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The First Spark Spectrum of Copper

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VII—The First Spark Spectrum of Copper

By A. G. Shenstone

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The fundamental multiplets of the copper spark spectrum were first described in 1927.* They consist of the combinations between a low $^{3\,\&\,1}$D, a middle set of terms $^{3\,\&\,1}$P, D, F, and a high $^{3\,\&\,1}$D. That partial analysis revealed that the theory of series limits in complex spectra as given by Hund† was certainly not applicable in spectra of the type of Cu II and might indeed be quite erroneous. Since the lack of an adequate vacuum spectrograph at Princeton prevented further progress in the analysis, Professor Gibbs and Mr. Kruger at Cornell undertook the problem and were successful in adding two more $^{3\,\&\,1}$D terms to the series.‡ Those terms quite definitely proved the inapplicability of the original Hund theory of limits, which had in the meantime been changed rather radically to correspond to the observations in this and other spectra. It does not, in its present form, pretend to predict limits except in the simpler cases.§

In addition to the terms mentioned above, Kruger identified a number of high odd terms, some of which have proved real, but only one correctly named. Other additions have been made by Lang, who discovered the predicted low ^{1}S term,‖ and by Menzies who added a number of even levels.¶ The present paper is an extension of that previous work and gives a practically complete description of the spectrum, including the identification of terms arising from every type of electron configuration that can be expected to occur. It has involved a very large amount of labour over a number of years.

Apparatus and Observations

It is futile to endeavour to obtain the complete spectrum of a once ionized metal atom by means of a spark discharge. The low multiplets appear in such a source with great intensity, and some important higher ones appear as diffuse lines, but the remaining multiplets are either not excited at all, or else are so diffuse as to be

* Shenstone, 'Phys. Rev.,' vol. 29, p. 380 (1927).
† "Linienspektra" (Springer, 1927).
‡ Kruger, 'Phys. Rev.,' vol. 34, p. 1122 (1929).
§ Hund, 'Z. Physik,' vol. 52, p. 601 (1929).
‖ 'Phys. Rev.,' vol. 31, p. 773 (1928).
¶ 'Proc. Roy. Soc.,' A, vol. 119, p. 249 (1928).

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indistinguishable from the background—which amounts to the same thing. The negative pole of an arc is much more suitable as a source of spark lines, and it was first used in the present work with sufficient effectiveness to reveal several new groups of diffuse lines in the visible. Subsequent observations have shown that only the strongest lines appeared in those groups. The source finally used, the Schuler tube, is almost ideal for the observation of metal spark spectra which do not require too high an excitation energy. It had previously been used very effectively by Professor PASCHEN and his students, as for example for Al II.*

The general characteristics of the Schuler tube have been described so frequently that I need only mention the characteristics of the special form which I found most suitable for copper. In order to get rapid evaporation of the metal into the discharge the hollow cathode was made of thin tungsten or molybdenum foil suspended on fine tungsten wires. It was about 1 cm in diameter and 5 cm long and was usually half filled with copper foil. Some observations were made with neon as the conducting gas, but for the complete excitation helium is necessary. The current was supplied usually by a 700 volt D.C. generator and was controlled by resistances. The tube when cold and filled with circulating helium at about 3 mm pressure operates on about one ampere and 200 volts, and the spectrum is mainly helium. As the temperature of the cathode reaches the melting point of copper, the discharge changes completely and becomes a brilliant green, the helium lines fading and hundreds of copper arc and spark lines appearing in the visible. At the same time, the potential rises to 500 or 600 volts, the current dropping to perhaps 0·4 amp. When the tube is in this condition the external resistance can be varied over a wide range without any great effect on the current. A still further intensification of the copper lines can be produced by lowering the helium pressure. The helium was continuously purified by means of a mischmetal hollow-cathode discharge and a chabizite trap immersed in liquid air.

The spectrum was observed with a number of instruments. Wherever possible spectra were photographed with a 21-ft concave grating (ruled by Professor R. W. WOOD) mounted in PASCHEN's manner. For the red and near infra-red a 10-ft Rowland grating in an Eagle mounting was employed. This was much faster than the large grating but gave inferior definition. In the further ultra-violet a Hilger E. 1 spectrograph was used ; and a few faint short wave-length lines were obtained with a small Hilger instrument which transmits to λ 1795 when filled with nitrogen. Throughout the whole visible spectrum the grating observations were supplemented by long exposures on a Hilger E. 1 glass spectrograph. Iron standards were used for the grating measurements and known copper lines for the prism measurements.

Dr. G. KRUGER kindly allowed me to study his Schuler tube plates of the vacuum region, but the measurements from these were later replaced by the wave-lengths obtained from a plate of much higher dispersion which I took on the vacuum spectrograph at the Massachusetts Institute of Technology through the kindness of Dr. J. C.

* SAWYER and PASCHEN, 'Ann. Physik,' vol. 84, p. 1 (1927).

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BOYCE.* This plate is of the greatest importance in the analysis. It was exposed for less than an hour and exhibits many more lines than do KRUGER's earlier plates, exposed for 10 to 18 hours. The wave-lengths were calculated initially from the known helium and hydrogen lines, but they were later corrected from the analysis itself in a way which is described below. The method was first used by A. FOWLER.† The focus of this plate was not exact, the lines being broadened. Curiously, the first order lines were all sharp on both edges, while the second order lines were sharp on one edge and shaded on the other. Since this asymmetry probably persists even in the position of best focus, it is obvious that measurement by the superposition of orders is always untrustworthy.

The remaining unobserved portion of the spectrum, the infra-red, was photographed at the Bureau of Standards at Washington, D.C., where Dr. MEGGERS was kind enough to allow me to use his infra-red concave grating spectrograph. There can be no doubt that very few lines between λ 10,000 and λ 600 have escaped detection. Intensities are, of necessity, rough visual estimates of photographic blackening and are quite untrustworthy outside any narrow range of wave-lengths. The actual range of intensities must be enormous, judging from the fact that the strongest lines on the prism plates were composed of over 60 diffraction fringes.

THE ANALYSIS

The once ionized copper atom contains ten electrons outside tightly bound closed shells. The low structures to be expected are, therefore, representable by the symbols $3d^{10}$, $3d^9 4s$, $3d^8 4s^2$. From the series in the arc spectrum, $3d^{10}\ {}^1S$ should be about 22,000 wave-numbers below $3d^9 4s\,{}^3D_3$, and from Gibb's analysis of Cu III, it can be predicted that $3d^8 4s^2\ {}^3F$ should lie above $3d^9 4s\,{}^3D$ by about 50,000 wave-numbers. The higher terms should have structures $3d^9 nx$ and $3d^8 4snx$. Of the latter type of structure only $3d^8 4s4p$ should be in the energy range capable of excitation in the helium filled Schuler tube.

All the expected structures have been found. They are exhibited in Table I with notes regarding the letters used to distinguish them from one another. Tables II and III contain all the even and odd terms found, with term connexions and numbers of combinations, the notation used being that suggested by RUSSELL, SHENSTONE, and TURNER in their " Report on notation for atomic spectra."‡ The levels are given in numerical order because to group them as terms in such a spectrum as this would be quite misleading. The energy values are measured upwards from $4s\,{}^3D_3$. The lowest level, $a\,{}^1S_0$, is not used as the zero because of the inaccuracy in its determination. The notation adopted is designed to give as much information as possible

* COMPTON and BOYCE, ' Rev. Sci. Inst.,' vol. 5, p. 218 (1934).
† ' Proc. Roy. Soc.,' A, vol. 123, p. 428 (1929).
‡ ' Phys. Rev.,' vol. 33, p. 900 (1929).

without being cumbersome. The electron notation for the levels of the structure d^8sp is manifestly too long for such a complicated spectrum.

The most completely developed term system is the one founded on the $3d^9$ ^{2}D ion, which has a doublet separation of 2070 wave-numbers. The addition of an outer electron, in general, gives two groups of levels founded on $^2D_{2\frac{1}{2}}$ and $^2D_{1\frac{1}{2}}$ with approximately the same separation. This grouping of the levels is evident even in the low terms and becomes increasingly so in the higher groups, where j—j coupling is approached. In such cases it is theoretically incorrect to use the term notation applicable to L—S coupling. For the sake of simplicity in the description, I have, however, used the L—S notation, basing my choice of term names on the following usual intensity rule.

The strongest groups of lines occur from transitions between consecutive members of the electron sequence s—p—d—f—g. In any one group the strongest lines are those for which L and J of the atom change in the same direction as the 1 of the electron, *i.e.*, for the electron transition d—f the strong lines should be d^3S_1—$f^3P_2^0$, d^3P_2—$f^3D_3^0$, etc. The use of this rule leads, with little ambiguity, to complete L—S term symbols throughout the $3d^9nx$ portion of the spectrum.

$3d^9ns^3D^1D$—This structure yields a series of five members from $n = 4$ to $n = 8$, which has been used to calculate the ionization potential. The last four terms were fitted to an extended Ritz formula

$$T_n = \frac{4R}{(n + \mu + \alpha T_n + \beta T_n^2)^2},$$

in which

$$\mu = 0 \cdot 83331$$

$$\alpha = -0 \cdot 3964\ 10^{-6}$$

$$\beta = -0 \cdot\ 892\ 10^{-12}$$

The first term then has a calculated Rydberg denominator of 1·75919 to be compared with the observed 1·75981, a very close agreement for the first term of a series. The value of the term is 141737·0.

The method of calculation of the formula is simple. Let x_1, x_2, x_3, x_4, be the fractional parts of the denominators when the correct limit is chosen, and y_1, y_2, y_3, be

$$\frac{x_1 - x_2}{T_1 - T_2}, \quad \frac{x_2 - x_3}{T_2 - T_3}, \quad \frac{x_3 - x_4}{T_3 - T_4}.$$

Then

$$\frac{y_1 - y_2}{y_2 - y_3} = \frac{T_1 - T_3}{T_2 - T_4}.$$

The right-hand side of this equation depends on observed quantities only; the left-hand side depends on the limit chosen and can be varied at will by varying that limit. Very few trials are necessary to find the limit which satisfies the equation and the constants are then given in succession by the intermediate equations

$$y_1 - y_2 = \beta\,(T_1 - T_3)$$
$$y_1 = \alpha + \beta\,(T_1 + T_2)$$
$$x_1 = \mu + \alpha\, T_1 + \beta\, T_1^2$$

The ionization potential equivalent to the total difference $d^{10}\,{}^1S - d^9\,{}^2D_{2\frac{1}{2}}$ is 20·18 volts. It is worthy of note that the difference in Cu III d^9 $({}^2D_{2\frac{1}{2}} - {}^2D_{1\frac{1}{2}})$ of 2070 wave-numbers persists through Cu II as d^9ns $({}^3D_3 - {}^3D_1)$ and through Cu I as d^94sns $({}^4D_{3\frac{1}{2}} - {}^4D_{\frac{1}{2}})$.

$3d^9np$—Three groups of levels attributable to this structure corresponding to $n = 4, 5, 6$, have been found. The two higher groups are strongly perturbed by the levels of the structure d^84s4p and will be considered in that connexion below.

$3d^9nd$—Three complete sets of levels and part of a fourth $n - 4, 5, 6, 7$, appear in the analysis. They all show j—j coupling, and the grouping of the levels is almost exactly as in Ni I.† The series of individual levels are approximately Ritzian except for ${}^3P_0$ and ${}^1S_0$. In a plot of $(n^* - n)$ against term value, the former series is very steep (large α) and concave upwards. The latter series is extremely concave downwards.

$3d^9nf$—The strongest group of new lines brought out partially by the arc and completely by the Schuler tube lies in the blue. It consists chiefly of the lines due to the transition $4d - 4f$. The intensity rule allows the naming of the $4f$ levels in two groups. The lower group, built on the ${}^2D_{2\frac{1}{2}}$ limit contains all of the P levels and the two higher J-values of the other triplets. The remaining triplet and singlet levels appear in pairs, by L—values, in the higher group.

A second series member d^95f and part of a third are also present in the spectrum.

The transition $3d^{10} - 3d^9nf$ is, of course, a very probable one. It gives very strong lines in the far ultra-violet, corresponding to $a^1S_0 - nf\,{}^3P_1{}^0$ $a^1S_0 - nf\,{}^1P_1{}^0$ $a^1S_0 - nf\,{}^3D_1{}^0$.

$3d^95g$—The plate taken at the Bureau of Standards shows a very strong set of lines near λ 10,000, where the transition $4f - 5g$ should be found. The expectation was that the levels should again be in two groups containing 12 and 8 levels respectively. The analysis gave, unexpectedly, half those numbers. An examination of the intensities, however, indicates very strongly that each empirical level is in reality double, the pairs being ${}^3D_3{}^1D_2$, ${}^3D_{2,1}$, ${}^3F_{4,3}$, ${}^3G_{5,4}$, ${}^3H_{6,5}$, ${}^3I_{7,6}$ on ${}^2D_{2\frac{1}{2}}$; and ${}^3F_2{}^1F_3$, ${}^3G_3{}^1G_4$, ${}^3H_4{}^1H_5$, ${}^3I_5{}^1I_6$ on ${}^2D_{1\frac{1}{2}}$. These pairs must be extremely close, since the ability of a large grating to resolve small wave-number differences at λ 10,000 is very great indeed. The result is surprising because an extrapolation of differences from

† Russell, 'Phys. Rev.,' vol. 34, p. 821 (1929).

the $5f$ levels would give quite measurable separations in $5g$. Both the structures d^9f and d^9g are here analysed for the first time in any spectrum.

In all the d^9nx groups, the order of the levels is similar. The lowest level is always a component of the triplet of smallest L—value, followed by the triplet of highest L, the remaining triplets following more or less in order of the magnitude of L.

$3d^84s^2$—From a knowledge of the ion difference $d^9\ {}^2\mathrm{D} - d^8s\,{}^4\mathrm{F}$, the position of $3d^84s^2\ {}^3\mathrm{F}$ can be estimated as about 50,000 wave-numbers above $3d^94s$. This unfortunately places it on top of the levels $3d^94p$ with which it should make strong combinations. The corresponding ${}^1\mathrm{D}\ {}^3\mathrm{P}\ {}^1\mathrm{G}\ {}^1\mathrm{S}$ should be sufficiently higher to give lines in the visible. This is the case ; and, in fact, one of these levels was found and the remainder could have been found from spark and arc observations, because the combinations $d^94p - d^8s^2$ are all sharp lines. The discovery of $d^8s^2\ {}^3\mathrm{F}$ was only possible after the d^95p levels had been found, with which it combines with moderate intensity. $d^8s^2\ {}^1\mathrm{S}_0$ has not been found in this or any other spectrum.

$3d^84s4p$ *and Perturbations*—The levels of this structure should combine with d^94s and d^84s^2, but not with d^95s because the latter transition corresponds to a double electron change. The structure gives no less than 90 levels, of which 68 have been found. They occur in groups corresponding to the parent terms in Cu III, $3d^84s\ {}^4\mathrm{F}{}^2\mathrm{F}\ {}^2\mathrm{D}\ {}^4\mathrm{P}{}^2\mathrm{P}\ {}^2\mathrm{G}\ {}^2\mathrm{S}$, and they extend over a wave-number distance of 42,300. For that reason they overlap all of the odd levels of type $3d^9nx$ and mix with them both energetically and in character. This sharing of characteristics introduces in some cases such ambiguity that it is perhaps wrong to name the levels and so imply that they have a definite origin. The most striking case occurs amongst the d^95p levels, where there are two interlopers from $d^84s\ ({}^2\mathrm{F})\ 4p$ which have been so completely absorbed that it is impossible to be certain which two are chiefly of the latter origin. The selection which has been made may be incorrect. In that same group there also occurs the strangest disturbance of intensities that I know of in any spectrum. The combination $4s\,{}^3\mathrm{D}_3 - 5p\,{}^3\mathrm{F}_4^0$ should be the strongest line produced by the $4s - 5p$ transition, but it is entirely missing. From the other combinations there can be no doubt of the reality and of the character of $5p\,{}^3\mathrm{F}_4^0$.

Many other intensity and combination anomalies occur where the terms of different structure are close to each other. For instance, there are large numbers of double electron transitions, including $d^8s^2 - d^9f$, $d^8sp - d^9g$ in which $\Delta\, l_1 = 2$, $\Delta\, l_2 = 3$; and $d^9s - d^9f$ in which $\Delta\, l = 3$. In such cases one can take the following attitude. The level attributed to d^8sp which combines with d^9g is very near to d^9f and in the wave mechanics would be described as partly of origin d^8sp and partly d^9f. It is the latter part of its character which allows the combination with d^9g. Conversely, the levels of d^9f are partly of origin d^8sp and can, therefore, combine with d^8s^2 and d^9s. Many levels could not have been definitely established if such unusual electron transitions did not occur. A case in point is the discovery of $u\,{}^3\mathrm{H}_4^0$ and $u\,{}^1\mathrm{H}_5^0$ from their strong combinations with the d^94d group. From their position they can only be of origin d^8s (^{2}G) $4p$. The remaining levels $^3H_5{}^0$ and $^3H_6{}^0$ have not been found, probably because they are insufficiently perturbed to combine with known terms.

The proximity of levels of different origins is also responsible for displacements of levels from their natural positions.* The d^9np groups are most obviously perturbed in this manner, as is evident from their wide departures from a Ritz formula.

The same groups illustrate the difficulty of correlating individual levels to particular levels of the ion. The usual rule in series of this sort d^94p, $5p$, $6p$, is that series of levels of the same J must not cross. By this rule $4p^3F_2{}^0$ is built on $^2D_{2\frac{1}{2}}$ and $^3D_2{}^0$ on $^2D_{1\frac{1}{2}}$, while the reverse correlation must be assumed for the same levels in the $5p$ and $6p$ groups. In the present analysis, I have preferred to deny the validity of the rule by associating the $4p^3F_2{}^0$ and $^3D_2{}^0$ levels in series with their higher members. The rule seems to be inapplicable also in the case of the $np^3D_1{}^0$ and $^1P_1{}^0$ series which cross even though they have a common limit. The curious types of convergence to which the rules would lead in the case of Ni I were pointed out by Russell.†

An examination of the term table will show that several levels are based on single lines, but it will be found in all such cases that the levels have few other combining possibilities and those improbable. Where there is any doubt the level has been marked with a question sign. As an example of a level based on a single combination consider $sp^5G_5{}^0$. The only possible combination with a low level is with $s^2\ ^3F_4$. The other sp^5G levels all give lines in combination with $s^2\ ^3$F which appear in the neon as well as the helium Schuler tube. In that part of the spectrum there remains just one strong line of the correct character, the one chosen as $s^2\ ^3F - sp^5G_5{}^0$. The choice is substantiated by a comparison with Ni I (*loc. cit.*).† The undiscovered level sp^5G_6 must be metastable, having no low level with which to combine.

The assignment of names to levels is to a certain extent arbitrary because of the paucity of combinations and their irregularity. Especially the levels of the group extending from 103,300 to 109,400 are unsatisfactory. They are so mixed in character that it is doubtful whether they should be given definite names. The level $x^5D_3{}^0$ could possibly be $x^5D_4{}^0$. In that case $x^5D_{2,1}$ is probably all three of the levels $x^5D_3{}^0$, $x^5D_2{}^0$, and $x^5D_1{}^0$.

The classification of levels was assisted by a comparison with other spectra and by the limited energy available for excitation in the Schuler tube. From an examination of complicated spectra it can be deduced that the energy necessary to excite a $4s$ electron of $3d^n4s^2$ to a $4p$ state is approximately the same from each term of d^ns^2 to its corresponding triad of d^nsp. Thus, in Cu II, the difference between $d^8s^2\ ^3$F and its lower triad of d^8sp should be approximately equal to the difference between $d^8s^2\ ^1$D and its triad, and so forth. An examination of the term table shows that the groups of levels do occur in just this manner, the difference varying between 38,300 and 40,300. On this basis, the undiscovered $d^8s^2\ ^1$S must lie at about

* Shenstone and Russell, 'Phys. Rev.,' vol. 39, p. 415 (1932).

† 'Phys. Rev.,' vol. 34, p. 821 (1929).

128,000 — 40,000 = 88,000. It should combine with $4p^1P_1$ and there are several suitable unidentified lines in the correct part of the wave-length table. As no means of determining the choice have been found this level still remains undiscovered.

The excitation limits of the Schuler tube* facilitate particularly the discovery of high terms which make few combinations. With neon as the conducting gas, the excitation is limited to terms about 90,000 cm^{-1} so that the lines which appear must belong to comparatively low levels ; but, with helium, the intense excitation should extend to a point about 24·5 volts above the highest metastable state in Cu I, $d^9s^2\ {}^2D_{1\frac{1}{2}}$. This reaches to terms about 127,000 cm^{-1}. One can then safely conclude that all lines of wave-number greater than, for instance, 130,000 must be combinations of a^1S_0 and all beyond 85,500 must be either from a^1S_0 or $4s^3D^1D$. In this way the possible origins of the short wave-length lines are so reduced that one can afford to try them in all possible positions.

The statements just made regarding the helium Schuler tube must be qualified to the following extent. When the tube is run very hot, excitation by electron bombardment produces a considerable number of faint lines of Cu III requiring a further 20 volts energy. Fortunately the low multiplets of Cu III have been found by Gibbs (private communication) and can be eliminated from the tables.

Calculation of Ultra-Violet Standards

The relative values of all the levels of d^94s, d^94p, d^95s are fixed by Burns and Walter's interferometer measurements,† to an accuracy of about 0·03 wave-numbers. An exception is, perhaps, $4p^3P_0^0$ the error in which may be 0·1 cm^{-1}. The values of d^95p are determined from a large number of infra-red grating measurements of the lines $d^95s - d^95p$. The values of d^96s are in turn determined in the same way relative to d^95p. Blue lines measured with the 21-ft grating determine d^97s relative to d^05p. From the consistency of the lines on which all these values are based, I believe it is correct to deduce that the term values are accurate to 0·1 wave-numbers. This means that we can calculate the wave-numbers of the combinations $d^94s - d^95p$, $d^94p - d^96s$, $d^94p - d^97s$ to that accuracy. This leads to wave-length values in the vacuum region which have an accuracy varying from 0·003A at λ 1700 to 0·0006 at λ 800. This is well beyond the accuracy attainable with any existing vacuum spectrograph except in high orders. The accuracy could be further increased by interferometer measures of the infra-red and visible spectrum.

It was mentioned above that the ultra-violet spectrum was first measured using hydrogen and helium standards which were very unsatisfactory because of diffuseness and self-reversal. After the levels of Cu II had been determined as just described, the ultra-violet combinations were calculated and used as new standards. The resulting correction curves were so smooth as to leave no doubt of the consistency of

* Sawyer, ' Phys. Rev.,' vol. 36, p. 44 (1930).

† ' Publications of the Allegheny Observatory,' vol. 8, No. 3, p. 27 (1930).

the calculated standards. A further, less accurate, extension of the standardization was made by using the measures of the three lines $a^1S_0 - 4p^3P_1$, $4p^3D_1$, $4p^1P_1$ to calculate a^1S_0. The mean value $-$ 21,928·6 should not be in error by more than 0·2 wave-numbers. This allows the calculation of the lines $a^1S_0 - 5p^3P_1$, etc. In addition, a few levels of d^8sp d^98s and d^9f were considered to be determined with sufficient accuracy and their combinations used as standards.

The calculated lines are marked C1, C2, etc., in the wave-length list ; the number indicating the estimated accuracy in tenths of a wave-number. The corresponding errors in wave-length are, of course, given by $\delta\lambda = \frac{\delta\nu}{\nu^2} 10^8 A°$. A large number of additional lines could have been calculated from levels given to two places of decimals in the term table. They would have errors of about 0·3 wave-numbers.

The wave-length table includes all observed lines with the exception of a few which were excessively faint or of doubtful origin. The instrument used in the wave-length determination is given in each case. When more than one term assignment is given for a line, the first is the most probable. A very few lines of moderate intensity remain unidentified and may be ascribed to predicted levels which have not been discovered. A comparison of the ultra-violet lines produced in the Schuler tube with those which appear in a spark discharge can be made by referring to a recent paper by Bloch, Bloch, and Farineau.* The lists contain only a few lines in common, the strong lines of Bloch's list being mainly Cu III which is almost absent in the Schuler tube.

