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The Asymmetric Rotor

II. Calculation of Dipole Intensities and Line Classification*

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A table of line strengths for rigid asymmetric rotors is given, by means of which to this approximation the relative intensities of all important rotational lines up to $J<13$ for all bands of any molecule can be readily calculated, provided the asymmetry is roughly the same in the initial and final states. A classification of the irregularly spaced lines of the asymmetric rotor is made into "sub-branches" defined by the changes of the K values of the initial level in the limiting prolate and oblate symmetric rotors, and into "wings" which collect together lines of the sub-branches which have uniformly varying strength and Boltzmann factor, and fairly uniform spacing.

I. INTRODUCTION

In a series of papers, of which this is the second, we propose to make a systematic approach to the analysis of the rotational structure of molecular spectra.[1] If the molecule is an asymmetric rotor, the stochastic method is the only one applicable. In the first paper a table was given from which the energy levels, and hence term values, for any molecule could be easily obtained from assumed values of interatomic angles and distances. Although line position is the primary tool used in the interpretation of spectra, it is not sufficient in complex spectra of asymmetric-rotor molecules with large moments of inertia, where the lines are neither regularly spaced nor completely resolved. In such bands intensities are equally important in analysis. In this paper we calculate the line strengths from the square of the elements of the direction-cosine matrices, covering, somewhat coarsely, the whole range of asymmetry possible for all levels up to $J<13$. Relative intensities can be easily calculated from the strengths.

No tables of line strengths or intensities have appeared hitherto in the literature. It has been customary to use the limiting prolate or oblate symmetric-rotor intensities for transitions from levels of high or low τ, respectively (τ being an ordinal index labelling the levels having the same quantum number J). The numerical results given here show that these can be in error by large factors, even with a low degree of asymmetry. The strengths of lines from intermediate τ levels are often of quite unexpected magnitudes.

A qualitative classification of the lines of the asymmetric rotor has been made. There are the usual P, Q, and R branches, determined by the change in total angular momentum J. As in the symmetric rotor these are divided into sub-branches, determined by changes in internal angular momentum around the symmetry axes, except that in the asymmetric rotor there are two pseudo-quantum numbers K_{-1} and K_1, introduced in our classification of energy levels.[1] Both of these K's obey the symmetric-rotor rules as far as parity goes. The principal sub-branches are those in which the magnitude of the change of both K's is the same as in the symmetric rotor $(0, \pm 1)$; next in importance are those for which only one ΔK is 0 or ± 1, and the other $|\Delta K|$ is greater than 1; and the least important are the "forbidden" sub-branches for which both $|\Delta K|$'s are greater than 1. Finally the lines of the sub-branches are classified into wings, in which one K or the other is held constant. This procedure groups together lines whose strength and Boltzmann factors vary uniformly and whose positions are as regular as can be expected.

* This paper is based on a portion of a thesis presented by R. M. Hainer in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Graduate School of Brown University.

[1] G. W. King, R. M. Hainer, and P. C. Cross, J.Chem. Phys. **11**, 27 (1943), the first of this series, which will hereafter be referred to as I.

This classification, coupled with the quantitative results which enable one to neglect various sub-branches and wings in appropriate ranges of asymmetry, clarifies the rotational structure of the bands of the asymmetric rotor.

II. ABSORPTION INTENSITY AND PROPERTIES OF THE DIRECTION-COSINE MATRICES

The intensity of a spectral line may, in principle, be evaluated by the application of the quantum theory of Einstein transition probabilities. Thus the intensity of absorption for the transition $n''\rightarrow n'$ is

$$I_{n'';n'}=\frac{8\pi^3\nu N g_{n''}(1-e^{-h\nu/kt})\exp(-E_{n''}/kt)}{3hc\Sigma g_n\exp(-E_n/kt)}\times|\mu_{n'';n'}|^2, \quad (1)$$

where n stands for all the quantum numbers describing the state, $E_{n''}$ is the energy of the lower state, $g_{n''}$ its weight factor. N is the number of molecules per cc and ν is the frequency of the absorption line. The last factor $|\mu_{n'';n'}|^2$, is to be taken as $|\int\psi^*_{n''}\mu\psi_{n'}dv|^2$, the square of the magnitude of the $n''; n'$ element in the matrix of the dipole vector μ. It can be expanded as $\Sigma_F|(\mu_F)_{n'';n'}|^2$, where F represents X, Y, Z, the axes of the space-fixed Cartesian system in terms of which the radiation field is described. In the absence of an external field (1) can be summed over the Zeeman components.

In molecular spectra for which the separation of the wave functions into a rotational part ψ_R and a vibrational-electronic part $\psi_{V,e}$ is a satisfactory approximation,

$$\int\psi^*_{n''}\mu_F\psi_{n'}dv=\Sigma_g\int\psi^*_{R''}\Phi_{Fg}\psi_{R'}dv \int\psi^*_{V'',e''}\mu_g\psi_{V',e'}dv, \quad (2)$$

where the μ_g's are the components of the electric moment associated with the vibrational-electronic selection rules along the x, y, z axes of a molecule-fixed Cartesian system in terms of which the shift of electron density due to changing vibrational and electronic wave functions may be described. The Φ_{Fg} are the direction cosines between the space-fixed F and rotating g axes. No loss of generality is incurred by identifying the x, y, z axes with the principal axes of inertia a, b, c of the molecule.[1] Thus except for the magnitude of the permanent and induced electric moments, $\int\psi^*_{V'',e''}\mu_g\psi_{V',e'}dv$, the intensities of the lines in the rotational structure of a band are readily evaluated from (1) and the elements of the matrices of the direction cosines in the representations which diagonalize the energy matrices for the upper and lower states.

The direction cosines are the elements of an orthogonal transformation from molecule-fixed to space-fixed coordinates, satisfying the relations

$$\mathcal{P}_F=\Sigma_g\Phi_{Fg}P_g, \quad P_g=\Sigma_F\Phi_{Fg}\mathcal{P}_F, \quad (3)$$

where P_g and $\mathcal{P}_F$ are the components of angular momentum in the molecule-fixed and in the space-fixed coordinate systems, respectively. Applying the laws of non-commuting vector analysis to the basic commutation rules of Heisenberg, or by expressing the P_g, $\mathcal{P}_F$, and Φ_{Fg} as functions of a set of Eulerian angles and obtaining the corresponding Schrödinger operators, one may derive the following commutation rules. These rules and the values of the matrix elements have been given before,[2] but as it is necessary in the symmetry classification of the lines to use a representation consistent with that used for the calculation of the energies and transformations, the commutation rules and direction-cosine matrices are given here for the phase relations chosen in I, footnote 10:

$$P_xP_y-P_yP_x=-i\hbar P_z, \quad \text{etc.}, \quad (4)$$

$$\mathcal{P}_X\mathcal{P}_Y-\mathcal{P}_Y\mathcal{P}_X=i\hbar\mathcal{P}_Z, \quad \text{etc.} \quad (5)$$

$$\mathcal{P}_X\Phi_{Yg}-\Phi_{Yg}\mathcal{P}_X=-\mathcal{P}_Y\Phi_{Xg}+\Phi_{Xg}\mathcal{P}_Y = i\hbar\Phi_{Zg}, \text{ etc.}, \quad (6)$$

$$P_x\Phi_{Fy}-\Phi_{Fy}P_x=-P_y\Phi_{Fx}+\Phi_{Fx}P_y = -i\hbar\Phi_{Fz}, \text{ etc.} \quad (7)$$

The other equations are obtained by a cyclic permutation of the indices.

$$\mathcal{P}_F\Phi_{Fg}-\Phi_{Fg}\mathcal{P}_F=P_g\Phi_{Fg}-\Phi_{Fg}P_g=0 \quad (8)$$

and

$$\Phi_{Fg}\Phi_{F'g'}-\Phi_{F'g'}\Phi_{Fg}=0. \quad (9)$$

[2] D. M. Dennison, in Rev. Mod. Phys. **3**, 280 (1931) and earlier papers published the square of the elements summed over the Zeeman components. H. B. G. Casimir, Zeits. f. Physik **59**, 623 (1929) gave in detail the commutation rules and matrix elements in the representation used by O. Klein, Zeits. f. Physik **58**, 730 (1929).

TABLE I. Values of the elements of all the direction-cosine matrices, separated into the three factors of (16). Note how the factor dependent on K changes with the internal axes $g=x, y, z$, and the factor dependent on M changes in the same way with the external axes $F=X, Y, Z$.

Matrix-element factor	Value of J': $J+1$	J	$J-1$
$(\Phi_{Fg})_{J,J'}$	$[4(J+1)\sqrt{(2J+1)(2J+3)}]^{-1}$	$[4J(J+1)]^{-1}$	$[4J\sqrt{4J^2-1}]^{-1}$
$(\Phi_{Fz})_{J,K;J'K}$	$2\sqrt{(J+K+1)(J-K+1)}$	$2K$	$-2\sqrt{J^2-K^2}$
$(\Phi_{Fy})_{J,K;J',K\pm1} = \mp i(\Phi_{Fx})_{J,K;J',K\pm1}$	$\mp\sqrt{(J\pm K+1)(J\pm K+2)}$	$\sqrt{(J\mp K)(J\pm K+1)}$	$\mp\sqrt{(J\mp K)(J\mp K-1)}$
$(\Phi_{Zg})_{J,M;J',M}$	$2\sqrt{(J+M+1)(J-M+1)}$	$2M$	$-2\sqrt{J^2-M^2}$
$(\Phi_{Yg})_{J,M;J',M\pm1} = \pm i(\Phi_{Xg})_{J,M;J',M\pm1}$	$\mp\sqrt{(J\pm M+1)(J\pm M+2)}$	$\sqrt{(J\mp M)(J\pm M+1)}$	$\mp\sqrt{(J\mp M)(J\mp M-1)}$

Since by definition

$$P^2=P_x^2+P_y^2+P_z^2=\mathcal{P}_X^2+\mathcal{P}_Y^2+\mathcal{P}_Z^2, \quad (10)$$

$$P^2P_g-P_gP^2=P^2\mathcal{P}_F-\mathcal{P}_FP^2=0. \quad (11)$$

Also

$$H=\tfrac{1}{2}(P_x^2/I_x+P_y^2/I_y+P_z^2/I_z) \quad (12)$$

(since x, y, z are identified with the principal axes of inertia) and

$$HP_g-P_gH=0, \quad H\mathcal{P}_F-\mathcal{P}_FH=0. \quad (13)$$

Choosing a representation which simultaneously diagonalizes P^2, P_z, and $\mathcal{P}_Z$, one may obtain the following solution of the above equations.

$$\begin{aligned}(P_y)_{J,K,M;\,J,K+1,M}&=-i(P_x)_{J,K,M;\,J,K+1,M}\\&=(\hbar/2)[J(J+1)-K(K+1)]^{\frac{1}{2}},\\(P_z)_{J,K,M;\,J,K,M}&=\hbar K,\end{aligned} \quad (14)$$

and

$$\begin{aligned}(\mathcal{P}_Y)_{J,K,M;\,J,K,M+1}&=i(\mathcal{P}_X)_{J,K,M;\,J,K,M+1}\\&=(\hbar/2)[J(J+1)-M(M+1)]^{\frac{1}{2}},\\(\mathcal{P}_Z)_{J,K,M;\,J,K,M}&=\hbar M,\end{aligned} \quad (15)$$

where the phase factors are such that P_y and $\mathcal{P}_Y$ are real and positive (see I-5 ff.), and where $|K|\leqslant J\geqslant|M|$.

From the above equations and choice of phases, the elements $(\Phi_{Fg})_{JKM;J'K'M'}$ of the direction-cosine matrices given in Table I were derived by the method outlined in Born and Jordan,[3] i.e., solving the above equations algebraically. Each element is composed of three factors: a J, J' component which is constant for a given ΔJ, i.e., for a given P, Q, or R block; a $JK, J'K'$ component which is independent of M, M'; and a $JM, J'M'$ component which is independent of K, K'. Thus an element has the structure

$$(\Phi_{Fg})_{J,K,M;J',K',M'}=(\Phi_{Fg})_{J;J'}\cdot(\Phi_{Fg})_{J,K;J',K'}\cdot(\Phi_{Fg})_{J,M;J',M'}. \quad (16)$$

[3] M. Born and P. Jordan, *Elementare Matrixmechanik* (Julius Springer, Berlin, 1930), Chapter IV, especially pp. 143. H. Rademacher and F. Reiche, Zeits. f. Physik **41**, 453 (1927), have evaluated the integrals $\int\psi_R\Phi_{Fg}\psi_{R'}{}^*dv$. Their results, which are not given in a form convenient for our purpose, may, however, be shown to agree with the elements in Table I.

III. CALCULATION OF DIRECTION-COSINE MATRICES

Symmetric-Rotor Direction Cosines in a Four-Group Representation

The symmetric-rotor basis functions employed in Table I belong to the group D_∞, whereas the asymmetric-rotor functions belong to the Four Group V. In order to calculate the asymmetric-rotor line strengths and to correlate them properly with the components of the degenerate pairs to which they converge in the symmetric-rotor limiting cases, it is necessary to transform to a set of symmetric-rotor basis functions, the Wang functions, which also belong to the Four Group. This transformation X, defined in (I-26) and (I-29), is easily applied by inspection to the direction-cosine matrices of the symmetric rotor in the representations of D_∞ as given in Table I, to give

$$\Phi_{Fg}{}^S=X'\Phi_{Fg}X. \quad (17)$$

The elements of the $\Phi_{Fg}{}^S$ yield the intensities of the limiting symmetric-rotor transitions in a somewhat unusual form in that the strengths of the two component transitions connecting two doubly degenerate pairs of energy levels are given in terms of a species classification of the energy levels which applies over the entire range of asymmetry, including both the prolate- and oblate-symmetric limiting cases.

Asymmetric-Rotor Direction Cosines

An asymmetric-rotor wave function may be expressed as a linear combination of Wang functions of the same symmetry. Thus the direction-cosine matrices for the asymmetric rotor $\Phi_{Fg}{}^{A}$ can be calculated from the Φ_{Fg} given in Table 1 by

$$\Phi_{Fg}{}^{A}=T_1{}'\Phi_{Fg}{}^{S}T_2=T_1{}'X'\Phi_{Fg}XT_2. \qquad (18)$$

T_1 and T_2 are the transformation matrices for the lower and upper states, respectively. In this paper we shall consider only cases in which the asymmetry (defined uniquely by one parameter κ, I-11) is approximately the same in the two states, so that $T_1\sim T_2\sim T$.

The transformation matrix T is diagonal with respect to J. For each J it is split into four submatrices, one belonging to each of the four species of levels. The submatrices, given by (I-54), may be calculated by the procedure described in some detail in I—Section VI.

In the absence of external fields which remove the space degeneracy, X and T are both diagonal with respect to J and M, and the factors $(\Phi_{Fg})_{J;J'}$ and $(\Phi_{Fg})_{J,M;J',M'}$ of (16) are invariant under transformation by XT. Hence, in making our numerical computations, only the factor $(\Phi_{Fg})_{J,K;J'K'}$ was transformed.

Evaluation of Line Strengths

To include all the degenerate components contributing to a given transition, $J_\tau\rightarrow J'_{\tau'}$, the direction-cosine elements $(\Phi_{Fg}{}^{A})_{J,\tau,M;J',\tau',M'}$ are squared and summed over M, M', and F. In the absence of external fields, X, Y, and Z are equivalent, and the summation of the squared elements over F may be accomplished by multiplying the squared elements for any given F by the factor three. Thus:

$$\sum_{F,M,M'}|\Phi_{Fg}|^2_{J,\tau,M;J',\tau',M'}=3|\Phi_{Zg}|^2_{J;J'}\cdot|\Phi_{Zg}{}^{A}|^2_{J,\tau;J',\tau'}\cdot\sum_{M,M'}|\Phi_{Zg}|^2_{J,M;J',M'} \qquad (19)$$

(where Z on the right hand could be replaced by X or Y) and is called the *line strength* of the transition with the component of the electric moment μ_g, by analogy with the term used in atomic spectra.[4] The amount of calculation is minimized by transforming $(\Phi_{Zz})_{J,K;J',K'}$ and $(\Phi_{Z\,y+ix})_{J,K;J',K'}$, from the latter of which the elements of $(\Phi_{Zx}{}^{A})_{J,\tau;J'\tau'}$ and $(\Phi_{Zy}{}^{A})_{J,\tau;J',\tau'}$ are obtained by inspection.

