,3}$
	3		2915.458	34289.91	$4d^7D_3-6f^7F_{4,3,2}$
	2		2914.956	34295.82	$4d^7D_2-6f^7F_{3,2,1}$
10	4	1	2902.902	34438.22	$a^5D_3-z^5D_4$
	1		2898.531	34490.15	$z^5D_3-e^5G_4$
15	10	2	2897.066	34507.59	$a^5D_4-z^5D_4$
	0		2889.424	34598.85	$z^5D_2-e^5G_2$
	0		2889.311	34600.21	$z^5D_2-e^5G_3$
	2		2888.809	34606.22	$z^5D_1-e^5G_2$
	1		2871.679	34812.64	$z^5F_3-e^5G_4$
	0		2871.489	34814.95	$z^5F_3-e^5G_3$
	0		2870.665	34824.94	$z^5F_2-e^5G_3$
	4u		2868.887	34846.52	$z^5F_4-e^5G_5$ also Mn I
	0		2868.098	34856.10	$z^5F_4-e^5G_4$
1u	5		2862.410	34925.36	$z^5F_5-e^5G_6$
	1		2860.629	34947.11	$z^5F_5-e^5G_5$
2	1u		2821.840	35427.46	$a^5D_3-z^5P_3$
20	10	4	2816.329	35496.79	$a^5D_4-z^5P_3$
3	3	1	2811.438	35558.53	$a^5D_2-z^5P_2$
7	6	2	2811.290	35560.40	$a^5D_3-z^5P_2$
0	0		2809.661	35581.02	$a^5D_1-z^5P_2$
	5		2806.513	35620.93	$z^5H_7-e^5G_6$
3	3u	1	2805.207	35637.52	$a^5D_2-z^5P_1$
2	2u		2803.442	35659.95	$a^5D_1-z^5P_1$
	5		2797.580	35734.67	$z^5H_6-e^5G_5$
5u	50	2	2796.113	35753.42	$4p^7P_4-5s^7S_3$
	5		2789.306	35840.66	$z^5H_5-e^5G_4$
	6		2781.935	35935.62	$z^5H_4-e^5G_3$
5u	50	2	2775.654	36016.94	$4p^7P_3-5s^7S_3$, $z^5H_3-e^5G_2$
2	1u		2763.165	36179.71	$4p^5P_3-4p^7D_3$
2	2	1	2762.548	36187.80	$4p^5P_3-4d^7D_4$
5u	50	1	2762.090	36193.80	$4p^7P_2-5s^7S_3$
12	8	2	2724.461	36693.66	$a^5P_1-z^5F_1$
10	10	2	2722.097	36725.52	$a^5P_1-z^5F_2$, $a^5P_2-z^5F_1$
?	3	0	2720.013	36753.66	$a^5P_3-z^5F_4$
10	10	2	2719.739	36757.36	$a^5P_2-z^5F_2$
?	8	2	2719.018	36767.11	$a^5P_2-z^5F_3$ also Fe
8	4	1	2717.531	36787.23	$a^5P_3-z^5F_2$
8	8	1	2716.800	36797.12	$a^5P_3-z^5F_3$
15	8	4	2711.630	36867.28	$a^5G_2-z^5G_2$
()					
?	6	2	2711.568	36868.12	$a^5G_3-z^5G_2$
?	2	0	2710.392	36884.11	$a^5G_2-z^5G_3$
()					
18	8	4	2710.335	36884.89	$a^5G_3-z^5G_3$
9	8	3	2709.973	36889.82	$a^5G_4-z^5G_3$
5	4	1	2708.813	36905.61	$a^5G_3-z^5G_4$
20	20	5	2708.454	36910.52	$a^5G_4-z^5G_4$
	5		2707.915	36917.85	$z^5G_6-e^5G_6$
10	10	2	2707.546	36922.88	$a^5G_5-z^5G_4$
6	4	1	2706.639	36935.26	$a^5G_4-z^5G_5$
1	1		2706.094	36942.69	$a^5P_1-z^5D_1$
25	25	5	2705.734	36947.61	$a^5G_5-z^5G_5$
10	5	2	2705.561	36949.97	$a^5P_1-z^5D_2$
	4		2704.043	36970.70	$z^5G_5-e^5G_5$
15	7		2703.972	36971.68	$a^5G_6-z^5G_5$
1			2703.74	36974.6	$a^5P_2-z^5D_1$
?	2		2703.508	36978.03	$a^5P_1-z^5S_2$
()					
3	1	1	2703.455	36978.75	$a^5G_5-z^5G_6$
	1		2702.240	36995.48	$z^5G_4-e^5G_5$
30	20	8	2701.696	37002.83	$a^5G_6-z^5G_6$
	4		2701.528	37005.13	$z^5G_4-e^5G_4$
	0		2701.351	37007.55	$z^5G_4-e^5G_3$
12	12	4	2701.171	37010.02	$a^5P_2-z^5S_2$
10	10	4	2701.035	37011.88	$a^5P_3-z^5D_2$
	1		2700.011	37025.92	$z^5G_3-e^5G_4$
	2		2699.853	37028.09	$z^5G_3-e^5G_3$
8	5	2	2698.989	37039.94	$a^5P_3-z^5S_2$
	3		2698.729	37043.51	$z^5G_2-e^5G_2$
	0		2698.623	37044.96	$z^5G_2-e^5G_3$
5	8	3	2695.366	37089.72	$a^5P_2-z^5D_3$
15	10	4	2693.191	37119.67	$a^5P_3-z^5D_3$
	0		2680.776	37291.47	$a^5D_2-y^5F_1$
6	5	1	2679.165	37313.99	$a^5D_1-y^5F_1$
7	5	1	2677.853	37332.29	$a^5D_0-y^5F_1$
5	5	1	2674.990	37372.22	$a^5D_2-y^5F_2$
	0		2674.861	37374.03	$a^5D_3-y^5F_2$
12	6	2	2673.384	37394.68	$a^5D_1-y^5F_2$
20	20	5	2672.588	37405.81	$a^5P_3-z^5D_4$
12	6	3	2667.033	37483.72	$a^5D_2-y^5F_3$
?	2	1	2666.895	37485.66	$a^5D_3-y^5F_3$
	1		2662.764	37543.81	$4d^7D_5-7f^7F_{6,5,4}$
	0		2661.994	37554.67	$4d^7D_4-7f^7F_{5,4,3}$
	0		2661.420	37562.77	$4d^7D_3-7f^7F_{4,3,2}$
	0		2661.005	37568.62	$4d^7D_2-7f^7F_{3,2,1}$
10	6	2	2655.925	37640.48	$a^5D_3-y^5F_4$
1	2	0	2651.039	37709.85	$a^5D_4-y^5F_4$
20	7	4	2639.857	37869.58	$a^5D_4-y^5F_5$
20	20	5	2638.179	37893.66	$a^5G_2-z^5H_3$
()					
?	3	0	2638.127	37894.40	$a^5G_3-z^5H_3$
25	20	6	2632.358	37977.45	$a^5G_3-z^5H_4$
8	4	1	2632.016	37982.38	$a^5G_4-z^5H_4$
25	20	9	2625.607	38075.09	$a^5G_4-z^5H_5$
4	5	1	2624.768	38087.25	$a^5G_5-z^5H_5$