Hyperfine Structure

Some observations of line structure were made by means of a small quartz spectrograph accommodating a quartz Lummer plate. The $4s - 4p$ lines between λ 2240 and λ 2135 were examined. The resolutions are poor but are consistent with $I = \frac{3}{2}$, deduced from the arc spectrum by Ritschl.† There is no evidence of isotopic displacements. The splitting factors are approximately as follows :—

$4s^3D_3$	$a \sim 60$
$^3D_2$	$a \sim 30$
$^3D_1$	Narrow
$^1D_2$	$a \sim 50$

Zeeman Effect

The Zeeman effect of the low multiplets of Cu II was described in my original paper.‡ The levels of d^94s, d^94p, d^95s have approximately Lande g-values, except $4p^3D_3{}^0$ and $4p^1F_3{}^0$ which appear to share about equally the sum of their proper values.

* 'J. Phys. Rad.,' vol. 3, p. 437 (1932).
† 'Z. Physik,' vol. 79, p. 1 (1932).
‡ Shenstone, 'Phys. Rev.,' vol. 29, p. 380 (1927).

TABLE I—PREDICTED AND IDENTIFIED TERMS

Ion	Added Electron	Terms	Prefix and Remarks
$3d^9\ ^2D$	$4s$	$^{3\ \&\ 1}D$	$4s$
	$5s$	$^{3\ \&\ 1}D$	$5s$
	$6s$	$^{3\ \&\ 1}D$	$6s$
	$7s$	$^{3\ \&\ 1}D$	$7s$
	$8s$	$^{3\ \&\ 1}D$	$8s\ ^3D_3\ ^3D_2$ only
	$4p$	$^{3\ \&\ 1}P\ D\ F$	$4p$
	$5p$	$^{3\ \&\ 1}P\ D\ F$	$5p$
	$6p$	$^{3\ \&\ 1}P\ D\ F$	$6p\ ^3P_0$ missing
	$3d$	^1S	a
	$4d$	$^{3\ \&\ 1}S\ P\ D\ F\ G$	$4d$
	$5d$	$^{3\ \&\ 1}S\ P\ D\ F\ G$	$5d$
	$6d$	$^{3\ \&\ 1}S\ P\ D\ F\ G$	$6d$
	$7d$	$^{3\ \&\ 1}S\ P\ D\ F\ G$	$7d$ Partial only
	$4f$	$^{3\ \&\ 1}P\ D\ F\ G\ H$	$4f$
	$5f$	$^{3\ \&\ 1}P\ D\ F\ G\ H$	$5f$
	$6f$	$^{3\ \&\ 1}P\ D\ F\ G\ H$	$6f$ Partial only
	$5g$	$^{3\ \&\ 1}D\ F\ G\ H\ I$	$5g$
$3d^84s$	$4s$	$^3F\ ^3P\ ^1S\ ^1D\ ^1G$	$s^2\ ^1S_0$ missing
$3d^84s^4F$	$4p$	$^{5\ \&\ 3}D\ F\ G$	sp for quintets, v for triplets
$3d^84s^2F$	$4p$	$^{3\ \&\ 1}D\ F\ G$	z
$3d^84s^2D$	$4p$	$^{3\ \&\ 1}P\ D\ F$	$y\ ^3P_1\ ^3P_0$ missing
$3d^84s^4P$	$4p$	$^{5\ \&\ 3}S\ P\ D$	x for quintets, triplets missing
$3d^84s^2P$	$4p$	$^{3\ \&\ 1}S\ P\ D$	$w\ ^{3\ \&\ 1}S$ missing
$3d^84s^2G$	$4p$	$^{3\ \&\ 1}F\ G\ H$	$u\ ^3F,\ ^3H_4,\ ^1H_5$ only
$3d^84s^2S$	$4p$	$^{3\ \&\ 1}P$	$t\ ^3P_2$ only

TABLE II—EVEN TERMS OF Cu II

1†‡	2	3	4	5	6	7
L	$3d^{10}$	a^1S_0	−21928·6	1·63768		15
S	$d^9(^2D_{2\frac{1}{2}})4s$	$4s^3D_3$	0·00	1·75981	*	55
S	$d^9(^2D_{2\frac{1}{2}})4s$	$4s^3D_2$	918·43	1·76554	*	69
S	$d^9(^2D_{1\frac{1}{2}})4s$	$4s^3D_1$	2069·71	1·75981	*	42
S	$d^9(^2D_{1\frac{1}{2}})4s$	$4s^1D_2$	4335·92	1·77405		50

† Column 1. Discoverer
,, 2. Electron Structure
,, 3. Designation
,, 4. Numerical Value

† Column 5. Rydberg Denominator
,, 6. Term Connexions
,, 7. Number of Combinations

‡ Explanation of Column 1—
L LANG, 'Phys. Rev.,' vol. 31, p. 773 (1928).
M MENZIES, 'Proc. Roy. Soc.,' A, vol. 119, p. 249 (1928).
K KRUGER, 'Phys. Rev.,' vol. 34, p. 1122 (1929).
G GIBBS, Manuscript.
S SHENSTONE

TABLE II—continued

1†‡	2	3	4	5	6	7
S	$d^8 4s^2$	$s^2\ ^3F_4$	47776·2	1·68418	*	43
S	$d^8 4s^2$	$s^2\ ^3F_3$	49602·9		*	47
S	$d^8 4s^2$	$s^2\ ^3F_2$	50795·4		*	43
S	$d^8 4s^2$	$s^2\ ^1D_2$	63460·17			21
S	$d^8 4s^2$	$s^2\ ^3P_2$	66433·43		*	18
S	$d^8 4s^2$	$s^2\ ^3P_1$	66676·56		*	17
S	$d^8 4s^2$	$s^2\ ^3P_0$	66997·49		*	10
M	$d^8 4s^2$	$s^2\ ^1G_4$	73637·05			10
S	$d^9(^2D_{2\frac{1}{2}})5s$	$5s^3D_3$	86086·26	2·80849	*	24
S	$d^9(^2D_{2\frac{1}{2}})5s$	$5s^3D_2$	86407·09	2·81661	*	23
S	$d^9(^2D_{1\frac{1}{2}})5s$	$5s^3D_1$	88156·02	2·80848	*	16
S	$d^9(^2D_{1\frac{1}{2}})5s$	$5s^1D_2$	88437·65	2·81561		23
S	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3S_1$	92582·84	2·98832		27
S	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3G_5$	93640·60	3·02100	*	13
S	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3P_2$	93710·42	3·02319	. *	36
S	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3G_4$	93734·17	3·02395	* .	15
S	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3P_1$	93736·80	3·02403	. *	24
S	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3D_3$	94151·86	3·03719	. . *	21
S	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3F_3$	94397·56	3·04505	. . . *	24
S	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3F_4$	94442·81	3·04651	. . . *	20
M	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3D_2$	94459·40	3·04705	. . * .	20
S	$d^9(^2D_{2\frac{1}{2}})4d$	$4d^3P_0$	94648·21	3·05316	. * . .	9
M	$d^9(^2D_{1\frac{1}{2}})4d$	$4d^1P_1$	95303·09	3·00828	. . .	15
S	$d^9(^2D_{1\frac{1}{2}})4d$	$4d^3G_3$	95818·85	3·02441	* . .	22
S	$d^9(^2D_{1\frac{1}{2}})4d$	$4d^1G_4$	95954·54	3·02870	. .	18
S	$d^9(^2D_{1\frac{1}{2}})4d$	$4d^3D_1$	95999·88	3·03013	* .	13
M	$d^9(^2D_{1\frac{1}{2}})4d$	$4d^1D_2$	96234·90	3·03759	.	25
S	$d^9(^2D_{1\frac{1}{2}})4d$	$4d^1F_3$	96555·40	3·04788	.	12
M	$d^9(^2D_{1\frac{1}{2}})4d$	$4d^3F_2$	96603·55	3·04944	*	17
S	$d^9(^2D_{1\frac{1}{2}})4d$	$4d^1S_0$	100487·5	3·18320		7
K	$d^9(^2D_{2\frac{1}{2}})6s$	$6s^3D_3$	111665·63	3·82059	*	25
K	$d^9(^2D_{2\frac{1}{2}})6s$	$6s^3D_2$	111799·47	3·82913	*	24
K	$d^9(^2D_{1\frac{1}{2}})6s$	$6s^3D_1$	113736·01	3·82060	*	17
K	$d^9(^2D_{1\frac{1}{2}})6s$	$6s^1D_2$	113831·67	3·82656		22
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3S_1$	114408·28	4·00771		8
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3G_5$	114797·33	4·03652	*	5
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3P_2$	114825·51	4·03864	. *	8
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3G_4$	114836·78	4·03949	* .	6
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3P_1$	114844·6	4·04009	. *	11
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3D_3$	114990·75	4·05112	. . *	13
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3F_3$	115106·37	4·05991	. . . *	8
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3F_4$	115115·85	4·06064	. . . *	9
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3D_2$	115145·15	4·06285	. . * .	12
S	$d^9(^2D_{2\frac{1}{2}})5d$	$5d^3P_0$	115685·7	4·10481	. * . .	$4p$ & $5p^3P_1^0$
S	$d^9(^2D_{1\frac{1}{2}})5d$	$5d^1P_1$	116664·50	4·02145	. . .	7

†‡ *See* footnote on p. 204.

TABLE II—continued

1†‡	2	3	4	5	6	7
S	$d^9(^2D_{1\frac{1}{2}})5d$	$5d\,^3G_3$	116890·57	4·03827	* . .	6
S	$d^9(^2D_{1\frac{1}{2}})5d$	$5d\,^1G_4$	116954·4	4·04306	. .	7
S	$d^9(^2D_{1\frac{1}{2}})5d$	$5d\,^3D_1$	116969·83	4·04424	* .	10
S	$d^9(^2D_{1\frac{1}{2}})5d$	$5d\,^1D_2$	117052·7	4·05052	.	10
S	$d^9(^2D_{1\frac{1}{2}})5d$	$5d\,^1F_3$	117190·9	4·06000	.	7
S	$d^9(^2D_{1\frac{1}{2}})5d$	$5d\,^3F_2$	117213·5	4·06270	*	10
S	$d^9(^2D_{1\frac{1}{2}})5d$	$5d\,^1S_0$	118660·8	4·17800		$4p$ & $5p\,^1P_1{}^0$
K	$d^9(^2D_{2\frac{1}{2}})7s$	$7s\,^3D_3$	122886·33	4·82553	*	19
K	$d^9(^2D_{2\frac{1}{2}})7s$	$7s\,^3D_2$	122954·49	4·83426	*	22
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3D_2$	124122·74	4·99200	. *	4
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3D_1$	124122·74	4·99200	. *	
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3I_7$	124140·41	4·99450	. . *	$4f\,^3H_6{}^0$
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3I_6$	124140·41	4·99450	. . *	$4f\,^3H_5{}^0$
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3D_3$	124144·35	4·99505	. * .	5
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^1D_2$	124144·35	4·99505	. .	
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3F_4$	124165·51	4·99805	. . *	5
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3F_3$	124165·51	4·99805	. . *	
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3H_6$	124174·82	4·99935	. * . .	6
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3H_5$	124174·82	4·99935	. * . .	
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3G_5$	124178·73	4·99995	. . . . *	6
S	$d^9(^2D_{2\frac{1}{2}})5g$	$5g\,^3G_4$	124178·73	4·99995	. . . . *	
S	$d^9(^2D_{2\frac{1}{2}})6d$	$6d\,^3S_1$	124287·1	5·01541	. . . . .	$4p$ & $5p\,^3P_2{}^0$
S	$d^9(^2D_{2\frac{1}{2}})6d$	$6d\,^3G_5$	124474·3	5·04259	. . . . . *	3
S	$d^9(^2D_{2\frac{1}{2}})6d$	$6d\,^3P_2$	124487·1	5·04441	. . . . . . *	6
S	$d^9(^2D_{2\frac{1}{2}})6d$	$6d\,^3G_4$	124494·8	5·04553	. . . . . * .	3
S	$d^9(^2D_{2\frac{1}{2}})6d$	$6d\,^3P_1$	124499·0	5·04618	. . . . . . *	9
S	$d^9(^2D_{2\frac{1}{2}})6d$	$6d\,^3D_3$	124567·6	5·05624	. . . . *	10
S	$d^9(^2D_{2\frac{1}{2}})6d$	$6d\,^3F_3$	124628·0	5·06512	. . . . *	10
S	$d^9(^2D_{2\frac{1}{2}})6d$	$6d\,^3F_4$	124631·2	5·06565	. . . . *	9
S	$d^9(^2D_{2\frac{1}{2}})6d$	$6d\,^3D_2$	124646·7	5·06788	. . . . * .	12
K	$d^9(^2D_{1\frac{1}{2}})7s$	$7s\,^3D_1$	124957·71	4·82570	*	14
K	$d^9(^2D_{1\frac{1}{2}})7s$	$7s\,^1D_2$	125007·88	4·83205	. . . .	20
S	$d^9(^2D_{1\frac{1}{2}})6d$	$6d\,^3P_0$	125169·5	5·14725	. . . . . . * . .	$4p$ & $5p\,^3P_1{}^0$
S	$d^9(^2D_{1\frac{1}{2}})5g$	$5g\,^3F_2$	126205·39	4·99382	. . *	4
S	$d^9(^2D_{1\frac{1}{2}})5g$	$5g\,^1F_3$	126205·39	4·99382	. . . . . .	
S	$d^9(^2D_{1\frac{1}{2}})5g$	$5g\,^3I_5$	126217·17	4·99550	. *	$4f\,^3H_4{}^0$
S	$d^9(^2D_{1\frac{1}{2}})5g$	$5g\,^1I_6$	126217·17	4·99550	. . . . .	$4f\,^1H_5{}^0$
S	$d^9(^2D_{1\frac{1}{2}})5g$	$5g\,^3G_3$	126239·17	4·99865	. * . . .	4
S	$d^9(^2D_{1\frac{1}{2}})5g$	$5g\,^1G_4$	126239·17	4·99865	. . . .	
S	$d^9(^2D_{1\frac{1}{2}})5g$	$5g\,^3H_4$	126250·70	5·00029	* . . .	4
S	$d^9(^2D_{1\frac{1}{2}})5g$	$5g\,^1H_5$	126250·70	5·00029	. . .	
S	$d^9(^2D_{1\frac{1}{2}})6d$	$6d\,^1P_1$	126433·1	5·02641	. . .	5
S	$d^9(^2D_{1\frac{1}{2}})6d$	$6d\,^3G_3$	126553·4	5·04388	* . .	4
S	$d^9(^2D_{1\frac{1}{2}})6d$	$6d\,^1G_4$	126587·0	5·04812	. .	$4p$ & $5p\,^1F_3{}^0$
S	$d^9(^2D_{1\frac{1}{2}})6d$	$6d\,^3D_1$	126593·2	5·04888	* .	$4p$ & $5p\,^3P_0{}^0$

†‡ *See* footnote on p. 204.

TABLE II—continued

1†‡	2	3	4	5	6	7
S	$d^9(^2D_{1\frac{1}{2}})6d$	$6d\,^1D_2$	126630·7	5·05529	.	6
S	$d^9(^2D_{1\frac{1}{2}})6d$	$6d\,^1F_3$	126702·6	5·06576	.	4
S	$d^9(^2D_{1\frac{1}{2}})6d$	$6d\,^3F_2$	126714·0	5·06747	*	5
S	$d^9(^2D_{1\frac{1}{2}})6d$	$6d\,^1S_0$	127274·5	5·15275		$4p$ & $5p\,^1P_1{}^0$
S	$d^9(^2D_{2\frac{1}{2}})8s$	$8s\,^3D_3$	128814·3	5·82804	*	5
S	$d^9(^2D_{2\frac{1}{2}})8s$	$8s\,^3D_2$	128854·0	5·83709	*	7
S	$d^9(^2D_{2\frac{1}{2}})7d$	$7d\,^3S_1$	129621·4 ?	6·01910	.	$5p\,^3P_2{}^0$
S	$d^9(^2D_{2\frac{1}{2}})7d$	$7d\,^3G_5$	129727·8	6·04570	. *	3
S	$d^9(^2D_{2\frac{1}{2}})7d$	$7d\,^3P_2$	129734·8 ?	6·04740	. . *	$5p\,^3P_2{}^0$
S	$d^9(^2D_{2\frac{1}{2}})7d$	$7d\,^3G_4$	129739·8 ?	6·04870	. * .	$4p\,^3F_3{}^0$
S	$d^9(^2D_{2\frac{1}{2}})7d$	$7d\,^3P_1$	129741·6 ?	6·0492	. . *	$4f\,^3D_2{}^0$
S	$d^9(^2D_{2\frac{1}{2}})7d$	$7d\,^3D_3$	129779·7	6·05880	. . .	5
S	$d^9(^2D_{2\frac{1}{2}})7d$	$7d\,^3F_3$	129815·0 ?	6·06770	. . . *	$5p\,^3F_3{}^0 4f\,^3G_4{}^0$
S	$d^9(^2D_{2\frac{1}{2}})7d$	$7d\,^3F_4$	129816·5	6·06810	. . . *	4
S	$d^9(^2D_{1\frac{1}{2}})7d$	$7d\,^3G_3$	131814·8??	6·0500	. * . .	$4p\,^3F_2{}^0 4f\,^3G_3{}^0$

LIMIT LEVELS IN Cu III.

G	$d^9\ ^2D_{2\frac{1}{2}}$	141737
G	$d^9\ ^2D_{1\frac{1}{2}}$	143807
G	$d^8 4s\,^4F_{4\frac{1}{2}}$	202529
G	$d^8 4s\,^4F_{3\frac{1}{2}}$	203789
G	$d^8 4s\,^4F_{2\frac{1}{2}}$	204867
G	$d^8 4s\,^4F_{1\frac{1}{2}}$	205611

†‡ *See* footnote on p. 204.

TABLE III—ODD TERMS OF Cu II

1†‡	2	3	4	5	6	7
S	$d^9(^2D_{2\frac{1}{2}})4p$	$4p\,^3P_2{}^0$	44490·05	2·12457	*	34
S	$d^9(^2D_{2\frac{1}{2}})4p$	$4p\,^3P_1{}^0$	45987·97	2·14111	*	37
S	$d^9(^2D_{2\frac{1}{2}})4p$	$4p\,^3F_3{}^0$	46519·15	2·14708	. *	29
S	$d^9(^2D_{2\frac{1}{2}})4p$	$4p\,^3F_4{}^0$	46802·22	2·15028	. *	20
S	$d^9(^2D_{1\frac{1}{2}})4p$	$4p\,^3P_0{}^0$	46921·65	2·12852	* .	12
S	$d^9(^2D_{1\frac{1}{2}})4p$	$4p\,^3F_2{}^0$	47939·51	2·13921	*	24
S	$d^9(^2D_{2\frac{1}{2}})4p$	$4p\,^3D_3{}^0$	48912·90	2·17457	*	33

† Column 1. Discoverer
,, 2. Electron Structure
,, 3. Designation
,, 4. Numerical Value

† Column 5. Rydberg Denominator
,, 6. Term Connexions
,, 7. Number of Combinations

‡ Explanation of Column 1.
L LANG, 'Phys. Rev.,' vol. 31, p. 773 (1928).
M MENZIES, 'Proc. Roy. Soc.,' A, vol. 119, p. 249 (1928).
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S SHENSTONE.

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TABLE III—continued

1†‡	2	3	4	5	6	7
S	$d^9(^2D_{2\frac{1}{2}})4p$	$4p\,^3D_2^0$	49565·32	2·18227	*	36
S	$d^9(^2D_{1\frac{1}{2}})4p$	$4p\,^1F_3^0$	49991·53	2·16307	.	30
S	$d^9(^2D_{1\frac{1}{2}})4p$	$4p\,^3D_1^0$	51173·50	2·17682	*	32
S	$d^9(^2D_{1\frac{1}{2}})4p$	$4p\,^1D_2^0$	51424·83	2·17978		36
S	$d^9(^2D_{1\frac{1}{2}})4p$	$4p\,^1P_1^0$	51667·26	2·18265		32
S	$d^8s(^4F)4p$	$sp\,^5D_4^0$	86013·5	1·94093	*	$4s\,^3D_3$, $s^2\,^3F_4$
S	$d^8s(^4F)4p$	$sp\,^5D_3^0$	87347·3		*	$4s\,^3D_{3,\,2}$, $^1D_2$, $s^2\,^3F_3$
S	$d^8s(^4F)4p$	$sp\,^5D_2^0$	88434·8		*	$4s\,^3D_{2,\,1}$, $s^2\,^3F_{3,\,2}$
S	$d^8s(^4F)4p$	$sp\,^5G_5^0$	88703·0		. *	$s^2\,^3F_4$
S	$d^8s(^4F)4p$	$sp\,^5D_1^0$	89195·4 ?		* .	$4s\,^3D_1$, $5d\,^3F_2$
S	$d^8s(^4F)4p$	$sp\,^5G_4^0$	89290·2		*	$4s\,^3D_3$, $s^2\,^3F_3$
S	$d^8s(^4F)4p$	$sp\,^5G_3^0$	89948·0		*	$4s\,^3D_{3,\,2}$, $s^2\,^3F_2$
S	$d^8s(^4F)4p$	$sp\,^5G_2^0$	90495·9 ?		*	$4s\,^3D_1$
S	$d^8s(^4F)4p$	$sp\,^5F_4^0$	91374·2		*	$4s\,^3D_3$, $s^2\,^3F_{4,\,3}$
S	$d^8s(^4F)4p$	$sp\,^5F_3^0$	92071·4		*	$4s\,^3D_{3,\,2}$, $s^2\,^3F_{3,\,,2}$ $5d\,^3D_3$
S	$d^8s(^4F)4p$	$sp\,^5F_2^0$	92553·9		*	$4s\,^3D_{2,\,1}$, $s^2\,^3F_2$
S	$d^8s(^4F)4p$	$sp\,^5F_1^0$	92827·8		*	$4s\,^3D_1$, $s^2\,^3F_2$
S	$d^8s(^2F)4p$	$z\,^3G_4^0$	93431·2		*	$4s$ & $6s\,^3D_3$, $s^2\,^3F_4$
S	$d^8s(^2F)4p$	$z\,^3G_5^0$	93617·7		*	$s^2\,^3F_4$
K	$d^8s(^2F)4p$	$z\,^3D_3^0$	94446·87		* .	9
K	$d^8s(^2F)4p$	$z\,^3F_3^0$	94715·36		. . *	9
S	$d^8s(^2F)4p$	$z\,^3D_2^0$	95201·76		* . .	9
S	$d^8s(^2F)4p$	$z\,^3F_4^0$	95738·0		. . *	7
S	$d^8s(^2F)4p$	$z\,^3D_1^0$	96142·74		* . .	9
K	$d^8s(^2F)4p$	$z\,^3G_3^0$	96214·37		* .	11
S	$d^8s(^2F)4p$	$z\,^1G_4^0$	97062·9		.	6
K	$d^8s(^2F)4p$	$z\,^3F_2^0$	97111·08		*	13
K	$d^9(^2D_{2\frac{1}{2}})5p$	$5p\,^3P_2^0$	98163·76	3·17393	*	28
S	$d^9(^2D_{2\frac{1}{2}})5p$	$5p\,^3F_3^0$	98756·16	3·19572	. *	21
S	$d^9(^2D_{2\frac{1}{2}})5p$	$5p\,^3F_4^0$	98861·23	3·19964	. *	13
S	$d^8s(^2F)4p$	$z\,^1D_2^0$	98947·53		. .	19
K	$d^9(^2D_{2\frac{1}{2}})5p$	$5p\,^3P_1^0$	98991·08	3·20448	* .	25
K	$d^8s(^2F)4p$	$z\,^1F_3^0$	99150·52		. .	26
S	$d^9(^2D_{2\frac{1}{2}})5p$	$5p\,^3D_3^0$	99596·28	3·22742	. . *	21
S	$d^9(^2D_{2\frac{1}{2}})5p$	$5p\,^3D_2^0$	100053·31	3·24506	. . *	26
S	$d^9(^2D_{1\frac{1}{2}})5p$	$5p\,^3P_0^0$	100295·52	3·17617	* . .	8
K	$d^9(^2D_{1\frac{1}{2}})5p$	$5p\,^3F_2^0$	100817·43	3·19540	* .	21
S	$d^9(^2D_{1\frac{1}{2}})5p$	$5p\,^1P_1^0$	100939·32	3·19994	.	25
S	$d^9(^2D_{1\frac{1}{2}})5p$	$5p\,^1F_3^0$	101088·33	3·20552	.	13
S	$d^9(^2D_{1\frac{1}{2}})5p$	$5p\,^3D_1^0$	101376·36	3·21625	*	15
S	$d^9(^2D_{1\frac{1}{2}})5p$	$5p\,^1D_2^0$	101628·34	3·22600		23
S	$d^8s(^2D)4p$	$y\,^3D_3^0$	103302·0		*	$4s\,^3D_{3,\,2}$, $^1D_2$, $s^2\,^3F_4$
S	$d^8s(^2D)4p$	$y\,^3D_2^0$	103319·2		*	$4s$, $5s$, s^2 7
S	$d^8s(^2D)4p$	$y\,^1P_1^0$	103471·2		.	$4s\,^1D_2$, $5s\,^3D_2$, $a\,^1S_0$
S	$d^8s(^2D)4p$	$y\,^3D_1^0$	103640·1		*	$4s\,^3D_{2,\,1}$, $^1D_2$

†‡ *See* footnote on p. 204.