The orthogonal properties of the direction-cosine matrices aid in the calculation since they result in several kinds of stability[5] under unitary transformations. The following laws of "spectroscopic stability" were used to detect and eliminate errors in the matrix multiplications:

$$\sum_{J'=J-1}^{J}\sum_{\tau'}|\Phi_{Fg}{}^{A}|^2_{J,\tau;J'\tau'}=[2J]^2, \qquad (20)$$

$$\sum_{J'=J}^{J+1}\sum_{\tau'}|\Phi_{Fg}{}^{A}|^2_{J,\tau;J'\tau'}=[2(J+1)]^2, \qquad (21)$$

$$\sum_{F,J',\tau',M',M}|\Phi_{Fg}{}^{A}|^2_{J,\tau,M;J',\tau',M'}=2J+1, \qquad (22)$$

$$\sum_{F,g,\tau',M',M}|\Phi_{Fg}{}^{A}|^2_{J,\tau,M;J',\tau',M'}=2J'+1, \qquad (23)$$

$$\sum_{F,\tau,\tau',M',M}|\Phi_{Fg}{}^{A}|^2_{J,\tau,M;J',\tau',M'}=\tfrac{1}{3}(2J+1)(2J'+1). \qquad (24)$$

The line strengths of all permitted asymmetric-rotor transitions involving levels of $J<13$, except for high order "forbidden" sub-branches of line strength no greater than 0.0030, are tabulated in a condensed form in the Appendix.[6]

All calculations were done to six decimal places and rounded off to four. A systematic application of the sum rules is believed to have eliminated all errors except inaccuracies due to rounding off. In taking sums by rule (22) the deviation from the exact value was found to be 0.0001 in many levels of low J's rising to 0.0003 in $J=6$, to 0.0004 in $J=11$, and to 0.0005 in $J=12$, where the sum involves seventeen levels each of which was rounded off to the fourth decimal.

[4] E. U. Condon and G. H. Shortley, *The Theory of Atomic Spectra* (Macmillan, Cambridge, England, 1935), p. 98.

[5] See, for atomic spectra, Condon and Shortley, reference 4, p. 71, and for Raman spectra, G. Placzek and E. Teller, Zeits. f. Physik **81**, 209 (1933).

[6] The various sum rules do not apply to the data of the Appendix because of these omissions.

TABLE II. Direction of the electric moment permitting transitions between states belonging to the representations of the Four Group.

Rep.		A ee	B_a eo	B_b oo	B_c oe
A	ee	—	a	b	c
B_a	eo	a	—	c	b
B_b	oo	b	c	—	a
B_c	oe	c	b	a	—

TABLE III. Allowed changes in representation, labelled by the KK notation, for the three components of the electric moment, which show the selection rules in terms of parity changes in the K's.

Initial representation	Final representation for moment parallel to a (least)	b (middle)	c (greatest)
ee	eo	oo	oe
eo	ee	oe	oo
oo	oe	ee	eo
oe	oo	eo	ee
Parity change is in	K_1	$K_{-1}K_1$	K_{-1}

IV. SELECTION RULES

The selection rules for the asymmetric rotor were given by Dennison[7] in terms of the + − notation. They can be stated quite simply in the KK notation, i.e., in terms of the symmetric-rotor selection rules, in a form which is valuable in unravelling the structure of the spectrum.

Since the transformation matrices are diagonal with respect to J, the selection rules for J in the asymmetric rotor are the same as in the symmetric rotor. Thus, $\Delta J=0, \pm 1$, corresponding to Q, R, and P branches, respectively. The rules for K_{-1} and K_1 can be obtained very easily by means of group theory as follows. The components of the electric moment along the molecular a, b, c axes belong, respectively, to the representations B_a, B_b, B_c, of the Four Group (I—Table IV). The product of the characters of the representations of the initial and final wave functions and of the vector must be +1 for all group operators. Thus, if the representation of one is A, the other two must belong to the same representation, and if no representation is A, all must be different. Table II gives the permitted changes in representation for each component of the electric moment. These changes can now be interpreted in terms of the symmetric-rotor rules applied to each K index individually, except that the magnitude of ΔK, instead of being restricted to 0 and ± 1 in the parallel and perpendicular directions of electric moment, respectively, is merely restricted to even and odd changes. (We shall see below, however, that the 0 and ± 1 lines are of most significance in the asymmetric case.) If **o** and **e** are operators representing odd and even changes in K, the combined operators **eo**, **oo**, **oe**, to be applied to the double suffix, belong to the representations of the Four Group, *eo* (or B_a), *oo* (or B_b), and *oe* (or B_c), respectively, and in this way are directly related to the components of the electric moment a, b, c which also belong to these respective representations. The remaining operator **ee** belongs to representation *ee* (or A), but no branches of this type occur. The results for the asymmetric rotor can be summarized as follows (see also Table III).

For the electric moment parallel to the axis of least moment of inertia (a) the parity of the K_{-1} index does not change.

For the electric moment parallel to the axis of greatest moment of inertia (c) the parity of the K_1 index does not change.

For the electric moment parallel to the axis of intermediate moment of inertia (b) neither of the K indices does not change, i.e., both change.

These rules are independent of J or ΔJ values.

In the general case of the asymmetric rotor **e** can stand for $\Delta K=0, \pm 2, \pm 4$, etc., and the operator **o** can stand for $\Delta K=\pm 1, \pm 3$, etc. However, not all numerical combinations of ΔK_{-1} and ΔK_1 are possible because the sum $K_{-1}+K_1$ for any level is equal to J for even levels, and $J+1$ for odd levels.[8] The permitted values of $\Delta(K_{-1}+K_1)=\Delta K_{-1}+\Delta K_1=$sum of the two operators **e** and **o** are given in Table IV.

Notation: In the symmetric rotor the branches of the spectrum are identified by a literal notation, i.e., for $\Delta J=0$, $+1$ and -1 by Q, R, and P,

[7] D. M. Dennison, Rev. Mod. Phys. **3**, 280 (1931).

[8] Odd and even levels are defined by the parity of γ in the definition of the Wang functions as positive and negative combinations of the symmetric-rotor functions (I-26). There are six different sets of γ (of which only two are distinct) corresponding to the six choices of symmetric-rotor functions. The γ used here, and in I—Table VIII, is that used with the functions which become the prolate and oblate functions in the limiting cases. The parity of γ, hence the level, can be readily found either from I—Table VIII or from the parity of the $J+K_{-1}+K_1$ or of $J+\tau$. See also reference 9.

respectively, and for $\Delta K=0$, $+1$ and -1 by q, r, and p, respectively, which define "sub-branches." Some authors have used such a notation for the asymmetric rotor near the limiting case of symmetry. However, half the sub-branches are not included in this notation, and some of them are among the strongest. It would be convenient to generalize these definitions so that the same concept of sub-branches could be used to describe the structure of the asymmetric-rotor spectrum, where the ΔK's can change by ± 2, ± 3, etc. Unfortunately, an extension of the literal notation becomes clumsy, so that we suggest a return to the numerical values of the ΔK's. For example, the asymmetric-rotor sub-branch R_{qr}, meaning $\Delta J=+1$, $\Delta K_{-1}=0$, and $\Delta K_1=1$, would be written $R_{0,1}$. Then a sub-branch such as $P_{\bar{2},1}$ would mean $\Delta J=-1$, $\Delta K_{-1}=-2$, $\Delta K_1=1$. Sometimes it may be simpler to identify transitions by $\Delta\tau=\Delta K_{-1}-\Delta K_1$. However, $\Delta\tau$ does not uniquely define a sub-branch, although with the direction of the electric moment specified, it is sufficient.

TABLE IV. Permitted changes in $\Delta(K_{-1}+K_1)=\Delta K_{-1}+\Delta K_1$. This table can also be used to find the parity of the levels from which the various transitions can arise. E.g., if $\Delta J=0$, $\Delta K_{-1}=1$, and $\Delta K_1=-1$, the sum $\Delta(K_{-1}+K_1)$ is 0, and the transitions can arise from even and odd levels to give both ${}^{b,e}Q_{1,\bar{1}}$ and ${}^{b,o}Q_{1,\bar{1}}$ sub-branches. If $\Delta J=-1$, $\Delta K_{-1}=1$, $\Delta K_1=-3$, then the sum is -2 and such transitions arise only from odd levels to give only ${}^{b,o}P_{1,\bar{3}}$.

Initial γ	P	Q	R
even	$-1, 0$	$0, 1$	$1, 2$
odd	$-1, -2$	$0, -1$	$1, 0$

In the identification of a sub-branch, the direction of the moment, as determined from the parities of the two ΔK's (Tables II and III), is indicated in a superscript, as is the parity of the initial level, e.g., ${}^{a,e}R_{0,1}$.

Branches of the Asymmetric Rotor

The distribution of sub-branches in the matrix of the line strengths between all states is shown in (25) where the non-zero elements have been indicated by inserting the values of ΔK_{-1} and ΔK_1.

	0_{00} e	1_{01} e	1_{11} o	1_{10} e	2_{02} e	2_{12} o	2_{11} e	2_{21} o	2_{20} e	3_{03} e	3_{13} o	3_{12} e	3_{22} o	3_{21} e	3_{31} o	3_{30} e
$0_{00}e$		01	$11*$	$10\dagger$												
$1_{01}e$	$0\bar{1}$	—	$10\dagger$	$1\bar{1}*$	01	$11*$	$10\dagger$	—	$2\bar{1}$							
$1_{11}o$	$\bar{1}\bar{1}*$	$\bar{1}0\dagger$	—	$0\bar{1}$	$\bar{1}1*$	01	—	$10\dagger$	$1\bar{1}*$							
$1_{10}e$	$\bar{1}0\dagger$	$\bar{1}1*$	01	—	$\bar{1}2\dagger$	—	01	$11*$	$10\dagger$							
$2_{02}e$		$0\bar{1}$	$1\bar{1}*$	$1\bar{2}\dagger$	—	$10\dagger$	$1\bar{1}*$	$2\bar{1}$	—	01	$11*$	$10\dagger$	—	$2\bar{1}$	$3\bar{1}*$	$3\bar{2}\dagger$
$2_{12}o$		$\bar{1}\bar{1}*$	$0\bar{1}$	—	$\bar{1}0\dagger$	—	$0\bar{1}$	$1\bar{1}*$	$1\bar{2}\dagger$	$\bar{1}1*$	01	—	$10\dagger$	$1\bar{1}*$	$2\bar{1}$	—
$2_{11}e$		$\bar{1}0\dagger$	—	$0\bar{1}$	$\bar{1}1*$	01	—	$10\dagger$	$1\bar{1}*$	$\bar{1}2\dagger$	—	01	$11*$	$10\dagger$	—	$2\bar{1}$
$2_{21}o$		—	$\bar{1}0\dagger$	$\bar{1}\bar{1}*$	$\bar{2}1$	$\bar{1}1*$	$\bar{1}0\dagger$	—	$0\bar{1}$	—	$\bar{1}2\dagger$	$\bar{1}1*$	01	—	$10\dagger$	$1\bar{1}*$
$2_{20}e$		$\bar{2}1$	$\bar{1}1*$	$\bar{1}0\dagger$	—	$\bar{1}2\dagger$	$\bar{1}1*$	01	—	$\bar{2}3$	$\bar{1}3*$	$\bar{1}2\dagger$	—	01	$11*$	$10\dagger$
$3_{03}e$					$0\bar{1}$	$1\bar{1}*$	$1\bar{2}\dagger$	—	$2\bar{3}$	—	$10\dagger$	$1\bar{1}*$	$2\bar{1}$	—	$3\bar{2}\dagger$	$3\bar{3}*$
$3_{13}o$					$\bar{1}\bar{1}*$	$0\bar{1}$	—	$1\bar{2}\dagger$	$1\bar{3}*$	$\bar{1}0\dagger$	—	$0\bar{1}$	$1\bar{1}*$	$1\bar{2}\dagger$	—	$2\bar{3}$
$3_{12}e$					$\bar{1}0\dagger$	—	$0\bar{1}$	$1\bar{1}*$	$1\bar{2}\dagger$	$\bar{1}1*$	01	—	$10\dagger$	$1\bar{1}*$	$2\bar{1}$	—
$3_{22}o$					—	$\bar{1}0\dagger$	$\bar{1}\bar{1}*$	$0\bar{1}$	—	$\bar{2}1$	$\bar{1}1*$	$\bar{1}0\dagger$	—	$0\bar{1}$	$1\bar{1}*$	$1\bar{2}\dagger$
$3_{21}e$					$\bar{2}1$	$\bar{1}1*$	$\bar{1}0\dagger$	—	$0\bar{1}$	—	$\bar{1}2\dagger$	$\bar{1}1*$	01	—	$10\dagger$	$1\bar{1}*$
$3_{31}o$					$\bar{3}1*$	$\bar{2}1$	—	$\bar{1}0\dagger$	$\bar{1}\bar{1}*$	$\bar{3}2\dagger$	—	$\bar{2}1$	$\bar{1}1*$	$\bar{1}0\dagger$	—	$0\bar{1}$
$3_{30}e$					$\bar{3}2\dagger$	—	$\bar{2}1$	$\bar{1}1*$	$\bar{1}0\dagger$	$\bar{3}3*$	$\bar{2}3$	—	$\bar{1}2\dagger$	$\bar{1}1*$	01	—

(25)

Plain numerals are used for branches appearing with a component along a, an asterisk the component along b, and a dagger the component along c. It is seen that the transitions of any sub-branch appear only along diagonals of the blocks. Half the sub-branches arise from either odd or even levels. Examination of the numerical values of the others, which arise from both odd and even levels, shows that the strengths alternate in value. A smooth trend of numbers is obtained by separating the latter into "e" and "o" parts (arising from even and odd levels, respectively), each of which will henceforth be called a sub-branch,[9] e.g., ${}^{b,e}Q_{\bar{1},1}$ and ${}^{b,o}Q_{\bar{1},1}$. The e and o parts have now the same number of lines as the other sub-branches.

TABLE V. Summary of arrangement of sub-branches in the Table of Line Strengths in the Appendix. The reverse, inverse, and inverse-reverse (see Section VI) of any sub-branch are to be found in the same row of the table as is the primary. Sub-branches in columns 1 and 2 and columns 3 and 4 are reverses of each other and have the same strengths. Sub-branches in columns 3 and 4 are inverses of those in columns 1 and 2 and have the same strengths for opposite signs of κ. Column 5 summarizes the maximum line strengths found in any group of sub-branches by giving the number of digits in the strength $\times 10^4$, for five values of κ, ∓ 1, ∓ 0.5, 0, ± 0.5, and ± 1, where the upper sign applies to the sub-branches in columns 1 and 2, and the lower sign to those in columns 3 and 4.