21-foot grating except those whose wave-lengths are followed by an asterisk. The latter were taken from plates photographed with the quartz prism instrument. All wave-lengths are air wave-lengths.

The lines below 2000A are given in Table IIB. The vacuum spectrographs were necessarily employed for this region, and only vacuum wave-lengths are recorded.

It is perhaps worth noting that the number of lines in this list which originate in levels near 114,000 wave numbers, and which occur in the neon but not in the helium Schuler tube pictures, illustrates the enhancements that are obtained by the use of different noble gases.

Conclusion

Although most of the strong lines have been classified, there remain many unidentified. Large numbers of these are undoubtedly due to triplet-triplet combinations. There are, however, striking omissions among the quintet terms, of which the most notable are the $3d^5(^4F)4s\ ^5F$ and its triad of odd terms, and the two remaining terms of $3d^4(^6D)4sp$.

A few of the triplet terms have been dis-

Table IIA.—*Continued.*

1	2	3	4	5	6
28	30	10	2618.144	38183.61	$a^5G_5-z^5H_6$
4	2*u*	1	2616.489	38207.76	$a^5G_6-z^5H_6$
30	30	10	2610.207	38299.71	$a^5G_6-z^5H_7$
75	30	30	2605.696	38366.01	$4s^7S_3-4p^7P_2$, $a^5P_2-z^5P_2$
15	4	3	2603.727	38395.02	$a^5P_3-z^5P_3$
3	3	2	2603.045	38405.08	$a^5D_2-y^5P_1$
5	2	1	2601.526	38427.50	$a^5D_1-y^5P_1$
4	1	0	2600.285	38445.85	$a^5D_0-y^5P_1$
6	1	1	2599.036	38464.32	$a^5D_2-y^5P_2$
15	6	3	2598.910	38466.18	$a^5P_1-z^5P_2$, $a^5D_3-y^5P_2$
2*u*			2597.56	38486.2	$a^5D_1-y^5P_2$
3			2596.76	38498.1	$a^5P_2-z^5P_2$
6	3	2	2594.736	38528.06	$a^5P_3-z^5P_2$
0	0		2594.404	38532.98	$a^5D_3-y^5P_3$
90	50	50	2593.731	38542.98	$4s^7S_3-4p^7P_3$, $a^5P_1-z^5P_1$
7	3	2	2591.432	38577.17	$a^5P_2-z^5P_1$
	3		2590.229	38594.05	$4p^5P_1-4d^5D_2$
5	4	1	2589.987	38598.70	$4p^5P_1-4d^5D_1$ blend?
	2		2589.824	38601.13	$4p^5P_1-4d^5D_0$
10	5	2	2589.729	38602.54	$a^5D_4-y^5P_3$
3*uu*	5	2	2585.889	38659.86	$4p^5P_2-4d^5D_3$
2*uu*	4	1	2585.440	38666.57	$4p^5P_2-4d^5D_2$
1*uu*	2	0	2585.130	38671.21	$4p^5P_2-4d^5D_1$
4*uu*	10	3	2578.813	38765.93	$4p^5P_3-4d^5D_4$
2*uu*	4	1	2578.280	38773.95	$4p^5P_3-4d^5D_3$
2*uu*	?		2577.84	38780.6	$4p^5P_3-4d^5D_2$
100	50	50	2576.113	38806.56	$4s^7S_3-4p^7P_4$
2	1		2566.035	38958.96	$a^5G_4-z^5F_5$
10	20	2	2565.219	38971.35	$a^5G_5-z^5F_5$
30	50	6	2563.641	38995.34	$a^5G_6-z^5F_5$
1	1		2559.737	39054.81	$a^5G_3-z^5F_4$
2	2		2559.676	39055.73	$a^5G_2-z^5F_1$
10	10	3	2559.413	39059.75	$a^5G_4-z^5F_4$
25	20	5	2558.607	39072.05	$a^5G_5-z^5F_4$
?	2		2557.595	39087.51	$a^5G_2-z^5F_2$
( )					
15	6	2	2557.540	39088.35	$a^5G_3-z^5F_2$
?	0		2556.942	39097.49	$a^5G_2-z^5F_3$
( )					
12	8	2	2556.893	39098.24	$a^5G_3-z^5F_3$
20	15	4	2556.571	39103.17	$a^5G_4-z^5F_3$
5	5	0	2553.263	39153.83	$a^5D_3-y^5D_4$
15	15	3	2548.752	39223.12	$a^5D_4-y^5D_4$
13	15	3	2543.461	39304.70	$a^5G_2-z^5D_1$
?	4		2542.984	39312.08	$a^5G_2-z^5D_2$
( )					
12	10	3	2542.928	39312.94	$a^5G_3-z^5D_2$
?	2		2541.168	39340.17	$a^5G_2-z^5S_2$
( )					
8	6	1	2541.115	39340.99	$a^5G_3-z^5S_2$