TABLE III—continued

1†‡	2	3	4	5	6	7
K	$d^8s(^4P)4p$	$x^5S_2^0$	106437·1			$4s$, s^2 5
S	$d^8s(^2D)4p$	$y^3F_3^0$	106630·3		*	$4s$, $5s$, s^2 7
S	$d^8s(^2D)4p$	$y^3F_2^0$	106641·0		*	$4s^3D_{2,1}$, $s^2\,{}^3F_{3,2}$
S	$d^8s(^2D)4p$	$y^3F_4^0$	106849·5		*	$4s$ & $5s^3D_3$
S	$d^8s(^4P)4p$	$x^5P_2^0$	106924·7		*	$4s^3D_{3,2}$, $^1D_2$, $s^2\,{}^3F_3$
S	$d^8s(^4P)4p$	$x^5P_3^0$	107188·3		*	$4s^3D_3$, $^1D_2$, $s^2\,{}^3F_{4,3}$
S	$d^8s(^4P)4p$	$x^5P_1^0$	107831·0		*	$4s$, s^2 7
S	$d^8s(^2D)4p$	$y^3P_2^0$	108457·8			$4s$, s^2, $6d$ 8
S	$d^8s(^2D)4p$	$y^1D_2^0$	108703·8			$4s$ & $5s^1D_2$
S	$d^8s(^4P)4p$	$x^5D_{2,1}^0$	109016		*	16
S	$d^8s(^2D)4p$	$y^1F_3^0$	109115·5		.	10
S	$d^8s(^4P)4p$	$x^5D_0^0$	109277·4		*	$s^2\,{}^3P$, $4d^3S_1$, $^3P_1$
S	$d^8s(^4P)4p$	$x^5D_3^0$	109384·1		*	$4s$ & $5s^3D_3$, $s^2\,{}^3F_{4,3}$
K	$d^8s(^2P)4p$	$w^3P_2^0$	111897·6		*	8
S	$d^8s(^2P)4p$	$w^3D_3^0$	112056·0		* .	7
S	$d^8s(^4F)4p$	$v^3G_5^0$	112182·0		. . *	$s^2\,{}^3F_4$, $4d^3F_4$
S	$d^8s(^2P)4p$	$w^3P_1^0$	112431·3		. * .	10
S	$d^8s(^2P)4p$	$w^3D_2^0$	112747·0		* . .	8
S	$d^8s(^4F)4p$	$v^3F_4^0$	112814·4		. . . . *	s^2, $4d$ 5
K	$d^8s(^4P)4p$	$w^3D_1^0$	113207·0		* . . .	$4s$, s^2, $4d$ 5
S	$d^8s(^4P)4p$	$w^3P_0^0$	113555·7		* . .	$4s^3D_1$, $4d^3S_1$
S	$d^8s(^4F)4p$	$v^3D_3^0$	113805·0		* . .	10
S	$d^8s(^4F)4p$	$v^3G_4^0$	113906·3		. * .	s^2, $4d$, $5g$ 6
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3P_1^0$	113935·33	3·97349	. * . .	12
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3P_0^0$	113973·83	3·97623	. * . .	5
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3P_2^0$	113982·39	3·97683	. * . .	11
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3H_6^0$	114002·67	3·97831	. . . *	3
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3H_5^0$	114005·55	3·98751	. . . *	6
S	$d^8s(^2P)4p$	$w^1D_2^0$	114023·95		. . . .	10
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^1P_1^0$	114029·86	3·98026	. . . .	9
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3D_3^0$	114061·55	3·98223	. * . . .	13
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3D_2^0$	114085·66	3·98423	. * . . .	12
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3F_3^0$	114107·04	3·98577	. . . . . . *	15
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3F_4^0$	114204·46	3·99280	. . . . . . *	13
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3G_5^0$	114232·33	3·99488	. . . . *	8
S	$d^9(^2D_{2\frac{1}{2}})4f$	$4f^3G_4^0$	114341·66	4·00279	. . . . *	14
S	$d^8s(^4F)4p$	$v^3F_3^0$	114513·45		. . . * . . .	9
S	$d^8s(^2G)4p$	$u^3H_4^0$	114765·5		. . . .	6
S	$d^8s(^4F)4p$	$v^3D_2^0$	114870·7		*	$4s$, s^2 5
S	$d^8s(^4F)4p$	$v^3G_3^0$	115149·0		. . *	s^2, $4d$ 5
S	$d^8s(^2G)4p$	$u^1H_5^0$	115153·9		. . . . . .	$4d^3G_{5,4}$, $^1G_4$
S	$d^8s(^2P)4p$	$w^1P_1^0$	115284·1		. . . . . .	$4s$, s^2, $4d$ 4
S	$d^8s(^4F)4p$	$v^3F_2^0$	115720·5		. . * . . .	10
S	$d^8s(^4F)4p$	$v^3D_1^0$	115985·2		*	6
S	$d^8s(^2G)4p$	$u^3F_4^0$	116010·3		. * . . .	$4s^3D_3$, $s^2\,{}^3F_{4,3}$

†‡ *See* footnote on p. 204.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

Table III—continued

1†‡	2	3	4	5	6	7
S	$d^9(^2D_{1\frac{1}{2}})4f$	$4f\,^1D_2^0$	116074·60	3·97843	. . . . .	5
S	$d^9(^2D_{1\frac{1}{2}})4f$	$4f\,^3D_1^0$	116100·10	3·97956	*	8
S	$d^9(^2D_{1\frac{1}{2}})4f$	$4f\,^1H_5^0$	116135·72	3·98285	. . . .	5
S	$d^9(^2D_{1\frac{1}{2}})4f$	$4f\,^3H_4^0$	116145·07	3·98350	. * . .	5
S	$d^9(^2D_{1\frac{1}{2}})4f$	$4f\,^1F_3^0$	116202·21	3·98759	. . .	8
S	$d^9(^2D_{1\frac{1}{2}})4f$	$4f\,^3F_2^0$	116248·62	3·99100	. * .	10
S	$d^9(^2D_{1\frac{1}{2}})4f$	$4f\,^1G_4^0$	116291·47	3·99403	. .	8
S	$d^9(^2D_{1\frac{1}{2}})4f$	$4f\,^3G_3^0$	116333·23	3·99712	. *	10
K	$d^8s(^2G)4p$	$u\,^3F_3^0$	116473·6		*	9
S	$d^8s(^2G)4p$	$u\,^3F_2^0$	117099·6		*	5
S	$d^9(^2D_{2\frac{1}{2}})6p$	$6p\,^3P_2^0$	117288·7 ?	4·23724	*	$5s\,^3D_{3,\,2}$, $4d\,^3D_3$
S	$d^9(^2D_{2\frac{1}{2}})6p$	$6p\,^3P_1^0$	117313·0	4·23934	*	6
S	$d^9(^2D_{2\frac{1}{2}})6p$	$6p\,^3F_3^0$	117402·7	4·24714	*	8
S	$d^9(^2D_{2\frac{1}{2}})6p$	$6p\,^3F_4^0$	117467·2	4·25278	*	4
S	$d^9(^2D_{2\frac{1}{2}})6p$	$6p\,^3D_2^0$	117781·6	4·28061	. *	5
S	$d^9(^2D_{2\frac{1}{2}})6p$	$6p\,^3D_3^0$	117812·5	4·28339	. *	6
S	$d^8s(^4P)4p$	1_1^0	118553·1 ?		. .	$4s\,^3D_1$, $s^2\,^3F_2$
S	$d^9(^2D_{1\frac{1}{2}})6p$	$6p\,^1P_1^0$	119055·6	4·21127	. .	3
S	$d^9(^2D_{1\frac{1}{2}})6p$	$6p\,^1F_3^0$	119275·5	4·23000	. .	6
S	$d^9(^2D_{1\frac{1}{2}})6p$	$6p\,^3D_1^0$	119316·0	4·23359	. *	3
S	$d^9(^2D_{1\frac{1}{2}})6p$	$6p\,^1D_2^0$	119613·5	4·25955	.	7
S	$d^9(^2D_{1\frac{1}{2}})6p$	$6p\,^3F_2^0$	119805·3	4·27664	*	6
S	$d^8s(^4P)4p$	3_1^0	122312·0 ?			$4s\,^3D_2$, $s^2\,^3P_0$
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3P_0^0$	123961·0	4·97022	*	2
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3P_1^0$	123972·5	4·97083	*	3
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3P_2^0$	123998·9	4·97444	*	6
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3H_5^0$	124017·2	4·97700	*	4
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3H_6^0$	124023·1	4·97783	*	$4d\,^3G_5$
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^1P_1^0$	124027·1	4·97841	.	4
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3D_3^0$	124049·8	4·98167	* .	4
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3D_2^0$	124056·8	4·98261	* .	4
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3F_3^0$	124092·9	4·98765	. . *	4
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3F_4^0$	124095·4	4·98806	. . *	3
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3G_4^0$	124100·9	4·98882	. . . *	2
S	$d^9(^2D_{2\frac{1}{2}})5f$	$5f\,^3G_5^0$	124103·9	4·98929	. . . *	2
S	$d^9(^2D_{1\frac{1}{2}})5f$	$5f\,^1D_2^0$	126059·1	4·97311	. . . .	5
S	$d^9(^2D_{1\frac{1}{2}})5f$	$5f\,^3D_1^0$	126087·7	4·97711	* . . .	5
S	$d^9(^2D_{1\frac{1}{2}})5f$	$5f\,^1H_5^0$	126100·2	4·97894	. . .	$4d\,^1G_4$
S	$d^9(^2D_{1\frac{1}{2}})5f$	$5f\,^3H_4^0$	126105·1	4·97965	* . .	$4d\,^3F_3\,^3G_3$
S	$d^9(^2D_{1\frac{1}{2}})5f$	$5f\,^1F_3^0$	126133·1	4·98350	. .	$4d\,^3P_2\,^1D_2\,^1F_3$
S	$d^9(^2D_{1\frac{1}{2}})5f$	$5f\,^3F_2^0$	126137·7	4·98417	* .	$4d\,^3F_2\,^3G_3\,^3D_1$
S	$d^9(^2D_{1\frac{1}{2}})5f$	$5f\,^3G_3^0$	126174·6	4·98941	*	6
S	$d^9(^2D_{1\frac{1}{2}})5f$	$5f\,^1G_4^0$	126177·0	4·98976		$4d\,^1F_3\,^1G_4$
S	$d^8s(^2S)4p$	$t\,^3P_2^0$	128321			$4s\,^3D_{3,\,2}$, $^1D_2$
S	$d^9(^2D_{2\frac{1}{2}})6f$	$6f\,^3H_5$	129443·7	5·97540	*	$4d$ & $5d\,^3G_4$

†‡ *See* footnote on p. 204.

TABLE III—continued

1†‡	2	3	4	5	6	7
S	$d^9(^2D_{2\frac{1}{2}})6f$	$6f\,^3P_2{}^0$	129446·7	5·97610	.	$4d\,^3S_1\ ^3P_2$
S	$d^9(^2D_{2\frac{1}{2}})6f$	$6f\,^3H_6{}^0$	129449·2	5·97670	*	$4d$ & $5d\,^3G_5$
S	$d^9(^2D_{2\frac{1}{2}})6f$	$6f\,^3D_3{}^0$	129473·8 ?	5·98250	. *	$4d\,^3P_2\ ^3D_3$
S	$d^9(^2D_{2\frac{1}{2}})6f$	$6f\,^3D_2{}^0$	129475·2 ?	5·98300	. *	$4d\,^3S_1\ ^3P_1\ ^3D_2$
S	$d^9(^2D_{2\frac{1}{2}})6f$	$6f\,^3F_3{}^0$	129490·6 ?	5·98690	. .	$4d\,^3F_{4,\,3}$
S	$d^9(^2D_{1\frac{1}{2}})6f$	$6f\,^1H_5{}^0$	131521·5 ?	5·97730	. .	$4d\,^1G_4$
S	$d^9(^2D_{1\frac{1}{2}})6f$	$6f\,^3H_4{}^0$	131526·9 ?	5·97870	* .	$4d$ & $5d\,^3G_3$

LIMIT LEVELS IN CU III—

G	$d^9\ ^2D_{2\frac{1}{2}}$	141737
G	$d^9\ ^2D_{1\frac{1}{2}}$	143807
G	$d^84s\,^4F_{4\frac{1}{2}}$	202529
G	$d^84s\,^4F_{3\frac{1}{2}}$	203789
G	$d^84s\,^4F_{2\frac{1}{2}}$	204867
G	$d^84s\,^4F_{1\frac{1}{2}}$	205611

†‡ *See* footnote on p. 204.

TABLE IV—LIST OF OBSERVED LINES OF COPPER II

1*†	2	3	4	5
BG	10172·45	0	9827·78	
BG	10166·91	15	9833·14	$4f\,^3G_4{}^0$—$5g\,^3H_5$
BG	10162·88	1	9837·04	$4f\,^3G_4{}^0$—$5g\,^3G_4$
BG	10092·27	0	9905·88	$4f\,^3G_3{}^0$—$5g\,^3G_3$
BG	10080·47	10	9917·46	$4f\,^3G_3{}^0$—$5g\,^3H_4$
BG	10055·02	30	9942·56	$4f\,^3G_5{}^0$—$5g\,^3H_6$
BG	10051·12	3	9946·42	$4f\,^3G_5{}^0$—$5g\,^3G_5$
BG	10049·88	1	9947·65	$4f\,^1G_4{}^0$—$5g\,^1G_4$
BG	10040·53	0	9956·91	$4f\,^3F_2{}^0$—$5g\,^3F_2$
BG	10038·19	15	9959·23	$4f\,^1G_4{}^0$—$5g\,^1H_5$
BG	10036·32	5	9961·08	$4f\,^3F_4{}^0$—$5g\,^3F_4$
BG	10026·93	1	9970·41	$4f\,^3F_4{}^0$—$5g\,^3H_5$
BG	10023·05	30	9974·27	$4f\,^3F_4{}^0$—$5g\,^3G_5$
BG	10006·68	10	9990·59	$4f\,^3F_2{}^0$—$5g\,^3G_3$
BG	9994·32	1*u*	10002·94	$4f\,^1F_3{}^0$—$5g\,^1F_3$

* Column 1, Instrument; 2, wave-length, λ (air) above 2000 H, λ (vac) below 2000 H; 3, intensity (where two intensities are given, the first is the Neon, the second the Helium Schuler tube), *u* = diffuse, *d* = double; 4, wave-number; 5, classification.

† Explanation of Column 1.

BG	Bureau of Standards 21 ft. grating.	BI	The interferometer of Burns and Walters.
VG	M.I.T. Vacuum 2 m grating.	CI	Calculated from Burns's Interferometer measures.
LG	Princeton, 21 ft. grating.		
SG	,, 10 ft. ,,	C1	Calculated wave-number ± 0·1.
P	Hilger E.I. Prism, glass or quartz.	C2	,, ,, ± 0·2.
SP	,, small quartz prism.	C3	,, ,, ± 0·3.
		C4	,, ,, ± 0·4.

TABLE IV—continued

1*†	2	3	4	5
BG	9960·46	15	10036·95	$4f\,^1F_3^0$—$5g\,^1G_4$
BG	9960·07	10	10037·34	$5p\,^1D_2^0$—$6s\,^3D_3$
				$4f\,^3F_3^0$—$5g\,^1D_2$
BG	9939·05	20*d*	10058·57	$4f\,^3D_2^0$—$5g\,^1D_2$
				$4f\,^3F_3^0$—$5g\,^3F_3$
BG	9926·10	10	10071·69	$4f\,^3F_3^0$—$5g\,^3G_4$
BG	9925·67	20	10072·13	$4f\,^3H_4^0$—$5g\,^3I_5$
BG	9918·05	15	10079·87	$4f\,^3D_2^0$—$5g\,^3F_3$
BG	9916·52	30	10081·42	$4f\,^1H_5^0$—$5g\,^1I_6$
BG	9915·20	1	10082·75	$4f\,^3D_3^0$—$5g\,^3D_3$
BG	9905·44	2	10092·88	$4f\,^1P_1^0$—$5g\,^3D_2$
BG	9894·44	5	10103·92	$4f\,^3D_3^0$—$5g\,^3F_4$
BG	9893·04	5*u*	10105·30	$4f\,^3D_1^0$—$5g\,^3F_2$
				$4f\,^3H_4^0$—$5g\,^3H_4$
BG	9884·09	10*u*	10114·50	$4f\,^1P_1^0$—$5g\,^1D_2$
				$4f\,^1H_5^0$—$5g\,^1H_5$
BG	9881·57	15	10117·08	$4f\,^3D_3^0$—$5g\,^3G_4$
BG	9878·43	0	10120·29	$w\,^1D_2^0$—$5g\,^3D_3$
BG	9870·93	0 ?	10127·98	$5s\,^3D_3$—$z\,^3G_3^0$
BG	9868·20	15	10130·78	$4f\,^1D_2^0$—$5g\,^1F_3$
BG	9864·26	40	10134·83	$4f\,^3H_5^0$—$5g\,^3I_6$
BG	9861·41	50	10137·77	$4f\,^3H_6^0$—$5g\,^3I_7$
BG	9858·87	3*u*	10140·37	$4f\,^3P_2^0$—$5g\,^3D_2$
BG	9850·58	3	10148·91	$4f\,^3P_0^0$—$5g\,^3D_1$
BG	9848·27	0	10151·29	
BG	9837·94	25	10161·94	$4f\,^3P_2^0$—$5g\,^3D_3$
BG	9830·90	5	10169·22	$4f\,^3H_5^0$—$5g\,^3H_5$
BG	9829·06	3	10171·13	$5p\,^1D_2^0$—$6s\,^3D_2$
BG	9828·06	5	10172·16	$4f\,^3H_6^0$—$5g\,^3H_6$
BG	9817·46	0	10183·14	$4f\,^3P_2^0$—$5g\,^3F_3$
BG	9813·35	20	10187·41	$4f\,^3P_1^0$—$5g\,^3D_2$
BG	9735·94	15	10268·41	$v\,^3G_4^0$—$5g\,^3H_5$
BG	9733·97	0 ?	10270·49	$4f\,^3F_4^0$—$6d\,^3G_5$?
BG	9732·28	3	10272·27	$v\,^3G_4^0$—$5g\,^3G_4$
BG	9688·71	10	10318·46	$5s\,^1D_2$—$5p\,^3F_3^0$
SG	9512·43	2	10509·68	$5s\,^1D_2$—$z\,^1D_2^0$
SG	9473·36	1	10553·02	$5s\,^1D_2$—$5p\,^3P_1^0$?
SG	9463·71	3	10563·79	$4f\,^3P_1^0$—$6d\,^3P_1$?
SG	9451·59	2	10577·33	$5p\,^1F_3^0$—$6s\,^3D_3$
SG	9332·04	5	10712·83	$5s\,^1D_2$—$z\,^1F_3^0$
SG	9230·59	0	10830·57	
SG	9226·86	1	10834·95	$5s\,^3D_1$—$5p\,^3P_1^0$
SG	9205·40	20	10860·21	$5p\,^1P_1^0$—$6s\,^3D_2$
SG	9103·33	10	10981·97	$5p\,^3F_2^0$—$6s\,^3D_2$
SG	8609·26	3	11612·24	$5p\,^3D_2^0$—$6s\,^3D_3$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
SG	8606·64	1	11615·75	$5s\,{}^1D_2$—$5p\,{}^3D_2^0$
SG	8511·04	40	11746·22	$5p\,{}^3D_2^0$—$6s\,{}^3D_2$
SG	8503·46	15	11756·69	$5s\,{}^3D_2$—$5p\,{}^3P_2^0$
SG	8477·26	10	11793·03	$4p\,{}^1P_1^0$—$s^2\,{}^1D_2$
SG	8306·60	1	12035·32	$4p\,{}^1D_2^0$—$s^2\,{}^1D_2$
SG	8283·21	60	12069·30	$5p\,{}^3D_3^0$—$6s\,{}^3D_3$
SG	8277·60	50	12077·48	$5s\,{}^3D_3$—$5p\,{}^3P_2^0$
SG	8256·90	5	12107·76	$5p\,{}^1D_2^0$—$6s\,{}^3D_1$
SG	8235·30	10	12139·50	$5s\,{}^3D_1$—$5p\,{}^3P_0^0$
SG	8192·28	30	12203·26	$5p\,{}^3D_3^0$—$6s\,{}^3D_2$
				$5p\,{}^1D_2^0$—$6s\,{}^1D_2$
SG	8095·55	40	12349·07	$5s\,{}^3D_2$—$5p\,{}^3F_3^0$
SG	8088·58	20	12359·72	$5p\,{}^3D_1^0$—$6s\,{}^3D_1$
SG	8075·46	2	12379·80	$5s\,{}^1D_2$—$5p\,{}^3F_2^0$
SG	8026·45	10	12455·39	$5p\,{}^3D_1^0$—$6s\,{}^1D_2$
SG	7996·72	10	12501·69	$5s\,{}^1D_2$—$5p\,{}^1P_1^0$
SG	7988·17	60	12515·07	$z\,{}^1F_3^0$—$6s\,{}^3D_3$
SG	7972·01	8	12540·44	$5s\,{}^3D_2$—$z\,{}^1D_2^0$
SG	7944·42	25	12583·99	$5s\,{}^3D_2$—$5p\,{}^3P_1^0$
SG	7902·57	25	12650·64	$5s\,{}^1D_2$—$5p\,{}^1F_3^0$
SG	7895·83	20	12661·41	$5s\,{}^3D_1$—$5p\,{}^3F_2^0$
SG	7890·56	3	12669·89	$5s\,{}^3D_3$—$5p\,{}^3F_3^0$
SG	7860·58	5	12718·21	$z\,{}^1D_2^0$—$6s\,{}^3D_3$
SG	7845·03	25	12743·42	$5s\,{}^3D_2$—$z\,{}^1F_3^0$
				$5p\,{}^1F_3^0$—$6s\,{}^1D_2$
SG	7825·66	50	12774·97	$5s\,{}^3D_3$—$5p\,{}^3F_4^0$
SG	7820·57	5	12783·28	$5s\,{}^3D_1$—$5p\,{}^1P_1^0$
SG	7812·33	10	12796·76	$5p\,{}^1P_1^0$—$6s\,{}^3D_1$
SG	7807·66	75	12804·42	$5p\,{}^3F_4^0$—$6s\,{}^3D_3$
SG	7805·19	25	12808·46	$5p\,{}^3P_1$—$6s\,{}^3D_2$
SG	7778·74	30	12852·02	$z\,{}^1D_2^0$—$6s\,{}^3D_2$
SG	7754·37	10	12892·41	$5p\,{}^1P_1^0$—$6s\,{}^1D_2$
SG	7744·09	5	12909·52	$5p\,{}^3F_3^0$—$6s\,{}^3D_3$
SG	7738·68	30	12918·55	$5p\,{}^3F_2^0$—$6s\,{}^3D_1$
SG	7726·64	5	12938·68	$5s\,{}^1D_2$—$5p\,{}^3D_1^0$
P	7681·15	0	13015·3	$5p\,{}^3F_2^0$—$6s\,{}^1D_2$
SG	7664·70	75	13043·24	$5p\,{}^3F_3^0$—$6s\,{}^3D_2$
SG	7652·36	30	13064·27	$5s\,{}^3D_3$—$z\,{}^1F_3^0$
SG	7579·87	10	13189·21	$5s\,{}^3D_2$—$5p\,{}^3D_3^0$
SG	7579·02	30	13190·69	$5s\,{}^1D_2$—$5p\,{}^1D_2^0$
SG	7562·01	25	13220·36	$5s\,{}^3D_1$—$5p\,{}^3D_1^0$
SG	7438·15	15	13440·51	$5p\,{}^3P_0^0$—$6s\,{}^3D_1$
P	7433·85	5	13448·3	$4d\,{}^1S_0$—$4f\,{}^3P_1^0$
P	7420·70	8	13472·1	$5s\,{}^3D_1$—$5p\,{}^1D_2^0$
SG	7404·34	100	13501·88	$5p\,{}^3P_2^0$—$6s\,{}^3D_3$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
SG	7399·89	20	13509·99	$5s\,{}^3D_3-5p\,{}^3D_3^0$
P	7382·18	10	13542·4	$4d\,{}^1S_0-4f\,{}^1P_1^0$
SG	7331·74	15	13635·58	$5p\,{}^3P_2^0-6s\,{}^3D_2$
SG	7326·02	15	13646·22	$5s\,{}^3D_2-5p\,{}^3D_2^0$
SG	7306·60	12	13682·49	$5p\,{}^3D_2^0-6s\,{}^3D_1$
SG	7255·83	20	13778·23	$5p\,{}^3D_2^0-6s\,{}^1D_2$
SG	7194·92	15	13894·87	$4p\,{}^3D_2^0-s^2\,{}^1D_2$
P	7189·74	0	13904·9	$5p\,{}^1P_1^0-5d\,{}^3P_1$
P	7022·75	2	14235·5	$5p\,{}^3D_3^0-6s\,{}^1D_2$
P	6889·76	1	14410·3	$5s\,{}^3D_2-5p\,{}^3F_2^0$
P	6879·47	1	14532·0	$5s\,{}^3D_2-5p\,{}^1P_1^0$
P	6872·43	3	14546·9	$4p\,{}^3D_3^0-s^2\,{}^1D_2$
P	6869·10	1	14553·9	$z\,{}^3F_2^0-6s\,{}^3D_3$
P	6868·10	0	14556·1	$4d\,{}^3D_2-x\,{}^5D_{2,1}$?
P	6845·97	0	14603·1	$z\,{}^1G_4^0-6s\,{}^3D_3$
P	6844·43	1	14606·4	$5d\,{}^3G_4-6f\,{}^3H_5^0$
P	6837·64	0	14620·9	$4d\,{}^3F_3-x\,{}^5D_{2,1}^0$
P	6830·73	0	14635·7	$5d\,{}^3G_3-6f\,{}^3H_4^0$
P	6823·40	3	14651·4	$5d\,{}^3G_5-6f\,{}^3H_6^0$
P	6809·90	4	14680·5	$z\,{}^1F_3^0-6s\,{}^1D_2$
P	6806·60	4	14687·6	$z\,{}^3F_2^0-6s\,{}^3D_2$
P	6780·40	3	14744·3	$5p\,{}^3P_1^0-6s\,{}^3D_1$
P	6770·70	8	14765·5	$4p\,{}^1P_1^0-s^2\,{}^3P_2$
P	6758·55	8	14792·0	$5p\,{}^3D_2^0-5d\,{}^3P_1$
P	6749·97	3	14810·8	
P	6737·64	5	14839·7	$5p\,{}^3P_1^0-6s\,{}^1D_2$
P	6717·04	0	14883·4	$z\,{}^1D_2^0-6s\,{}^1D_2$
SG	6660·99	8	15008·65	$4p\,{}^1D_2^0-s^2\,{}^3P_2$
SG	6659·57	0	15011·84	
P	6649·22	2	15035·2	$5p\,{}^1D_2^0-5d\,{}^1P_1$
SG	6641·41	10	15052·89	$5p\,{}^3D_2^0-5d\,{}^3F_3$
P	6631·85	2	15074·6	$5p\,{}^3F_3^0-6s\,{}^1D_2$
SG	6624·29	8	15091·80	$5p\,{}^3D_2^0-5d\,{}^3D_2$
P	6593·23	0	15162·9	$5s\,{}^3D_1-y\,{}^3D_2^0$
SG	6564·50	10	15229·25	$5p\,{}^3D_3^0-5d\,{}^3P_2$
P	6555·05	5	15251·2	$4p\,{}^1D_2^0-s^2\,{}^3P_1$
P	6551·58	2	15259·3	$4p\,{}^3D_1^0-s^2\,{}^3P_2$
P	6541·93	2	15281·8	$4d\,{}^3P_1-x\,{}^5D_{2,1}^0$
P	6530·30	8	15309·0	$4d\,{}^3P_2-x\,{}^5D_{2,1}^0$?
P	6524·12	2	15323·5	
P	6521·14	1*u*	15330·5	$4p\,{}^1P_1^0-s^2\,{}^3P_0$
SG	6494·04	30	15394·49	$5p\,{}^3D_3^0-5d\,{}^3D_3$
P	6489·10	1	15406·2	$4d\,{}^3P_2-y\,{}^1F_3^0$
SG	6484·46	20	15417·23	$5p\,{}^3P_1^0-5d\,{}^3S_1$
SG	6481·46	15	15424·27	$5p\,{}^1D_2^0-5d\,{}^1D_2$