"Symmetric-rotor" sub-branches a and c sub-branches				Strengths
Prolate and Oblate				
${}^{c,e}Q_{1,0}$	${}^{c,o}Q_{\bar{1},0}$	${}^{a,e}Q_{0,1}$	${}^{a,o}Q_{0,\bar{1}}$	6,6,6,6,6
${}^{c,e}R_{1,0}$	${}^{c,e}P_{\bar{1},0}$	${}^{a,e}R_{0,1}$	${}^{a,e}P_{0,\bar{1}}$	6,6,6,6,6
${}^{c,o}R_{1,0}$	${}^{c,o}P_{\bar{1},0}$	${}^{a,o}R_{0,1}$	${}^{a,o}P_{0,\bar{1}}$	6,6,6,6,6
Prolate only (c)		Oblate only (a)		
${}^{c,e}Q_{\bar{1},2}$	${}^{c,o}Q_{1,\bar{2}}$	${}^{a,e}Q_{2,\bar{1}}$	${}^{a,o}Q_{\bar{2},1}$	5,5,5,4,0
${}^{c,e}R_{\bar{1},2}$	${}^{c,e}P_{1,\bar{2}}$	${}^{a,e}R_{2,\bar{1}}$	${}^{a,e}P_{\bar{2},1}$	5,5,4,4,0
${}^{c,o}R_{\bar{1},2}$	${}^{c,o}P_{1,\bar{2}}$	${}^{a,o}R_{2,\bar{1}}$	${}^{a,o}P_{\bar{2},1}$	5,4,4,4,0
b sub-branches				
Prolate and Oblate				
${}^{b,e}Q_{\bar{1},1}$	${}^{b,e}Q_{1,\bar{1}}$	${}^{b,e}Q_{1,\bar{1}}$§	${}^{b,e}Q_{\bar{1},1}$§	6,5,5,5,6
${}^{b,o}Q_{\bar{1},1}$	${}^{b,o}Q_{1,\bar{1}}$	${}^{b,o}Q_{1,\bar{1}}$§	${}^{b,o}Q_{\bar{1},1}$§	5,5,5,5,5
${}^{b,e}R_{1,1}$	${}^{b,o}P_{\bar{1},\bar{1}}$	${}^{b,e}R_{1,1}$§	${}^{b,o}P_{\bar{1},\bar{1}}$§	6,6,6,6,6
${}^{b,o}R_{\bar{1},1}$	${}^{b,e}P_{1,\bar{1}}$	${}^{b,o}R_{1,\bar{1}}$	${}^{b,e}P_{\bar{1},1}$	5,6,6,6,6
Prolate only		Oblate only		
${}^{b,e}R_{\bar{1},3}$	${}^{b,o}P_{1,\bar{3}}$	${}^{b,e}R_{3,\bar{1}}$	${}^{b,o}P_{\bar{3},1}$	5,4,4,4,0
First-order forbidden sub-branches				
a and c sub-branches				
${}^{c,o}Q_{\bar{3},2}$	${}^{c,e}Q_{3,\bar{2}}$	${}^{a,o}Q_{2,\bar{3}}$	${}^{a,e}Q_{\bar{2},3}$	0,4,4,4,0
${}^{c,e}Q_{\bar{3},4}$	${}^{c,o}Q_{3,\bar{4}}$	${}^{a,e}Q_{4,\bar{3}}$	${}^{a,o}Q_{\bar{4},3}$	0,3,3,2,0
${}^{c,e}R_{3,\bar{2}}$	${}^{c,e}P_{\bar{3},2}$	${}^{a,e}R_{\bar{2},3}$	${}^{a,e}P_{2,\bar{3}}$	0,4,4,4,0
${}^{c,o}R_{3,\bar{2}}$	${}^{c,o}P_{\bar{3},2}$	${}^{a,o}R_{\bar{2},3}$	${}^{a,o}P_{2,\bar{3}}$	0,3,3,3,0
${}^{c,e}R_{\bar{3},4}$	${}^{c,e}P_{3,\bar{4}}$	${}^{a,e}R_{4,\bar{3}}$	${}^{a,e}P_{\bar{4},3}$	0,3,3,2,0
${}^{c,o}R_{\bar{3},4}$	${}^{c,o}P_{3,\bar{4}}$	${}^{a,o}R_{4,\bar{3}}$	${}^{a,o}P_{\bar{4},3}$	0,2,2,1,0
b sub-branches				
${}^{b,e}Q_{\bar{3},3}$	${}^{b,e}Q_{3,\bar{3}}$	${}^{b,e}Q_{3,\bar{3}}$§	${}^{b,e}Q_{\bar{3},3}$§	0,4,4,4,0
${}^{b,o}Q_{\bar{3},3}$	${}^{b,o}Q_{3,\bar{3}}$	${}^{b,o}Q_{3,\bar{3}}$§	${}^{b,o}Q_{\bar{3},3}$§	0,3,3,3,0
${}^{b,o}R_{\bar{3},3}$	${}^{b,e}P_{3,\bar{3}}$	${}^{b,o}R_{3,\bar{3}}$	${}^{b,e}P_{\bar{3},3}$	0,3,3,3,0
${}^{b,e}R_{\bar{3},5}$	${}^{b,o}P_{3,\bar{5}}$	${}^{b,e}R_{5,\bar{3}}$	${}^{b,o}P_{\bar{5},3}$	0,2,2,2,0

§ Same lines as in columns 1 and 2, but sorted on K_1.

The values of the line strengths decrease away from the principal diagonal as ΔK_{-1}, ΔK_1 (and hence $\Delta\tau$) increase, i.e., as the departure from the selection rules of the symmetric rotor increases.

V. STRUCTURE OF THE SPECTRUM

The principal lines in the spectrum of the asymmetric rotor are those which occur in the symmetric rotor, if we first resolve the doubly degenerate levels of the latter into their Wang components, which retain their identity as the rotor becomes asymmetric. The resolution of this degeneracy, which splits the symmetric-rotor energy levels into those of the asymmetric rotor, also is responsible for a splitting of the p, q, and r sub-branches of the oblate- and prolate-rotor spectra into the sub-branches of the asymmetric-rotor spectra.

The principal sub-branches of the asymmetric rotor are those for which both K's change by 0 or ± 1, and so become p, q, or r branches in both the prolate- and the oblate-symmetric limiting cases. These sub-branches are listed first in the Table of Line Strengths found in the Appendix (of which Table V is a summary), and are shown diagrammatically by heavy lines in Fig. 1.

The next important sub-branches are those in which ΔK changes by 0, ± 1, i.e., which are p, q, or r sub-branches in either the prolate or oblate case, but for which the other index operator has an absolute value greater than 1, corresponding to forbidden transitions of zero intensity in the other symmetry case (oblate or prolate, respectively). These sub-branches, such as $P_{1,\bar{3}}$, are listed second in the tables, and are shown by light lines in Fig. 1. Note that in transitions of the symmetric rotor in the Wang resolution, changes in the K which is not the true quantum number can have an absolute value greater than unity.

[9] Since the parity of the initial levels with respect to γ has no direct significance in spectrum analysis, and since the representation of the Four Group to which the initial level belongs is of importance because differing nuclear-spin weight factors may have to be applied to each, one might expect a sub-division of the sub-branches on ee, eo, oe, and oo. The sorting of sub-branches into four parts arising from each of these species of the initial levels does not give smooth sequences of strengths. The parity of $J+\gamma$, not γ alone, is characteristic of each symmetry species (I—Table VIII); or, from the opposite point of view, each sub-branch, even when divided into γ-even and γ-odd components, arises from levels of all four species.

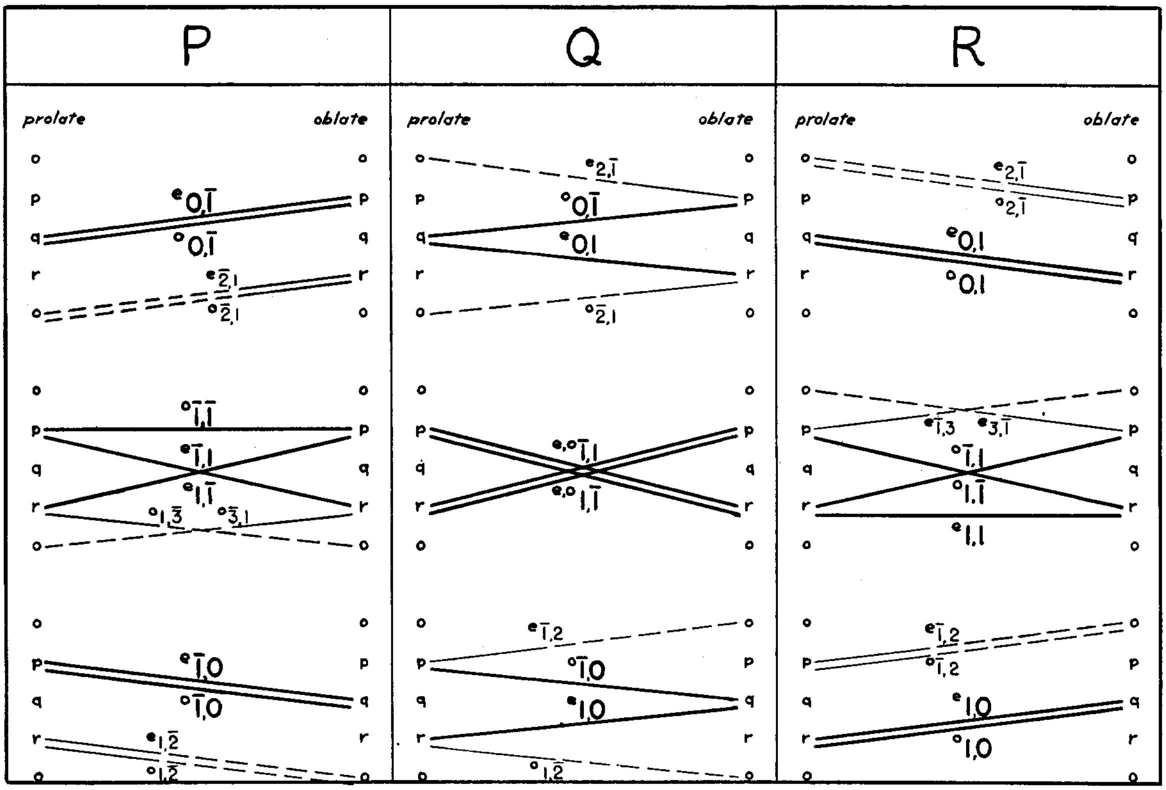

FIG. 1. A chart correlating the sub-branches of the asymmetric rotor with those of the symmetric-rotor limiting cases. Those permitted in both the prolate and oblate rotors, and hence of high strength throughout the whole range of asymmetry are indicated by heavy lines. Pairs of sub-branches arising from the same permitted sub-branch in one limiting case and going to the same or different sub-branches in the other case have about the same strengths. Sub-branches permitted in only one or the other limit are shown by fine lines. The strengths of the strong wings fall off very rapidly on moving away from the permitted limiting cases, and so can be neglected (as shown by dashed lines) except close to the limiting case where they are permitted.

Finally, in the last part of the tables we have listed sub-branches of the asymmetric rotor which are forbidden in both prolate and oblate limiting cases. These not only have very low intensities even for the most asymmetric rotor, but also do not occur below certain values of J. Even with a favorable Boltzmann factor these sub-branches can usually be disregarded in the structure of the rotational spectra of the asymmetric rotor. We have only tabulated the "first-order" forbidden sub-branches, $|\Delta\tau|=5$, 6, 7, 8, which appear first at $J\geqslant 3$. The highest strength of any forbidden line calculated ($J<13$) is 0.3100. Second-order forbidden transitions, $|\Delta\tau|=9$, 10, 11, 12, which appear first at $J\geqslant 5$, have strengths no greater than 0.0030; higher orders, $\Delta\tau>12$, which begin at $J\geqslant 7$, have strengths less than 0.0001.

VI. TABLES OF LINE STRENGTHS

Certain symmetrical relations in the matrices, based on the KK notation just discussed, enable us to condense the tabulation of the numerical material to one-quarter of the total number of transitions. Let us consider a transition from a level with $J=j$, $K_{-1}=k$, $K_1=l$, $\tau=t$, or $j_{kl,\,t}$, to another level $h_{mn,\,s}$; let this be called a "primary" transition. Related to this transition is the "reverse" transition $h_{mn,\,s}\rightarrow j_{kl,\,t}$. The term "reverse" is chosen because the spectral lines of the pure rotational emission spectra will suffer "line reversal" by the reverse transition, a well-known phenomenon in atomic spectra.[10] The strength for the reverse transition appears on the opposite

[10] In the pure rotational emission spectrum (1) would be replaced by an equation involving both Einstein coefficients.

side of the main diagonal of (25) from that on which the primary transition is located. When the asymmetry parameter is the same in the two states (the only case considered in this work), these two elements are numerically equal. In the Appendix a transition beginning on $j_{kl,t}$ is listed in column 1, the final level being read in column 2. The line strengths given in the next columns, 3–7 (with the upper sign of κ) are the same for another line, the reverse of the above, whose *initial* level is given in column 2 and *final* level in column 1. The columns in the Appendix are headed by the name of the sub-branch whose initial levels are given in that column, the final levels being found in the adjacent column.

The asymmetry parameter κ used in Part I simplified the study of the energy levels because the patterns for positive values of κ were inverted for negative κ, i.e.,

$$E(\kappa)j_{kl,t}=-E(-\kappa)j_{lk,-t}. \tag{26}$$

Therefore, the transformation matrices and hence (25) for negative values of κ will be numerically the same as for the positive values, but will have the row and column labelling inverted. Thus for a primary transition at κ there is an "inverse" transition $j_{lk,-t}\rightarrow h_{nm,-s}$ at $-\kappa$ which has the same strength as the primary. Finally, for a primary transition there is an inverse-reverse $h_{nm,-s}\rightarrow j_{lk,-t}$. The reverse and the inverse-reverse strengths are the same at opposite signs of κ. The lines which are inverses and inverse-reverses of the ones we chose as primary (column 1) in the Appendix are to be found by reading their initial levels in columns 8 and 9, respectively. The lower sign of κ in columns 3–7 is to be used for these lines.

As one would expect, the sub-branches appearing when the electric moment is parallel to the least axis are inverses of those appearing when the moment is parallel to the greatest, and vice versa. Inverses of b sub-branches are b sub-branches, and in some cases a b sub-branch is its own inverse, so that the same sub-branch reappears in columns 8 and 9 (see also Table V).

The sub-branches appearing in the four columns of the Appendix, or in the same row of Table V, form a group. The reverse, inverse, and inverse-reverse of any one of the group is also a member of the group (a consequence of the Four-Group symmetry). All members of the group have the same value of $|\Delta J|$ and $|\Delta\tau|$. In the following we shall identify a group by the sub-branch appearing in the first column. The discussion of the variation of line strength with J or κ is the same for all members of the group.

Arrangement of Lines Within Sub-Branches: Wings

As in the symmetric-rotor spectrum, a sub-branch of the asymmetric-rotor spectrum is composed of lines which can be classified either by J or a K. In order to list the lines in a way so that there is a continuous trend in the line strengths, one can hold K fixed and list by increasing J, or hold J fixed and list by K. The former is probably the most natural in spectrum analysis as it enables one to group together the dominant lines of a sub-branch, then the next most important, and so on. In the tables, then, we have sorted the lines of the sub-branches into "wings" of which there are two types: those in which K_{-1} is held constant, J varies (labelled wing $-K_{-1}$); and those in which K_1 is held constant (labelled wing $+K_1$). For any given sub-branch sorting on one of the two K's picks out the strongest lines starting from any J level and collects them into the first wing, then collects the second strongest into the second wing, etc. In the tables all sub-branches are sorted this way. Sorting on the other K usually picks out the weakest lines into the first wings, etc., an arrangement which is valuable for extrapolation to high J's, but not used here except by accident (see b branches). Wings also have the valuable properties that the Boltzmann factors and line positions vary uniformly for the lines standing in a wing. Lines in the same wing have like variation in strength with degree of asymmetry.

The strongest lines in the spectrum will be those which have a high transition probability and a favorable Boltzmann factor (low K_{-1} or τ). A sorting on K_{-1} would pick out lines with the most favorable Boltzmann factor. Unfortunately, for half the lines this is not compatible with high strength, and in most spectra the latter outweighs the Boltzmann factor at low J's. Thus, in the Appendix the sub-branches have been sorted for high strength on whichever K is necessary.

It is not always feasible to do this for all values of κ simultaneously.

For the sub-branches appearing with the moment parallel to c it is possible to sort the lines (on K_{-1}) whereby the first wing contains the strongest lines both on account of high transition probability and favorable Boltzmann factor, with two exceptions, ${}^cR_{1,0}$ and ${}^cP_{\bar{1},0}$, where it is impossible to sort for both simultaneously. In the table these sub-branches have been sorted (on K_1) for high strength. In a band associated with a moment parallel to c these two sub-branches will be much weaker than ${}^cQ_{\bar{1},0}$ and ${}^cQ_{1,0}$.

Except for ${}^aR_{0,1}$ and ${}^aP_{0,\bar{1}}$ (the inverses of the two exceptions just mentioned in c bands), the sub-branches appearing with moment parallel to a cannot be sorted for both influences favorable and are sorted (on K_{-1}) for high strength only. For many molecules, e.g., H_2S, this is more satisfactory than sorting for Boltzmann factor, and not for strength, because the latter usually outweighs the former. However, there may be some examples where the K_{-1} wings for the sub-branches listed on the right-hand side of the table are preferable. It is not at all difficult to pick them out from the tables. Since the two exceptions ${}^aR_{0,1}$ and ${}^aP_{0,\bar{1}}$ also have favorable Boltzmann factors, they will be the outstanding sub-branches of bands associated with a moment parallel to a, as is indeed the case in the 10,100A band of H_2S.[11]

The ${}^bQ$ branches can be sorted for both influences favorable only in one range of κ, namely, on K_{-1} for negative κ, and on K_1 for positive κ. Since these branches are their own inverses, the same numbers appear in both halves of the range of κ, so that K_{-1} wings can be found by reading from left to right and K_1 wings by reading from right to left. A similar situation exists with ${}^{b,e}R_{1,1}$ and ${}^{b,o}P_{\bar{1},\bar{1}}$.

The sub-branches ${}^bR_{\bar{1},1}$ and ${}^bP_{1,\bar{1}}$ can be sorted on K_{-1} for both high strength and favorable Boltzmann factor simultaneously whereas their inverses can be sorted only for one or the other, and the arrangement of the table has compelled their sorting to be on K_1, for high strength only.

The sorting of the prolate-or-oblate sub-branches is such that it favors high strength near $\kappa=-1$ (the commonest range of asymmetry), simultaneously favoring the Boltzmann factor for c branches and two b branches.