8	6	1	2538.047	39388.54	$a^5D_2-y^5D_3$
10	10	1	2537.926	39390.42	$a^5D_3-y^5D_3$
5	3		2535.980	39420.65	$a^5G_3-z^5D_3$
7	5		2535.660	39425.62	$a^5G_4-z^5D_3$
7	8	1	2534.223	39447.97	$a^5D_2-y^5D_2$
7	4	0	2534.102	39449.86	$a^5D_3-y^5D_2$
1	0*u*		2533.463	39459.79	$a^5D_4-y^5D_3$
7	5	0	2533.336	39461.80	$a^5D_2-y^5D_1$
8	6	0	2532.782	39470.42	$a^5D_1-y^5D_2$
4	1		2531.897	39484.21	$a^5D_1-y^5D_1$
5	3		2531.804	39485.67	$a^5D_1-y^5D_0$
7	4	0	2530.725	39502.50	$a^5D_0-y^5D_1$
1			2517.39	39711.9	$a^5G_4-z^5D_4$
4	2*u*		2516.600	39724.20	$a^5G_5-z^5D_4$
1*uu*	5		2479.346	40321.04	$z^5H_7-e^5H_7$
	1		2473.64*	40414.1	$z^5H_6-e^5H_5$
	3		2473.560	40415.35	$z^5H_6-e^5H_6$
	2		2467.753	40510.45	$z^5H_5-e^5H_5$
	2		2462.407	40598.39	$z^5H_4-e^5H_4$
	0		2462.12*	40603.1	$z^5H_4-e^5H_5$
2*uu*	10		2458.583	40661.52	$z^5H_7-e^5I_8$
	0		2457.885	40673.07	$z^5H_7-e^5I_7$
	1		2457.785	40674.74	$z^5H_3-e^5H_3$
1*uu*	8	0	2453.620	40743.76	$4p^7P_4-4d^7D_3$
3*uu*	15	1	2453.133	40751.85	$4p^7P_4-4d^7D_4$
7*uu*	25	2	2452.488	40762.57	$4p^7P_4-4d^7D_5$
	5		2452.323	40765.31	$z^5H_6-e^5I_7$
	0		2452.172	40767.72	$z^5H_6-e^5I_6$
	1		2446.592	40860.79	$z^5H_5-e^5I_5$
	6		2446.385	40864.25	$z^5H_5-e^5I_6$
	0		2441.475	40946.42	$z^5H_4-e^5I_4$
	5		2441.059	40953.40	$z^5H_4-e^5I_5$
3*uu*	10	0	2438.192	41001.56	$4p^7P_3-4d^7D_2$
4*uu*	15	1	2437.848	41007.34	$4p^7P_3-4d^7D_3$
5*uu*	20	1	2437.368	41015.42	$4p^7P_3-4d^7D_4$
1*uu*	5		2436.539	41029.37	$z^5H_3-e^5I_4$
4*uu*	10	1	2427.939	41174.69	$4p^7P_2-4d^7D_1$
4*uu*	8	1	2427.719	41178.42	$4p^7P_2-4d^7D_2$
3*uu*	7	1	2427.379	41184.18	$4p^7P_2-4d^7D_3$
	1		2419.81	41313.0	$a^5P_1-y^5P_1$
	1		2417.94	41344.9	$a^5P_2-y^5P_1$
2	4		2416.35	41372.2	$a^5P_1-y^5P_2$
1	2		2412.74	41434.1	$a^5P_3-y^5P_2$
3	4		2410.57	41471.1	$a^5P_2-y^5P_3$
0	1		2408.85	41501.0	$a^5P_3-y^5P_3$
	5		2402.071	41618.07	$z^5G_6-e^5H_7$
	1		2401.946	41620.23	$z^5G_6-e^5H_6$
	0		2400.211	41650.31	$z^5G_5-e^5H_5$
	4		2400.150	41651.37	$z^5G_5-e^5H_6$
	0		2399.050	41670.47	$z^5G_4-e^5H_4$
	3		2398.789	41675.00	$z^5G_4-e^5H_5$
	0		2398.23*	41684.7	$z^5G_3-e^5H_3$
	2		2397.866	41691.04	$z^5G_3-e^5H_4$
	2		2397.286	41701.13	$z^5G_2-e^5H_3$
3	4		2373.36	42121.5	$a^5P_3-y^5D_4$
2	1		2361.76	42328.4	$a^5P_2-y^5D_3$
1	2		2360.24*	42355.5	$a^5P_1-y^5D_2$
1	1		2360.10	42358.1	$a^5P_3-y^5D_3$
	2		2359.44*	42369.9	$a^5P_1-y^5D_1$
	0		2359.37*	42371.1	$a^5P_1-y^5D_0$
	0		2358.46	42387.6	$a^5P_2-y^5D_2$
	0		2357.65*	42402.1	$a^5P_2-y^5D_1$
	0		2356.78*	42417.7	$a^5P_3-y^5D_2$
	2		2348.82*	42561.5	$a^5G_2-y^5F_1$
	3		2344.32*	42643.2	$a^5G_3-y^5F_2$
	0		2338.21*	42754.6	$a^5G_3-y^5F_3$
	1*u*		2337.96*	42759.2	$a^5G_4-y^5F_3$ also Fe
	0		2329.50*	42914.5	$a^5G_4-y^5F_4$
	2		2328.83*	42926.9	$a^5G_5-y^5F_4$
	0		2320.20*	43086.4	$a^5G_5-y^5F_5$
	2		2318.89*	43110.8	$a^5G_6-y^5F_5$
	8		2305.010	43370.40	$4s^7S_3-4p^5P_3$
	3		2298.95	43484.6	$4s^7S_3-4p^5P_2$

TABLE IIB. *Classified lines below 2000A. Columns 1 and 2, intensities due to neon and helium Schuler tube, respectively. Column 3, wave-length in vacuum. Column 4, wave number. Column 5, designation.*