*† *See* footnote on p. 211.

Table IV—continued

1*†	2	3	4	5
P	6479·64	2	15428·7	
P	6476·16	0	15437·0	$4f\,^3G_4{}^0—7d\,^3D_3$
LG	6470·152	50	15451·33	$z\,^3G_3{}^0—6s\,^3D_3$
P	6466·60	3	15459·8	$z\,^1D_2{}^0—5d\,^3S_1$
P	6462·90	0	15468·7	$x\,^5D_{2,1}{}^0—6d\,^3P_2$
P	6460·63	0	15474·1	$4f\,^3G_4{}^0—7d\,^3F_3$
P	6457·54	3	15481·5	$4f\,^3G_3{}^0—7d\,^3G_3$
				$x\,^5D_{2,1}{}^0—6d\,^3P_1$
P	6452·40	0	15493·8	$4f\,^3G_5{}^0—7d\,^3G_5$
SG	6448·49	10	15503·23	$4p\,^3D_1{}^0—s^2\,^3P_1$
P	6443·47	5	15515·3	$y\,^1F_3{}^0—6d\,^3F_4$
LG	6441·698	40	15519·58	$5p\,^3D_3{}^0—5d\,^3F_4$
P	6432·78	3	15541·1	$4d\,^3P_1—x\,^5D_0{}^0$
				$5s\,^3D_3—5p\,^1D_2{}^0$?
SG	6423·90	30	15562·58	$5p\,^1D_2{}^0—5d\,^1F_3$
P	6418·45	0	15575·8	$4f\,^3F_4{}^0—7d\,^3D_3$
SG	6414·62	20	15585·09	$z\,^3G_3{}^0—6s\,^3D_2$
SG	6411·18	10	15593·45	$5p\,^3D_1{}^0—5d\,^3D_1$
P	6403·70	5	15611·7	$4f\,^3F_4{}^0—7d\,^3F_4$
				$4d\,^1S_0—4f\,^3D_1$
P	6394·34	1	15634·5	$x\,^5D_{2,1}{}^0—6d\,^3D_2$?
P	6385·60	0	15655·9	$4f\,^3D_2{}^0—7d\,^3P_1$?
P	6381·00	0	15667·2	$5p\,^3P_2{}^0—6s\,^1D_2$
SG	6377·84	20	15674·96	$z\,^1F_3{}^0—5d\,^3P_2$
SG	6373·27	5	15686·21	$z\,^1F_3{}^0—5d\,^3G_4$
SG	6357·45	15	15725·24	$5p\,^1P_1{}^0—5d\,^1P_1$
P	6326·77	1	15801·5	$5p\,^1F_3{}^0—5d\,^3G_3$
P	6326·10	3	15803·2	
P	6318·00	3	15823·4	$4p\,^3D_1{}^0—s^2\,^3P_0$
P	6312·83	20	15836·4	$5p\,^3D_1{}^0—5d\,^3F_2$
LG	6311·292	30	15840·25	$z\,^1F_3{}^0—5d\,^3D_3$
LG	6305·956	15	15853·65	$5p\,^3P_1{}^0—5d\,^3P_1$
LG	6300·988	40	15866·15	$5p\,^1F_3{}^0—5d\,^1G_4$
SG	6288·72	5	15897·10	$z\,^1D_2{}^0—5d\,^3P_1$
LG	6276·708	10	15927·52	
LG	6276·624	10	15927·74	$z\,^3F_4{}^0—6s\,^3D_3$
LG	6273·330	60	15936·10	$5p\,^3F_4{}^0—5d\,^3G_5$
P	6265·94	1	15954·9	$z\,^1F_3{}^0—5d\,^3F_3$
LG	6261·826	40	15965·38	$z\,^1F_3{}^0—5d\,^3F_4$
SG	6257·86	5	15975·49	$5p\,^3F_4{}^0—5d\,^3G_4$
P	6250·74	0	15993·7	$z\,^1F_3{}^0—5d\,^3D_2$
P	6236·54	0	16030·1	$5p\,^1P_1{}^0—5d\,^3D_1$
LG	6219·818	30	16073·20	$5p\,^3F_2{}^0—5d\,^3G_3$
LG	6216·910	60	16080·72	$5p\,^3F_3{}^0—5d\,^3G_4$
SG	6208·46	15	16102·61	$5p\,^1F_3{}^0—5d\,^1F_3$

*† *See* footnote on p. 211.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

TABLE IV—continued

1*†	2	3	4	5
SG	6204·27	15	16113·48	$5p^1P_1^0$—$5d^1D_2$
P	6199·90	1	16124·8	$5p^1F_3^0$—$5d^3F_2$
SG	6198·11	5	16129·50	$5p^3F_4^0$—$5d^3D_3$
SG	6188·69	20	16154·05	$5p^3P_1^0$—$5d^3D_2$
LG	6186·860	20	16158·83	$z^1D_2^0$—$5d^3F_3$
LG	6172·020	20	16197·68	$z^1D_2^0$—$5d^3D_2$
P	6158·00	5	16234·6	$5p^3F_3^0$—$5d^3D_3$
SG	6154·24	30	16244·48	$5p^3P_2^0$—$5d^3S_1$
SG	6150·42	20	16254·56	$5p^3F_4^0$—$5d^3F_4$
LG	6114·468	20	16350·14	$5p^3F_3^0$—$5d^3F_3$
SG	6110·90	5	16359·68	$5p^3F_3^0$—$5d^3F_4$
SG	6107·45	10	16368·92	$5p^3P_0^0$—$5d^1P_1$
SG	6105·97	5	16372·89	$5p^3F_2^0$—$5d^1F_3$
SG	6100·01	5	16388·89	$5p^3F_3^0$—$5d^3D_2$
SG	6097·33	10	16396·09	$5p^3F_2^0$—$5d^3F_2$
LG	6080·320	30	16441·96	$4p^1F_3^0$—$s^2\ {}^3P_2$
SG	6072·25	5	16463·81	$z^3D_2^0$—$6s^3D_3$
SG	6023·25	10	16597·74	$z^3D_2^0$—$6s^3D_2$
SG	6013·40	8	16624·93	$z^3F_2^0$—$6s^3D_1$
LG	6000·104	40	16661·77	$5p^3P_2^0$—$5d^3P_2$
SG	5995·59	10	16674·32	$5p^3P_0^0$—$5d^3D_1$
SG	5993·27	8	16680·77	$5p^3P_2^0$—$5d^3P_1$
SG	5988·30	25	16694·62	$5p^3P_1^0$—$5d^3P_0$
				$4d^3S_1$—$x^5D_0^0$
P	5979·20	3	16720·0	$z^3F_2^0$—$6s^1D_2$
LG	5941·168	50	16826·96	$5p^3P_2^0$—$5d^3D_3$
SG	5937·59	5	16837·20	$5p^3D_2^0$—$5d^3G_3$
P	5929·28	1	16860·8	$4d^1G_4$—$v^3F_4^0$?
P	5926·90	3	16867·6	$4p^3D_2^0$—$s^2\ {}^3P_2$
P	5909·85	1	16916·2	$5p^3D_2^0$—$5d^3D_1$
SG	5901·21	5	16940·99	$4p^3F_3^0$—$s^2\ {}^1D_2$
LG	5897·986	25	16950·25	$z^3F_3^0$—$6s^3D_3$
P	5858·63	5	17064·1	$5s^3D_2$—$y^1P_1^0$
P	5851·93	2	17083·6	$z^3F_3^0$—$6s^3D_2$
P	5842·67	4	17110·7	$4p^3D_2^0$—$s^2\ {}^3P_1$
P	5833·68	5	17137·1	$5p^3D_2^0$—$5d^1F_3$
P	5826·02	10	17159·6	$5p^3D_2^0$—$5d^3F_2$
SG	5806·00	25	17218·80	$z^3D_3^0$—$6s^3D_3$
P	5761·37	2*u*	17352·2	$z^3D_3^0$—$6s^3D_2$
P	5759·43	5*u*	17358·0	$5p^3D_3^0$—$5d^1G_4$
P	5752·35	1	17379·4	$4d^3F_2$—$4f^3P_2^0$
SG	5721·78	20	17472·24	$4p^3P_1^0$—$s^2\ {}^1D_2$
P	5706·00	1*u*	17520·6	$4p^3D_3^0$—$s^2\ {}^3P_2$
SG	5692·41	2	17562·39	$x^5P_2^0$—$6d^3P_2$
SG	5689·86	5	17570·26	$4d^1D_2$—$v^3D_3^0$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
SG	5682·42	20	17593·27	$z^3D_1^0$—$6s^3D_1$
P	5676·05	1*u*	17613·0	$4d^3F_4$—$w^3D_3^0$
P	5664·47	3	17649·0	$4d^1F_3$—$4f^3F_4^0$
P	5651·63	0	17689·1	$z^3D_1^0$—$6s^1D_2$
P	5647·90	0	17700·8	$4d^1D_2$—$4f^3P_1^0$
SG	5641·30	20	17721·50	$5p^1P_1^0$—$5d^1S_0$
P	5637·32	1*u*	17734·0	$z^1G_4^0$—$5d^3G_5$
P	5635·57	2	17739·5	$4d^3F_4$—$v^3G_5^0$
P	5633·14	3	17747·2	$4d^1D_2$—$4f^3P_2^0$
P	5621·63	0	17783·5	$4d^3P_0$—$w^3P_1^0$
P	5620·84	0	17786·0	$4d^1F_3$—$4f^3G_4^0$
P	5615·20	5	17803·9	$z^1F_3^0$—$5d^1G_4$
P	5600·38	0	17851·0	$4d^1D_2$—$4f^3D_2^0$
P	5593·73	5	17872·2	$4d^1D_2$—$4f^3F_3^0$
P	5584·23	0	17902·6	$z^1F_3^0$—$5d^1D_2$
P	5562·61	0	17972·2	$4d^3D_1$—$4f^3P_0^0$
				$4d^3D_2$—$w^3P_1^0$
P	5560·50	0	17979·0	$5p^3P_1^0$—$5d^3D_1$
P	5543·48	1	18034·2	$z^3F_2^0$—$5d^3D_2$
P	5541·61	1	18040·3	$z^1F_3^0$—$5d^1F_3$
P	5538·33	0	18051·0	$4d^1G_4$—$4f^3H_5^0$
P	5534·98	3	18061·9	$5p^3P_1^0$—$5d^1D_2$
P	5527·12	1	18087·6	$4d^3G_3$—$v^3G_4^0$
P	5523·17	1	18105·4	$z^1D_2^0$—$5d^1D_2$
P	5496·85	0	18187·2	$4d^3P_2$—$w^3P_2^0$
P	5495·04	0	18193·2	$5s^1D_2$—$y^3F_3^0$
P	5482·65	3	18234·3	$z^3G_4^0$—$6s^3D_3$
P	5473·04	1	18266·3	$z^3D_1^0$—$5d^3S_1$
				$4d^3G_3$—$4f^3D_2^0$
P	5469·63	3	18277·7	$4d^1G_4$—$4f^3G_5^0$
P	5466·46	1	18288·3	$4d^3G_3$—$4f^3F_3^0$
P	5449·42	1	18345·5	$4d^3P_2$—$w^3D_3^0$
P	5441·64	1	18371·7	$4d^3F_4$—$v^3F_4^0$
P	5437·36	2*u*	18386·2	$4d^1G_4$—$4f^3G_4^0$
P	5397·34	0	18522·5	$4d^3G_3$—$4f^3G_4^0$
P	5393·96	3	18534·1	$z^3D_2^0$—$6s^3D_1$
P	5390·45	5	18546·2	$4d^3F_2$—$v^3G_3^0$
P	5386·58	0	18559·5	$4d^3P_0$—$w^3D_1^0$
P	5384·87	0	18565·4	$4d^1S_0$—$6p^1P_1^0$?
P	5376·85	3	18593·1	$4d^1F_3$—$v^3G_3^0$
P	5368·42	10	18622·3	$z^3G_3^0$—$5d^3G_4$
P	5365·62	5	18632·0	$4d^1P_1$—$4f^3P_1^0$
P	5356·88	1	18662·4	$4d^3D_3$—$v^3F_4^0$
P	5354·87	0	18669·4	$4d^1P_1$—$4f^3P_0^0$
P	5347·77	1	18694·2	$4d^3P_1$—$w^3P_1^0$

*† *See* footnote on p. 211.

Table IV—continued

1*†	2	3	4	5
				$4d^3G_3$—$v^3F_3^{\circ}$
P	5345·25	0	18703·0	$z^3D_1^{\circ}$—$5d^3P_1$
P	5340·11	1	18721·0	$4d^1P_1$—$w^1D_2^{\circ}$
				$4d^3P_2$—$w^3P_1^{\circ}$
P	5335·55	1	18737·0	$4p^3F_2^{\circ}$—$s^2\ ^3P_1$
P	5328·81	3	18760·7	
P	5314·62	0	18810·8	$4d^1G_4$—$u^3H_4^{\circ}$
LG	5276·522	15	18946·62	$4d^3G_3$—$u^3H_4^{\circ}$
LG	5269·988	30	18970·11	$4p^3P_2^{\circ}$—$s^2\ ^1D_2$
P	5258·88	0	19010·2	$4d^3P_1$—$w^3D_2^{\circ}$
P	5254·26	0	19026·9	$5p^3P_2^{\circ}$—$5d^1F_3$
P	5245·36	10	19059·2	$z^3F_4^{\circ}$—$5d^3G_5$
P	5229·58	3	19116·7	$4d^3F_2$—$v^3F_2^{\circ}$
LG	5207·128	20	19199·11	$4d^1G_4$—$u^1H_5^{\circ}$
P	5192·66	0	19252·6	$z^3F_4^{\circ}$—$5d^3D_3$
LG	5183·364	20	19287·13	$4d^3P_0$—$4f^3P_1^{\circ}$
P	5175·89	2	19315·0	$4d^3S_1$—$w^3P_2^{\circ}$
P	5172·03	0	19329·4	$4d^3G_3$—$v^3G_3^{\circ}$
P	5163·06	0	19363·0	$4d^3F_4$—$v^3D_3^{\circ}$
LG	5158·090	10	19381·64	$4d^3P_0$—$4f^1P_1^{\circ}$
				$4d^3F_2$—$v^3D_1^{\circ}$
P	5130·60	1	19485·5	$4d^1D_2$—$v^3F_2^{\circ}$
P	5127·65	1	19496·7	$4d^3F_2$—$4f^3D_1^{\circ}$
				$4d^3P_2$—$w^3D_1^{\circ}$
LG	5124·461	20	19508·83	$4d^3F_3$—$v^3G_4^{\circ}$
LG	5120·745	20	19522·98	$4d^3D_2$—$4f^3P_2^{\circ}$
LG	5108·331	3	19570·43	$4d^3D_2$—$4f^1P_1^{\circ}$
P	5100·08	10	19602·1	$4d^3D_2$—$4f^3D_3^{\circ}$
LG	5095·746	1	19618·76	$4d^3F_4$—$4f^3D_3^{\circ}$
LG	5093·792	20	19626·29	$4d^3D_2$—$4f^3D_2^{\circ}$
				$4d^3F_3$—$w^1D_2^{\circ}$
LG	5088·932	10	19645·03	$4d^3F_2$—$4f^3F_2^{\circ}$
LG	5088·487	10	19646·75	$4d^1F_3$—$4f^1F_3^{\circ}$
LG	5088·260	30	19647·62	$4d^3D_2$—$4f^3F_3^{\circ}$
LG	5083·991	15	19664·12	$4d^3F_3$—$4f^3D_3^{\circ}$
				$4d^3F_4$—$4f^3F_3^{\circ}$
LG	5077·805	5	19688·08	$4d^3F_3$—$4f^3D_2^{\circ}$
P	5076·56	1	19692·9	$4d^1F_3$—$4f^3F_2^{\circ}$
LG	5072·293	20	19709·47	$4d^3F_3$—$4f^3F_3^{\circ}$
LG	5067·082	30	19729·74	$4d^3F_2$—$4f^3G_3^{\circ}$
LG	5065·448	40	19736·10	$4d^1F_3$—$4f^1G_4^{\circ}$
LG	5064·678	0	19739·11	$y^1F_3^{\circ}$—$8s^3D_2$?
LG	5060·635	30	19754·88	$4p^3P_0^{\circ}$—$s^2\ ^3P_1$
LG	5058·897	30	19761·66	$4d^3F_4$—$4f^3F_4^{\circ}$
LG	5051·778	60	19789·51	$4d^3F_4$—$4f^3G_5^{\circ}$