Variation of Line Strengths with Asymmetry

The double suffix notation for the lines and sub-branches shows qualitatively the way the asymmetric-rotor sub-branches resolve, in the limiting cases, into p, q, r, or forbidden symmetric-rotor sub-branches. (See Fig. 1.) Quantitatively this classification offers further simplifications because in some of the sub-branches the resolved pairs either have the same or very closely the same strengths, while other pairs diverge and the strength of one member dies out very rapidly with increasing asymmetry.

The best example is the ${}^cQ_{\bar{1},0}$ group. Here the prolate ${}^aQ_q$ sub-branch splits into ${}^{a,o}Q_{0,\bar{1}}$ and ${}^{a,e}Q_{0,1}$ which are their own reverses, and so are numerically the same. In the oblate limit, however, they show entirely different characteristics. Here they become one component of ${}^aQ_p$ and of ${}^aQ_r$, respectively. The other component of ${}^aQ_p$ is ${}^{a,e}Q_{2,\bar{1}}$, i.e., oblate ${}^aQ_p$ splits into the prolate-and-oblate ${}^{a,o}Q_{0,\bar{1}}$ and the oblate-only ${}^{a,e}Q_{2,\bar{1}}$. Numerically, these two sub-branches arising from ${}^aQ_p$ have nothing in common except the limiting oblate strength. The same applies to their reverses, which coalesce into ${}^aQ_r$ oblate. A similar situation applies, of course, to the other sub-branches of this group which appear with the c moment.

The prolate-and-oblate ${}^bQ_{\bar{1},1}$ group of sub-branches split from ${}^bQ_p$ or ${}^bQ_r$ into odd and even sub-branches with slightly different strength in the asymmetric region. Similarly, the prolate ${}^aR_q$ sub-branch splits into ${}^{a,e}R_{0,1}$ and ${}^{a,o}R_{0,1}$, which have very closely the same strengths over most of the range of κ.

The prolate-and-oblate ${}^bR_{1,1}$ group and the ${}^bR_{1,\bar{1}}$ group with which it coalesces in one or other of the limiting cases similarly differ only slightly in strength. But the ${}^bR_{1,\bar{1}}$ group in the other limiting case pairs up with the prolate-or-oblate decadent ${}^bR_{3,\bar{1}}$ group, with which it has nothing in common except the limiting value.

All the lines in ${}^bR_{1,1}$ (and ${}^bP_{\bar{1},\bar{1}}$) remain at

[11] P. C. Cross, Phys. Rev. **47**, 7 (1935) and J. Chem. Phys. **5**, 370 (1937).

practically the same strength for all values of κ, as one would expect from the unique symmetry of these sub-branches (degenerating to the ${}^bR_r$ and ${}^bP_p$ in both limits). The other prolate-and-oblate sub-branches contain several types of wings. Some have about the same strength at all values of κ. Others remain fairly constant throughout most of the range, then decrease very rapidly to a half or a tenth of their strength; e.g., in ${}^{a,o}Q_{0,\bar{1}}$ the transition $12_{12,1}\rightarrow 12_{12,0}$ stays at a value of 23 from $\kappa=-1$ to $+0.5$, then drops to 12.5 at $\kappa=+1.0$. The ${}^bR_{\bar{1},1}$ group of sub-branches contain certain wings which are as decadent as the prolate-or-oblate sub-branches; e.g., in ${}^{b,o}R_{1,\bar{1}}$ the transition $11_{1,11}\rightarrow 12_{2,10}$ changes from 3.7917 for the prolate rotor to 0.0967 at $\kappa=-0.5$, i.e., by a factor of 40 in the range where most triatomic molecules lie. Lines with similar decay characteristics are sometimes better grouped together by sorting on the K other than the one used in the tables.

All the wings of the prolate-or-oblate sub-branches decrease abruptly in strength at one end of the range of κ. The stronger wings drop in strength by a factor of 10 to 40 in the quarter next to their permitted symmetric rotor, while the weaker wings stay at a fairly constant strength over three-quarters of the range, then abruptly drop to zero strength in the quarter just before the forbidden limit.

The strengths of all the "forbidden" sub-branches have a characteristic similar to that of the prolate-or-oblate sub-branches. In one quarter of the range of κ the strengths rise abruptly from zero to the maximum value, then decrease more uniformly over the remaining three-quarters of the range.

It is evident that the rapid changes in strength with κ that occur in many strong lines can be very confusing in spectrum analysis, and can account for "missing" lines so often reported.

In any particular case the number of important sub-branches is considerably reduced from the number tabulated here in detail for all values of κ. Some of the prolate-or-oblate sub-branches and many wings of the others have negligible intensities for $-0.5<\kappa<+0.5$. Further, if one neglects the splitting of the prolate-and-oblate branches, the principal structure of the bands of the asymmetric rotor is made up of sub-branches characteristic of the prolate- or oblate-symmetric rotor, although the actual strengths of the lines will have changed, in most cases, by a large factor.

Interpolation for Intermediate Values of κ

The strengths of the transitions of the symmetric rotor from which those for the asymmetric rotor were calculated give us the values at the two ends of the range of κ. Naturally, the first calculations were done for the most asymmetric rotor with $\kappa=0$. The rapid changes in strength with asymmetry described above made it necessary to take an intermediate point, which we chose as $\kappa=-0.5$ (from which $\kappa=+0.5$ follows by symmetry). With five points we originally hoped to be able to use the recently published *Tables of the 5-Point Lagrangean Interpolation*.[12] Unfortunately, five-point Lagrangian interpolation gives a quite erroneous value when applied to the abruptly changing prolate-and-oblate lines, or to any prolate-or-oblate or forbidden lines, because the Lagrangian polynomial becomes oscillatory to accommodate the rapid changes in the functions, which characteristically take place over small ranges of κ. In extreme cases even negative strengths result. In general, three-point interpolation is preferable, or better, the average of two overlapping three-point interpolations.

For many strong lines, and in three-quarters of the range for all the others, linear interpolation is accurate enough to compare with most experimental data.

Variation of Line Strength with J and K

The arrangement of lines into wings allows a fairly straightforward extrapolation to higher J's when the strengths are increasing. Decreasing strengths, however, should be extrapolated with care. We hope at some later date to investigate high J transitions by means of the Correspondence Principle. It should be noted in extra-

[12] *Table of 5-Point Lagrangean Interpolation Coefficients (From 0 to 2, Argument 0.001, 7-Place)*. Mathematical Tables Project, Works Projects Administration for the City of New York sponsored by National Bureau of Standards.

polating that the two methods of sorting into wings complement each other. In this connection an irregularity of the wings +0 and −0 should be mentioned. These wings in the positive and negative range of κ, respectively, have about twice the strength of the others because they connect levels which are not degenerate ($K_{\pm 1}=0$) in the symmetric rotor. These lines take all the transition probability which is normally divided between two degenerate levels.

VII. CONCLUSION

The table of line strengths, when combined with Boltzmann and nuclear spin weight factors, gives a numerical value for the relative intensity of a line in the spectrum of the asymmetric rotor, and thus eliminates the troublesome uncertainty as to the strength with which a line is to be expected. This is particularly valuable for those lines whose intensities change rapidly with asymmetry.

With the energy level table of Part I and the strengths of this paper, one is in a position to draw up spectra of any molecule, given its dimensions of the upper and lower states, with one limitation. That is, if the asymmetries of the two states are appreciably different, the tables of line strengths may not be adequate, for in this case the direction-cosine matrices are no longer symmetrical, so that the reverse and primary sub-bands do not have identical strengths. Calculations for extreme changes in κ show there is a considerable redistribution of line strength among the transitions from a given level.

The results of the calculations reported in Parts I and II of this series have been applied to the calculation of pure rotation and vibration-rotation spectra of simple molecules, employing punched-card-machine methods. The ease with which representative spectra can be prepared in this manner makes the method of successive approximations more attractive in the analysis of rotational structure. When our present calculations have been extended by means of the Correspondence Principle to the energies and intensities for $J>12$, considerable information may be obtainable from unresolved band envelopes.

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APPENDIX. TABLE OF LINE STRENGTHS

The line strengths listed here (see Tables VI and VII) are the squares of the elements of the direction-cosine matrices in the representation which diagonalizes the energy matrix of the asymmetric rotor, summed over the Zeeman components and multiplied by 3 to account for the three equivalent space-fixed directions, i.e., line strength for the component of the electric moment μ_g, parallel to the molecule-fixed axes $g=a,\ b,\ c$ is

$$\sum_{F=X,Y,Z}\sum_{M''}\sum_{M'}|(\Phi_{Fg}{}^{A})_{J'',\tau'',M'';\,J',\tau',M'}|^2 =3\sum_{M''}\sum_{M'}\left|\int \psi^*_{J'',\tau'',M''}\Phi_{Fg}{}^{A}\psi_{J',\tau',M'}dv\right|^2$$

[where J, τ, M stand for R in (2)] and thus is the corresponding prefactor on the right-hand side of (2) summed over X, Y, Z, M', and M''. Actual intensities can then be obtained by substituting (2) in (1) provided the values of the integrals $\int\psi^*_{V'',e''}\mu_g\psi_{V',e'}dv$ are known. Relative intensities are obtained by putting such of these integrals that are non-vanishing equal to unity.

The entries have also been multiplied by 10^4 to eliminate decimal points. The parameter of asymmetry

$$\kappa=(2b-a-c)/(a-c)$$

where a, b, c equal $\hbar^2/2I_a$, $\hbar^2/2I_b$, $\hbar^2/2I_c$, respectively, and where the condition $I_a\leq I_b\leq I_c$ is applied in assigning the moments of inertia.

Transitions are classified by sub-branches which head the column in which the initial level can be found (identified by $J_{K_{-1},K_1;\tau}$) and whose final level is in the adjacent column on the same row.

The lines in each sub-branch are listed in wings which can be identified by K_{-1} or K_1, whichever is held constant, as can be determined by the subscripts of the initial levels.

Sub-branches in adjacent columns have identical strengths. Those in columns 1 and 2 apply to the upper sign of κ; those in columns 8 and 9 apply to the lower sign.

The strengths found in columns 3 and 7 are those occurring in the prolate- and oblate-symmetric rotor. When no entry is given, the transition is forbidden. "High order forbidden" branches for which $|\Delta\tau|\geq 9$ have been omitted. When the entry is 0, the strength is less than 0.0001.

TABLE VI. Symmetric-rotor sub-branches.

A. a and c prolate-and-oblate sub-branches.

Sub-branch				κ			Sub-branch	
${}^{c,e}Q_{1,0}$	${}^{c,o}Q_{\bar{1},0}$	∓1	∓0.5	0	±0.5	±1	${}^{a,e}Q_{0,1}$	${}^{a,o}Q_{0,\bar{1}}$
$1_{0,1;-1}$	$1_{1,1;0}$	15000	15000	15000	15000	15000	$1_{1,0;1}$	$1_{1,1;0}$
$2_{0,2;-2}$	$2_{1,2;-1}$	25000	28223	31100	32845	33333	$2_{2,0;2}$	$2_{2,1;1}$
$3_{0,3;-3}$	$3_{1,3;-2}$	35000	45104	50431	52155	52500	$3_{3,0;3}$	$3_{3,1;2}$
$4_{0,4;-4}$	$4_{1,4;-3}$	45000	64494	70244	71708	72000	$4_{4,0;4}$	$4_{4,1;3}$
$5_{0,5;-5}$	$5_{1,5;-4}$	55000	84696	90073	91399	91667	$5_{5,0;5}$	$5_{5,1;4}$
$6_{0,6;-6}$	$6_{1,6;-5}$	65000	104928	109923	111174	111429	$6_{6,0;6}$	$6_{6,1;5}$
$7_{0,7;-7}$	$7_{1,7;-6}$	75000	125065	129799	131004	131250	$7_{7,0;7}$	$7_{7,1;6}$
$8_{0,8;-8}$	$8_{1,8;-7}$	85000	145135	149698	150871	151111	$8_{8,0;8}$	$8_{8,1;7}$
$9_{0,9;-9}$	$9_{1,9;-8}$	95000	165170	169614	170764	171000	$9_{9,0;9}$	$9_{9,1;8}$
$10_{0,10;-10}$	$10_{1,10;-9}$	105000	185187	189544	190677	190909	$10_{10,0;10}$	$10_{10,1;9}$
$11_{0,11;-11}$	$11_{1,11;-10}$	115000	205194	209484	210603	210834	$11_{11,0;11}$	$11_{11,1;10}$
$12_{0,12;-12}$	$12_{1,12;-11}$	125000	225195	229434	230542	230769	$12_{12,0;12}$	$12_{12,1;11}$
$2_{1,1;0}$	$2_{2,1;1}$	8333	8333	8333	8333	8333	$2_{1,1;0}$	$2_{1,2;-1}$
$3_{1,2;-1}$	$3_{2,2;0}$	14583	16278	18811	21875	23333	$3_{2,1;1}$	$3_{2,2;0}$
$4_{1,3;-2}$	$4_{2,3;-1}$	20250	26168	34242	39363	40500	$4_{3,1;2}$	$4_{3,2;1}$
$5_{1,4;-3}$	$5_{2,4;-2}$	25667	39338	52949	57742	58667	$5_{4,1;3}$	$5_{4,2;2}$
$6_{1,5;-4}$	$6_{2,5;-3}$	30952	56179	72319	76548	77381	$6_{5,1;4}$	$6_{5,2,3}$
$7_{1,6;-5}$	$7_{2,6;-4}$	36161	75597	91744	95646	96429	$7_{6,1;5}$	$7_{6,2;4}$
$8_{1,7;-6}$	$8_{2,7;-5}$	41319	95950	111231	114943	115694	$8_{7,1;6}$	$8_{7,2;5}$
$9_{1,8;-7}$	$9_{2,8;-6}$	46444	116333	130792	134381	135111	$9_{8,1;7}$	$9_{8,2;6}$
$10_{1,9;-8}$	$10_{2,9;-7}$	51545	136551	150418	153921	154636	$10_{9,1;8}$	$10_{9,2;7}$
$11_{1,10;-9}$	$11_{2,10;-8}$	56629	156642	170100	173540	174242	$11_{10,1;9}$	$11_{10,2;8}$
$12_{1,11;-10}$	$12_{2,11;-9}$	61699	176660	189825	193216	193910	$12_{11,1;10}$	$12_{11,2;9}$
$3_{2,1;1}$	$3_{3,1;2}$	8750	7403	6406	5944	5833	$3_{1,2;-1}$	$3_{1,3;-2}$
$4_{2,2;0}$	$4_{3,2;1}$	15750	13221	13196	15598	18000	$4_{2,2;0}$	$4_{2,3;-1}$
$5_{2,3;-1}$	$5_{3,3;0}$	22000	19105	23397	30662	33000	$5_{3,2;1}$	$5_{3,3;0}$
$6_{2,4;-2}$	$6_{3,4;-1}$	27857	26374	38620	47709	49524	$6_{4,2;2}$	$6_{4,3;1}$
$7_{2,5;-3}$	$7_{3,5;-2}$	33482	36237	57062	65399	66964	$7_{5,2;3}$	$7_{5,3;2}$
$8_{2,6;-4}$	$8_{3,6;-3}$	38958	49682	76155	83565	85000	$8_{6,2;4}$	$8_{6,3;3}$
$9_{2,7;-5}$	$9_{3,7;-4}$	44333	66864	95251	102089	103444	$9_{7,2;5}$	$9_{7,3;4}$
$10_{2,8;-6}$	$10_{3,8;-5}$	49636	86630	114393	120880	122183	$10_{8,2;6}$	$10_{8,3;5}$
$11_{2,9;-7}$	$11_{3,9;-6}$	54886	107332	133621	139873	141136	$11_{9,2;7}$	$11_{9,3;6}$
$12_{2,10;-8}$	$12_{3,10;-7}$	60096	128002	152940	159022	160256	$12_{10,2;8}$	$12_{10,3;7}$
$4_{3,1;2}$	$4_{4,1;3}$	9000	7587	6026	4847	4500	$4_{1,3;-2}$	$4_{1,4;-3}$
$5_{3,2;1}$	$5_{4,2;2}$	16500	13464	11058	11750	14667	$5_{2,3;-1}$	$5_{2,4;-2}$
$6_{3,3;0}$	$6_{4,3;1}$	23214	18339	17488	23981	27857	$6_{3,3;0}$	$6_{3,4;-1}$
$7_{3,4;-1}$	$7_{4,4;0}$	29464	22914	27745	39794	42857	$7_{4,3;1}$	$7_{4,4;0}$
$8_{3,5;-2}$	$8_{4,5;-1}$	35417	28185	43063	56506	59028	$8_{5,3;2}$	$8_{5,4;1}$
$9_{3,6;-3}$	$9_{4,6;-2}$	41167	35293	61523	73754	76000	$9_{6,3;3}$	$9_{6,4;2}$
$10_{3,7;-4}$	$10_{4,7;-3}$	46773	45350	80547	91464	93546	$10_{7,3;4}$	$10_{7,4;3}$
$11_{3,8;-5}$	$11_{4,8;-4}$	52273	59213	99473	109542	111515	$11_{8,3;5}$	$11_{8,4;4}$
$12_{3,9;-6}$	$12_{4,9;-5}$	57692	76888	118383	127913	129808	$12_{9,3;6}$	$12_{9,4;5}$
$5_{4,1;3}$	$5_{5,1;4}$	9167	7777	6127	4374	3667	$5_{1,4;-3}$	$5_{1,5;-4}$
$6_{4,2;2}$	$6_{5,2;3}$	17024	14084	10758	9464	12381	$6_{2,4;-2}$	$6_{2,5;-3}$
$7_{4,3;1}$	$7_{5,3;2}$	24107	19340	15156	18769	24107	$7_{3,4;-1}$	$7_{3,5;-2}$
$8_{4,4;0}$	$8_{5,4;1}$	30694	23768	21441	33034	37778	$8_{4,4;0}$	$8_{4,5;-1}$
$9_{4,5;-1}$	$9_{5,5;0}$	36944	27638	31860	49002	52778	$9_{5,4;1}$	$9_{5,5;0}$
$10_{4,6;-2}$	$10_{5,6;-1}$	42955	31542	47402	65474	68727	$10_{6,4;2}$	$10_{6,5;1}$
$11_{4,7;-3}$	$11_{5,7;-2}$	48788	36457	66028	82425	85379	$11_{7,4;3}$	$11_{7,5;2}$
$12_{4,8;-4}$	$12_{5,8;-3}$	54487	43527	85120	99805	102564	$12_{8,4;4}$	$12_{8,5;3}$
$6_{5,1;4}$	$6_{6,1;5}$	9286	7913	6271	4244	3095	$6_{1,5;-4}$	$6_{1,6;-5}$
$7_{5,2;3}$	$7_{6,2;4}$	17411	14552	11116	8220	10714	$7_{2,5;-3}$	$7_{2,6;-4}$
$8_{5,3;2}$	$8_{6,3;3}$	24792	20246	14956	14996	21250	$8_{3,5;-2}$	$8_{3,6;-3}$
$9_{5,4;1}$	$9_{6,4;2}$	31667	25157	18940	27035	33778	$9_{4,5;-1}$	$9_{4,6;-2}$
$10_{5,5;0}$	$10_{6,5;1}$	38182	29364	25162	42308	47727	$10_{5,5;0}$	$10_{5,6;-1}$
$11_{5,6;-1}$	$11_{6,6;0}$	44432	32945	35783	58220	62727	$11_{6,5;1}$	$11_{6,6;0}$
$12_{5,7;-2}$	$12_{6,7;-1}$	50481	36135	51610	74526	78526	$12_{7,5;2}$	$12_{7,6;1}$