1	2	3	4	5
5	11	1960.358	51011.1	$b^5D_4-w^5F_4$
0	1	1955.060	51149.3	$b^5D_2-w^5F_1$
7	12	1954.855	51154.7	$b^5D_3-w_5F_3$
30	40	1953.233	51197.2	$b^5D_4-w^5F_5$
7	15	1950.919	51257.9	$b^5D_2-w^5F_2$
6	10	1948.277	51327.4	$b^5D_1-w^5F_1$
20	40	1947.945	51336.2	$b^5D_3-w^5F_4$
5	4	1946.919	51363.2	$b^5D_2-w^5P_1$
9	10	1946.335	51378.6	$b^5D_3-w^5P_2$
12	25	1945.150	51409.9	$b^5D_2-w^5F_3$
5	12	1944.794	51419.3	$b^5D_0-w^5F_1$
10	15	1944.168	51435.9	$b^5D_1-w^5F_2$
20	12	1942.645	51476.2	$b^5D_4-w^5P_3$
6	8	1940.191	51541.3	$b^5D_1-w^5P_1$
10	10	1936.717	51633.8	$b^5D_2-w^5P_2$,
				$b^5D_0-w^5P_1$
2		1934.790	51685.2	$3d^5D_0-z^5F_1$
1		1932.600	51743.8	$3d^5D_1-z^5F_1$
10	5	1931.408	51775.7	$3d^5D_1-z^5F_2$
8	7	1930.437	51801.7	$b^5D_3-w^5P_3$
1		1928.121	51864.0	$3d^5D_2-z^5F_1$
9	2	1926.939	51895.8	$3d^5D_2-z^5F_2$
15	10	1926.579	51905.5	$3d^5D_2-z^5F_3$
10	5	1925.506	51934.4	$3d^5D_0-z^5D_1$
10	5	1923.341	51992.9	$3d^5D_1-z^5D_1$
10	5	1923.060	52000.4	$3d^5D_1-z^5D_2$
5	2	1922.036	52028.2	$3d^5D_1-z^5S_2$
25	15	1921.245	52049.6	$3d^5D_3-z^5F_4$
2		1920.959	52057.3	$b^5D_2-w^5P_3$
3	−1	1920.018	52082.8	$3d^5D_3-z^5F_2$
7	8	1919.639	52093.1	$3d^5D_3-z^5F_3$
2		1918.908	52113.0	$3d^5D_2-z^5D_1$
6	5	1918.637	52120.3	$3d^5D_2-z^5D_2$
4		1917.599	52148.5	$3d^5D_2-z^5S_2$
30	20	1915.095	52216.7	$3d^5D_4-z^5F_5$
12	5	1914.677	52228.1	$3d^5D_2-z^5D_3$
12	10	1911.395	52317.8	$3d^5D_4-z^5F_4$
5	0	1909.830	52360.7	$3d^5D_4-z^5F_3$
8	2	1907.839	52415.3	$3d^5D_3-z^5D_3$
1		1898.134	52683.3	$3d^5D_4-z^5D_3$
5	0	1897.464	52701.9	$3d^5D_3-z^5D_4$
2		1869.042	53503.3	$3d^5D_2-z^5P_3$
4	1	1868.588	53516.3	$3d^5D_1-z^5P_2$
0		1868.312	53524.2	$b^5D_4-v^5F_4$
5	2	1867.872	53536.8	$3d^5D_0-z^5P_1$
10	8	1865.831	53595.4	$3d^5D_1-z^5P_1$
12	8	1865.547	53603.6	$b^5D_3-v^5P_2$
8	5	1865.296	53610.8	$b^5D_2-v^5P_1$
15	10	1864.617	53630.3	$b^5D_4-v^5F_5$
10	8	1864.403	53636.5	$3d^5D_2-z^5P_2$
20	15	1862.816	53682.2	$b^5D_4-v^5P_3$
10	6	1862.518	53690.7	$3d^5D_3-z^5P_3$
10	8	1861.663	53715.4	$3d^5D_2-z^5P_1$
3	0	1860.425	53751.1	$b^5D_3-v^5F_3$
8	8	1859.444	53779.5	$b^5D_4-w^5D_3$
10	8	1859.119	53788.9	$b^5D_1-v^5P_1$
20	12	1857.918	53823.7	$3d^5D_3-z^5P_2$
10	10	1857.018	53849.8	$b^5D_3-v^5F_4$
12	10	1856.700	53859.0	$v^5D_2\ -v^5P_2$
9	5	1855.942	53881.0	$b^5D_0-v^5P_1$
20	12	1854.902	53911.2	$b^5D_4-w^5D_4$
3		1854.268	53929.6	$b^5D_2-v^5F_2$
25	20	1853.271	53958.6	$3d^5D_4-z^5P_3$
10	10	1852.810	53972.1	$b^5D_3-w^5D_2$
15	12	1851.597	54007.4	$b^5D_3-v^5P_3$,
				$b^5D_2-v^5F_3$
5	8	1850.602	54036.5	$b^5D_1-v^5P_2$
3	0	1849.937	54055.9	$b^5D_1-v^5F_1$
20	15	1848.266	54104.8	$b^5D_3-w^5D_3$
10	8	1848.161	54107.8	$b^5D_1-v^5F_2$
10	10	1847.780	54119.0	$b^5D_2-w^5D_1$
4	2	1846.790	54148.0	$b^5D_0-v^5F_1$
5	( )	1844.080	54227.6	$b^5D_2-w^5D_2$
	15			
6	( )	1844.027	54229.1	$b^5D_1-w^5D_0$
1		1843.784	54236.3	$b^5D_3-w^5D_4$
5	2	1842.871	54263.1	$b^5D_2-v^5P_3$
3		1841.718	54297.1	$b^5D_1-w^5D_1$
5	1	1839.595	54359.8	$b^5D_2-w^5D_3$
3	2	1838.607	54389.0	$b^5D_0-w^5D_1$
4	2	1838.050	54405.5	$b^5D_1-w^5D_2$
25	6	1834.572	54508.6	$b^5D_4-v^5D_3$
20	4	1828.250	54697.1	$b^5D_3-v_5D_2$
50	15	1827.078	54732.2	$b^5D_4-v^5D_4$
30	8	1823.697	54833.7	$b^5D_3-v^5D_3$
8	5	1823.049	54853.2	$4p^5P_1-6s^5S_2$
10	2	1822.212	54878.3	$b^5D_2-v^5D_1$
9	8	1820.648	54925.5	$4p^5P_2-6s^5S_2$