*† See footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
LG	5047·343	10	19806·90	$4d^3F_3$—$4f^3F_4^0$
LG	5041·322	10	19830·55	$4d^3D_3$—$4f^3P_2^0$
LG	5039·002	10	19839·68	$4d^1D_2$—$4f^1D_2^0$
P	5036·74	0	19848·6	$4d^3S_1$—$w^3P_1^0$
LG	5031·298	1	19870·06	$4d^3F_2$—$u^3F_3^0$
LG	5030·778	2	19872·12	$4d^3D_3$—$w^1D_2^0$
LG	5024·027	5	19898·82	$4d^3F_4$—$4f^3G_4^0$
LG	5021·285	20	19909·69	$4d^3D_3$—$4f^3D_3^0$
LG	5020·139	5	19914·23	$4p^3F_3^0$—$s^2\,^3P_2$
LG	5016·285	1	19929·53	
LG	5015·207	10	19933·81	$4d^3D_3$—$4f^3D_2^0$
LG	5012·611	20	19944·14	$4d^3F_3$—$4f^3G_4^0$
LG	5009·833	20	19955·19	$4d^3D_3$—$4f^3F_3^0$
LG	5006·787	30	19967·34	$4d^1D_2$—$4f^1F_3^0$
P	4994·94	1	20014·7	$4d^1D_2$—$4f^3F_2^0$
LG	4985·503	40	20052·58	$4d^3D_3$—$4f^3F_4^0$
LG	4985·136	2	20054·06	$4d^3D_2$—$v^3F_3^0$
P	4981·05	1	20070·5	$4d^3G_4$—$v^3D_3^0$
				$4d^3F_4$—$v^3F_3^0$
LG	4980·006	10	20074·71	$4d^3D_1$—$4f^1D_2^0$
LG	4974·151	10	20098·34	$4d^1D_2$—$4f^3G_3^0$
LG	4973·689	10	20100·21	$4d^3D_1$—$4f^3D_1^0$
LG	4969·812	3	20115·89	$4d^3F_3$—$v^3F_3^0$
LG	4955·964	5	20172·10	$4d^3G_4$—$v^3G_4^0$
LG	4953·733	50	20181·18	$4d^1G_4$—$4f^1H_5^0$
LG	4951·627	12	20189·76	$4d^3D_3$—$4f^3G_4^0$
LG	4951·454	3	20190·48	$4d^1G_4$—$4f^3H_4^0$
LG	4949·479	3	20198·52	$4d^3P_1$—$4f^3P_1^0$
LG	4943·020	20	20224·92	$4d^3P_2$—$4f^3P_1^0$
LG	4940·060	5*u*	20237·04	$4d^3P_1$—$4f^3P_0^0$
LG	4939·680	1	20238·59	$4d^1D_2$—$u^3F_3^0$
LG	4937·967	15	20245·61	$4d^3P_1$—$4f^3P_2^0$
LG	4937·462	1	20247·69	$4d^1G_4$—$4f^1F_3^0$
LG	4937·196	20	20248·78	$4d^3D_1$—$4f^3F_2^0$
LG	4932·985	1	20266·06	$5s^1D_2$—$y^1D_2^0$
				$4d^3G_5$—$v^3G_4^0$
LG	4931·653	100	20271·54	$4d^3G_4$—$4f^3H_5^0$
LG	4931·483	20	20272·24	$4d^3P_2$—$4f^3P_2^0$
LG	4928·463	1	20284·66	
LG	4927·818	1	20287·31	$4d^3P_1$—$w^1D_2^0$
LG	4926·390	20	20293·19	$4d^3P_1$—$4f^1P_1^0$
LG	4921·461	3	20313·52	$4d^3P_2$—$w^1D_2^0$
LG	4920·031	5	20319·42	$4d^3P_2$—$4f^1P_1^0$
LG	4918·373	30	20326·27	$4d^3G_3$—$4f^3H_4^0$
LG	4915·821	15	20336·82	$4d^1G_4$—$4f^1G_4^0$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
LG	4912·909	20	20348·88	$4d^3P_1$—$4f^3D_2^0$
LG	4912·362	15	20351·14	$4d^3P_2$—$4f^3D_3^0$
LG	4909·726	100	20362·07	$4d^3G_5$—$4f^3H_6^0$
LG	4909·032	5	20364·95	$4d^3G_5$—$4f^3H_5^0$
LG	4908·275	0	20368·09	$4d^3F_3$—$u^3H_4^0$
LG	4906·548	20	20375·26	$4d^3P_2$—$4f^3D_2^0$
LG	4901·412	25	20396·61	$4d^3P_2$—$4f^3F_3^0$
LG	4900·454	1	20400·60	$z^3F_3^0$—$5d^3F_4$
LG	4896·396	3	20417·50	$4d^1P_1$—$v^3F_2^0$
LG	4893·491	1	20429·62	$4d^3G_3$—$4f^3F_2^0$
				$z^3F_3^0$—$5d^3D_2$
LG	4889·690	30	20445·50	$4p^3P_1^0$—$s^2\ ^3P_2$
LG	4883·761	3	20470·32	$4d^3G_4$—$4f^3F_4^0$
LG	4883·217	3	20472·60	$4d^3G_3$—$4f^1G_4^0$
LG	4873·291	15	20514·30	$4d^3G_3$—$4f^3G_3^0$
P	4866·27	1	20543·9	$5s^3D_3$—$y^3F_3^0$
				$z^3D_3^0$—$5d^3D_3$
LG	4861·548	2	20563·85	$4d^3G_5$—$4f^3F_4^0$
LG	4854·966	30	20591·73	$4d^3G_5$—$4f^3G_5^0$
LG	4851·248	15	20607·51	$4d^3G_4$—$4f^3G_4^0$
LG	4847·368	2	20624·01	$4d^3S_1$—$w^3D_1^0$
P	4840·14	1	20654·8	$4d^3G_3$—$u^3F_3^0$
P	4836·79	1	20669·1	$z^3D_3^0$—$5d^3F_4$
P	4833·75	1	20682·1	$4d^1P_1$—$v^3D_1^0$
LG	4832·236	30	20688·69	$4p^3P_1^0$—$s^2\ ^3P_1$
LG	4829·326	1	20701·06	$4d^3G_5$—$4f^3G_4^0$
P	4814·86	1	20763·2	$5s^3D_3$—$y^3F_4^0$
LG	4812·940	40	20771·53	$4d^1P_1$—$4f^1D_2^0$
LG	4811·160	1	20779·22	$4d^3G_4$—$v^3F_3^0$
LG	4807·039	10	20797·03	$4d^1P_1$—$4f^3D_1^0$
LG	4805·651	3	20803·04	$4d^3P_2$—$v^3F_3^0$
P	4791·17	1	20865·9	$4d^1D_2$—$u^3F_2^0$?
P	4773·03	1	20945·2	$4d^1P_1$—$4f^3F_2^0$
LG	4766·729	5	20972·90	$4d^3S_1$—$w^3P_0^0$
LG	4758·421	30	21009·52	$4p^3P_1^0$—$s^2\ ^3P_0$
LG	4753·458	3	21031·45	$4d^3G_4$—$u^3H_4^0$
P	4744·67	1	21070·4	$z^3D_1^0$—$5d^3F_2$
LG	4687·770	5	21326·16	$5p^1D_2^0$—$7s^3D_2$
LG	4681·990	50	21352·49	$4d^3S_1$—$4f^3P_1^0$
LG	4673·555	30	21391·02	$4d^3S_1$—$4f^3P_0^0$
LG	4671·686	40	21399·58	$4d^3S_1$—$4f^3P_2^0$
LG	4667·297	15	21419·70	$4d^3G_4$—$u^1H_5^0$
LG	4662·638	15	21441·10	$4d^3S_1$—$w^1D_2^0$
LG	4661·350	15	21447·03	$4d^3S_1$—$4f^1P_1^0$
LG	4660·294	8	21451·89	$4d^3P_0$—$4f^3D_1^0$

* † *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
LG	4649·266	10	21502·77	$4d\,^3S_1$—$4f\,^3D_2^0$
LG	4647·021	1	21513·16	$4d\,^3G_5$—$u\,^1H_5^0$
LG	4639·583	1	21547·65	$4d\,^3P_1$—$w\,^1P_1^0$
LG	4608·457	5	21693·18	$4d\,^3F_4$—$4f\,^1H_5^0$
LG	4597·942	5	21742·79	$4d\,^3D_2$—$4f\,^1F_3^0$
LG	4596·903	10	21747·70	$4d\,^3F_3$—$4f\,^3H_4^0$
LG	4575·653	1	21848·70	$4d\,^3F_4$—$4f\,^1G_4^0$
LG	4557·522	1	21935·62	$4d\,^3F_3$—$4f\,^3G_3^0$
LG	4555·922	5–100	21943·32	$4p\,^3P_2^0$—$s^2\,^3P_2$
LG	4551·849	1	21962·96	$4d\,^3G_3$—$6p\,^3D_2^0$
LG	4541·032	25	22015·27	$5p\,^1P_1^0$—$7s\,^3D_2$
LG	4540·335	1–10	22018·65	
LG	4540·207	10*d*	22019·27	
LG	4516·050	5	22137·06	$5p\,^3F_2^0$—$7s\,^3D_2$
LG	4515·524	1	22139·64	$4d\,^3D_3$—$4f\,^1G_4^0$
LG	4505·997	3–75	22186·44	$4p\,^3P_2^0$—$s^2\,^3P_1$
LG	4462·684	3	22401·77	$4d\,^3G_4$—$4f\,^1H_5^0$
LG	4461·646	2	22406·99	
LG	4444·823	3	22491·79	$4d\,^3P_2$—$4f\,^1F_3^0$
P	4441·64	0	22507·9	$z\,^3D_3^0$—$5d\,^1G_4$
P	4440·81	1	22512·1	$4d\,^3P_1$—$4f\,^3F_2^0$
P	4380·76	2	22820·7	$4d\,^1D_2$—$6p\,^1P_1^0$
LG	4378·430	8*d*	22832·84	$5p\,^3D_2^0$—$7s\,^3D_3$
LG	4365·362	30	22901·19	$5p\,^3D_2^0$—$7s\,^3D_2$
LG	4361·813	1	22919·83	$sp\,^5F_3^0$—$5d\,^3D_3$?
P	4346·70	1	22999·5	$5p\,^1D_2^0$—$6d\,^3F_3$
P	4320·78	1	23137·5	$4d\,^3S_1$—$v\,^3F_2^0$
				$4d\,^3D_3$—$6p\,^3P_2^0$?
LG	4292·469	30	23290·09	$5p\,^3D_3^0$—$7s\,^3D_3$
P	4291·10	2	23297·5	$5s\,^3D_3$—$x\,^5D_3^0$
P	4287·11	0	23319·2	$4d\,^1G_4$—$6p\,^1F_3^0$
LG	4285·239	10	23329·38	$5p\,^1D_2^0$—$7s\,^3D_1$
LG	4279·959	20	23358·16	$5p\,^3D_3^0$—$7s\,^3D_2$
LG	4276·044	30	23379·55	$5p\,^1D_2^0$—$7s\,^1D_2$
P	4267·60	1	23425·8	$s^2\,^1G_4$—$z\,^1G_4^0$
P	4255·59	3	23491·9	$4d\,^3S_1$—$4f\,^1D_2^0$
P	4251·00	1	23517·3	$4d\,^3S_1$—$4f\,^3D_1^0$
P	4246·97	1	23539·6	$5p\,^1F_3^0$—$6d\,^3F_3$
				$4d\,^1S_0$—$5f\,^1P_1^0$
P	4243·35	2	23559·7	$5p\,^1P_1^0$—$6d\,^3P_1$
P	4241·40	0	23570·5	$4d\,^1D_2$—$6p\,^3F_2^0$
LG	4239·448	25	23581·36	$5p\,^3D_1^0$—$7s\,^3D_1$
LG	4230·444	10	23631·55	$5p\,^3D_1^0$—$7s\,^1D_2$
LG	4227·936	30	23645·58	$4p\,^1F_3^0$—$s^2\,^1G_4$
P	4219·36	1	23693·6	$4d\,^3P_2$—$6p\,^3F_3^0$

*† *See* footnote on p. 211.

Table IV—continued

1*†	2	3	4	5
P	4216·89	3	23707·5	$5p\,^1P_1^0-6d\,^3D_2$
LG	4211·861	30	23735·81	$z\,^1F_3^0-7s\,^3D_3$
P	4198·63	1	23810·6	$5p\,^3F_2^0-6d\,^3F_3$
P	4195·76	1	23826·9	$4d\,^3G_5-6p\,^3F_4^0$
P	4195·34	1	23829·3	$5p\,^3F_2^0-6d\,^3D_2$
LG	4179·512	30	23919·52	$5p\,^1F_3^0-7s\,^1D_2$
P	4176·11	5	23939·0	$z\,^1D_2^0-7s\,^3D_3$
LG	4171·858	25	23963·41	$5p\,^3P_1^0-7s\,^3D_2$
LG	4164·288	20	24006·96	$z\,^1D_2^0-7s\,^3D_2$
LG	4162·296	8	24018·45	$5p\,^1P_1^0-7s\,^3D_1$
LG	4161·155	30	24025·04	$5p\,^3F_4^0-7s\,^3D_3$
LG	4153·623	10	24068·60	$5p\,^1P_1^0-7s\,^1D_2$
LG	4143·020	5	24130·20	$5p\,^3F_3^0-7s\,^3D_3$
LG	4141·296	20	24140·25	$5p\,^3F_2^0-7s\,^3D_1$
P	4132·62	3	24190·9	$5p\,^3F_2^0-7s\,^1D_2$
LG	4131·359	35	24198·31	$5p\,^3F_3^0-7s\,^3D_2$
P	4089·52	1	24445·9	$5p\,^3D_2^0-6d\,^3P_1$
LG	4068·090	5	24574·61	$5p\,^3D_2^0-6d\,^3F_3$
LG	4065·009	3	24593·27	$5p\,^3D_2^0-6d\,^3D_2$
LG	4053·658	10	24662·14	$5p\,^3P_0^0-7s\,^3D_1$
LG	4043·751	35	24722·56	$5p\,^3P_2^0-7s\,^3D_3$
LG	4043·502	75	24724·08	$4p\,^3D_3^0-s^2\,^1G_4$
LG	4032·642	3	24790·66	$5p\,^3P_2^0-7s\,^3D_2$
P	4030·34	0	24804·8	$5p\,^1D_2^0-6d\,^1P_1$
P	4014·18	2	24904·7	$5p\,^3D_2^0-7s\,^3D_1$
LG	4006·159	3	24954·54	$5p\,^3D_2^0-7s\,^1D_2$
LG	4003·470	2	24971·30	$5p\,^3D_3^0-6d\,^3D_3$
P	3998·33	1	25003·4	$5p\,^1D_2^0-6d\,^1D_2$
LG	3993·295	5	25034·92	$5p\,^3D_3^0-6d\,^3F_4$
LG	3987·021	3	25074·32	$5p\,^1D_2^0-6d\,^1F_3$
P	3985·21	1	25085·7	$5p\,^1D_2^0-6d\,^3F_2$
LG	3945·749	2	25336·59	$z\,^1F_3^0-6d\,^3P_2$
LG	3945·570	5	25337·74	$5p\,^3D_1^0-6d\,^3F_2$
P	3944·53	0	25344·4	$z\,^1F_3^0-6d\,^3G_4$
LG	3934·105	1	25411·57	$5p\,^3D_3^0-7s\,^1D_2$
LG	3933·260	3	25417·03	$z\,^1F_3^0-6d\,^3D_3$
LG	3923·438	3	25480·66	$z\,^1F_3^0-6d\,^3F_4$
LG	3921·398	0	25493·92	$5p\,^1P_1^0-6d\,^1P_1$
LG	3920·641	5	25498·74	$5p\,^1F_3^0-6d\,^1G_4$
LG	3919·166	1*u*	25508·44	$5p\,^3P_1^0-6d\,^3P_1$
P	3912·39	1*u*	25552·6	$z\,^1D_2^0-6d\,^3P_1$
LG	3903·163	15	25613·02	$5p\,^3F_4^0-6d\,^3G_5$
LG	3896·682	3	25655·62	$5p\,^3P_1^0-6d\,^3D_2$
LG	3892·913	5	25680·45	$z\,^1D_2^0-6d\,^3F_3$
LG	3891·114	2	25692·33	$5p\,^1P_1^0-6d\,^1D_2$

*† *See* footnote on p. 211.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

Table IV—continued

1*†	2	3	4	5
LG	3890·073	3	25699·20	$z^1D_2^0-6d^3D_2$
LG	3884·523	5	25735·92	$5p^3F_2^0-6d^3G_3$
LG	3884·120	10	25738·59	$5p^3F_3^0-6d^3G_4$
LG	3879·387	5	25769·99	$5p^3F_4^0-6d^3F_4$
LG	3873·197	1	25811·17	$5s^3D_3-w^3P_2^0$
				$5p^3F_3^0-6d^3D_3$
P	3872·86	0	25813·4	$5p^3F_2^0-6d^1D_2$
P	3871·45	0	25822·8	$z^1G_4^0-7s^3D_3$
LG	3868·358	3	25843·46	$z^3F_2^0-7s^3D_2$
LG	3866·291	2	25857·28	$z^1F_3^0-7s^1D_2$
LG	3864·121	5	25871·80	$5p^3F_3^0-6d^3F_3$
P	3859·39	0	25903·5	$4d^3P_2-6p^1D_2^0$
LG	3851·052	0	25959·60	$s^2\,^1G_4-5p^3D_3^0$
P	3850·03	2	25966·5	$5p^3P_1^0-7s^3D_1$
LG	3849·570	2	25969·59	$5s^3D_3-w^3D_3^0$
LG	3842·577	4	26016·85	$5p^3P_1^0-7s^1D_2$
LG	3836·150	4	26060·44	$z^1D_2^0-7s^1D_2$
LG	3826·908	5	26123·37	$5p^3P_2^0-6d^3S_1$
LG	3818·869	3	26178·36	$5p^3P_1^0-6d^3P_0$
P	3801·51	1	26297·9	$5p^3P_0^0-6d^3D_1$
LG	3797·832	5	26323·37	$5p^3P_2^0-6d^3P_2$
LG	3796·126	1	26335·20	$5p^3P_2^0-6d^3P_1$
				$5p^1P_1^0-6d^1S_0$
LG	3786·261	5	26403·81	$5p^3P_2^0-6d^3D_3$
P	3772·47	0	26500·3	$5p^3D_2^0-6d^3G_3$
P	3756·40	0	26649·2	$5p^3D_2^0-6d^1F_3$
P	3749·42	0	26661·1	$5s^3D_3-w^3D_2^0$
				$5p^3D_2^0-6d^3F_2$
LG	3748·207	3	26671·87	$z^3G_3^0-7s^3D_3$
LG	3738·637	3	26740·14	$z^3G_3^0-7s^3D_2$
P	3724·20	0	26843·8	$5p^3P_2^0-7s^1D_2$
LG	3713·082	0	26924·18	
LG	3692·366	0	27075·23	
LG	3686·555	5–100	27117·90	$4p^3F_3^0-s^2\,^1G_4$
LG	3682·428	10	27148·30	$z^3F_4^0-7s^3D_3$
LG	3633·110	0	27516·81	$z^3F_2^0-6d^3F_3$
LG	3611·084	0	27684·65	$z^3D_2^0-7s^3D_3$
LG	3602·227	2	27752·72	$z^3D_2^0-7s^3D_2$
LG	3590·087	1	27846·56	$z^3F_2^0-7s^3D_1$
P	3568·02	0	28018·8	$sp^5D_1^0-5d^3F_2$?
LG	3548·742	3	28170·98	$z^3F_3^0-7s^3D_3$
LG	3506·840	0	28507·58	$z^3D_3^0-7s^3D_2$
LG	3481·909	0	28711·69	
P	3402·81	1	29379·1	$4d^3P_0-5f^1P_1^0$
LG	3392·792	0	29465·8	$s^2\,^3P_1-z^3D_1^0$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
LG	3384·948	3	29534·10	$4d\,^3F_2$—$5f\,^3F_2^0$
LG	3384·341	1	29539·40	$4d\,^3D_2$—$5f\,^3P_2^0$
LG	3380·717	10	29571·06	$4d\,^3F_2$—$5f\,^3G_3^0$
LG	3379·961	3	29577·68	$4d\,^1F_3$—$5f\,^1F_3^0$
LG	3378·512	3	29590·36	$4d\,^3D_2$—$5f\,^3D_3^0$
LG	3378·216	1	29592·96	
LG	3377·706	5	29597·42	$4d\,^3D_2$—$5f\,^3D_2^0$
LG	3376·615	1	29606·99	$4d\,^3F_4$—$5f\,^3D_3^0$
LG	3374·953	20	29621·57	$4d\,^1F_3$—$5f\,^1G_4^0$
LG	3373·594	15	29633·50	$4d\,^3D_2$—$5f\,^3F_3^0$
LG	3371·412	8	29652·68	$4d\,^3F_4$—$5f\,^3F_4^0$
LG	3370·645	1	29659·42	$4d\,^3F_3$—$5f\,^3D_2^0$
LG	3370·457	30	29661·08	$4d\,^3F_4$—$5f\,^3G_5^0$
LG	3370·163	0	29663·67	$z\,^1F_3^0$—$8s\,^3D_3$
LG	3366·560	5	29695·41	$4d\,^3F_3$—$5f\,^3F_3^0$
LG	3366·269	10	29697·98	$4d\,^3F_3$—$5f\,^3F_4^0$
P	3365·65	15	29703·4	$4d\,^3F_3$—$5f\,^3G_4^0$
LG	3359·717	0	29755·89	$z\,^3D_2^0$—$7s\,^3D_1$
LG	3355·649	2	29791·96	
LG	3355·019	0	29797·56	
LG	3352·044	8	29824·00	$4d\,^1D_2$—$5f\,^1D_2^0$
LG	3349·463	5	29846·98	$4d\,^3D_3$—$5f\,^3P_2^0$
P	3348·84	1	29852·5	$z\,^3F_3^0$—$6d\,^3D_3$
				$4d\,^1D_2$—$5f\,^3D_1^0$
LG	3347·677	0	29862·91	$5p\,^3P_1^0$—$8s\,^3D_2$
LG	3343·743	20	29898·04	$4d\,^1D_2$—$5f\,^1F_3^0$
				$4d\,^3D_3$—$5f\,^3D_3^0$
LG	3339·084	3	29939·76	$4d\,^1D_2$—$5f\,^3G_3^0$
LG	3338·937	3	29941·13	$4d\,^3D_3$—$5f\,^3F_3^0$
LG	3338·647	10	29943·67	$4d\,^3D_3$—$5f\,^3F_4^0$
LG	3325·812	8	30059·23	$4d\,^3D_1$—$5f\,^1D_2^0$
LG	3323·735	5	30078·01	
LG	3322·632	1	30088·00	$4d\,^3D_1$—$5f\,^3D_1^0$
LG	3321·553	1	30097·77	$5p\,^3F_3^0$—$8s\,^3D_2$
LG	3320·039	1	30111·49	
LG	3317·140	5	30137·81	$4d\,^3D_1$—$5f\,^3F_2^0$
LG	3316·279	20	30145·63	$4d\,^1G_4$—$5f\,^1H_5^0$
P	3312·01	0	30184·5	$z\,^3D_3^0$—$6d\,^3F_4$
LG	3308·109	0	30220·08	$4d\,^1G_4$—$5f\,^3G_3^0$
				$5p\,^3D_3^0$—$7d\,^3F_4$
LG	3307·857	0	30222·38	$4d\,^1G_4$—$5f\,^1G_4^0$
LG	3307·669	0	30224·10	$4d\,^3P_1$—$5f\,^3P_0^0$
LG	3303·516	5	30262·10	$4d\,^3P_2$—$5f\,^3P_1^0$
				$4d\,^3P_1$—$5f\,^3P_2^0$
LG	3301·228	40	30283·07	$4d\,^3G_4$—$5f\,^3H_5^0$

*† *See* footnote on p. 211.

MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES
THE ROYAL SOCIETY A
PHILOSOPHICAL TRANSACTIONS OF

TABLE IV—continued

1*†	2	3	4	5
LG	3300·885	20	30286·22	$4d\,^3G_3$—$5f\,^3H_4^0$
LG	3300·644	10	30288·43	$4d\,^3P_2$—$5f\,^3P_2^0$
LG	3300·444	5	30290·26	$4d\,^3P_1$—$5f\,^1P_1^0$
LG	3297·301	1	30319·13	$4d\,^3G_3$—$5f\,^3F_2^0$
LG	3297·199	10	30320·07	$4d\,^3P_1$—$5f\,^3D_2^0$
LG	3295·103	15	30339·36	$4d\,^3P_2$—$5f\,^3D_3^0$
LG	3294·336	3	30346·42	$4d\,^3P_2$—$5f\,^3D_2^0$
LG	3293·334	2	30355·65	$4d\,^3G_3$—$5f\,^3G_3^0$
LG	3292·124	10	30366·81	$4d\,^3G_4$—$5f\,^3G_4^0$
LG	3291·055	0	30376·67	$4d\,^3G_5$—$5f\,^3H_5^0$
LG	3290·422	50	30382·52	$4d\,^3G_5$—$5f\,^3H_6^0$ $4d\,^3P_2$—$5f\,^3F_3^0$
LG	3281·696	10	30463·30	$4d\,^3G_5$—$5f\,^3G_5^0$
LG	3261·647	1	30650·55	$5p\,^3P_2^0$—$8s\,^3D_3$
LG	3250·469	10	30755·95	$4d\,^1P_1$—$5f\,^1D_2^0$
LG	3241·835	0	30837·86	$5s\,^1D_2$—$6p\,^1F_3^0$
P	3238·83	5	30866·5	$5p\,^3F_4^0$—$7d\,^3G_5$
LG	3237·252	0	30881·52	$5s\,^3D_2$—$6p\,^3P_2^0$
LG	3234·729	0	30905·60	$5s\,^3D_2$—$6p\,^3P_1^0$
P	3233·39	1	30918·4	$4p\,^3F_4^0$—$7d\,^3D_3$
LG	3229·550	0	30955·16	$4p\,^3F_4^0$—$7d\,^3F_4$
LG	3225·351	1	30995·46	$5s\,^3D_2$—$6p\,^3F_3^0$
P	3218·77	3	31058·8	$5p\,^3F_3^0$—$7d\,^3F_3$
LG	3206·692	0	31175·82	$5s\,^1D_2$—$6p\,^1D_2^0$
LG	3203·939	0	31202·59	$5s\,^3D_3$—$6p\,^3P_2^0$
LG	3191·100	0	31328·13	
LG	3186·017	5	31378·11	$4d\,^3S_1$—$5f\,^3P_0^0$
LG	3185·729	2	31380·95	$5s\,^3D_3$—$6p\,^3F_4^0$
LG	3184·843	15	31389·68	$4d\,^3S_1$—$5f\,^3P_1^0$
LG	3182·175	10	31415·99	$4d\,^3S_1$—$5f\,^3P_2^0$
LG	3179·793	5	31439·53	$4d\,^3P_0$—$5f\,^3D_1^0$
LG	3177·965	3	31457·61	$5p\,^3P_2^0$—$7d\,^3S_1$
LG	3174·959	0	31487·39	$s^2\,^3P_1$—$5p\,^3P_2^0$
P	3166·56	5	31570·9	$5p\,^3P_2^0$—$7d\,^3P_2$
LG	3163·67	0	31559·7	$4d\,^3D_2$—$5f\,^1D_2^0$
P	3162·03	3	31616·1	$5p\,^3P_2^0$—$7d\,^3D_3$
P	3158·64	5	31650·1	$5s\,^3D_1$—$6p\,^3F_2^0$
LG	3152·883	3	31707·85	$4d\,^3F_3$—$5f\,^3H_4^0$
LG	3151·049	10	31726·31	$5s\,^3D_3$—$6p\,^3D_3^0$
LG	3150·538	3	31731·45	$4d\,^3F_4$—$5f\,^3G_3^0$? $s^2\,^3P_2$—$5p\,^3P_2^0$?
P	3146·01	0	31777·1	$4d\,^3F_3$—$5f\,^3G_3^0$
P	3124·73	1	31993·5	$s^2\,^3P_0$—$5p\,^3P_1^0$
P	3083·37	1	32422·7	$4d\,^3P_2$—$5f\,^1F_3^0$
P	3055·59	0	32717·4	$s^2\,^3P_2$—$z\,^1F_3^0$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
P	2986·33	2	33476·2	$4d\,^3S_1—5f\,^1D_2^0$
P	2981·80	0	33527·0	$5s\,^3D_3—6p\,^1D_2^0$
LG	2976·965	2	33581·49	
P	2973·65	1	33618·9	$s^2\,^3P_1—5p\,^3P_0^0$
LG	2945·368	2	33941·7	$s^2\,^3P_0—5p\,^1P_1^0$
P	2927·27	1	34151·5	
P	2907·92	1	34378·8	$s^2\,^3P_0—5p\,^3D_1^0$
P	2897·22	0	34505·8	$s^2\,^3P_2—5p\,^1P_1^0$
P	2884·20	20–60	34661·5	$4p\,^1D_2^0—5s\,^3D_3$
P	2881·03	0	34699·7	$s^2\,^3P_1—5p\,^3D_1^0$
P	2880·70	1	34703·6	$s^2\,^1D_2—5p\,^3P_2^0$
LG	2877·698	80–40	34739·83	$4p\,^1P_1^0—5s\,^3D_2$
P	2860·25	0	34951·7	$s^2\,^3P_1—5p\,^1D_2^0$
P	2859·00	1	34967·0	
LG	2857·746	10–5	34982·36	$4p\,^1D_2^0—5s\,^3D_2$
P	2855·03	1	35015·7	$4d\,^3D_2—6f\,^3D_2^0$
P	2852·40	1	35047·9	$4d\,^3F_4—6f\,^3F_3^0$
P	2851·91	1	35053·9	
P	2848·72	2	35093·2	$4d\,^3F_3—6f\,^3F_3^0$
P	2848·52	3	35095·7	
P	2846·86	1	35116·1	
LG	2840·489	2–2	35194·88	$s^2\,^3P_2—5p\,^1D_2^0$
BI	2837·364	60–50	35233·64	$4p\,^3D_1^0—5s\,^3D_2$
P	2836·30	1	35246·8	
P	2830·31	2	35321·5	$4d\,^3D_3—6f\,^3D_3^0$
P	2813·63	1	35530·8	$s^2\,^1D_2—5p\,^3P_1^0$
P	2810·80	3	35566·6	$4d\,^1G_4—6f\,^1H_5^0$
P	2799·69	2	35707·8	$4d\,^3G_3—6f\,^3H_4^0$
LG	2799·536	5	35709·70	$4d\,^3G_4—6f\,^3H_5^0$
P	2797·44	2	35736·4	$4d\,^3P_2—6f\,^3P_2^0$
P	2797·26	2	35738·7	$4d\,^3P_1—6f\,^3D_2^0$
P	2795·65	1	35759·4	
P	2795·31	2	35763·7	$4d\,^3P_2—6f\,^3D_3^0$
LG	2791·798	10	35808·68	$4d\,^3G_5—6f\,^3H_6^0$
P	2788·25	1–1	35854·2	
BI	2769·666	70–50	36094·80	$4p\,^1F_3^0—5s\,^3D_3$
P	2763·02	2–0	36181·6	
P	2762·50	1	36188·4	
LG	2745·275	60–20	36415·47	$4p\,^1F_3^0—5s\,^3D_2$
LG	2739·768	70–8	36488·67	$4p\,^1P_1^0—5s\,^3D_1$
LG	2737·339	10–10	36521·04	$4p\,^3D_2^0—5s\,^3D_3$
P	2731·93	1–2	36593·3	$s^2\,^1D_2—5p\,^3D_2^0$
BI	2721·675	100–25	36731·22	$4p\,^1D_2^0—5s\,^3D_1$
BI	2718·775	100–35	36770·40	$4p\,^1P_1^0—5s\,^1D_2$
BI	2713·505	80–50	36841·80	$4p\,^3D_2^0—5s\,^3D_2$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
P	2711·88	5	36863·9	$4d\,{}^3S_1$—$6f\,{}^3P_2^0$
P	2710·23	0	36886·3	$s^2\,{}^3P_2$—$y\,{}^3D_2^0$
P	2709·79	0	36892·3	$4d\,{}^3S_1$—$6f\,{}^3D_2^0$
P	2708·27	1	36913·0	
BI	2703·184	100–30	36982·46	$4p\,{}^3D_1^0$—$5s\,{}^3D_1$
BI	2700·963	100–30	37012·87	$4p\,{}^1D_2^0$—$5s\,{}^1D_2$
BI	2689·299	80–50	37173·39	$4p\,{}^3D_3^0$—$5s\,{}^3D_3$
P	2681·18	1	37286·0	
P	2676·08	0–2	37357·0	$s^2\,{}^1D_2$—$5p\,{}^3F_2^0$
BI	2666·288	50–20	37494·19	$4p\,{}^3D_3^0$—$5s\,{}^3D_2$
P	2655·94	0	37640·2	$s^2\,{}^3F_2$—$sp^5D_2^0$
P	2648·60	3	37744·6	$s^2\,{}^3F_3$—$sp^5D_3^0$
P	2636·62	0	37916·0	$s^2\,{}^1D_2$—$5p\,{}^3D_1^0$
BI	2620·675	5–5	38146·74	$4p\,{}^3F_2^0$—$5s\,{}^3D_3$
P	2619·23	2–1	38167·8	$s^2\,{}^1D_2$—$5p\,{}^1D_2^0$
P	2614·41	1–8	38238·1	$s^2\,{}^3F_4$—$sp^5D_4^0$
P	2609·91	1–0	38304·1	
P	2605·97	1	38361·9	
BI	2600·266	100–20	38446·13	$4p\,{}^1F_3^0$—$5s\,{}^1D_2$
BI	2598·813	70–20	38467·62	$4p\,{}^3F_2^0$—$5s\,{}^3D_2$
BI	2590·526	90–15	38590·66	$4p\,{}^3D_2^0$—$5s\,{}^3D_1$
P	2574·39	0	38832·5	$s^2\,{}^3F_3$—$sp^5D_2^0$
BI	2571·746	60–10	38872·45	$4p\,{}^3D_2^0$—$5s\,{}^1D_2$
P	2553·32	1–3	39153·0	$s^2\,{}^3F_2$—$sp^5G_3^0$
BI	2544·802	90–100	39284·00	$4p\,{}^3F_4^0$—$5s\,{}^3D_3$
BI	2529·302	100–50	39524·72	$4p\,{}^3D_3^0$—$5s\,{}^1D_2$
BI	2526·589	60–25	39567·16	$4p\,{}^3F_3^0$—$5s\,{}^3D_3$
P	2518·95	5–8	39687·1	$s^2\,{}^3F_3$—$sp^5G_4^0$
BI	2506·270	90–30	39887·92	$4p\,{}^3F_3^0$—$5s\,{}^3D_2$
BI	2489·652	5–5	40154·14	$4s\,{}^1D_2$—$4p\,{}^3P_2^0$
BI	2485·787	100–20	40216·57	$4p\,{}^3F_2^0$—$5s\,{}^3D_1$
P	2477·12	2	40357·3	
P	2476·46	0	40368·1	$s^2\,{}^1G_4$—$4f\,{}^3H_5^0$
BI	2473·332	50–20	40419·07	$4p\,{}^3P_1^0$—$5s\,{}^3D_2$
P	2468·51	50–5	40498·0	$4p\,{}^3F_2^0$—$5s\,{}^1D_2$
P	2460·88	1	40623·6	
P	2458·81	2	40657·8	
P	2457·69	3	40676·3	
P	2448·21	5	40833·8	$s^2\,{}^3P_0$—$x\,{}^5P_1^0$
P	2443·32	2–6	40915·5	$4p\,{}^1P_1^0$—$4d\,{}^3S_1$
P	2442·67	10–15	40926·4	$s^2\,{}^3F_4$—$sp^5G_5^0$
P	2430·69	0	41128·1	$s^2\,{}^1G_4$—$u\,{}^3H_4^0$
P	2428·92	1–8	41158·0	$4p\,{}^1D_2^0$—$4d\,{}^3S_1$
BI	2424·436	60–50	41234·18	$4p\,{}^3P_0^0$—$5s\,{}^3D_1$
P	2421·96	0	41276·3	$s^2\,{}^3F_2$—$sp^5F_3^0$

*† *See* footnote on p. 211.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

TABLE IV—continued

1*†	2	3	4	5
P	2420·48	1	41301·6	
P	2414·84	5	41398·0	$s^2\ {}^3P_2$—$x^5P_1^0$
P	2414·18	5	41409·4	$4p^3D_1^0$—$4d^3S_1$
BI	2403·335	100–100	41596·14	$4p^3P_2^0$—$5s^3D_3$
BI	2400·112	30–20	41652·03	$4s^1D_2$—$4p^3P_1^0$
P	2393·99	2	41758·5	$s^2\ {}^3F_2$—$sp^5F_2^0$
P	2393·24	2	41771·6	$s^2\ {}^3F_3$—$sp^5F_4^0$
P	2384·94	15–10	41917·0	$4p^3P_2^0$—$5s^3D_2$
P	2384·80	5—	41918·5	$4p^3F_3^0$—$5s^1D_2$
P	2379·39	3	42014·8	$s^2\ {}^3P_0$—$x^5D_{2,1}^0$?
P	2378·83	10	42024·6	$s^2\ {}^3P_2$—$y^3P_2^0$
P	2378·39	2	42032·4	$s^2\ {}^3F_2$—$sp^5F_1^0$
P	2377·78	0	42043·2	$4p^1P_1^0$—$4d^3P_2$
P	2376·29	5–50	42069·5	$4p^1P_1^0$—$4d^3P_1$
P	2370·74	80–20	42168·0	$4p^3P_1^0$—$5s^3D_1$
BI	2369·887	60–100	42183·21	$4s^1D_2$—$4p^3F_3^0$
P	2364·15	3	42285·6	$4p^1D_2^0$—$4d^3P_2$
P	2362·68	2	42311·9	$4p^1D_2^0$—$4d^3P_1$
P	2361·19	3	42338·6	$s^2\ {}^3P_1$—$x^5D_{2,1}^0$?
BI	2356·638	2–10	42420·34	$4s^3D_1$—$4p^3P_2^0$
P	2355·02	80–15	42449·5	$4p^3P_1^0$—$5s^1D_2$
P	2353·96	2	42468·6	$s^2\ {}^3F_3$—$sp^5F_3^0$
P	2350·20	0	42536·6	$4p^3D_1^0$—$4d^3P_2$
P	2348·74	1–15	42563·0	$4p^3D_1^0$—$4d^3P_1$
P	2347·89	0	42578·3	$s^2\ {}^3P_2$—$x^5D_{2,1}^0$?
P	2346·65	0	42600·9	$s^2\ {}^3P_1$—$x^5D_0^0$
P	2342·17	3	42682·3	$s^2\ {}^3P_2$—$y^1F_3^0$
P	2341·34	1	42697·4	
P	2339·73	3	42726·9	$4p^1D_2^0$—$4d^3D_3$
P	2336·17	2–20	42791·9	$4p^1P_1^0$—$4d^3D_2$
P	2323·93	1	43017·3	$4p^3D_2^0$—$4d^3S_1$
P	2323·01	8	43034·4	$4p^1D_2^0$—$4d^3D_2$
P	2315·68	1	43170·5	$s^2\ {}^1D_2$—$y^3F_3^0$
P	2309·51	6	43285·8	$4p^3D_1^0$—$4d^3D_2$
P	2299·47	7	43474·8	$4p^3D_1^0$—$4d^3P_0$
BI	2294·364	45–40	43571·61	$4s^3D_2$—$4p^3P_2^0$
P	2292·95	0	43598·4	$s^2\ {}^3F_4$—$sp^5F_4^0$
CI	2292·681	1	43603·59	$4s^1D_2$—$4p^3F_2^0$
LG	2290·998	2–15	43635·62	$4p^1P_1^0$—$4d^1P_1$
P	2289·40	10–1	43666·0	$4p^3P_2^0$—$5s^3D_1$
LG	2286·642	2–15	43718·73	$4p^1F_3^0$—$4d^3P_2$
P	2278·33	1–7	43878·2	$4p^1D_2^0$—$4d^1P_1$
BI	2276·253	50–35	43918·25	$4s^3D_1$—$4p^3P_1^0$
P	2274·74	45–3	43947·5	$4p^3P_2^0$—$5s^1D_2$
P	2265·36	1–7	44129·5	$4p^3D_1^0$—$4d^1P_1$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
P	2264·55	2	44145·1	$4p\,^3D_2^0—4d\,^3P_2$
LG	2263·780	10–35	44160·21	$4p\,^1F_3^0—4d\,^3D_3$
LG	2263·212	1–8	44171·29	$4p\,^3D_2^0—4d\,^3P_1$
LG	2254·975	2–6	44332·63	$4p\,^1P_1^0—4d\,^3D_1$
P	2253·00	2	44371·4	$s^2\,^1D_2—x\,^5P_1^0$?
P	2251·84	2	44394·4	$4p\,^1D_2^0—4d\,^3G_3$
LG	2248·960	5–25	44451·18	$4p\,^1F_3^0—4d\,^3F_4$
BI	2246·995	50–75	44490·05	$4s\,^3D_3—4p\,^3P_2^0$
P	2243·10	6	44567·3	$4p\,^1P_1^0—4d\,^1D_2$
BI	2242·613	50–50	44576·98	$4s\,^1D_2—4p\,^3D_3^0$
P	2242·14	6	44586·4	$4p\,^3D_2^0—4d\,^3D_3$
LG	2231·571	1–30	44797·52	$4p\,^3D_3^0—4d\,^3P_2$
LG	2230·948	5–30	44810·03	$4p\,^1D_2^0—4d\,^1D_2$
P	2230·40	10	44821·0	$4p\,^3D_3^0—4d\,^3G_4$
LG	2230·087‡	30	44827·3	$4p\,^3D_1^0—4d\,^3D_1$
LG	2229·850	5–30	44832·09	$4p\,^3D_2^0—4d\,^3F_3$
BI	2228·863	35–40	44851·94	$4s\,^3D_1—4p\,^3P_0^0$
LG	2226·773	5–40	44894·03	$4p\,^3D_2^0—4d\,^3D_2$
LG	2224·701	5–15	44935·84	$4p\,^1P_1^0—4d\,^3F_2$
P	2221·65	2	44997·6	$s^2\,^1D_2—y\,^3P_2^0$
LG	2218·504	5–25	45061·35	$4p\,^3D_1^0—4d\,^1D_2$
BI	2218·100	40–50	45069·55	$4s\,^3D_2—4p\,^3P_1^0$
LG	2215·100	5–35	45130·59	$4p\,^1D_2^0—4d\,^1F_3$
LG	2212·741	2–10	45178·70	$4p\,^1D_2^0—4d\,^3F_2$
BI	2210·259	25–60	45229·42	$4s\,^1D_2—4p\,^3D_2^0$
LG	2209·795	2–30	45238·89	$4p\,^3D_3^0—4d\,^3D_3$
P	2201·00	1	45419·7	$s^2\,^3F_2—z\,^3G_3^0$
LG	2200·498	2–25	45430·03	$4p\,^3D_1^0—4d\,^3F_2$
P	2200·30	1	45434·2	$s^2\,^3P_0—w\,^3P_1^0$
P	2197·84	1	45485·0	$4p\,^3D_3^0—4d\,^3F_3$
LG	2195·674	2–25	45529·84	$4p\,^3D_3^0—4d\,^3F_4$
BI	2192·260	15–75	45600·73	$4s\,^3D_2—4p\,^3F_3^0$
P	2190·50	1	45637·4	$s^2\,^1G_4—6p\,^1F_3^0$
BI	2189·621	15–50	45655·68	$4s\,^1D_2—4p\,^1F_3^0$
				$s^2\,^3F_4—z\,^3G_4^0$
				$s^2\,^1D_2—y\,^1F_3^0$
P	2189·36	3	45661·0	$4p\,^3P_0^0—4d\,^3S_1$
P	2182·85	6	45797·3	$4p\,^3F_2^0—4d\,^3P_1$
P	2181·41	4	45827·4	$4p\,^1F_3^0—4d\,^3G_3$
P	2180·74	2–10	45841·5	$s^2\,^3F_4—z\,^3G_5^0$
BI	2179·399	20–60	45869·79	$4s\,^3D_1—4p\,^3F_2^0$
LG	2174·968	50–35	45963·23	$4p\,^1F_3^0—4d\,^1G_4$
P	2172·53	1	46014·8	
P	2166·85	0	46135·5	$s^2\,^3F_3—z\,^3F_4^0$

*† *See* footnote on p. 211.
‡ Cu I and Cu II.

TABLE IV—continued

1*†	2	3	4	5
P	2161·80	1	46243·2	$4p\,{}^1F_3^0$—$4d\,{}^1D_2$
LG	2161·314	30–20	46253·57	$4p\,{}^3D_2^0$—$4d\,{}^3G_3$
P	2158·40	1	46315·9	$s^2\,{}^3F_2$—$z\,{}^3F_2^0$
P	2152·91	0	46434·1	$4p\,{}^3D_2^0$—$4d\,{}^3D_1$
LG	2151·801	20–25	46458·03	$4p\,{}^3F_2^0$—$4d\,{}^3F_3$
BI	2148·974	50–60	46519·14	$4s\,{}^3D_3$—$4p\,{}^3F_3^0$
P	2146·91	15–8	46563·9	$4p\,{}^1F_3^0$—$4d\,{}^1F_3$
P	2145·48	15–10	46594·9	$4p\,{}^3P_1^0$—$4d\,{}^3S_1$
P	2144·70	5–2	46611·8	$4p\,{}^1F_3^0$—$4d\,{}^3F_2$
				$s^2\,{}^3F_3$—$z\,{}^3G_3^0$
BI	2135·976	60–75	46802·18	$4s\,{}^3D_3$—$4p\,{}^3F_4^0$
BI	2134·355	35–35	46837·71	$4p\,{}^3F_4^0$—$4d\,{}^3G_5$
				$4s\,{}^1D_2$—$4p\,{}^3D_1^0$
P	2131·23	2	46906·3	$4p\,{}^3D_3^0$—$4d\,{}^3G_3$
P	2130·08	8	46931·6	$4p\,{}^3F_4^0$—$4d\,{}^3G_4$
BI	2126·028	50–50	47021·15	$4s\,{}^3D_2$—$4p\,{}^3F_2^0$
P	2125·24	4	47038·5	$4p\,{}^3D_2^0$—$4d\,{}^3F_2$
LG	2125·098	20–8	47041·73	$4p\,{}^3D_3^0$—$4d\,{}^1G_4$
BI	2122·966	50–50	47088·96	$4s\,{}^1D_2$—$4p\,{}^1D_2^0$
P	2118·38	2	47190·8	$4p\,{}^3F_3^0$—$4d\,{}^3P_2$
LG	2117·300	40–35	47214·96	$4p\,{}^3F_3^0$—$4d\,{}^3G_4$
P	2113·85	1	47292·1	
P	2112·53	1	47321·5	$4p\,{}^3D_3^0$—$4d\,{}^1D_2$
BI	2112·090	50–30	47331·41	$4s\,{}^1D_2$—$4p\,{}^1P_1^0$
P	2111·30	6	47349·2	$4p\,{}^3F_4^0$—$4d\,{}^3D_3$
P	2110·31	1	47371·3	$s^2\,{}^3P_2$—$v\,{}^3D_3^0$
P	2106·39	2	47459·5	$s^2\,{}^3F_3$—$z\,{}^1G_4^0$
BI	2104·782	50–40	47495·73	$4s\,{}^3D_1$—$4p\,{}^3D_2^0$
P	2100·38	0	47595·2	$4p\,{}^3F_4^0$—$4d\,{}^3F_3$
P	2098·72	2	47632·8	$4p\,{}^3F_3^0$—$4d\,{}^3D_3$
LG	2098·386	30–15	47640·46	$4p\,{}^3F_4^0$—$4d\,{}^3F_4$
P	2096·14	1	47690·7	$4p\,{}^3D_3^0$—$4d\,{}^3F_2$
P	2094·77	2	47722·6	$4p\,{}^3P_1^0$—$4d\,{}^3P_2$
LG	2093·606	20–10	47749·24	$4p\,{}^3P_1^0$—$4d\,{}^3P_1$
LG	2087·930	50–35*d*	47879·03	$4p\,{}^3F_3^0$—$4d\,{}^3F_3$
				$4p\,{}^3F_2^0$—$4d\,{}^3G_3$
CI	2085·295	15–8	47939·51	$4s\,{}^3D_3$—$4p\,{}^3F_2^0$
P	2084·33	2	47961·7	$s^2\,{}^3F_4$—$z\,{}^3F_4^0$
P	2082·92	2	47994·0	$4s\,{}^3D_2$—$4p\,{}^3D_3^0$
P	2080·03	2	48060·6	$4p\,{}^3F_2^0$—$4d\,{}^3D_1$
LG	2078·646	40–40	48092·85	$4p\,{}^3P_2^0$—$4d\,{}^3S_1$
P	2074·22	0	48195·6	$s^2\,{}^3F_2$—$5p\,{}^3P_1^0$
P	2069·92	2	48295·7	$4p\,{}^3F_2^0$—$4d\,{}^1D_2$
P	2066·25	10–8	48381·4	$4p\,{}^3P_0^0$—$4d\,{}^1P_1$
P	2062·41	20–10	48471·3	$4p\,{}^3P_1^0$—$4d\,{}^3D_2$

*† *See* footnote on p. 211.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

TABLE IV—continued

1*†	2	3	4	5
P	2058·63	0	48560·5	$s^2\,{}^3F_3$—$5p\,{}^3P_2^0$
CI	2054·969	50–50	48646·89	$4s\,{}^3D_2$—$4p\,{}^3D_2^0$
P	2054·43	6	48659·7	$4p\,{}^3P_1^0$—$4d\,{}^3P_0$
P	2054·27	4	48663·5	$4p\,{}^3F_2^0$—$4d\,{}^3F_2$
P	2047·65	20–8	48820·7	$4p\,{}^1P_1^0$—$4d\,{}^1S_0$
CI	2043·791	50–60	48912·90	$4s\,{}^3D_3$—$4p\,{}^3D_3^0$
CI	2037·119	50–30	49073·10	$4s\,{}^3D_2$—$4p\,{}^1F_3^0$
P	2036·97	1	49076·8	$4p\,{}^3P_0^0$—$4d\,{}^3D_1$
CI	2035·845	50–30	49103·79	$4s\,{}^3D_1$—$4p\,{}^3D_1^0$
P	2031·023	40–15	49220·36	$4p\,{}^3P_2^0$—$4d\,{}^3P_2$
P	2029·93	10–1	49246·8	$4p\,{}^3P_2^0$—$4d\,{}^3P_1$
P	2027·13	10–1	49315·0	$4p\,{}^3P_1^0$—$4d\,{}^1P_1$
				$4p\,{}^3D_1^0$—$4d\,{}^1S_0$
CI	2025·475	8	49355·12	$4s\,{}^3D_1$—$4p\,{}^1D_2^0$
P	2022·19	3–1	49435·3	$4p\,{}^3F_3^0$—$4d\,{}^1G_4$
P	2017·60	3–0	49547·6	$s^2\,{}^3F_3$—$5p\,{}^3D_3^0$
CI	2016·885	5–8	49565·32	$4s\,{}^3D_3$—$4p\,{}^3D_2^0$
CI	2015·576	5–5	49597·55	$4s\,{}^3D_1$—$4p\,{}^1P_1^0$
P	2012·96	15–15	49661·9	$4p\,{}^3P_2^0$—$4d\,{}^3D_3$
SP	2009·32	0	49752·0	$4p\,{}^3F_4^0$—$4d\,{}^1F_3$
SP	2002·27	3	49927·0	
CI	2000·339	60–60	49991·53	$4s\,{}^3D_3$—$4p\,{}^1F_3^0$
SP	1993·81	1	50155	
P	1990·20	5–1	50246·1	$4p\,{}^3P_1^0$—$4d\,{}^1D_2$
CI	1989·849	30–30	50255·07	$4s\,{}^3D_2$—$4p\,{}^3D_1^0$
SP	1984·75	1	50384·0	$s^2\,{}^1G_4$—$5f\,{}^3H_5^0$
CI	1979·947	50	50506·40	$4s\,{}^3D_2$—$4p\,{}^1D_2^0$
VG	1977·02	15	50581·2	$s^2\,{}^3F_2$—$5p\,{}^3D_1^0$
VG	1974·47	0	50646·5	$s^2\,{}^1D_2$—$4f\,{}^3F_3^0$
CI	1970·489	15	50748·83	$4s\,{}^3D_2$—$4p\,{}^1P_1^0$
VG	1967·99	2	50813·3	$4p\,{}^3P_2^0$—$4d\,{}^1P_1$
VG	1957·51	20	50185·3	$s^2\,{}^3F_4$—$5p\,{}^3F_4^0$
VG	1952·56	5	51214·8	$s^2\,{}^3F_3$—$5p\,{}^3F_2^0$
VG	1946·49	10	51374·5	$s^2\,{}^3F_4$—$z\,{}^1F_3^0$
CI	1944·586	25	51424·83	$4s\,{}^3D_3$—$4p\,{}^1D_2^0$
VG	1929·74	25*d*	51820·5	$s^2\,{}^3F_4$—$5p\,{}^3D_3^0$
				$s^2\,{}^1D_2$—$w\,{}^1P_1^0$
VG	1928·45	1	51855·1	
VG	1922·13	5	52025·6	$s^2\,{}^3F_3$—$5p\,{}^1D_2^0$
VG	1920·665	5	52065·3	$4p\,{}^3P_2^0$—$4d\,{}^1F_3$
VG	1882·24	1	53128·2	$s^2\,{}^3P_1$—$6p\,{}^3F_2^0$
VG	1861·56	0	53718·4	$s^2\,{}^3F_3$—$y\,{}^3D_2^0$
VG	1856·93	0	53852·3	$s^2\,{}^1D_2$—$6p\,{}^3P_1^0$
VG	1807·84	15	55314·6	$s^2\,{}^3P_0$—3_1^0 ?