TABLE VI.—*Continued.*

Sub-branch $^{c,e}Q1,0$	$^{c,o}Q\bar{1},0$	κ ∓ 1	∓ 0.5	0	± 0.5	± 1	Sub-branch $^{a,e}Q0,1$	$^{a,o}Q0,\bar{1}$
$7_{6,1;5}$	$7_{7,1;6}$	9375	8011	6383	4273	2679	$7_{1,6;-5}$	$7_{1,7;-6}$
$8_{6,2;4}$	$8_{7,2;5}$	17708	14899	11514	7682	9444	$8_{2,6;-4}$	$8_{2,7;-5}$
$9_{6,3;3}$	$9_{7,3;4}$	25333	20931	15562	12549	19000	$9_{3,6;-3}$	$9_{3,7;-4}$
$10_{6,4;2}$	$10_{7,4;3}$	32455	26254	18837	21925	30545	$10_{4,6;-2}$	$10_{4,7;-3}$
$11_{6,5;1}$	$11_{7,5;2}$	39205	30943	22510	36052	43561	$11_{5,6;-1}$	$11_{5,7;-2}$
$12_{6,6;0}$	$12_{7,6;1}$	45673	35027	28709	51607	57692	$12_{6,6;0}$	$12_{6,7;-1}$
$8_{7,1;6}$	$8_{8,1;7}$	9444	8087	6468	4346	2361	$8_{1,7;-6}$	$8_{1,8;-7}$
$9_{7,2;5}$	$9_{8,2;6}$	17944	15167	11832	7594	8444	$9_{2,7;-5}$	$9_{2,8;-6}$
$10_{7,3;4}$	$10_{8,3;5}$	25773	21462	16215	11172	17182	$10_{3,7;-4}$	$10_{3,8;-5}$
$11_{7,4;3}$	$11_{8,4;4}$	33106	27105	19675	18011	27879	$11_{4,7;-3}$	$11_{4,8;-4}$
$12_{7,5;2}$	$12_{8,5;3}$	40064	32174	22501	30163	40064	$12_{5,7;-2}$	$12_{5,8;-3}$
$9_{8,1;7}$	$9_{9,1;8}$	9500	8146	6535	4418	2111	$9_{1,8;-7}$	$9_{1,9;-8}$
$10_{8,2;6}$	$10_{9,2;7}$	18136	15380	12081	7731	7636	$10_{2,8;-6}$	$10_{2,9;-7}$
$11_{8,3;5}$	$11_{9,3;6}$	26136	21887	16748	10598	15682	$11_{3,8;-5}$	$11_{3,9;-6}$
$12_{8,4;4}$	$12_{9,4;5}$	33654	27788	20570	15383	25641	$12_{4,8;-4}$	$12_{4,9;-5}$
$10_{9,1;8}$	$10_{10,1;9}$	9545	8194	6588	4479	1909	$10_{1,9;-8}$	$10_{1,10;-9}$
$11_{9,2;7}$	$11_{10,2;8}$	18295	15554	12280	7933	6970	$11_{2,9;-7}$	$11_{2,10;-8}$
$12_{9,3;6}$	$12_{10,3;7}$	26442	22237	17176	10563	14423	$12_{3,9;-6}$	$12_{3,10;-7}$
$11_{10,1;9}$	$11_{11,1;10}$	9583	8234	6631	4530	1742	$11_{1,10;-9}$	$11_{1,11;-10}$
$12_{10,2;8}$	$12_{11,2;9}$	18429	15699	12443	8126	6410	$12_{2,10;-8}$	$12_{2,11;-9}$
$12_{11,1;10}$	$12_{12,1;11}$	9615	8268	6667	4571	1603	$12_{1,11;-10}$	$12_{1,12;-11}$
$^{c,e}R1,0$	$^{c,e}P\bar{1},0$	∓ 1	∓ 0.5	0	± 0.5	± 1	$^{a,e}R0,1$	$^{a,e}P0,\bar{1}$
$0_{0,0;0}$	$1_{1,0;1}$	10000	10000	10000	10000	10000	$0_{0,0;0}$	$1_{0,1;-1}$
$1_{1,0;1}$	$2_{2,0;2}$	15000	16934	18660	19707	20000	$1_{0,1;-1}$	$2_{0,2;-2}$
$2_{2,0;2}$	$3_{3,0;3}$	25000	25893	27201	29029	30000	$2_{0,2;-2}$	$3_{0,3;-3}$
$3_{3,0;3}$	$4_{4,0;4}$	35000	35773	36728	38312	40000	$3_{0,3;-3}$	$4_{0,4;-4}$
$4_{4,0;4}$	$5_{5,0;5}$	45000	45745	46619	47897	50000	$4_{0,4;-4}$	$5_{0,5;-5}$
$5_{5,0;5}$	$6_{6,0;6}$	55000	55730	56582	57727	60000	$5_{0,5;-5}$	$6_{0,6;-6}$
$6_{6,0;6}$	$7_{7,0;7}$	65000	65721	66562	67660	70000	$6_{0,6;-6}$	$7_{0,7;-7}$
$7_{7,0;7}$	$8_{8,0;8}$	75000	75714	76549	77628	80000	$7_{0,7;-7}$	$8_{0,8;-8}$
$8_{8,0;8}$	$9_{9,0;9}$	85000	85708	86539	87610	90000	$8_{0,8;-8}$	$9_{0,9;-9}$
$9_{9,0;9}$	$10_{10,0;10}$	95000	95704	96531	97597	100000	$9_{0,9;-9}$	$10_{0,10;-10}$
$10_{10,0;10}$	$11_{11,0;11}$	105000	105701	106525	107588	110000	$10_{0,10;-10}$	$11_{0,11;-11}$
$11_{11,0;11}$	$12_{12,0;12}$	115000	115698	116519	117580	120000	$11_{0,11;-11}$	$12_{0,12;-12}$
$1_{0,1;-1}$	$2_{1,1;0}$	15000	15000	15000	15000	15000	$1_{1,0;1}$	$2_{1,1;0}$
$2_{1,1;0}$	$3_{2,1;1}$	16667	22500	25581	26509	26667	$2_{1,1;0}$	$3_{1,2;-1}$
$3_{2,1;1}$	$4_{3,1;2}$	26250	29261	33801	36902	37500	$3_{1,2;-1}$	$4_{1,3;-2}$
$4_{3,1;2}$	$5_{4,1;3}$	36000	38400	41758	46530	48000	$4_{1,3;-2}$	$5_{1,4;-3}$
$5_{4,1;3}$	$6_{5,1;4}$	45833	48106	50867	55604	58333	$5_{1,4;-3}$	$6_{1,5;-4}$
$6_{5,1;4}$	$7_{6,1;5}$	55714	57930	60533	64605	68571	$6_{1,5;-4}$	$7_{1,6;-5}$
$7_{6,1;5}$	$8_{7,1;6}$	65625	67805	70356	73938	78750	$7_{1,6;-5}$	$8_{1,7;-6}$
$8_{7,1;6}$	$9_{8,1;7}$	75556	77710	80235	83593	88889	$8_{1,7;-6}$	$9_{1,8;-7}$
$9_{8,1;7}$	$10_{9,1;8}$	85500	87636	90142	93412	99000	$9_{1,8;-7}$	$10_{1,9;-8}$
$10_{9,1;8}$	$11_{10,1;9}$	95455	97576	100068	103301	109091	$10_{1,9;-8}$	$11_{1,10;-9}$
$11_{10,1;9}$	$12_{11,1;10}$	105416	107526	110008	113219	119166	$11_{1,10;-9}$	$12_{1,11;-10}$
$2_{0,2;-2}$	$3_{1,2;-1}$	20000	18636	17345	16724	16667	$2_{2,0;2}$	$3_{2,1;1}$
$3_{1,2;-1}$	$4_{2,2;0}$	18750	29055	30992	30230	30000	$3_{2,1;1}$	$4_{2,2;0}$
$4_{2,2;0}$	$5_{3,2;1}$	28000	34387	41441	42462	42000	$4_{2,2;0}$	$5_{2,3;-1}$
$5_{3,2;1}$	$6_{4,2;2}$	37500	41961	49227	53738	53333	$5_{2,3;-1}$	$6_{2,4;-2}$
$6_{4,2;2}$	$7_{5,2;3}$	47143	51182	56697	64087	64286	$6_{2,4;-2}$	$7_{2,5;-3}$
$7_{5,2;3}$	$8_{6,2;4}$	56875	60756	65450	73564	75000	$7_{2,5;-3}$	$8_{2,6;-4}$
$8_{6,2;4}$	$9_{7,2;5}$	66667	70451	74899	82413	85556	$8_{2,6;-4}$	$9_{2,7;-5}$
$9_{7,2;5}$	$10_{8,2;6}$	76500	80218	84567	91174	96000	$9_{2,7;-5}$	$10_{2,8;-6}$
$10_{8,2;6}$	$11_{9,2;7}$	86364	90031	94328	100297	106364	$10_{2,8;-6}$	$11_{2,9;-7}$
$11_{9,2;7}$	$12_{10,2;8}$	96250	99880	104134	109796	116666	$11_{2,9;-7}$	$12_{2,10;-8}$