9	0	1819.751	54952.6	$b^5D_2-v^5D_2$
6	2	1817.493	55020.8	$b^5D_1-v^5D_0$
10	10	1816.866	55039.8	$4p^5P_3-6s^5S_2$
20	7	1816.287	55057.4	$b^5D_3-v^5D_4$,
				$b^5D_1-v^5D_1$
20	6	1815.243	55089.0	$b^5D_2-v^5D_3$
15	6	1813.863	55130.8	$b^5D_1-v^5D_2$
10	0	1813.287	55148.5	$b^5D_0-v^5D_1$
−1		1811.904	55190.7	$3d^5D_0-y^5F_1$
−1		1809.983	55249.1	$3d^5D_1-y^5F_1$
0		1807.347	55329.7	$3d^5D_1-y^5F_2$
−1		1804.446	55418.7	$b^5D_4-u^5F_3$
8		1803.023	55462.4	$b^5D_4-u^5F_4$
( )				
12		1802.979	55463.8	$b^5D_4-u^5F_5$
50	10	1801.272	55516.3	$b^5D_4-u^5P_3$
2	5	1799.792	55561.9	$3d^5D_2-y^5F_3$
4		1793.903	55744.4	$b^5D_3-u^5F_3$
0		1793.755	55749.0	$3d^5D_3-y^5F_3$
3		1792.519	55787.4	$b^5D_3-u^5F_4$
25	4	1791.884	55807.2	$b^5D_3-u^5P_2$
20		1790.788	55841.3	$b^5D_3-u^5P_3$
1		1788.783	55903.9	$3d^5D_3-y^5F_4$
2		1787.477	55944.8	$b^5D_2-u^5F_2$
	1	1786.322	55980.9	$a^5D_2-x^5P_1$
1		1785.733	55999.4	$b^5D_2-u^5F_3$
−1	1	1785.026	56021.6	$a^5D_0-x^5P_1$
15		1784.245	56046.1	$b^5D_3-u^5P_1$
20	−1	1783.718	56062.7	$b^5D_2-u^5P_2$
0		1783.184	56079.5	$b^5D_1-u^5F_1$
5		1782.626	56097.0	$b^5D_3-u^5P_3$
0		1781.816	56122.5	$b^5D_1-u^5F_2$
−1		1780.248	56171.9	$3d^5D_4-y^5F_4$
	12	1778.686	56221.3	$a^5D_3-x^5P_2$,
				$a^5D_2-x^5P_2$
20		1778.595	56224.1	$a^5D_1-u^5P_1$
6		1778.090	56240.1	$a^5D_1-u^5P_2$
	0	1778.024	56242.2	$a^5D_1-x^5P_2$
3		1776.057	56304.5	$3d^5D_0-y^5P_1$
6		1775.693	56316.0	$a^5D_0-u^5P_1$
2		1775.194	56331.9	$3d^5D_4-y^5F_5$
5	0	1774.202	56363.4	$3d^5D_1-y^5P_1$
5		1772.349	56422.3	$3d^5D_1-y^5P_2$
1		1770.441	56483.1	$3d^5D_2-y^5P_1$
7	1	1768.591	56542.2	$3d^5D_2-y^5P_2$
1	7	1767.665	56571.8	$a^5D_3-x^5P_3$
5		1766.498	56609.2	$3d^5D_2-y^5P_3$
3	10	1765.495	56641.3	$a^5D_4-x^5P_3$
1		1762.754	56729.4	$3d^5D_3-y^5P_2$
10		1760.680	56796.2	$3d^5D_3-y^5P_3$
−1		1755.073	56977.7	$a^5P_2-5p^5P_3$
−1		1754.847	56985.0	$a^5P_1-5p^5P_2$
1		1754.136	57008.1	$a^5P_3-5p^5P_3$
−1		1752.932	57047.3	$a^5P_3-5p^5P_2$
0		1752.412	57064.2	$3d^5D_4-y^5P_3$
6	( )	1750.202	57136.3	$4p^5P_1-5d^5D_2$
	5u			
8	( )	1750.115	57139.1	$4p^5P_1-5d^5D_{1,\ 0}$
12	6	1748.137	57203.7	$4p^5P_2-5d^5D_3$
10	5	1748.000	57208.2	$4p^5P_2-5d^5D_2$
3		174791.9	57210.9	$4p^5P_2-5d^5D_1$
15	10	1744.836	57312.0	$4p^5P_3-5d^5D_4$
5	3	1744.659	57317.8	$4p^5P_3-5d^5D_3$
2		1744.537	57321.8	$4p^5P_3-5d^5D_2$
4	0	1743.349	57360.9	$3d^5D_0-y^5D_1$
6		1741.983	57405.8	$3d^5D_1-y^5D_2$
5		1741.651	57416.8	$3d^5D_3-y^5D_4$
4		1741.535	57420.6	$3d^5D_1-y^5D_{1,\ 0}$
6	3	1740.155	57466.1	$3d^5D_2-y^5D_3$
4	1	1738.349	57525.8	$3d^5D_2-y^5D_2$
5	2	1737.930	57539.7	$3d^5D_2-y^5D_1$
12	7	1734.491	57653.8	$3d^5D_3-y^5D_3$
15	10	1733.556	57684.9	$3d^5D_4-y^5D_4$
6	5	1732.707	57713.2	$3d^5D_3-y^5D_2$
5	3	1726.481	57921.3	$3d^5D_4-y^5D_3$
3		1725.621	57950.1	$b^5D_3-t^5F_4$
15	2	1725.295	57961.1	$b^5D_4-t^5F_5$
8		1716.138	58270.4	$b^5D_3-t^5F_3$
12	0	1715.984	58275.6	$b^5D_3-t^5F_4$
20		1714.403	58329.3	$b^5D_4-6f^5F_{5,\ 4,\ 3}$
6	0	1708.652	58525.7	$b^5D_2-t^5F_3$
4		1708.553	58529.0	$b^5D_2-t^5F_2$
15	0	1704.866	58655.6	$b^5D_3-6f^5F_{4,\ 3,\ 2}$
5		1703.366	58707.3	$b^5D_1-t^5F_2$
3		1700.692	58799.6	$b^5D_0-t^5F_1$
4	2	1700.355	58811.2	$4s^5S_2-z^5P_3$
	2	1698.132	58888.2	$a^5P_1-x^5P_1$
12		1697.526	58909.2	$b^5D_2-6f^5F_{3,\ 2,\ 1}$
15	20	1697.181	58921.2	$4p^5P_4-6s^5S_3$,
				$a^5P_2-x^5P_1$