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
VG	1800·95	2	55526·3	$s^2\,{}^3F_4$—$y^3D_3^0$
VG	1790·65	5	55845·6	$s^2\,{}^3F_2$—$y^3F_2^0$
VG	1759·49	1	56834·7	$s^2\,{}^3F_3$—$x^5S_2^0$
VG	1753·27	15	57036·3	$s^2\,{}^3F_3$—$y^3F_2^0$
VG	1744·50	20*d* ?	57323·0	$s^2\,{}^3F_2$—$x^5P_1^0$ $s^2\,{}^3F_3$—$x^5P_2^0$ $s^2\,{}^3P_1$—$5f\,{}^3P_2^0$
VG	1736·54	10	57585·8	$s^2\,{}^3F_3$—$x^5P_3^0$
VG	1734·21	3	57663·1	$s^2\,{}^3F_2$—$y^3P_2^0$
VG	1717·72	15	58216·7	$s^2\,{}^3F_2$—$x^5D_{2,1}^0$
VG	1714·65	0	58320·9	$s^2\,{}^3F_2$—$y^1F_3^0$
VG	1699·09	30	58855·0	$s^2\,{}^3F_4$—$y^3F_3^0$
VG	1683·15	40	59412·4	$s^2\,{}^3F_3$—$y^3P_2^0$ $s^2\,{}^3F_4$—$x^5P_3^0$ $s^2\,{}^3F_3$—$x^5D_{2,1}^0$
VG	1680·27	1 ?	59514·2	$s^2\,{}^3F_3$—$y^1F_3^0$
VG	1672·77	10	59781·1	$s^2\,{}^3F_3$—$x^5D_3^0$
C1	1663·003	30	60132·2	$4p\,{}^1P_1^0$—$6s\,{}^3D_2$
C1	1660·005	20	60240·8	$4p\,{}^1D_2^0$—$6s\,{}^3D_3$
C1	1656·326	20	60374·7	$4p\,{}^1D_2^0$—$6s\,{}^3D_2$
C1	1649·457	25	60626·0	$4p\,{}^3D_1^0$—$6s\,{}^3D_2$
VG	1636·61	10	61101·9	$s^2\,{}^3F_2$—$w^3P_2^0$
VG	1630·27	25	61339·5	$s^2\,{}^3F_4$—$y^1F_3^0$
VG	1623·17	30	61607·8	$s^2\,{}^3F_4$—$x^5D_3^0$
VG	1622·44	40	61635·6	$s^2\,{}^3F_2$—$w^3P_1^0$
C1	1621·426	60	61674·1	$4p\,{}^1F_3^0$—$6s\,{}^3D_3$
C1	1617·914	20	61808·0	$4p\,{}^1F_3^0$—$6s\,{}^3D_2$
VG	1614·145	1	61952·3	$s^2\,{}^3F_2$—$w^3D_2^0$
VG	1611·113	10	62068·9	$4p\,{}^1P_1^0$—$6s\,{}^3D_1$
C1	1610·298	15	62100·3	$4p\,{}^3D_2^0$—$6s\,{}^3D_3$
C1	1608·638	25	62164·4	$4p\,{}^1P_1^0$—$6s\,{}^1D_2$
C1	1606·834	40	62234·2	$4p\,{}^3D_2^0$—$6s\,{}^3D_2$
VG	1605·274	30	62294·7	$s^2\,{}^3F_3$—$w^3P_2^0$
C1	1604·848	20	62311·2	$4p\,{}^1D_2^0$—$6s\,{}^3D_1$
C1	1602·387	40	62406·9	$4p\,{}^1D_2^0$—$6s\,{}^1D_2$
VG	1602·250	15	62412·2	$s^2\,{}^3F_2$—$w^3D_1^0$
VG	1601·200	1?	62453·2	$s^2\,{}^3F_3$—$w^3D_3^0$
C1	1598·402	40	62562·5	$4p\,{}^3D_1^0$—$6s\,{}^3D_1$
VG	1596·745	1	62627·4	$s^2\,{}^1D_2$—$5f\,{}^3D_1^0$
C1	1593·557	60	62752·7	$4p\,{}^3D_3^0$—$6s\,{}^3D_3$
C1	1590·164	40	62886·6	$4p\,{}^3D_3^0$—$6s\,{}^3D_2$
VG	1587·675	0	62985·2	$4p\,{}^1D_2^0$—$5d\,{}^3S_1$
VG	1587·046	1	63010·1	$s^2\,{}^3F_2$—$v^3D_3^0$
VG	1583·683	50	63143·9	$s^2\,{}^3F_3$—$w^3D_2^0$
VG	1582·849	10	63177·2	$4p\,{}^1P_1^0$—$5d\,{}^3P_1$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
VG	1581·991	40	63211·5	$s^2\ {}^3F_3$—$v^3F_4^0$
VG	1581·416	0	63234·5	$s^2\ {}^3F_2$—$4f^1P_1^0$ $4p^3D_1^0$—$5d^3S_1$
VG	1580·628	30	63266·0	$s^2\ {}^3F_2$—$4f^3D_3^0$
VG	1580·025	15	63290·1	$s^2\ {}^3F_2$—$4f^3D_2^0$
VG	1579·492	30	63311·5	$s^2\ {}^3F_2$—$4f^3F_3^0$
VG	1577·282	0	63400·2	$4p^1D_2^0$—$5d^3P_2$
VG	1575·349	5	63478·0	$4p^1P_1^0$—$5d^3D_2$
VG	1573·174	0	63565·8	$4p^1D_2^0$—$5d^3D_3$
VG	1570·568	3	63671·2	$4p^3D_1^0$—$5d^3P_1$
VG	1570·035	2	63692·8	$4p^1D_2^0$—$5d^3F_3$?
VG	1569·426	10	63717·6	$s^2\ {}^3F_2$—$v^3F_3^0$
C1	1569·216	10	63726·1	$4p^3F_2^0$—$6s^3D_3$
C1	1566·411	40	63840·2	$4p^1F_3^0$—$6s^1D_2$
C1	1565·925	40	63860·0	$4p^3F_2^0$—$6s^3D_2$
VG	1563·189	5	63971·8	$4p^3D_1^0$—$5d^3D_2$
C1	1558·344	30	64170·7	$4p^3D_2^0$—$6s^3D_1$
VG	1557·583	20	64202·0	$s^2\ {}^3F_3$—$v^3D_3^0$
VG	1555·698	50	64279·8	$s^2\ {}^3F_4$—$w^3D_3^0$
VG	1555·134	40	64303·1	$s^2\ {}^3F_3$—$v^3G_4^0$
VG	1553·893	25	64354·5	$s^2\ {}^3F_2$—$v^3G_3^0$
VG	1552·641	50	64406·4	$s^2\ {}^3F_4$—$v^3G_5^0$
VG	1551·379	30	64458·8	$s^2\ {}^3F_3$—$4f^3D_3^0$
VG	1550·644	30	64489·3	$s^2\ {}^3F_2$—$w^1P_1^0$
VG	1550·292	3	64504·0	$s^2\ {}^3F_3$—$4f^3F_3^0$
VG	1549·560	2	64534·4	
VG	1547·950	10	64601·6	$s^2\ {}^3F_3$—$4f^3F_4^0$
VG	1544·674	40	64738·6	$s^2\ {}^3F_3$—$4f^3G_4^0$
C1	1541·701	75	64863·4	$4p^3F_4^0$—$6s^3D_3$
VG	1540·589	30	64910·2	$s^2\ {}^3F_3$—$v^3F_3^0$
C1	1540·391	30	64918·6	$4p^3D_3^0$—$6s^1D_2$
VG	1540·231	20	64925·3	$s^2\ {}^3F_2$—$v^3F_2^0$
VG	1538·488	10	64998·9	$4p^1F_3^0$—$5d^3D_3$ $4p^1P_1^0$—$5d^1P_1$
VG	1537·560	50	65038·1	$s^2\ {}^3F_4$—$v^3F_4^0$
VG	1535·515	15	65124·7	$4p^1F_3^0$—$5d^3F_4$
C1	1535·004	25	65146·4	$4p^3F_3^0$—$6s^3D_3$
VG	1533·976	25	65190·1	$s^2\ {}^3F_2$—$v^3D_1^0$
VG	1532·124	30	65268·9	$s^2\ {}^3F_3$—$v^3D_2^0$
VG	1531·832	50*d*	65281·3	$4p^3F_3^0$—$6s^3D_2$ $s^2\ {}^3F_2$—$4f^1D_2^0$ $4p^3D_2^0$—$5d^3P_1$
VG	1528·782	2	65411·5	$s^2\ {}^3F_2$—$4f^1F_3^0$?
VG	1528·140	3	65439·0	
VG	1527·801	5	65453·6	$s^2\ {}^3F_2$—$4f^3F_2^0$

*† *See* footnote on p. 211.

Table IV—continued

1*†	2	3	4	5
VG	1526·969	5	65489·2	$4p\,^3D_1^0$—$5d\,^1P_1$
VG	1525·794	30	65539·6	$s^2\,^3F_2$—$4f\,^3G_3^0$
				$4p\,^3D_2^0$—$5d\,^1F_3$
VG	1525·653	10	65545·7	$s^2\,^3F_3$—$v\,^3G_3^0$
				$4p\,^1D_2^0$—$5d\,^3D_1$
				$4p\,^1P_1^0$—$5d\,^3F_2$
VG	1524·857	20	65579·9	$4p\,^3D_2^0$—$5d\,^3D_2$
VG	1523·740	10	65628·0	$4p\,^1D_2^0$—$5d\,^1D_2$
VG	1522·575	15	65678·2	$s^2\,^3F_2$—$u\,^3F_3^0$
VG	1520·543	20	65766·0	$4p\,^1D_2^0$—$5d\,^1F_3$
VG	1519·832	60	65796·7	$4p\,^3F_2^0$—$6s\,^3D_1$
				$4p\,^3D_1^0$—$5d\,^3D_1$
C1	1519·491	50	65811·5	$4p\,^3P_1^0$—$6s\,^3D_2$
VG	1517·930	10	65879·2	$4p\,^3D_1^0$—$5d\,^1D_2$
C1	1517·630	20	65892·2	$4p\,^3F_2^0$—$6s\,^1D_2$
VG	1517·162	10	65912·5	$4p\,^3D_3^0$—$5d\,^3P_2$
VG	1516·902	5	65923·8	$4p\,^3D_3^0$—$5d\,^3G_4$
VG	1514·492	50	66028·7	$s^2\,^3F_4$—$v\,^3D_3^0$
VG	1514·238	10	66039·8	$4p\,^3D_1^0$—$5d\,^3F_2$
VG	1513·360	20	66078·1	$4p\,^3D_3^0$—$5d\,^3D_3$
VG	1512·457	20	66117·6	$s^2\,^3F_3$—$v\,^3F_2^0$
VG	1512·174	20	66130·0	$s^2\,^3F_4$—$v\,^3G_4^0$
VG	1510·502	35	66203·2	$4p\,^3D_3^0$—$5d\,^3F_4$
VG	1508·627	30	66285·4	$s^2\,^3F_4$—$4f\,^3D_3^0$
VG	1508·175	25	66305·3	$s^2\,^3F_2$—$u\,^3F_2^0$
VG	1505·848	5	66407·8	$s^2\,^3F_3$—$u\,^3F_4^0$
VG	1505·384	20	66428·2	$s^2\,^3F_4$—$4f\,^3F_4^0$
VG	1504·755	25	66456·0	$s^2\,^3F_4$—$4f\,^3G_5^0$
VG	1503·368	15	66517·3	$s^2\,^3F_2$—$6p\,^3P_1^0$
VG	1501·333	10	66607·5	$s^2\,^3F_2$—$6p\,^3F_3^0$
VG	1499·510	10	66688·5	$s^2\,^3F_3$—$4f\,^1G_4^0$
VG	1498·566	3	66730·5	$s^2\,^3F_3$—$4f\,^3G_3^0$
VG	1497·956	1	66757·6	
C2	1496·686	35	66814·3	$4p\,^3P_0^0$—$6s\,^3D_1$
VG	1495·426	25	66870·6	$s^2\,^3F_3$—$u\,^3F_3^0$
VG	1494·658	5	66904·9	$4p\,^3F_2^0$—$5d\,^3P_1$
VG	1493·359	25	66963·1	$4p\,^1F_3^0$—$5d\,^1G_4$
VG	1492·837	30	66986·5	$s^2\,^3F_2$—$6p\,^3D_2^0$
VG	1492·684	10	66993·4	$4p\,^1P_1^0$—$5d\,^1S_0$
VG	1492·149	10	67017·4	$s^2\,^3F_2$—$6p\,^3D_3^0$
VG	1488·638	75*d*	67175·5	$4p\,^3P_2^0$—$6s\,^3D_3$
				$4p\,^3F_2^0$—$5d\,^3F_3$?
VG	1485·659	40*d*	67310·2	$4p\,^3P_2^0$—$6s\,^3D_2$
				$4p\,^3F_3^0$—$6s\,^1D_2$
VG	1485·318	20	67325·7	$4p\,^3D_2^0$—$5d\,^3G_3$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
VG	1481·541	20	67497·3	$s^2\ {}^3F_3$—$u^3F_2^o$
VG	1478·230	2	67648·5	$4p^3D_2^o$—$5d^3F_2$
VG	1475·846	30	67757·7	$s^2\ {}^3F_2$—1_1^o
VG	1474·934	20	67799·6	$s^2\ {}^3F_3$—$6p^3F_3^o$
C1	1473·976	25	67843·7	$4p^3P_1^o$—$6s^1D_2$
VG	1473·531	15	67864·2	$s^2\ {}^3F_3$—$6p^3F_4^o$
VG	1472·399	20	67916·4	a^1S_0—$4p^3P_1^o$
VG	1470·697	40	67995·0	$4p^3F_4^o$—$5d^3G_5$
VG	1469·691	15	68041·5	$4p^3D_3^o$—$5d^1G_4$
VG	1466·751	5	68177·9	$s^2\ {}^3F_3$—$6p^3D_2^o$
VG	1466·519	10	68188·7	$4p^3F_4^o$—$5d^3D_3$
VG	1466·067	20	68209·7	$s^2\ {}^3F_3$—$6p^3D_3$
VG	1465·542	15	68234·1	$s^2\ {}^3F_4$—$u^3F_4^o$
VG	1463·771	50*d*	68316·7	$4p^3F_3^o$—$5d^3G_4$
				$4p^3F_4^o$—$5d^3F_4$
VG	1461·556	15	68420·2	$4p^3P_1^o$—$5d^3S_1$
VG	1459·412	25	68520·7	$s^2\ {}^3F_2$—$6p^3D_1^o$
VG	1458·004	30	68586·7	$4p^3F_3^o$—$5d^3F_3$
VG	1457·175	10	68625·9	$4p^3F_3^o$—$5d^3D_2$
VG	1455·655	3	68697·6	$s^2\ {}^3F_4$—$u^3F_3^o$
VG	1452·668	0	68838·9	$4p^3P_1^o$—$5d^3P_2$
VG	1452·291	20	68856·7	$4p^3P_1^o$—$5d^3P_1$
VG	1450·307	25	68950·9	$4p^3F_2^o$—$5d^3G_3$
VG	1449·056	20	69010·4	$s^2\ {}^3F_2$—$6p^3F_2^o$
VG	1448·676	1	69028·5	$4p^3F_2^o$—$5d^3D_1$
VG	1446·896	1	69113·5	$4p^3F_2^o$—$5d^1D_2$
VG	1445·982	20	69157·2	$4p^3P_1^o$—$6d^3D_2$
C1	1444·131	2	69245·8	$4p^3P_2^o$—$6s^3D_1$
VG	1443·541	10	69274·1	$4p^3F_2^o$—$5d^3F_2$
C1	1442·136	15	69341·6	$4p^3P_2^o$—$6s^1D_2$
VG	1436·233	15	69626·6	$s^2\ {}^3F_4$—$6p^3F_3^o$
VG	1435·312	10	69671·3	$s^2\ {}^3F_3$—$6p^1F_3^o$
VG	1434·916	25	69690·5	$s^2\ {}^3F_4$—$6p^3F_4^o$
VG	1434·758	15	69698·2	$4p^3P_1^o$—$5d^3P_0$
VG	1433·837	10	69742·9	$4p^3P_0^o$—$5d^1P_1$
VG	1430·243	40	69918·2	$4p^3P_2^o$—$5d^3S_1$
VG	1428·366	15	70010·1	$s^2\ {}^3F_3$—$6p^1D_2^o$
VG	1427·835	20	70036·1	$s^2\ {}^3F_4$—$6p^3D^o_3$
VG	1427·589	10	70048·2	$4p^3P_0^o$—$5d^3D_1$
VG	1421·760	25	70335·4	$4p^3P_2^o$—$5d^3P_2$
VG	1421·382	5	70354·1	$4p^3P_2^o$—$5d^3P_1$
VG	1419·742	2	70435·3	$4p^3F_3^o$—$5d^1G_4$
VG	1418·423	25	70500·8	$4p^3P_2^o$—$5d^3D_3$
VG	1414·897	10	70676·5	$4p^3P_1^o$—$5d^1P_1$
VG	1410·570	2	70893·3	

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
VG	1410·002	1	70921·9	
VG	1408·811	2	70981·8	$4p\,^3P_1^0$—$5d\,^3D_1$
VG	1407·160	15	71065·1	$4p\,^3P_1^0$—$5d\,^1D_2$
C1	1402·776	15	71287·2	$4p\,^1P_1^0$—$7s\,^3D_2$
C1	1399·355	3	71461·5	$4p\,^1D_2^0$—$7s\,^3D_3$
VG	1398·636	10	71498·2	$s^2\,^3F_4$—$6p\,^1F_3^0$
VG	1395·243	2	71672·1	
C1	1393·126	10	71781·0	$4p\,^3D_1^0$—$7s\,^3D_2$
VG	1377·477	3	72596·5	
VG	1375·520	3	72699·8	$4p\,^3P_2^0$—$5d\,^1F_3$
C1	1371·840	20	72894·8	$4p\,^1F_3^0$—$7s\,^3D_3$
VG	1371·451	2	72915·5	
C1	1370·558	2	72963·0	$4p\,^1F_3^0$—$7s\,^3D_2$
VG	1370·255	1	72979·1	$4p\,^1P_1^0$—$6d\,^3D_2$
VG	1367·952	25	73102·0	$a\,^1S_0$—$4p\,^3D_1^0$
C1	1363·501	5	73340·6	$4p\,^1P_1^0$—$7s\,^1D_2$
C1	1362·598	20	73389·2	$4p\,^3D_2^0$—$7s\,^1D_2$
C1	1359·935	5	73532·9	$4p\,^1D_2^0$—$7s\,^3D_1$
C1	1359·010	20	73583·0	$4p\,^1D_2^0$—$7s\,^1D_2$
VG	1358·764	30	73596·3	$a\,^1S_0$—$4p\,^1P_1^0$
C1	1355·304	15	73784·2	$4p\,^3D_1^0$—$7s\,^3D_1$
C1	1351·837	25	73973·4	$4p\,^3D_3^0$—$7s\,^3D_3$
C1	1350·592	15	74041·6	$4p\,^3D_3^0$—$7s\,^3D_2$
VG	1340·909	3	74576·3	$4p\,^1F_3^0$—$6d\,^3D_3$
VG	1339·769	5	74639·7	$4p\,^1F_3^0$—$6d\,^3F_4$
VG	1339·463	0	74656·8	$4p\,^1F_3^0$—$6d\,^3D_2$
VG	1337·544	0	74763·9	$4p\,^1P_1^c$—$6d\,^1P_1$
VG	1334·556	2*u*	74931·3	$4p\,^3D_2^0$—$6d\,^3P_1$
VG	1333·054	20*d*	75015·7	$4p\,^1F_3^0$—$7s\,^1D_2$ $4p\,^3F_2^0$—$7s\,^3D_2$
VG	1332·222	5	75062·6	$4p\,^3D_2^0$—$6d\,^3F_3$
VG	1331·887	5	75081·4	$4p\,^3D_2^0$—$6d\,^3D_2$
VG	1329·654	1*u*	75207·5	$4p\,^1D_2^0$—$6d\,^1D_2$
VG	1328·416	5	75277·6	$4p\,^1D_2^0$—$6d\,^1F_3$
C1	1326·394	10	75392·4	$4p\,^3D_2^0$—$7s\,^3D_1$
C1	1325·511	3	75442·6	$4p\,^3D_2^0$—$7s\,^1D_2$
VG	1325·270	1	75456·3	$4p\,^3D_1^0$—$6d\,^1D_2$
VG	1323·811	6	75539·5	$4p\,^3D_1^0$—$6d\,^3F_2$
VG	1323·187	3	75575·1	$4p\,^3D_3^0$—$6d\,^3P_2$
VG	1322·627	6	75607·1	$4p\,^1P_1^0$—$6d\,^1S_0$
VG	1321·788	5	75655·1	$4p\,^3D_3^0$—$6d\,^3D_3$
VG	1320·687	10	75718·2	$4p\,^3D_3^0$—$6d\,^3F_4$
C1	1314·335	30	76084·1	$4p\,^3F_4^0$—$7s\,^3D_3$
C1	1314·147	15	76095·0	$4p\,^3D_3^0$—$7s\,^1D_2$
VG	1311·757	1	76233·6	$s^2\,^3F_4$—$5f\,^3H_5^0$
C1	1309·463	15	76367·2	$4p\,^3F_3^0$—$7s\,^3D_3$
C1	1308·296	30	76435·3	$4p\,^3F^0$—$7s\,^3D_2$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
VG	1305·554	5	76595·8	$4p\,{}^1F_3^0$—$6d\,{}^1G_4$
VG	1303·979	2	76688·4	$4p\,{}^3F_2^0$—$6d\,{}^3F_3$
VG	1303·656	2	76707·4	$4p\,{}^3F_2^0$—$6d\,{}^3D_2$
C1	1299·267	10	76966·5	$4p\,{}^3P_1^0$—$7s\,{}^3D_2$
VG	1298·916	1	76987·3	$4p\,{}^3D_2^0$—$6d\,{}^3G_3$
C1	1298·394	15	77018·2	$4p\,{}^3F_2^0$—$7s\,{}^3D_1$
VG	1297·978	1	77042·9	
C1	1297·549	2	77068·4	$4p\,{}^3F_2^0$—$7s\,{}^1D_2$
VG	1287·464	15	77672·1	$4p\,{}^3F_4^0$—$6d\,{}^3G_5$
VG	1285·900	1	77766·5	$4p\,{}^3F_4^0$—$6d\,{}^3D_3$
VG	1285·520	1	77789·5	$4p\,{}^3D_3^0$—$6d\,{}^1F_3$
VG	1284·868	8	77829·0	$4p\,{}^3F_4^0$—$6d\,{}^3F_4$
VG	1283·823	1	77892·4	
VG	1282·450	15	77975·7	$4p\,{}^3F_3^0$—$6d\,{}^3G_4$
C2	1281·458	8	78036·1	$4p\,{}^3P_0^0$—$7s\,{}^3D_1$
VG	1281·098	3	78050·2	$4p\,{}^3F_3^0$—$6d\,{}^3D_3$
VG	1280·265	5	78108·8	$4p\,{}^3F_3^0$—$6d\,{}^3F_3$
VG	1279·947	0	78128·2	$4p\,{}^3F_3^0$—$6d\,{}^3D_2$
C1	1275·570	30	78396·3	$4p\,{}^3P_2^0$—$7s\,{}^3D_3$
C1	1274·463	3	78464·4	$4p\,{}^3P_2^0$—$7s\,{}^3D_2$
C1	1274·069	3	78488·7	$4p\,{}^3F_3^0$—$7s\,{}^1D_2$
VG	1273·704	2	78511·2	$4p\,{}^3P_1^0$—$6d\,{}^3P_1$
VG	1272·036	8	78614·1	$4p\,{}^3F_2^0$—$6d\,{}^3G_3$
VG	1271·326	2	78658·0	$4p\,{}^3P_1^0$—$6d\,{}^3D_2$
VG	1269·445	1	78774·6	$4p\,{}^3F_2^0$—$6d\,{}^3F_2$
VG	1268·710	0	78820·2	$4p\,{}^1F_3^0$—$8s\,{}^3D_3$
C1	1266·308	10	78969·7	$4p\,{}^3P_1^0$—$7s\,{}^3D_1$
C1	1265·504	15	79019·9	$4p\,{}^3P_1^0$—$7s\,{}^1D_2$
VG	1262·928	3	79181·1	$4p\,{}^3P_1^0$—$6d\,{}^3P_0$
VG	1261·213	0	79288·0	$4p\,{}^3D_2^0$—$8s\,{}^3D_3$
VG	1257·674	1	79511·9	$4p\,{}^3P_0^0$—$6d\,{}^1P_1$
VG	1255·162	1	79671·0	$4p\,{}^3P_0^0$—$6d\,{}^3D_1$
VG	1253·179	5	79797·1	$4p\,{}^3P_2^0$—$6d\,{}^3S_1$
C2	1250·045	10	79997·1	$4p\,{}^3P_2^0$—$6d\,{}^3P_2$
C2	1248·790	5	80077·5	$4p\,{}^3P_2^0$—$6d\,{}^3D_3$
VG	1243·032	1	80448·5	$4p\,{}^3P_1^0$—$6d\,{}^1P_1$
C1	1241·961	2	80517·8	$4p\,{}^3P_2^0$—$7s\,{}^1D_2$
VG	1240·025	1	80643·5	$4p\,{}^3P_1^0$—$6d\,{}^1D_2$
VG	1235·931	0	80910·7	$4p\,{}^3F_2^0$—$8s\,{}^3D_2$
C2	1219·332	1	82012·1	$4p\,{}^3F_4^0$—$8s\,{}^3D_3$
C2	1214·553	1	82334·8	$4p\,{}^3F_3^0$—$8s\,{}^3D_2$
VG	1206·770	0	82865·8	$4p\,{}^3P_1^0$—$8s\,{}^3D_2$
VG	1205·900	2	82925·6	$4p\,{}^3F_4^0$—$7d\,{}^3G_5$
VG	1205·179	0	82975·2	$4p\,{}^3F_4^0$—$7d\,{}^3D_3$
VG	1204·642	1	83012·2	$4p\,{}^3F_4^0$—$7d\,{}^3F_4$ $4s\,{}^1D_2$—$sp\,{}^5D_3^0$