TABLE VI.—*Continued.*

Sub-branch				κ			Sub-branch	
${}^{c,e}R1,0$	${}^{c,e}P\bar{1},0$	∓ 1	∓ 0.5	0	± 0.5	± 1	${}^{a,e}R0,1$	${}^{a,e}P0,\bar{1}$
$3_{0,3;-3}$	$4_{1,3;-2}$	25000	20331	18001	17567	17500	$3_{3,0;3}$	$4_{3,1;2}$
$4_{1,3;-2}$	$5_{2,3;-1}$	21000	34848	33475	32109	32000	$4_{3,1;2}$	$5_{3,2;1}$
$5_{2,3;-1}$	$6_{3,3;0}$	30000	41218	47032	45219	45000	$5_{3,2;1}$	$6_{3,3;0}$
$6_{3,3;0}$	$7_{4,3;1}$	39286	46575	57381	57683	57143	$6_{3,3;0}$	$7_{3,4;-1}$
$7_{4,3;1}$	$8_{5,3;2}$	48750	54876	64788	69691	68750	$7_{3,4;-1}$	$8_{3,5;-2}$
$8_{5,3;2}$	$9_{6,3;3}$	58333	64092	71834	80981	80000	$8_{3,5;-2}$	$9_{3,6;-3}$
$9_{6,3;3}$	$10_{7,3;4}$	68000	73557	80274	91312	91000	$9_{3,6;-3}$	$10_{3,7;-4}$
$10_{7,3;4}$	$11_{8,3;5}$	77727	83147	89526	100665	101818	$10_{3,7;-4}$	$11_{3,8;-5}$
$11_{8,3;5}$	$12_{9,3;6}$	87500	92819	90948	109320	112500	$11_{3,8;-5}$	$12_{3,9;-6}$
$4_{0,4;-4}$	$5_{1,4;-3}$	30000	20650	18478	18082	18000	$4_{4,0;4}$	$5_{4,1;3}$
$5_{1,4;-3}$	$6_{2,4;-2}$	23333	38686	34370	33475	33333	$5_{4,1;3}$	$6_{4,2;2}$
$6_{2,4;-2}$	$7_{3,4;-1}$	32143	48639	49439	47326	47143	$6_{4,2;2}$	$7_{4,3;1}$
$7_{3,4;-1}$	$8_{4,4;0}$	41250	52676	63082	60238	60000	$7_{4,3;1}$	$8_{4,4;0}$
$8_{4,4;0}$	$9_{5,4;1}$	50556	59229	73357	72645	72222	$8_{4,4;0}$	$9_{4,5;-1}$
$9_{5,4;1}$	$10_{6,4;2}$	60000	67888	80428	84877	84000	$9_{4,5;-1}$	$10_{4,6;-2}$
$10_{6,4;2}$	$11_{7,4;3}$	69546	77064	87093	96881	95455	$10_{4,6;-2}$	$11_{4,7;-3}$
$11_{7,4;3}$	$12_{8,4;4}$	79167	86444	95254	108226	106666	$11_{4,7;-3}$	$12_{4,8;-4}$
$5_{0,5;-5}$	$6_{1,5;-4}$	35000	20660	18847	18422	18333	$5_{5,0;5}$	$6_{5,1;4}$
$6_{1,5;-4}$	$7_{2,5;-3}$	25714	40254	35224	34447	34286	$6_{5,1;4}$	$7_{5,2;3}$
$7_{2,5;-3}$	$8_{3,5;-2}$	34375	54914	50352	48971	48750	$7_{5,2;3}$	$8_{5,3;2}$
$8_{3,5;-2}$	$9_{4,5;-1}$	43333	60334	65354	62490	62222	$8_{5,3;2}$	$9_{5,4;1}$
$9_{4,5;-1}$	$10_{5,5;0}$	52500	64543	79136	75309	75000	$9_{5,4;1}$	$10_{5,5;0}$
$10_{5,5;0}$	$11_{6,5;1}$	61818	72156	89354	87664	87273	$10_{5,5;0}$	$11_{5,6;-1}$
$11_{6,5;1}$	$12_{7,5;2}$	71250	80944	96120	99820	99167	$11_{5,6;-1}$	$12_{5,7;-2}$
$6_{0,6;-6}$	$7_{1,6;-5}$	40000	20793	19108	18664	18571	$6_{6,0;6}$	$7_{6,1;5}$
$7_{1,6;-5}$	$8_{2,6;-4}$	28125	40367	35988	35171	35000	$7_{6,1;5}$	$8_{6,2;4}$
$8_{2,6;-4}$	$9_{3,6;-3}$	36667	58807	51410	50241	50000	$8_{6,2;4}$	$9_{6,3;3}$
$9_{3,6;-3}$	$10_{4,6;-2}$	45500	68406	66193	64301	64000	$9_{6,3;3}$	$10_{6,4;2}$
$10_{4,6;-2}$	$11_{5,6;-1}$	54546	71334	81252	77627	77273	$10_{6,4;2}$	$11_{6,5;1}$
$11_{5,6;-1}$	$12_{6,6;0}$	63750	77023	95192	90399	90000	$11_{6,5;1}$	$12_{6,6;0}$
$7_{0,7;-7}$	$8_{1,7;-6}$	45000	20990	19300	18844	18750	$7_{7,0;7}$	$8_{7,1;6}$
$8_{1,7;-6}$	$9_{2,7;-5}$	30556	40255	36587	35733	35556	$8_{7,1;6}$	$9_{7,2;5}$
$9_{2,7;-5}$	$10_{3,7;-4}$	39000	60147	52457	51252	51000	$9_{7,2;5}$	$10_{7,3;4}$
$10_{3,7;-4}$	$11_{4,7;-3}$	47727	75043	67350	65775	65455	$10_{7,3;4}$	$11_{7,4;3}$
$11_{4,7;-3}$	$12_{5,7;-2}$	56667	79651	81971	79549	79167	$11_{7,4;3}$	$12_{7,5;2}$
$8_{0,8;-8}$	$9_{1,8;-7}$	50000	21170	19449	18985	18889	$8_{8,0;8}$	$9_{8,1;7}$
$9_{1,8;-7}$	$10_{2,8;-6}$	33000	40430	37059	36182	36000	$9_{8,1;7}$	$10_{8,2;6}$
$10_{2,8;-6}$	$11_{3,8;-5}$	41364	59963	53330	52078	51818	$10_{8,2;6}$	$11_{8,3;5}$
$11_{3,8;-5}$	$12_{4,8;-4}$	50000	78946	68596	66999	66667	$11_{8,3;5}$	$12_{8,4;4}$
$9_{0,9;-9}$	$10_{1,9;-8}$	55000	21315	19566	19097	19000	$9_{9,0;9}$	$10_{9,1;8}$
$10_{1,9;-8}$	$11_{2,9;-7}$	35454	40779	37443	36548	36364	$10_{9,1;8}$	$11_{9,2;7}$
$11_{2,9;-7}$	$12_{3,9;-6}$	43750	59640	54051	52766	52500	$11_{9,2;7}$	$12_{9,3;6}$
$10_{0,10;-10}$	$11_{1,10;-9}$	60000	21432	19662	19189	19091	$10_{10,0;10}$	$11_{10,1;9}$
$11_{1,10;-9}$	$12_{2,10;-8}$	37917	41138	37761	36854	36667	$11_{10,1;9}$	$12_{10,2;8}$
$11_{0,11;-11}$	$12_{1,11;-10}$	65000	21527	19742	19265	19167	$11_{11,0;11}$	$12_{11,1;10}$
${}^{c,o}R1,0$	${}^{c,o}P\bar{1},0$	∓ 1	∓ 0.5	0	± 0.5	± 1	${}^{a,o}R0,1$	${}^{a,o}P0,\bar{1}$
$1_{1,1;0}$	$2_{2,1;1}$	15000	15000	15000	15000	15000	$1_{1,1;0}$	$2_{1,2;-1}$
$2_{2,1;1}$	$3_{3,1;2}$	25000	25710	26243	26564	26667	$2_{1,2;-1}$	$3_{1,3;-2}$
$3_{3,1;2}$	$4_{4,1;3}$	35000	35758	36540	37210	37500	$3_{1,3;-2}$	$4_{1,4;-3}$
$4_{4,1;3}$	$5_{5,1;4}$	45000	45743	46583	47478	48000	$4_{1,4;-3}$	$5_{1,5;-4}$
$5_{5,1;4}$	$6_{6,1;5}$	55000	55730	56576	57578	58333	$5_{1,5;-4}$	$6_{1,6;-5}$
$6_{6,1;5}$	$7_{7,1;6}$	65000	65721	66561	67607	68571	$6_{1,6;-5}$	$7_{1,7;-6}$
$7_{7,1;6}$	$8_{8,1;7}$	75000	75714	76550	77609	78750	$7_{1,7;-6}$	$8_{1,8;-7}$
$8_{8,1;7}$	$9_{9,1;8}$	85000	85708	86539	87603	88889	$8_{1,8;-7}$	$9_{1,9;-8}$
$9_{9,1;8}$	$10_{10,1;9}$	95000	95704	96531	97595	99000	$9_{1,9;-8}$	$10_{1,10;-9}$
$10_{10,1;9}$	$11_{11,1;10}$	105000	105701	106525	107587	109091	$10_{1,10;-9}$	$11_{1,11;-10}$
$11_{11,1;10}$	$12_{12,1;11}$	115000	115698	116519	117580	119166	$11_{1,11;-10}$	$12_{1,12;-11}$

TABLE VI.—*Continued.*

Sub-branch ${}^{c,o}R_{1,0}$	Sub-branch ${}^{c,o}P_{\bar{1},0}$	κ ∓ 1	∓ 0.5	0	± 0.5	± 1	Sub-branch ${}^{a,o}R_{0,1}$	Sub-branch ${}^{a,o}P_{0,\bar{1}}$
$2_{1,2;-1}$	$3_{2,2;0}$	16667	16667	16667	16667	16667	$2_{2,1;1}$	$3_{2,2;0}$
$3_{2,2;0}$	$4_{3,2;1}$	26250	28258	29391	29882	30000	$3_{2,2;0}$	$4_{2,3;-1}$
$4_{3,2;1}$	$5_{4,2;2}$	36000	38290	40354	41637	42000	$4_{2,3;-1}$	$5_{2,4;-2}$
$5_{4,2;2}$	$6_{5,2;3}$	45833	48094	50537	52600	53333	$5_{2,4;-2}$	$6_{2,5;-3}$
$6_{5,2;3}$	$7_{6,2;4}$	55714	57929	60461	63088	64286	$6_{2,5;-3}$	$7_{2,6;-4}$
$7_{6,2;4}$	$8_{7,2;5}$	65625	67805	70340	73291	75000	$7_{2,6;-4}$	$8_{2,7;-5}$
$8_{7,2;5}$	$9_{8,2;6}$	75556	77710	80231	83338	85556	$8_{2,7;-5}$	$9_{2,8;-6}$
$9_{8,2;6}$	$10_{9,2;7}$	85500	87636	90142	93314	96000	$9_{2,8;-6}$	$10_{2,9;-7}$
$10_{9,2;7}$	$11_{10,2;8}$	95455	97576	100068	103262	106364	$10_{2,9;-7}$	$11_{2,10;-8}$
$11_{10,2;8}$	$12_{11,2;9}$	105416	107526	110008	113205	116666	$11_{2,10;-8}$	$12_{2,11;-9}$
$3_{1,3;-2}$	$4_{2,3;-1}$	18750	18207	17796	17564	17500	$3_{3,1;2}$	$4_{3,2;1}$
$4_{2,3;-1}$	$5_{3,3;0}$	28000	31148	32063	32074	32000	$4_{3,2;1}$	$5_{3,3;0}$
$5_{3,3;0}$	$6_{4,3;1}$	37500	41486	44187	45001	45000	$5_{3,3;0}$	$6_{3,4;-1}$
$6_{4,3;1}$	$7_{5,3;2}$	47143	51127	54949	56948	57143	$6_{3,4;-1}$	$7_{3,5;-2}$
$7_{5,3;2}$	$8_{6,3;3}$	56875	60749	64999	68208	68750	$7_{3,5;-2}$	$8_{3,6;-3}$
$8_{6,3;3}$	$9_{7,3;4}$	66667	70450	74791	78959	80000	$8_{3,6;-3}$	$9_{3,7;-4}$
$9_{7,3;4}$	$10_{8,3;5}$	76500	80217	84543	89339	91000	$9_{3,7;-4}$	$10_{3,8;-5}$
$10_{8,3;5}$	$11_{9,3;6}$	86364	90031	94320	99469	101818	$10_{3,8;-5}$	$11_{3,9;-6}$
$11_{9,3;6}$	$12_{10,3;7}$	96250	99880	104133	109453	112500	$11_{3,9;-6}$	$12_{3,10;-7}$
$4_{1,4;-3}$	$5_{2,4;-2}$	21000	19363	18449	18082	18000	$4_{4,1;3}$	$5_{4,2;2}$
$5_{2,4;-2}$	$6_{3,4;-1}$	30000	33887	33934	33473	33333	$5_{4,2;2}$	$6_{4,3;1}$
$6_{3,4;-1}$	$7_{4,4;0}$	39286	45000	47370	47311	47143	$6_{4,3;1}$	$7_{4,4;0}$
$7_{4,4;0}$	$8_{5,4;1}$	48750	54655	59178	60145	60000	$7_{4,4;0}$	$8_{4,5;-1}$
$8_{5,4;1}$	$9_{6,4;2}$	58333	64063	69788	72255	72222	$8_{4,5;-1}$	$9_{4,6;-2}$
$9_{6,4;2}$	$10_{7,4;3}$	68000	73554	79716	83787	84000	$9_{4,6;-2}$	$10_{4,7;-3}$
$10_{7,4;3}$	$11_{8,4;4}$	77727	83147	89384	94830	95455	$10_{4,7;-3}$	$11_{4,8;-4}$
$11_{8,4;4}$	$12_{9,4;5}$	87500	92819	99012	105459	106666	$11_{4,8;-4}$	$12_{4,9;-5}$
$5_{1,5;-4}$	$6_{2,5;-3}$	23333	20137	18843	18422	18333	$5_{5,1;4}$	$6_{5,2;3}$
$6_{2,5;-3}$	$7_{3,5;-2}$	32143	36189	35151	34447	34286	$6_{5,2;3}$	$7_{5,3;2}$
$7_{3,5;-2}$	$8_{4,5;-1}$	41250	48511	49684	48970	48750	$7_{5,3;2}$	$8_{5,4;1}$
$8_{4,5;-1}$	$9_{5,5;0}$	50556	58512	62686	62483	62222	$8_{5,4;1}$	$9_{5,5;0}$
$9_{5,5;0}$	$10_{6,5;1}$	60000	67785	74286	75273	75000	$9_{5,5;0}$	$10_{5,6;-1}$
$10_{6,5;1}$	$11_{7,5;2}$	69546	77050	84774	87504	87273	$10_{5,6;-1}$	$11_{5,7;-2}$
$11_{7,5;2}$	$12_{8,5;3}$	79167	86442	94594	99259	99167	$11_{5,7;-2}$	$12_{5,8;-3}$
$6_{1,6;-5}$	$7_{2,6;-4}$	25714	20629	19107	18664	18571	$6_{6,1;5}$	$7_{6,2;4}$
$7_{2,6;-4}$	$8_{3,6;-3}$	34375	37948	35978	35171	35000	$7_{6,2;4}$	$8_{6,3;3}$
$8_{3,6;-3}$	$9_{4,6;-2}$	43333	51721	51284	50241	50000	$8_{6,3;3}$	$9_{6,4;2}$
$9_{4,6;-2}$	$10_{5,6;-1}$	52500	62496	65297	64301	64000	$9_{6,4;2}$	$10_{6,5;1}$
$10_{5,6;-1}$	$11_{6,6;0}$	61818	71831	78026	77624	77273	$10_{6,5;1}$	$11_{6,6;0}$
$11_{6,6;0}$	$12_{7,6;1}$	71250	80896	89476	90385	90000	$11_{6,6;0}$	$12_{6,7;-1}$
$7_{1,7;-6}$	$8_{2,7;-5}$	28125	20944	19300	18844	18750	$7_{7,1;6}$	$8_{7,2;5}$
$8_{2,7;-5}$	$9_{3,7;-4}$	36667	39200	36585	35733	35556	$8_{7,2;5}$	$9_{7,3;4}$
$9_{3,7;-4}$	$10_{4,7;-3}$	45500	54420	52436	51252	51000	$9_{7,3;4}$	$10_{7,4;3}$
$10_{4,7;-3}$	$11_{5,7;-2}$	54546	66365	67167	65775	65455	$10_{7,4;3}$	$11_{7,5;2}$
$11_{5,7;-2}$	$12_{6,7;-1}$	63750	76087	80851	79549	79167	$11_{7,5;2}$	$12_{7,6;1}$
$8_{1,8;-7}$	$9_{2,8;-6}$	30556	21157	19449	18985	18889	$8_{8,1;7}$	$9_{8,2;6}$
$9_{2,8;-6}$	$10_{3,8;-5}$	39000	40063	37061	36182	36000	$9_{8,2;6}$	$10_{8,3;5}$
$10_{3,8;-5}$	$11_{4,8;-4}$	47727	56523	53327	52078	51818	$10_{8,3;5}$	$11_{8,4;4}$
$11_{4,8;-4}$	$12_{5,8;-3}$	56667	69870	68563	66999	66667	$11_{8,4;4}$	$12_{8,5;3}$
$9_{1,9;-8}$	$10_{2,9;-7}$	33000	21311	19566	19097	19000	$9_{9,1;8}$	$10_{9,2;7}$
$10_{2,9;-7}$	$11_{3,9;-6}$	41364	40664	37443	36548	36364	$10_{9,2;7}$	$11_{9,3;6}$
$11_{3,9;-6}$	$12_{4,9;-5}$	50000	58070	54050	52766	52500	$11_{9,3;6}$	$12_{9,4;5}$
$10_{1,10;-9}$	$11_{2,10;-8}$	35454	21431	19662	19189	19091	$10_{10,1;9}$	$11_{10,2;8}$
$11_{2,10;-8}$	$12_{3,10;-7}$	43750	41102	37761	36854	36667	$11_{10,2;8}$	$12_{10,3;7}$
$11_{1,11;-10}$	$12_{2,11;-9}$	37917	21526	19742	19265	19167	$11_{11,1;10}$	$12_{11,2;9}$