4	1	1696.516	58944.3	$4s^5S_2-z^5P_2$
3		1694.252	59023.1	$4s^5S_2-z^5P_1$
10		1692.457	59085.7	$b^5D_1-6f^5F_{2,\ 1}$
0	8	1691.246	59128.0	$a^5P_1-x^5P_2$
4		1689.845	59177.0	$b^5D_0-6f^5F_1$
15	15	1689.614	59185.1	$4p^7P_3-6s^7S_3$
1	15	1689.489	59189.5	$a^5P_3-x^5P_2$
10	10	1684.576	59362.1	$4p^7P_2-6s^7S_3$
0	10	1680.401	59509.6	$a^5P_2-x^5P_3$
2	15	1679.564	59539.3	$a^5P_3-x^5P_3$
6	?	1636.964	61088.7	$4p^7P_4-5d^7D_3$
	( )			
15	?	1636.869	61092.2	$4p^7P_4-5d^7D_4$
	( )			
25	40	1636.751	61096.6	$4p^7P_4-5d^7D_5$
7	?	1630.004	61349.5	$4p^7P_3-5d^7D_2$
	( )			
10	?	1629.940	61351.9	$4p^7P_3-5d^7D_3$
	( )			
20	30	1629.845	61355.5	$4p^7P_3-5d^7D_4$
20	( )	1625.353	61525.1	$4p^7P_2-5d^7D_{2,\ 1}$
	20			
10	( )	1625.278	61527.9	$4p^7P_2-5d^7D_3$
1		1618.366	61790.7	$4s^5S_2-y^5P_1$
1		1616.806	61850.3	$4s^5S_2-y^5P_2$
1		1615.046	61917.7	$4s^5S_2-y^5P_3$
4		1541.059	64890.4	$4p^5P_1-7s^5S_2$
5		1539.335	64963.1	$4p^5P_2-7s^5S_2$
7	1	1536.632	65077.4	$4p^5P_3-7s^5S_2$
25	4	1442.594	69319.6	$4p^7P_4-7s^7S_3$
15	1	1437.126	69583.3	$4p^7P_3-7s^7S_3$
15	1	1433.481	69760.2	$4p^7P_2-7s^7S_3$
5		1421.713	70337.7	$4p^5P_1-8s^5S_2$
8		1420.239	70410.7	$4p^5P_2-8s^5S_2$
40	6	1419.612	70441.8	$4p^7P_4-6d^7D_{5,\ 4,\ 3}$
10		1417.945	70524.6	$4p^5P_3-8s^5S_2$
30	6	1414.398	70701.4	$4p^7P_3-6d^7D_{4,\ 3,\ 2}$
25	5	1410.910	70876.2	$4p^7P_2-6d^7D_{3,\ 2,\ 1}$
2		1400.659	71394.9	$4p^5P_1-7d^5D_2$
3		1400.568	71399.6	$4p^5P_1-7d^5D_1$
2		1400.538	71401.1	$4p^5P_1-7d^5D_0$
4		1399.395	71459.4	$4p^5P_2-7d^5D_3$
3		1399.244	71467.2	$4p^5P_2-7d^5D_2$
2		1399.153	71471.8	$4p^5P_2-7d^5D_1$
6	2	1397.394	71561.8	$4p^5P_3-7d^5D_4$
3		1397.170	71573.3	$4p^5P_3-7d^5D_3$
2	3	1388.877	72000.6	$3d^5D_0-5p^5P_1$
2	3	1388.206	72035.4	$3d^5D_1-5p^5P_2$
3	5	1387.749	72059.1	$3d^5D_1-5p^5P_1$
10	7	1385.892	72155.7	$3d^5D_2-5p^5P_2$
4	4	1385.431	72179.7	$3d^5D_2-5p^5P_1$
4	6	1383.049	72304.0	$3d^5D_3-5p^5P_3$
10	10	1382.298	72343.3	$3d^5D_3-5p^5P_2$
15	12	1377.938	72572.2	$3d^5D_4-5p^5P_3$
	0	1360.236	73516.7	$a^5D_2-w^5F_2$
	2	1359.861	73536.9	$a^5D_1-w^5F_2$
1	0	1358.323	73620.2	$a^5D_2-w^5P_1$
1	0	1357.915	73642.3	$a^5D_1-w^5P_1$
	5	1357.451	73667.5	$a^5D_3-w^5F_3$,
				$a^5D_2-w^5F_3$
	5	1354.084	73850.7	$a^5D_3-w^5F_4$
6	5	1553.326	73892.0	$a^5D_3-w^5P_2$,
				$a^5D_3-w^5P_2$
1	0	1352.828	73919.2	$a^5D_4-w^5F_4$
2	5	1349.408	74106.6	$a^5D_4-w^5F_5$
	2	1345.619	74315.2	$a^5D_3-w^5P_2$,
				$a^5D_2-w^5P_2$
5	6	1344.352	74385.3	$a^5D_4-w^5P_3$
25		1335.271	74891.2	$4p^7P_4-8s^7S_3$
12		1330.606	75153.7	$4p^7P_3-8s^7S_3$
12		1327.476	75330.9	$4p^7P_2-8s^7S_3$
15		1323.784	75541.0	$4p^7P_4-7d^7D_{5,\ 4,\ 3}$
10		1319.209	75803.0	$4p^7P_3-7d^7D_{4,\ 3,\ 2}$
3	1	1318.086	75867.6	$a^5D_2-v^5P_1$
4	2	1317.703	75889.6	$a^5D_1-v^5P_1$
3	0	1317.392	75907.5	$a^5D_0-v^5P_1$
9		1316.161	75978.5	$4p^7P_2-7d^7D_{3,\ 2,\ 1}$
10	10	1313.766	76117.0	$a^5D_3-v^5P_2$,
				$a^5D_2-v^5P_2$
2	0	1313.407	76137.9	$a^5D_1-v^5P_2$
1		1309.293	76377.1	$a^5D_2-w^5D_1$
1		1307.409	76487.1	$a^5D_3-w^5D_2$
10	6	1306.814	76522.0	$a^5D_3-v^5P_3$
5	4	1306.168	76559.8	$a^5P_2-w^5P_1$
15	12	1305.628	76591.5	$a^5D_4-v^5P_3$
1		1302.117	76798.0	$a^5P_1-w^5P_2$
3	4	1301.061	76860.3	$a^5P_3-w^5P_2$
5		1296.669	77120.7	$a^5D_1-v^5D_0$
6	1	1296.429	77134.9	$a^5D_2-v^5D_1$
3		1296.031	77158.6	$a^5D_1-v^5D_1$
6	1	1295.736	77176.2	$a^5D_0-v^5D_1$