*† *See* footnote on p. 211.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

TABLE IV—continued

1*†	2	3	4	5
VG	1201·626	2	83220·6	$4p\,^3F_3^0$—$7d\,^3G_4$
VG	1192·261	2	83874·3	$4p\,^3F_2^0$—$7d\,^3G_3$
C2	1185·899	2	84324·2	$4p\,^3P_2^0$—$8s\,^3D_3$
VG	1162·610	3	86013·4	$4s\,^3D_3$—$sp^5D_4^0$
VG	1157·871	8	86365·4	$4s\,^3D_1$—$sp^5D_2^0$
VG	1157·021	5	86428·9	$4s\,^3D_2$—$sp^5D_3^0$
VG	1147·762	8	87126·1	$4s\,^3D_1$—$sp^5D_1^0$
VG	1144·853	30	87347·5	$4s\,^3D_3$—$sp^5D_3^0$
VG	1142·642	20	87516·5	$4s\,^3D_2$—$sp^5D_2^0$
VG	1130·887	1	88426·2	$4s\,^3D_1$—$sp^5G_2^0$
VG	1123·226	5	89029·3	$4s\,^3D_2$—$sp^5G_3^0$
VG	1119·945	15	89290·1	$4s\,^3D_3$—$sp^5G_4^0$
VG	1112·407	5	89895·2	
VG	1111·752	0	89948·1	$4s\,^3D_3$—$sp^5G_3^0$
C2	1109·742	1	90111·0	$4s\,^1D_2$—$z\,^3D_3^0$
C2	1106·446	3	90379·5	$4s\,^1D_2$—$z\,^3F_3^0$
VG	1105·182	5	90482·8	$4s\,^3D_1$—$sp^5F_2^0$
VG	1101·835	1	90757·7	$4s\,^3D_1$—$sp^5F_1^0$
VG	1097·049	25	91153·6	$4s\,^3D_2$—$sp^5F_3^0$
VG	1094·401	30	91374·2	$4s\,^3D_3$—$sp^5F_4^0$
VG	1091·288	5	91634·8	$4s\,^3D_2$—$sp^5F_2^0$
VG	1089·236	3	91807·5	$4s\,^1D_2$—$z\,^3D_1^0$
C2	1088·393	20	91878·5	$4s\,^1D_2$—$z\,^3G_3^0$
VG	1086·110	5	92071·7	$4s\,^3D_3$—$sp^5F_3^0$
VG	1077·888	1	92774·0	$4s\,^1D_2$—$z\,^3F_2^0$
VG	1073·738	30	93132·6	$4s\,^3D_1$—$z\,^3D_2^0$
VG	1070·308	15	93431·0	$4s\,^3D_3$—$z\,^3G_4^0$
C2	1069·193	50	93528·5	$4s\,^3D_2$—$z\,^3D_3^0$
C2	1066·133	20	93796·9	$4s\,^3D_2$—$z\,^3F_3^0$
C1	1065·781	20	93827·9	$4s\,^1D_2$—$5p\,^3P_2^0$
VG	1063·003	60	94073·1	$4s\,^3D_1$—$z\,^3D_1^0$
VG	1060·630	60	94283·6	$4s\,^3D_2$—$z\,^3D_2^0$
C1	1059·094	60	94420·3	$4s\,^1D_2$—$5p\,^3F_3^0$
C2	1058·796	40	94446·9	$4s\,^3D_3$—$z\,^3D_3^0$
VG	1056·952	60	94611·7	$4s\,^1D_2$—$z\,^1D_2^0$
C2	1055·795	40	94715·4	$4s\,^3D_3$—$z\,^3F_3^0$
C1	1054·690	60	94814·6	$4s\,^1D_2$—$z\,^1F_3^0$
VG	1052·170	20	95041·7	$4s\,^3D_1$—$z\,^3F_2^0$
VG	1050·399	10	95201·9	$4s\,^3D_3$—$z\,^3D_2^0$
VG	1050·153	10	95224·2	$4s\,^3D_2$—$z\,^3D_1^0$
C1	1049·754	50	95260·4	$4s\,^1D_2$—$5p\,^3D_3^0$
C2	1049·363	20	95295·9	$4s\,^3D_2$—$z\,^3G_3^0$
C1	1044·742	80	95717·4	$4s\,^1D_2$—$5p\,^3D_2^0$
VG	1044·516	80	95738·1	$4s\,^3D_3$—$z\,^3F_4^0$
VG	1039·569	60	96193·7	$4s\,^3D_2$—$z\,^3F_2^0$

*† *See* footnote on p. 211.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

TABLE IV—continued

1*†	2	3	4	5
C2	1039·345	60	96214·4	$4s^3\mathrm{D}_3$—$z^3\mathrm{G}_3^0$
C1	1036·468	60	96481·5	$4s^1\mathrm{D}_2$—$5p^3\mathrm{F}_2^0$
C1	1035·160	8	96603·4	$4s^1\mathrm{D}_2$—$5p^1\mathrm{P}_1^0$
VG	1033·560	10	96753·0	$4s^1\mathrm{D}_2$—$5p^1\mathrm{F}_3^0$
C1	1031·764	8	96921·4	$4s^3\mathrm{D}_1$—$5p^3\mathrm{P}_1^0$
VG	1030·261	20	97062·8	$4s^3\mathrm{D}_3$—$z^1\mathrm{G}_4^0$
VG	1029·747	10	97111·2	$4s^3\mathrm{D}_3$—$z^3\mathrm{F}_2^0$
C1	1028·326	25	97245·4	$4s^3\mathrm{D}_2$—$5p^3\mathrm{P}_2^0$
C1	1027·830	50	97292·4	$4s^1\mathrm{D}_2$—$5p^1\mathrm{D}_2^0$
C1	1022·100	5	97837·8	$4s^3\mathrm{D}_2$—$5p^3\mathrm{F}_3^0$
VG	1020·106	15	98029·0	$4s^3\mathrm{D}_2$—$z^1\mathrm{D}_2^0$
C1	1019·652	15	98072·7	$4s^3\mathrm{D}_2$—$5p^3\mathrm{P}_1^0$
C1	1018·705	50	98163·8	$4s^3\mathrm{D}_3$—$5p^3\mathrm{P}_2^0$
VG	1018·054	15*d*	98226·6	$4s^3\mathrm{D}_2$—$z^1\mathrm{F}_3^0$
				$4s^3\mathrm{D}_1$—$5p^3\mathrm{P}_0^0$
VG	1013·381	1	98679·6	$4s^3\mathrm{D}_2$—$5p^3\mathrm{D}_3^0$
VG	1012·680	3	98747·9	$4s^3\mathrm{D}_1$—$5p^3\mathrm{F}_2^0$
C1	1012·595	25	98756·2	$4s^3\mathrm{D}_3$—$5p^3\mathrm{F}_3^0$
C1	1011·433	2	98869·6	$4s^3\mathrm{D}_1$—$5p^1\mathrm{P}_1^0$
VG	1010·649	3	98946·3	$4s^3\mathrm{D}_3$—$z^1\mathrm{D}_2^0$
VG	1010·453	10	98965·5	$4s^1\mathrm{D}_2$—$y^3\mathrm{D}_3^0$
VG	1010·267	30	98983·7	$4s^1\mathrm{D}_2$—$y^3\mathrm{D}_2^0$
VG	1008·726	30	99134·9	$4s^3\mathrm{D}_2$—$5p^3\mathrm{D}_2^0$
				$4s^1\mathrm{D}_2$—$y^1\mathrm{P}_1^0$
C1	1008·568	30	99150·5	$4s^3\mathrm{D}_3$—$z^1\mathrm{F}_3^0$
VG	1006·979	1	99306·9	$4s^3\mathrm{D}_1$—$5p^3\mathrm{D}_1^0$
				$4s^1\mathrm{D}_2$—$y^3\mathrm{D}_1^0$
C1	1004·053	30	99596·3	$4s^3\mathrm{D}_3$—$5p^3\mathrm{D}_3^0$
C1	1001·010	8	99899·1	$4s^3\mathrm{D}_2$—$5p^3\mathrm{F}_2^0$
VG	999·799	5	100020·1	$4s^3\mathrm{D}_2$—$5p^1\mathrm{P}_1^0$
VG	998·310	8	100169·3	$4s^3\mathrm{D}_2$—$5p^1\mathrm{F}_3^0$
C1	992·951	25	100709·9	$4s^3\mathrm{D}_2$—$5p^1\mathrm{D}_2^0$
VG	989·245	8	101087·2	$4s^3\mathrm{D}_3$—$5p^1\mathrm{F}_3^0$
VG	987·656	10	101249·8	$4s^3\mathrm{D}_1$—$y^3\mathrm{D}_2^0$
VG	984·530	10	101571·3	$4s^3\mathrm{D}_1$—$y^3\mathrm{D}_1^0$
VG	984·015	1	101624·5	$4s^3\mathrm{D}_3$—$5p^1\mathrm{D}_2^0$?
VG	979·418	5	102101·4	$4s^1\mathrm{D}_2$—$x^5\mathrm{S}_2^0$
VG	977·567	25	102294·8	$4s^1\mathrm{D}_2$—$y^3\mathrm{F}_3^0$
VG	976·708	10	102384·7	$4s^3\mathrm{D}_2$—$y^3\mathrm{D}_3^0$
VG	976·540	10	102402·4	$4s^3\mathrm{D}_2$—$y^3\mathrm{D}_2^0$
VG	974·759	20	102589·5	$4s^1\mathrm{D}_2$—$x^5\mathrm{P}_2^0$
VG	973·508	2	102721·3	$4s^3\mathrm{D}_3$—$y^3\mathrm{D}_1^0$
VG	972·263	2	102852·8	$4s^1\mathrm{D}_2$—$x^5\mathrm{P}_3^0$
VG	968·037	25	103301·8	$4s^3\mathrm{D}_3$—$y^3\mathrm{D}_3^0$
VG	967·866	0	103320·1	$4s^3\mathrm{D}_3$—$y^3\mathrm{D}_2^0$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
VG	966·231	3	103494·9	$4s^1D_2$—$x^5P_1^0$
VG	960·409	20	104122·3	$4s^1D_2$—$y^3P_2^0$
VG	958·149	40	104367·9	$4s^1D_2$—$y^1D_2^0$ $4s^3D_1$—$x^5S_2^0$
VG	956·286	25	104571·2	$4s^3D_1$—$y^3F_2^0$
VG	955·321	5	104676·9	$4s^1D_2$—$x^5D_{2,1}^0$
VG	954·378	20	104780·3	$4s^1D_2$—$y^1F_3^0$
VG	951·413	5	105106·9	
VG	947·700	2	105518·6	$4s^3D_2$—$x^5S_2^0$
VG	945·976	50	105710·9	$4s^3D_2$—$y^3F_3^0$
VG	945·860	40	105723·9	$4s^3D_2$—$y^3F_2^0$
VG	945·524	60	105761·5	$4s^3D_1$—$x^5P_1^0$
VG	943·328	60	106007·6	$4s^3D_2$—$x^5P_2^0$
VG	939·522	10	106437·1	$4s^3D_3$—x^5S_2
VG	937·814	5	106630·9	$4s^3D_3$—$y^3F_3^0$
VG	935·892	60	106849·9	$4s^3D_3$—$y^3F_4^0$
VG	935·35	20	106911·5	$4s^3D_2$—$x^5P_1^0$
VG	935·25	40	106923·3	$4s^3D_3$—$x^5P_2^0$
VG	935·074	60	106943·4	$4s^3D_1$—$x^5D_{2,1}^0$
VG	932·940	60	107188·0	$4s^3D_3$—$x^5P_3^0$
VG	929·897	5	107538·8	$4s^3D_2$—$y^3P_2^0$
VG	929·732	2	107557·9	$4s^1D_2$—$w^3P_2^0$?
VG	925·125	30	108093·5	$4s^3D_2$—$x^5D_{2,1}^0$ $4s^1D_2$—$w^3P_1^0$
VG	924·239	50	108197·1	$4s^3D_2$—$y^1F_3^0$
VG	922·411	20	108411·6	$4s^1D_2$—$w^3D_2^0$
VG	922·017	60	108457·9	$4s^3D_3$—$y^3P_2^0$
VG	917·303	20	109015·2	$4s^3D_3$—$x^5D_2^0$
VG	914·209	80	109384·2	$4s^3D_3$—$x^5D_3^0$
VG	913·47	0	109472·7	$4s^1D_2$—$v^3D_3^0$
VG	912·414	3	109599·4	$4s^1D_2$—$4f^3P_1^0$
C2	912·022	0	109646·5	$4s^1D_2$—$4f^3P_2^0$
C2	911·654	1	109690·7	$4s^1D_2$—$w^1D_2^0$
VG	910·518	15	109828·6	$4s^3D_1$—$w^3P_2^0$
VG	906·109	40	110362·0	$4s^3D_1$—$w^3P_1^0$
VG	903·520	1	110678·2	$4s^3D_1$—$w^3D_2^0$
VG	901·071	60	110979·1	$4s^3D_2$—$w^3P_2^0$
VG	899·791	50	111136·9	$4s^3D_1$—$w^3D_1^0$ $4s^3D_2$—$w^3D_3^0$
VG	897·790	15	111384·6	$4s^1D_2$—$v^3F_2^0$
VG	896·970	40	111486·4	$4s^3D_1$—$w^3P_0^0$
VG	896·753	60	111513·4	$4s^3D_2$—$w^3P_1^0$
VG	894·226	40	111828·6	$4s^3D_2$—$w^3D_2^0$
VG	893·674	80	111897·6	$4s^3D_3$—$w^3P_2^0$
VG	892·411	50	112056·0	$4s^3D_3$—$w^3D_3^0$

*† *See* footnote on p. 211.

Table IV—continued

1*†	2	3	4	5
VG	890·567	60	112288·0	$4s\,^3D_2$—$w\,^3D_1^o$
VG	886·946	60	112746·4	$4s\,^3D_3$—$w\,^3D_2^o$
VG	886·515	10	112801·2	$4s\,^3D_1$—$v\,^3D_2^o$
VG	885·842	25	112886·9	$4s\,^3D_2$—$v\,^3D_3^o$
C2	884·824	5	113016·9	$4s\,^3D_2$—$4f\,^3P_1^o$
VG	884·430	8	113067·2	$4s\,^1D_2$—$6p\,^3F_3^o$
VG	884·127	10	113105·9	$4s\,^3D_2$—$w\,^1D_2^o$
C2	883·837	5	113143·1	$4s\,^3D_2$—$4f\,^3D_3^o$
VG	883·282	5	113214·1	$4s\,^3D_1$—$w\,^1P_1^o$
VG	880·325	5	113594·4	$4s\,^3D_2$—$v\,^3F_3^o$
VG	879·906	2	113648·5	$4s\,^3D_1$—$v\,^3F_2^o$
VG	878·696	50	113805·0	$4s\,^3D_3$—$v\,^3D_3^o$
VG	877·839	15	113916·1	$4s\,^3D_1$—$v\,^3D_1^o$
VG	877·559	20	113952·4	$4s\,^3D_2$—$v\,^3D_2^o$
VG	877·007	25	114024·2	$4s\,^3D_3$—$w\,^1D_2^o$
C2	876·719	20	114061·6	$4s\,^3D_3$—$4f\,^3D_3^o$
VG	873·264	15	114512·9	$4s\,^3D_3$—$v\,^3F_3^o$
VG	871·064	8	114802·1	$4s\,^3D_2$—$v\,^3F_2^o$
VG	870·544	8	114870·7	$4s\,^3D_3$—$v\,^3D_2^o$
VG	869·336	25	115030·3	$4s\,^3D_1$—$u\,^3F_2^o$
VG	869·062	10	115066·6	$4s\,^3D_2$—$v\,^3D_1^o$
VG	867·726	8	115243·7	$4s\,^3D_1$—$6p\,^3P_1^o$
C2	866·440	5	115414·8	$4s\,^3D_2$—$4f\,^3G_3^o$
VG	865·383	40	115555·8	$4s\,^3D_2$—$u\,^3F_3^o$
VG	864·199	10*d*	115714·1	$4s\,^3D_3$—$v\,^3F_2^o$
				$4s\,^3D_1$—$6p\,^3D_2^o$
VG	862·822	2	115898·7	
VG	862·011	40	116007·8	$4s\,^3D_3$—$u\,^3F_4^o$
VG	860·740	1	116179·1	$4s\,^3D_2$—$u\,^3F_2^o$
VG	859·158	0	116393·1	$4s\,^3D_2$—$6p\,^3P_1^o$
VG	858·482	25*d*	116484·7	$4s\,^3D_2$—$6p\,^3F_3^o$
				$4s\,^3D_1$—1_1^o
				$4s\,^3D_3$—$u\,^3F_3^o$
VG	855·701	10	116863·3	$4s\,^3D_2$—$6p\,^3D_2^o$
VG	855·474	5	116894·2	$4s\,^3D_2$—$6p\,^3D_3^o$
VG	853·56	1	117156·4	
VG	852·898	3	117247·3	$4s\,^3D_1$—$6p\,^3D_1^o$
VG	851·76	2	117404·0	$4s\,^3D_3$—$6p\,^3F_3^o$
VG	851·300	25	117467·4	$4s\,^3D_3$—$6p\,^3F_4^o$
VG	850·76	2	117542·0	$4s\,^3D_1$—$6p\,^1D_2^o$
VG	849·354	3	117736·5	$4s\,^3D_1$—$6p\,^3F_2^o$
VG	848·806	15	117812·5	$4s\,^3D_3$—$6p\,^3D_3^o$
VG	844·910	5	118355·8	$4s\,^3D_2$—$6p\,^1F_3^o$
VG	844·616	3	118397·0	$4s\,^3D_2$—$6p\,^3D_1^o$
VG	842·483	3	118696·8	$4s\,^3D_2$—$6p\,^1D_2^o$

*† *See* footnote on p. 211.

TABLE IV—continued

1*†	2	3	4	5
VG	841·105	2	118891·2	$4s\,^3D_2$—$6p\,^3F_2{}^0$
VG	839·47	1	119122·8	
VG	836·04	0	119611·5	$4s\,^3D_3$—$6p\,^1D_2{}^0$
C3	826·995	30	120919·7	$a\,^1S_0$—$5p\,^3P_1{}^0$
VG	824·635	2	121265·8	
VG	823·800	2	121388·7	$4s\,^3D_2$—$3_1{}^0$?
VG	822·500	1	121580·5	
C3	813·882	20	122867·9	$a\,^1S_0$—$5p\,^1P_1{}^0$
VG	811·29	1	123260·5	
C3	810·997	15	123305·0	$a\,^1S_0$—$5p\,^3D_1{}^0$
VG	810·635	1	123360·1	
VG	806·550	3	123984·9	$4s\,^1D_2$—$t\,^3P_2{}^0$
VG	797·452	10	125399·4	$a\,^1S_0$—$y\,^1P_1{}^0$
VG	784·94	0	127398·3	$4s\,^3D_2$—$t\,^3P_2{}^0$
VG	779·300	8	128320·3	$4s\,^3D_3$—$t\,^3P_2{}^0$
VG	777·71	0	128582·6	
VG	776·48	0	128786·3	
VG	768·48	0	130127·0	
VG	763·29	0	131011·8	
VG	752·80	0	132837·4	
C3	736·031	25	135863·9	$a\,^1S_0$—$4f\,^3P_1{}^0$
C3	735·519	20	135958·5	$a\,^1S_0$—$4f\,^1P_1{}^0$
C3	724·487	15	138028·7	$a\,^1S_0$—$4f\,^3D_1{}^0$
VG	718·171	10	139242·6	$a\,^1S_0$—$6p\,^3P_1{}^0$
VG	709·303	10	140983·5	$a\,^1S_0$—$6p\,^1P_1{}^0$
C4	685·396	2	145901·1	$a\,^1S_0$—$5f\,^3P_1{}^0$
C4	685·139	8	145955·7	$a\,^1S_0$—$5f\,^1P_1{}^0$
VG	675·601	2	148016·3	$a\,^1S_0$—$5f\,^3D_1{}^0$

*† *See* footnote on p. 211.

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SUMMARY

The spectrum of the copper cathode Schuler tube has been photographed with long exposures from λ 10,000 to λ 600. From the 1350 lines, the analysis has identified the following structures: $3d^9 4s$, $5s$, $6s$, $7s$, $8s$; $3d^9 4p$, $5p$, $6p$; $3d^{10}$;

$3d^9 4d$, $5d$, $6d$, $7d$; $3d^9 4f$, $5f$, $6f$; $3d^9 5g$; $3d^8 4s^2$; $3d^8 4s4p$. There are over forty series of three or more levels. The structures $d^9 f$ and $d^9 g$ are completely identified for the first time. The most striking feature is the number of levels which show the effects of mixed configurations. Perturbations in position and combining properties are common, including cases of $\Delta S = 2$ and of $\Delta l_1 = 2$, $\Delta l_2 = 3$.

The values of many high levels can be found accurately from cross combinations in the visible and near ultra-violet. Their combinations with low levels then form an excellent system of calculated wave-lengths down to λ 675, which can be used as accurate standards in that region.

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