TABLE VI.—*Continued.*

B. *a* and *c* prolate-or-oblate sub-branches

Sub-branch $^{c,e}Q\bar{1},2$	$^{c,o}Q1,\bar{2}$	∓1	∓0.5	κ 0	±0.5	±1	Sub-branch $^{a,e}Q2,\bar{1}$	$^{a,o}Q\bar{2},1$
$2_{2,0;2}$	$2_{1,2;-1}$	8333	5110	2233	488		$2_{0,2;-2}$	$2_{2,1;1}$
$3_{2,1;1}$	$3_{1,3;-2}$	14583	5722	1328	165		$3_{1,2;-1}$	$3_{3,1;2}$
$4_{2,2;0}$	$4_{1,4;-3}$	20250	4363	650	78		$4_{2,2;0}$	$4_{4,1;3}$
$5_{2,3;-1}$	$5_{1,5;-4}$	25667	2859	374	54		$5_{3,2;1}$	$5_{5,1;4}$
$6_{2,4;-2}$	$6_{1,6;-5}$	30952	1843	266	43		$6_{4,2;2}$	$6_{6,1;5}$
$7_{2,5;-3}$	$7_{1,7;-6}$	36161	1262	218	35		$7_{5,2;3}$	$7_{7,1;6}$
$8_{2,6;-4}$	$8_{1,8;-7}$	41319	945	183	30		$8_{6,2;4}$	$8_{8,1;7}$
$9_{2,7;-5}$	$9_{1,9;-8}$	46444	770	160	26		$9_{7,2;5}$	$9_{9,1;8}$
$10_{2,8;-6}$	$10_{1,10;-9}$	51545	664	141	23		$10_{8,2;6}$	$10_{10,1;9}$
$11_{2,9;-7}$	$11_{1,11;-10}$	56629	590	125	21		$11_{9,2;7}$	$11_{11,1;10}$
$12_{2,10;-8}$	$12_{1,12;-11}$	61699	533	115	19		$12_{10,2;8}$	$12_{12,1;11}$
$3_{3,0;3}$	$3_{2,2;0}$	8750	7055	4522	1458		$3_{0,3;-3}$	$3_{2,2;0}$
$4_{3,1;2}$	$4_{2,3;-1}$	15750	11214	4568	638		$4_{1,3;-2}$	$4_{3,2;1}$
$5_{3,2;1}$	$5_{2,4;-2}$	22000	12576	2754	274		$5_{2,3;-1}$	$5_{4,2;2}$
$6_{3,3;0}$	$6_{2,5;-3}$	27857	11283	1492	171		$6_{3,3;0}$	$6_{5,2;3}$
$7_{3,4;-1}$	$7_{2,6;-4}$	33482	8559	925	132		$7_{4,3;1}$	$7_{6,2;4}$
$8_{3,5;-2}$	$8_{2,7;-5}$	38958	5932	685	108		$8_{5,3;2}$	$8_{7,2;5}$
$9_{3,6;-3}$	$9_{2,8;-6}$	44333	4077	567	92		$9_{6,3;3}$	$9_{8,2;6}$
$10_{3,7;-4}$	$10_{2,9;-7}$	49636	2945	490	80		$10_{7,3;4}$	$10_{9,2;7}$
$11_{3,8;-5}$	$11_{2,10;-8}$	54886	2294	433	71		$11_{8,3;5}$	$11_{10,2;8}$
$12_{3,9;-6}$	$12_{2,11;-9}$	60096	1917	387	64		$12_{9,3;6}$	$12_{11,2;9}$
$4_{4,0;4}$	$4_{3,2;1}$	9000	7558	5617	2547		$4_{0,4;-4}$	$4_{2,3;-1}$
$5_{4,1;3}$	$5_{3,3;0}$	16500	13242	7983	1599		$5_{1,4;-3}$	$5_{3,3;0}$
$6_{4,2;2}$	$6_{3,4;-1}$	23214	17320	6820	681		$6_{2,4;-2}$	$6_{4,3;1}$
$7_{4,3;1}$	$7_{3,5;-2}$	29464	19464	4223	374		$7_{3,4;-1}$	$7_{5,3;2}$
$8_{4,4;0}$	$8_{3,6;-3}$	35417	19178	2433	273		$8_{4,4;0}$	$8_{6,3;3}$
$9_{4,5;-1}$	$9_{3,7;-4}$	41167	16526	1579	222		$9_{5,4;1}$	$9_{7,3;4}$
$10_{4,6;-2}$	$10_{3,8;-5}$	46773	12665	1205	188		$10_{6,4;2}$	$10_{8,3;5}$
$11_{4,7;-3}$	$11_{3,9;-6}$	52273	9080	1014	163		$11_{7,4;3}$	$11_{9,3;6}$
$12_{4,8;-4}$	$12_{3,10;-7}$	57692	6485	888	144		$12_{8,4;4}$	$12_{10,3;7}$
$5_{5,0;5}$	$5_{4,2;2}$	9167	7775	6052	3368		$5_{0,5;-5}$	$5_{2,4;-2}$
$6_{5,1;4}$	$6_{4,3;1}$	17024	14062	9982	3054		$6_{1,5;-4}$	$6_{3,4;-1}$
$7_{5,2;3}$	$7_{4,4;0}$	24107	19225	11103	1459		$7_{2,5;-3}$	$7_{4,4;0}$
$8_{5,3;2}$	$8_{4,5;-1}$	30694	23287	9000	720		$8_{3,5;-2}$	$8_{5,4;1}$
$9_{5,4;1}$	$9_{4,6;-2}$	36944	26001	5708	481		$9_{4,5;-1}$	$9_{6,4;2}$
$10_{5,5;0}$	$10_{4,7;-3}$	42955	26852	3433	382		$10_{5,5;0}$	$10_{7,4;3}$
$11_{5,6;-1}$	$11_{4,8;-4}$	48788	25327	2306	321		$11_{6,5;1}$	$11_{8,4;4}$
$12_{5,7;-2}$	$12_{4,9;-5}$	54487	21546	1796	277		$12_{7,5;2}$	$12_{9,4;5}$
$6_{6,0;6}$	$6_{5,2;3}$	9286	7912	6257	3863		$6_{0,6;-6}$	$6_{2,5;-3}$
$7_{6,1;5}$	$7_{5,3;2}$	17411	14550	10952	4657		$7_{1,6;-5}$	$7_{3,5;-2}$
$8_{6,2;4}$	$8_{5,4;1}$	24792	20233	13841	2772		$8_{2,6;-4}$	$8_{4,5;-1}$
$9_{6,3;3}$	$9_{5,5;0}$	31667	25098	14023	1322		$9_{3,6;-3}$	$9_{5,5;0}$
$10_{6,4;2}$	$10_{5,6;-1}$	38182	29140	11121	785		$10_{4,6;-2}$	$10_{6,5;1}$
$11_{6,5;1}$	$11_{5,7;-2}$	44432	32202	7197	595		$11_{5,6;-1}$	$11_{7,5;2}$
$12_{6,6;0}$	$12_{5,8;-3}$	50481	33921	4472	494		$12_{6,6;0}$	$12_{8,5;3}$
$7_{7,0;7}$	$7_{6,2;4}$	9375	8011	6381	4141		$7_{0,7;-7}$	$7_{2,6;-4}$
$8_{7,1;6}$	$8_{6,3;3}$	17708	14899	11480	5982		$8_{1,7;-6}$	$8_{3,6;-3}$
$9_{7,2;5}$	$9_{6,4;2}$	25333	20930	15306	4603		$9_{2,7;-5}$	$9_{4,6;-2}$
$10_{7,3;4}$	$10_{6,5;1}$	32455	26247	17406	2348		$10_{3,7;-4}$	$10_{5,6;-1}$
$11_{7,4;3}$	$11_{6,6;0}$	39205	30913	16805	1258		$11_{4,7;-3}$	$11_{6,6;0}$
$12_{7,5;2}$	$12_{6,7;-1}$	45673	34922	13192	878		$12_{5,7;-2}$	$12_{7,6;1}$
$8_{8,0;8}$	$8_{7,2;5}$	9444	8087	6468	4302		$8_{0,8;-8}$	$8_{2,7;-5}$
$9_{8,1;7}$	$9_{7,3;4}$	17944	15167	11825	6888		$9_{1,8;-7}$	$9_{3,7;-4}$
$10_{8,2;6}$	$10_{7,4;3}$	25773	21462	16158	6602		$10_{2,8;-6}$	$10_{4,7;-3}$
$11_{8,3;5}$	$11_{7,5;2}$	33106	27105	19325	3955		$11_{3,8;-5}$	$11_{5,7;-2}$
$12_{8,4;4}$	$12_{7,6;1}$	40064	32170	20771	2027		$12_{4,8;-4}$	$12_{6,7;-1}$
$9_{9,0;9}$	$9_{8,2;6}$	9500	8146	6535	4403		$9_{0,9;-9}$	$9_{2,8;-6}$
$10_{9,1;8}$	$10_{8,3;5}$	18136	15380	12079	7464		$10_{1,9;-8}$	$10_{3,8;-5}$
$11_{9,2;7}$	$11_{8,4;4}$	26136	21887	16736	8319		$11_{2,9;-7}$	$11_{4,8;-4}$
$12_{9,3;6}$	$12_{8,5;3}$	33654	27788	20487	6108		$12_{3,9;-6}$	$12_{5,8;-3}$

TABLE VI.—*Continued.*

Sub-branch ${}^{c,e}Q\bar{1},2$	${}^{c,o}Q1,\bar{2}$	κ ∓ 1	∓ 0.5	0	± 0.5	± 1	Sub-branch ${}^{a,e}Q2,\bar{1}$	${}^{a,o}Q\bar{2},1$
$10_{10,0;10}$	$10_{9,2;7}$	9545	8194	6588	4474		$10_{0,10;-10}$	$10_{2,9;-7}$
$11_{10,1;9}$	$11_{9,3;6}$	18295	15554	12279	7835		$11_{1,10;-9}$	$11_{3,9;-6}$
$12_{10,2;8}$	$12_{9,4;5}$	26442	22237	17173	9567		$12_{2,10;-8}$	$12_{4,9;-5}$
$11_{11,0;11}$	$11_{10,2;8}$	9583	8234	6631	4528		$11_{0,11;-11}$	$11_{2,10;-8}$
$12_{11,1;10}$	$12_{10,3;7}$	18429	15699	12443	8090		$12_{1,11;-10}$	$12_{3,10;-7}$
$12_{12,0;12}$	$12_{11,2;9}$	9615	8268	6667	4571		$12_{0,12;-12}$	$12_{2,11;-9}$
${}^{c,e}R\bar{1},2$	${}^{c,e}P1,\bar{2}$	∓ 1	∓ 0.5	0	± 0.5	± 1	${}^{a,e}R2,\bar{1}$	${}^{a,e}P\bar{2},1$
$1_{1,0;1}$	$2_{0,2;-2}$	5000	3066	1340	293		$1_{0,1;-1}$	$2_{2,0;2}$
$2_{1,1;0}$	$3_{0,3;-3}$	10000	4167	1086	157		$2_{1,1;0}$	$3_{3,0;3}$
$3_{1,2;-1}$	$4_{0,4;-4}$	15000	3944	800	123		$3_{2,1;1}$	$4_{4,0;4}$
$4_{1,3;-2}$	$5_{0,5;-5}$	20000	3386	696	117		$4_{3,1;2}$	$5_{5,0;5}$
$5_{1,4;-3}$	$6_{0,6;-6}$	25000	2976	667	114		$5_{4,1;3}$	$6_{6,0;6}$
$6_{1,5;-4}$	$7_{0,7;-7}$	30000	2770	656	112		$6_{5,1;4}$	$7_{7,0;7}$
$7_{1,6;-5}$	$8_{0,8;-8}$	35000	2686	649	111		$7_{6,1;5}$	$8_{8,0;8}$
$8_{1,7;-6}$	$9_{0,9;-9}$	40000	2652	644	110		$8_{7,1;6}$	$9_{9,0;9}$
$9_{1,8;-7}$	$10_{0,10;-10}$	45000	2634	640	109		$9_{8,1;7}$	$10_{10,0;10}$
$10_{1,9;-8}$	$11_{0,11;-11}$	50000	2621	637	109		$10_{9,1;8}$	$11_{11,0;11}$
$11_{1,10;-9}$	$12_{0,12;-12}$	55000	2610	634	108		$11_{10,1;9}$	$12_{12,0;12}$
$2_{2,0;2}$	$3_{1,2;-1}$	1667	2062	1905	776		$2_{0,2;-2}$	$3_{2,1;1}$
$3_{2,1;1}$	$4_{1,3;-2}$	3750	5114	2884	480		$3_{1,2;-1}$	$4_{3,1;2}$
$4_{2,2;0}$	$5_{1,4;-3}$	6000	7788	2336	310		$4_{2,2;0}$	$5_{4,1;3}$
$5_{2,3;-1}$	$6_{1,5;-4}$	8333	8748	1768	268		$5_{3,2;1}$	$6_{5,1;4}$
$6_{2,4;-2}$	$7_{1,6;-5}$	10714	8172	1529	254		$6_{4,2;2}$	$7_{6,1;5}$
$7_{2,5;-3}$	$8_{1,7;-6}$	13125	7135	1445	246		$7_{5,2;3}$	$8_{7,1;6}$
$8_{2,6;-4}$	$9_{1,8;-7}$	15556	6332	1406	240		$8_{6,2;4}$	$9_{8,1;7}$
$9_{2,7;-5}$	$10_{1,9;-8}$	18000	5885	1380	235		$9_{7,2;5}$	$10_{9,1;8}$
$10_{2,8;-6}$	$11_{1,10;-9}$	20455	5673	1360	232		$10_{8,2;6}$	$11_{10,1;9}$
$11_{2,9;-7}$	$12_{1,11;-10}$	22917	5570	1344	229		$11_{9,2;7}$	$12_{11,1;10}$
$3_{3,0;3}$	$4_{2,2;0}$	1250	1176	1316	1061		$3_{0,3;-3}$	$4_{2,2;0}$
$4_{3,1;2}$	$5_{2,3;-1}$	3000	3166	3516	1032		$4_{1,3;-2}$	$5_{3,2;1}$
$5_{3,2;1}$	$6_{2,4;-2}$	5000	6089	4448	613		$5_{2,3;-1}$	$6_{4,2;2}$
$6_{3,3;0}$	$7_{2,5;-3}$	7143	9630	3653	469		$6_{3,3;0}$	$7_{5,2;3}$
$7_{3,4;-1}$	$8_{2,6;-4}$	9375	12493	2828	426		$7_{4,3;1}$	$8_{6,2;4}$
$8_{3,5;-2}$	$9_{2,7;-5}$	11667	13383	2447	404		$8_{5,3;2}$	$9_{7,2;5}$
$9_{3,6;-3}$	$10_{2,8;-6}$	14000	12500	2301	389		$9_{6,3;3}$	$10_{8,2;6}$
$10_{3,7;-4}$	$11_{2,9;-7}$	16364	11048	2226	378		$10_{7,3;4}$	$11_{9,2;7}$
$11_{3,8;-5}$	$12_{2,10;-8}$	18750	9884	2174	370		$11_{8,3;5}$	$12_{10,2;8}$
$4_{4,0;4}$	$5_{3,2;1}$	1000	882	849	963		$4_{0,4;-4}$	$5_{2,3;-1}$
$5_{4,1;3}$	$6_{3,3;0}$	2500	2272	2651	1677		$5_{1,4;-3}$	$6_{3,3;0}$
$6_{4,2;2}$	$7_{3,4;-1}$	4286	4145	5108	1110		$6_{2,4;-2}$	$7_{4,3;1}$
$7_{4,3;1}$	$8_{3,5;-2}$	6250	6720	6025	747		$7_{3,4;-1}$	$8_{5,3;2}$
$8_{4,4;0}$	$9_{3,6;-3}$	8333	10196	5011	636		$8_{4,4;0}$	$9_{6,3;3}$
$9_{4,5;-1}$	$10_{3,7;-4}$	10500	14160	3947	590		$9_{5,4;1}$	$10_{7,3;4}$
$10_{4,6;-2}$	$11_{3,8;-5}$	12727	17215	3427	561		$10_{6,4;2}$	$11_{8,3;5}$
$11_{4,7;-3}$	$12_{3,9;-6}$	15000	18047	3214	540		$11_{7,4;3}$	$12_{9,3;6}$
$5_{5,0;5}$	$6_{4,2;2}$	833	730	638	723		$5_{0,5;-5}$	$6_{2,4;-2}$
$6_{5,1;4}$	$7_{4,3;1}$	2143	1898	1863	2013		$6_{1,5;-4}$	$7_{3,4;-1}$
$7_{5,2;3}$	$8_{4,4;0}$	3750	3384	4016	1833		$7_{2,5;-3}$	$8_{4,4;0}$
$8_{5,3;2}$	$9_{4,5;-1}$	5556	5182	6701	1165		$8_{3,5;-2}$	$9_{5,4;1}$
$9_{5,4;1}$	$10_{4,6;-2}$	7500	7437	7610	901		$9_{4,5;-1}$	$10_{6,4;2}$
$10_{5,5;0}$	$11_{4,7;-3}$	9545	10443	6398	809		$10_{5,5;0}$	$11_{7,4;3}$
$11_{5,6;-1}$	$12_{4,8;-4}$	11667	14380	5109	758		$11_{6,5;1}$	$12_{8,4;4}$
$6_{6,0;6}$	$7_{5,2;3}$	714	625	533	530		$6_{0,6;-6}$	$7_{2,5;-3}$
$7_{6,1;5}$	$8_{5,3;2}$	1875	1652	1470	1860		$7_{1,6;-5}$	$8_{3,5;-2}$
$8_{6,2;4}$	$9_{5,4;1}$	3333	2968	2958	2593		$8_{2,6;-4}$	$9_{4,5;-1}$
$9_{6,3;3}$	$10_{5,5;0}$	5000	4516	5406	1801		$9_{3,6;-3}$	$10_{5,5;0}$
$10_{6,4;2}$	$11_{5,6;-1}$	6818	6288	8298	1256		$10_{4,6;-2}$	$11_{6,5;1}$
$11_{6,5;1}$	$12_{5,7;-2}$	8750	8348	9203	1069		$11_{5,6;-1}$	$12_{7,5;2}$