TABLE IIB.—*Continued.*

1	2	3	4	5
10	3	1295.150	77211.1	$a^5D_3-v^5D_2$, $a^5D_2-v^5D_2$
10	2	1294.803	77231.8	$a^5D_1-v^5D_2$
2	2	1294.437	77253.7	$a^5P_2-w^5P_3$
1	0	1293.932	77283.8	$a^5P_3-w^5P_3$
15	7	1292.877	77346.9	$a^5D_3-v^5D_3$, $a^5D_2-v^5D_3$
10	() 15	1291.702	77417.2	$a^5D_4-v^5D_3$
10	()	1291.584	77424.3	$4s^5S_2-5p^5P_3$
10	5	1290.926	77463.8	$4s^5S_2-5p^5P_2$
8	2	1290.524	77487.9	$4s^5S_2-5p^5P_1$
15	4	1289.132	77571.6	$a^5D_3-v^5D_4$
15	6	1287.978	77641.1	$a^5D_4-v^5D_4$
2		1279.443	78159.0	$a^5D_2-u^5F_1$
10		1279.089	78180.6	$a^5D_1-u^5F_1$
15	1	1278.749	78201.4	$a^5D_2-u^5F_2$
10	0	1278.369	78224.7	$4p^7P_4-9s^7S_3$, $a^5D_1-u^5P_1$
20	4	1277.817	78258.5	$a^5D_3-u^5F_3$, $a^5D_2-u^5F_3$
20	4	1277.119	78301.2	$a^5D_2-u^5P_1$, $a^5D_3-u^5F_4$
10		1276.772	78322.5	$a^5D_3-u^5P_2$, $a^5D_2-u^5P_2$
8		1276.450	78342.3	$a^5D_1-u^5P_2$, $a^5D_0-u^5P_1$
20		1276.238	78355.3	$a^5D_3-u^5P_3$, $a^5D_2-u^5P_3$
40	7	1275.973	78371.6	$a^5D_4-u^5F_5$, $a^5D_4-u^5F_4$
20		1275.102	78425.1	$a^5D_4-u^5P_3$
2		1274.077	78488.2	$4p^7P_3-9s^7S_3$
2		1271.217	78664.8	$4p^7P_2-9s^7S_3$
5	1	1269.417	78776.3	$a^5P_1-v^5P_1$
10	5	1268.905	78808.1	$a^5P_2-v^5P_1$
10	4	1265.383	79027.4	$a^5P_1-v^5P_2$ blend
12	6	1264.447	79085.9	$a^5P_3-v^5P_2$
1		1263.794	79126.8	$a^5P_2-v^5F_2$
4		1262.566	79203.8	$a^5P_2-v^5F_3$
4	0	1262.353	79217.1	$a^5P_1-w^5D_0$
8	2	1261.282	79284.4	$a^5P_1-w^5D_1$
1	0	1260.768	79316.7	$a^5P_2-w^5D_1$
1		1260.523	79332.1	$a^5P_3-v^5F_4$
6	6	1259.967	79367.1	$4s^5S_2-x^5P_2$
8	1	1259.561	79392.7	$a^5P_1-w^5D_2$
12	1	1259.049	79425.0	$a^5P_2-w^5D_2$
15	5	1258.513	79458.8	$a^5P_2-v^5P_3$
15	3	1258.028	79489.5	$a^5P_3-v^5P_3$
10	2	1256.957	79557.2	$a^5P_2-w^5D_3$
8	2	1256.474	79587.8	$a^5P_3-w^5D_3$
6	7	1256.175	79606.7	$4s^5S_2-x^5P_2$
15	6	1254.407	79718.9	$a^5P_3-w^5D_4$
7	10	1250.681	79956.4	$4s^5S_2-x^5P_3$
6		1249.315	80043.9	$a^5P_1-v^5D_1$
4		1248.827	80075.1	$a^5P_2-v^5D_1$
5		1248.149	80118.6	$a^5P_1-v^5D_2$
15		1247.659	80150.1	$a^5P_2-v^5D_2$
15		1245.551	80285.7	$a^5P_2-v^5D_3$
0		1244.105	80379.1	$4p^7P_4-10s^7S_3$
10		1241.626	80539.5	$a^5P_3-v^5D_4$
0		1240.037	80642.7	$4p^7P_3-10s^7S_3$
1		1237.784	80789.5	$a^5D_3-t^5F_4$
20		1236.873	80849.0	$a^5G_3-5f^5F_2$, $a^5G_2-5f^5F_1$

1	2	3	4	5
20		1236.770	80855.8	$a^5G_4-5f^5F_3$
15		1236.545	80870.5	$a^5G_5-5f^5F_4$, $a^5D_4-t^5F_5$
25	3	1236.148	80896.5	$a^5G_2-v^5G_2$, $a^5G_6-5f^5F_5$
25	4	1235.869	80914.7	$a^5G_3-v^5G_3$
10		1235.793	80919.7	$a^5G_4-v^5G_3$
25		1235.463	80941.3	$a^5G_4-v^5G_4$
10	0	1235.273	80953.8	$a^5G_3-v^5G_4$
8	−2	1235.060	80967.7	$a^5G_4-v^5G_5$
25	5	1234.871	80980.1	$a^5G_5-v^5G_5$
8	−1	1234.507	81004.0	$a^5G_6-v^5G_5$
5		1234.301	81017.5	$a^5G_5-v^5G_6$
30	5	1233.952	81040.4	$a^5G_6-v^5G_6$
5		1231.346	81211.9	$a^5P_1-u^5P_1$
8		1231.101	81228.1	$a^5P_1-u^5P_2$
10		1230.873	81243.1	$a^5P_2-u^5P_1$
1		1230.622	81259.7	$a^5P_2-u^5P_2$
1		1230.457	81270.6	$a^5P_3-u^5F_4$
15		1230.152	81290.8	$a^5P_3-u^5P_2$
20		1230.106	81293.8	$a^5P_2-u^5P_3$
25		1229.653	81323.7	$a^5P_3-u^5P_3$
20	3	1228.423	81405.2	$a^5G_2-v^5F_1$
23	3	1227.638	81457.2	$a^5G_3-v^5F_2$
25	4	1226.396	81539.7	$a^5G_4-v^5F_3$
6	0	1224.928	81637.4	$a^5G_4-v^5F_4$
28	5	1224.733	81650.4	$a^5G_5-v^5F_4$
8	0	1223.152	81756.0	$a^5G_5-v^5F_5$
30	6	1222.785	81780.5	$a^5G_6-v^5F_5$
20		1205.423	82958.4	$a^5G_2-v^5H_3$
25		1204.619	83013.8	$a^5G_3-v^5H_4$
30		1203.252	83108.2	$a^5G_4-v^5H_5$
8		1203.068	83120.8	$a^5G_5-v^5H_5$
40		1201.570	83224.4	$a^5G_5-v^5H_6$
5		1201.233	83247.8	$a^5G_6-v^5H_6$
20	10	1201.124	83255.3	$4s^7S_3-z^7P_2$
25	11	1199.388	83375.9	$4s^7S_3-z^7P_3$
40		1199.341	83379.1	$a^5G_6-v^5H_7$
10		1198.630	83428.6	$a^5G_2-u^5F_1$
10		1197.996	83472.7	$a^5G_3-u_5F_2$
10		1197.565	83502.8	$3d^5D_0-4f^5F_1$
40	13	1197.172	83530.2	$4s^7S_3-z^7P_4$
25	6	1196.724	83561.4	$3d^5D_1-4f^5F_2$
20		1196.517	83575.9	$a^5G_4-u^5F_4$
25		1196.333	83588.8	$a^5G_5-u^5F_{5,4}$
30		1195.973	83613.9	$a^5G_6-u^5F_5$
30	8	1194.998	83682.1	$3d^5D_2-4f^5F_3$
40	10	1192.313	83870.6	$3d^5D_3-4f^5F_4$
50	12	1188.502	84139.5	$3d^5D_4-4f^5F_5$
1		1180.693	84696.0	$a^5D_4-t^5F_5$
15		1168.254	85597.8	$a^5G_4-u^5G_4$
5		1168.069	85611.4	$a^5G_5-u^5G_4$
9		1167.306	85667.3	$a^5G_4-u^5G_5$
20		1167.130	85680.2	$a^5G_5-u^5G_5$
8		1166.810	85703.7	$a^5G_6-u^5G_5$
10		1166.157	85751.7	$a^5G_5-u^5G_6$
25		1165.823	85776.3	$a^5G_6-u^5G_6$
30	12	1164.211	85895.1	$4s^7S_3-5p^7P_2$
40	14	1163.324	85960.6	$4s^7S_3-5p^7P_3$
50	16	1162.017	86057.3	$4s^7S_3-5p^7P_4$, $a^5G_4-t^5F_3$
20		1161.764	86076.0	$a^5G_5-t^5F_4$
3		1161.612	86087.3	$a^5G_5-t^5F_5$
20	0	1161.295	86110.8	$a^5G_6-t^5F_5$
20		1156.919	86436.5	$a^5G_3-6f^5F_2$
20		1156.834	86442.8	$a^5G_4-6f^5F_3$

1	2	3	4	5
25		1156.658	86456.0	$a^5G_5-6f^5F_4$
30		1156.345	86479.4	$a^5G_6-6f^5F_5$
6		1116.374	89575.7	$a^5G_2-s^5F_1$
6		1115.529	89643.6	$a^5G_3-s^5F_2$
0		1114.500	89726.3	$a^5G_3-s^5F_3$
8		1114.437	89731.4	$a^5G_4-s^5F_3$
0		1113.389	89815.9	$a^5G_4-s^5F_4$
9		1113.232	89828.5	$a^5G_5-s^5F_4$
0		1112.195	89912.3	$a^5G_5-s^5F_5$
10		1111.898	89936.3	$a^5G_6-s^5F_5$
−1		1093.218	91473.1	$3d^5D_1-w^5F_2$
1		1089.981	91744.7	$3d^5D_2-w^5F_3$
2		1085.619	92113.3	$3d^5D_3-w^5F_4$
5	2	1080.288	92567.9	$3d^5D_4-w^5F_5$
3		1077.017	92849.0	$3d^5D_4-w^5P_3$
10		1069.775	93477.6	$3d^5D_0-5f^5F_1$
20	1	1069.110	93535.7	$3d^5D_1-5f^5F_2$
23	3	1067.729	93656.7	$3d^5D_2-5f^5F_3$
25	4	1065.564	93847.0	$3d^5D_3-5f^5F_4$
1		1063.430	94035.3	$3d^5D_0-v^5F_1$
30		1062.507	94117.0	$3d^5D_4-5f^5F_5$
1		1061.640	94193.9	$3d^5D_2-v^5P_2$
1		1059.980	94341.4	$3d^5D_2-v^5F_3$
1		1059.530	94381.5	$3d^5D_3-v^5P_2$
4		1056.802	94625.1	$3d^5D_3-v^5F_4$
5		1052.599	95002.9	$3d^5D_4-v^5F_5$
5		1052.037	95053.7	$3d^5D_4-v^5P_3$
2u		1050.782	95167.2	$3d^5D_1-v^5D_2$
4		1047.952	95424.2	$3d^5D_2-v^5D_3$
1		1047.401	95474.4	$3d^5D_3-v^5D_2$
4		1045.887	95612.6	$3d^6D_3-v^5D_3$
3		1043.456	95835.4	$3d^5D_3-v^5D_4$
3		1042.979	95879.2	$3d^5D_4-v^5D_3$
8		1040.538	96104.1	$3d^5D_4-v^5D_4$
2		1032.687	96834.8	$3d^5D_4-u^5F_5$
10	5	1030.866	97005.8	$4s^5S_2-w^5P_1$
18	4	1027.995	97276.7	$4s^5S_2-w^5P_2$
20	10	1023.546	97699.6	$4s^5S_2-w^5P_3$
0u		1013.349	98682.7	$3d^5D_0-t^5F_1$
4		1012.713	98744.6	$3d^5D_1-t^5F_2$
5		1011.506	98862.5	$3d^5D_2-t^5F_3$
6		1009.562	99052.8	$3d^5D_3-t^5F_4$
10		1009.448	99064.1	$3d^5D_0-6f^5F_1$
12		1008.848	99123.0	$3d^5D_1-6f^5F_2$
15		1007.612	99244.5	$3d^5D_2-6f^5F_3$
15	5	1007.530	99252.6	$4s^5S_2-v^5P_1$
7		1006.721	99332.4	$3d^5D_4-t^5F_5$
22		1005.702	99433.0	$3d^5D_3-6f^5F_4$
20	4	1005.019	99500.6	$4s^5S_2-v^5P_2$
22		1003.000	99700.9	$3d^5D_4-6f^5F_5$
25	6	1000.956	99904.5	$4s^5S_2-v^5P_3$
15		983.403	101687.7	$4s^5S_2-u^5P_1$
20		983.240	101704.5	$4s^5S_2-u^5P_2$
25		982.901	101739.6	$4s^5S_2-u^5P_3$
0		978.703	102176.0	$3d^5D_0-7f^5F_1$
5		978.115	102237.5	$3d^5D_1-7f^5F_2$
7		976.964	102357.9	$3d^5D_2-7f^5F_3$
8		975.189	102544.2	$3d^5D_3-7f^5F_4$
10		972.547	102822.8	$3d^5D_4-7f^5F_5$
−1		957.205	104470.8	$3d^5D_2-8f^5F_3$
0		955.481	104659.3	$3d^5D_3-8f^5F_4$
1		953.039	104927.5	$3d^5D_4-8f^5F_5$

covered, but inasmuch as they represent a mere fragment of the system and have not as yet been connected by intersystem lines to the normal state, it was thought best not to include them in this report.

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