TABLE VI.—*Continued.*

Sub-branch		κ					Sub-branch	
$^{c,e}R\bar{1},2$	$^{c,e}P1,\bar{2}$	∓1	∓0.5	0	±0.5	±1	$^{a,e}R2,\bar{1}$	$^{a,e}P\bar{2},1$
$7_{7,0;7}$	$8_{6,2;4}$	625	546	463	411		$7_{0,7;-7}$	$8_{2,6;-4}$
$8_{7,1;6}$	$9_{6,3;3}$	1667	1465	1267	1486		$8_{1,7;-6}$	$9_{3,6;-3}$
$9_{7,2;5}$	$10_{6,4;2}$	3000	2656	2402	2962		$9_{2,7;-5}$	$10_{4,6;-2}$
$10_{7,3;4}$	$11_{6,5;1}$	4545	4065	4106	2664		$10_{3,7;-4}$	$11_{5,6;-1}$
$11_{7,4;3}$	$12_{6,6;0}$	6250	5659	6816	1772		$11_{4,7;-3}$	$12_{6,6;0}$
$8_{8,0;8}$	$9_{7,2;5}$	556	485	411	341		$8_{0,8;-8}$	$9_{2,7;-5}$
$9_{8,1;7}$	$10_{7,3;4}$	1500	1316	1129	1154		$9_{1,8;-7}$	$10_{3,7;-4}$
$10_{8,2;6}$	$11_{7,4;3}$	2727	2407	2110	2759		$10_{2,8;-6}$	$11_{4,7;-3}$
$11_{8,3;5}$	$12_{7,5;2}$	4167	3705	3398	3519		$11_{3,8;-5}$	$12_{5,7;-2}$
$9_{9,0;9}$	$10_{8,2;6}$	500	436	369	298		$9_{0,9;-9}$	$10_{2,8;-6}$
$10_{9,1;8}$	$11_{8,3;5}$	1364	1195	1021	932		$10_{1,9;-8}$	$11_{3,8;-5}$
$11_{9,2;7}$	$12_{8,4;4}$	2500	2201	1910	2276		$11_{2,9;-7}$	$12_{4,8;-4}$
$10_{10,0;10}$	$11_{9,2;7}$	455	397	335	268		$10_{0,10;-10}$	$11_{2,9;-7}$
$11_{10,1;9}$	$12_{9,3;6}$	1250	1094	933	797		$11_{1,10;-9}$	$12_{3,9;-6}$
$11_{11,0;11}$	$12_{10,2;8}$	417	363	307	244		$11_{0,11;-11}$	$12_{2,10;-8}$
$^{c,o}R\bar{1},2$	$^{c,o}P1,\bar{2}$	∓1	∓0.5	0	±0.5	±1	$^{a,o}R2,\bar{1}$	$^{a,o}P\bar{2},1$
$2_{2,1;1}$	$3_{1,3;-2}$	1667	956	423	103		$2_{1,2;-1}$	$3_{3,1;2}$
$3_{2,2;0}$	$4_{1,4;-3}$	3750	1742	609	118		$3_{2,2;0}$	$4_{4,1;3}$
$4_{2,3;-1}$	$5_{1,5;-4}$	6000	2228	657	116		$4_{3,2;1}$	$5_{5,1;4}$
$5_{2,4;-2}$	$6_{1,6;-5}$	8333	2480	661	114		$5_{4,2;2}$	$6_{6,1;5}$
$6_{2,5;-3}$	$7_{1,7;-6}$	10714	2590	655	112		$6_{5,2;3}$	$7_{7,1;6}$
$7_{2,6;-4}$	$8_{1,8;-7}$	13125	2627	649	111		$7_{6,2;4}$	$8_{8,1;7}$
$8_{2,7;-5}$	$9_{1,9;-8}$	15556	2633	644	110		$8_{7,2;5}$	$9_{9,1;8}$
$9_{2,8;-6}$	$10_{1,10;-9}$	18000	2627	640	109		$9_{8,2;6}$	$10_{10,1;9}$
$10_{2,9;-7}$	$11_{1,11;-10}$	20455	2619	637	109		$10_{9,2;7}$	$11_{11,1;10}$
$11_{2,10;-8}$	$12_{1,12;-11}$	22917	2610	634	108		$11_{10,2;8}$	$12_{12,1;11}$
$3_{3,1;2}$	$4_{2,3;-1}$	1250	1025	643	213		$3_{1,3;-2}$	$4_{3,2;1}$
$4_{3,2;1}$	$5_{2,4;-2}$	3000	2317	1159	269		$4_{2,3;-1}$	$5_{4,2;2}$
$5_{3,3;0}$	$6_{2,5;-3}$	5000	3522	1389	265		$5_{3,3;0}$	$6_{5,2;3}$
$6_{3,4;-1}$	$7_{2,6;-4}$	7143	4450	1442	254		$6_{4,3;1}$	$7_{6,2;4}$
$7_{3,5;-2}$	$8_{2,7;-5}$	9375	5049	1429	246		$7_{5,3;2}$	$8_{7,2;5}$
$8_{3,6;-3}$	$9_{2,8;-6}$	11667	5372	1403	240		$8_{6,3;3}$	$9_{8,2;6}$
$9_{3,7;-4}$	$10_{2,9;-7}$	14000	5507	1379	235		$9_{7,3;4}$	$10_{9,2;7}$
$10_{3,8;-5}$	$11_{2,10;-8}$	16364	5539	1360	232		$10_{8,3;5}$	$11_{10,2;8}$
$11_{3,9;-6}$	$12_{2,11;-9}$	18750	5523	1344	229		$11_{9,3;6}$	$12_{11,2;9}$
$4_{4,1;3}$	$5_{3,3;0}$	1000	869	664	300		$4_{1,4;-3}$	$5_{3,3;0}$
$5_{4,2;2}$	$6_{3,4;-1}$	2500	2168	1455	440		$5_{2,4;-2}$	$6_{4,3;1}$
$6_{4,3;1}$	$7_{3,5;-2}$	4286	3662	2018	447		$6_{3,4;-1}$	$7_{5,3;2}$
$7_{4,4;0}$	$8_{3,6;-3}$	6250	5157	2266	424		$7_{4,4;0}$	$8_{6,3;3}$
$8_{4,5;-1}$	$9_{3,7;-4}$	8333	6471	2309	404		$8_{5,4;1}$	$9_{7,3;4}$
$9_{4,6;-2}$	$10_{3,8;-5}$	10500	7475	2272	389		$9_{6,4;2}$	$10_{8,3;5}$
$10_{4,7;-3}$	$11_{3,9;-6}$	12727	8130	2220	378		$10_{7,4;3}$	$11_{9,3;6}$
$11_{4,8;-4}$	$12_{3,10;-7}$	15000	8481	2173	370		$11_{8,4;4}$	$12_{10,3;7}$
$5_{5,1;4}$	$6_{4,3;1}$	833	729	601	346		$5_{1,5;-4}$	$6_{3,4;-1}$
$6_{5,2;3}$	$7_{4,4;0}$	2143	1889	1489	603		$6_{2,5;-3}$	$7_{4,4;0}$
$7_{5,3;2}$	$8_{4,5;-1}$	3750	3329	2360	656		$7_{3,5;-2}$	$8_{5,4;1}$
$8_{5,4;1}$	$9_{4,6;-2}$	5556	4947	2953	626		$8_{4,5;-1}$	$9_{6,4;2}$
$9_{5,5;0}$	$10_{4,7;-3}$	7500	6629	3209	589		$9_{5,5;0}$	$10_{7,4;3}$
$10_{5,6;-1}$	$11_{4,8;-4}$	9545	8239	3235	561		$10_{6,5;1}$	$11_{8,4;4}$
$11_{5,7;-2}$	$12_{4,9;-5}$	11667	9627	3171	540		$11_{7,5;2}$	$12_{9,4;5}$
$6_{6,1;5}$	$7_{5,3;2}$	714	625	527	357		$6_{1,6;-5}$	$7_{3,5;-2}$
$7_{6,2;4}$	$8_{5,4;1}$	1875	1651	1386	726		$7_{2,6;-4}$	$8_{4,5;-1}$
$8_{6,3;3}$	$9_{5,5;0}$	3333	2962	2400	873		$8_{3,6;-3}$	$9_{5,5;0}$
$9_{6,4;2}$	$10_{5,6;-1}$	5000	4489	3326	858		$9_{4,6;-2}$	$10_{6,5;1}$
$10_{6,5;1}$	$11_{5,7;-2}$	6818	6181	3940	804		$10_{5,6;-1}$	$11_{7,5;2}$
$11_{6,6;0}$	$12_{5,8;-3}$	8750	7975	4195	758		$11_{6,6;0}$	$12_{8,5;3}$

TABLE VI.—*Continued.*

Sub-branch ${}^{c,o}R\bar{1},2$	${}^{c,o}P1,\bar{2}$	∓ 1	∓ 0.5	κ 0	± 0.5	± 1	Sub-branch ${}^{a,o}R2,\bar{1}$	${}^{a,o}P\bar{2},1$
$7_{7,1;6}$	$8_{6,3;3}$	625	546	462	341		$7_{1,7;-6}$	$8_{3,6;-3}$
$8_{7,2;5}$	$9_{6,4;2}$	1667	1465	1251	793		$8_{2,7;-5}$	$9_{4,6;-2}$
$9_{7,3;4}$	$10_{6,5;1}$	3000	2656	2267	1069		$9_{3,7;-4}$	$10_{5,6;-1}$
$10_{7,4;3}$	$11_{6,6;0}$	4545	4062	3368	1110		$10_{4,7;-3}$	$11_{6,6;0}$
$11_{7,5;2}$	$12_{6,7;-1}$	6250	5646	4336	1050		$11_{5,7;-2}$	$12_{7,6;1}$
$8_{8,1;7}$	$9_{7,3;4}$	556	485	411	317		$8_{1,8;-7}$	$9_{3,7;-4}$
$9_{8,2;6}$	$10_{7,4;3}$	1500	1316	1126	808		$9_{2,8;-6}$	$10_{4,7;-3}$
$10_{8,3;5}$	$11_{7,5;2}$	2727	2407	2082	1216		$10_{3,8;-5}$	$11_{5,7;-2}$
$11_{8,4;4}$	$12_{7,6;1}$	4167	3704	3209	1361		$11_{4,8;-4}$	$12_{6,7;-1}$
$9_{9,1;8}$	$10_{8,3;5}$	500	436	369	290		$9_{1,9;-8}$	$10_{3,8;-5}$
$10_{9,2;7}$	$11_{8,4;4}$	1364	1195	1021	786		$10_{2,9;-7}$	$11_{4,8;-4}$
$11_{9,3;6}$	$12_{8,5;3}$	2500	2201	1904	1296		$11_{3,9;-6}$	$12_{5,8;-3}$
$10_{10,1;9}$	$11_{9,3;6}$	455	397	335	265		$10_{1,10;-9}$	$11_{3,9;-6}$
$11_{10,2;8}$	$12_{9,4;5}$	1250	1094	931	741		$11_{2,10;-8}$	$12_{4,9;-5}$
$11_{11,1;10}$	$12_{10,3;7}$	417	363	307	243		$11_{1,11;-10}$	$12_{3,10;-7}$

C. b prolate-and-oblate sub-branches

${}^{b,e}Q\bar{1},1$	${}^{b,e}Q1,\bar{1}$	∓ 1	∓ 0.5	0	± 0.5	± 1	${}^{b,e}Q1,\bar{1}$	${}^{b,e}Q\bar{1},1$
$1_{1,0;1}$	$1_{0,1;-1}$	15000	15000	15000	15000	15000	$1_{0,1;-1}$	$1_{1,0;1}$
$2_{1,1;0}$	$2_{0,2;-2}$	25000	21289	16667	12044	8333	$2_{1,1;0}$	$2_{2,0;2}$
$3_{1,2;-1}$	$3_{0,3;-3}$	35000	23196	14583	10583	8750	$3_{2,1;1}$	$3_{3,0;3}$
$4_{1,3;-2}$	$4_{0,4;-4}$	45000	22157	13527	10617	9000	$4_{3,1;2}$	$4_{4,0;4}$
$5_{1,4;-3}$	$5_{0,5;-5}$	55000	20634	13413	10753	9167	$5_{4,1;3}$	$5_{5,0;5}$
$6_{1,5;-4}$	$6_{0,6;-6}$	65000	19779	13484	10861	9286	$6_{5,1;4}$	$6_{6,0;6}$
$7_{1,6;-5}$	$7_{0,7;-7}$	75000	19511	13559	10943	9375	$7_{6,1;5}$	$7_{7,0;7}$
$8_{1,7;-6}$	$8_{0,8;-8}$	85000	19487	13620	11008	9444	$8_{7,1;6}$	$8_{8,0;8}$
$9_{1,8;-7}$	$9_{0,9;-9}$	95000	19524	13669	11060	9500	$9_{8,1;7}$	$9_{9,0;9}$
$10_{1,9;-8}$	$10_{0,10;-10}$	105000	19565	13710	11103	9545	$10_{9,1;8}$	$10_{10,0;10}$
$11_{1,10;-9}$	$11_{0,11;-11}$	115000	19604	13744	11139	9583	$11_{10,1;9}$	$11_{11,0;11}$
$12_{1,11;-10}$	$12_{0,12;-12}$	125000	19633	13774	11170	9615	$12_{11,1;10}$	$12_{12,0;12}$
$2_{2,0;2}$	$2_{1,1;0}$	8333	12044	16667	21289	25000	$2_{0,2;-2}$	$2_{1,1;0}$
$3_{2,1;1}$	$3_{1,2;-1}$	14583	24417	28872	24417	14583	$3_{1,2;-1}$	$3_{2,1;1}$
$4_{2,2;0}$	$4_{1,3;-2}$	20250	36119	31154	20622	15750	$4_{2,2;0}$	$4_{3,1;2}$
$5_{2,3;-1}$	$5_{1,4;-3}$	25667	43650	28164	20038	16500	$5_{3,2;1}$	$5_{4,1;3}$
$6_{2,4;-2}$	$6_{1,5;-4}$	30952	45529	26402	20356	17024	$6_{4,2;2}$	$6_{5,1;4}$
$7_{2,5;-3}$	$7_{1,6;-5}$	36161	43602	26163	20670	17411	$7_{5,2;3}$	$7_{6,1;5}$
$8_{2,6;-4}$	$8_{1,7;-6}$	41319	41002	26300	20926	17708	$8_{6,2;4}$	$8_{7,1;6}$
$9_{2,7;-5}$	$9_{1,8;-7}$	46444	39408	26465	21134	17944	$9_{7,2;5}$	$9_{8,1;7}$
$10_{2,8;-6}$	$10_{1,9;-8}$	51545	38815	26611	21307	18136	$10_{8,2;6}$	$10_{9,1;8}$
$11_{2,9;-7}$	$11_{1,10;-9}$	56629	38701	26737	21452	18295	$11_{9,2;7}$	$11_{10,1;9}$
$12_{2,10;-8}$	$12_{1,11;-10}$	61699	38736	26846	21576	18429	$12_{10,2;8}$	$12_{11,1;10}$
$3_{3,0;3}$	$3_{2,1;1}$	8750	10583	14583	23196	35000	$3_{0,3;-3}$	$3_{1,2;-1}$
$4_{3,1;2}$	$4_{2,2;0}$	15750	20622	31154	36119	20250	$4_{1,3;-2}$	$4_{2,2;0}$
$5_{3,2;1}$	$5_{2,3;-1}$	22000	32340	44017	32340	22000	$5_{2,3;-1}$	$5_{3,2;1}$
$6_{3,3;0}$	$6_{2,4;-2}$	27857	45986	45920	29422	23214	$6_{3,3;0}$	$6_{4,2;2}$
$7_{3,4;-1}$	$7_{2,5;-3}$	33482	58783	41862	29481	24107	$7_{4,3;1}$	$7_{5,2;3}$
$8_{3,5;-2}$	$8_{2,6;-4}$	38958	66715	39333	29932	24792	$8_{5,3;2}$	$8_{6,2;4}$
$9_{3,6;-3}$	$9_{2,7;-5}$	44333	68174	38859	30348	25333	$9_{6,3;3}$	$9_{7,2;5}$
$10_{3,7;-4}$	$10_{2,8;-6}$	49636	65282	38980	30705	25773	$10_{7,3;4}$	$10_{8,2;6}$
$11_{3,8;-5}$	$11_{2,9;-7}$	54886	61636	39182	31011	26136	$11_{8,3;5}$	$11_{9,2;7}$
$12_{3,9;-6}$	$12_{2,10;-8}$	60096	59285	39377	31275	26442	$12_{9,3;6}$	$12_{10,2;8}$
$4_{4,0;4}$	$4_{3,1;2}$	9000	10617	13527	22157	45000	$4_{0,4;-4}$	$4_{1,3;-2}$
$5_{4,1;3}$	$5_{3,2;1}$	16500	20038	28164	43650	25667	$5_{1,4;-3}$	$5_{2,3;-1}$
$6_{4,2;2}$	$6_{3,3;0}$	23214	29422	45920	45986	27857	$6_{2,4;-2}$	$6_{3,3;0}$
$7_{4,3;1}$	$7_{3,4;-1}$	29464	39987	59402	39987	29464	$7_{3,4;-1}$	$7_{4,3;1}$
$8_{4,4;0}$	$8_{3,5;-2}$	35417	52950	60829	38601	30694	$8_{4,4;0}$	$8_{5,3;2}$
$9_{4,5;-1}$	$9_{3,6;-3}$	41167	67954	55712	38960	31667	$9_{5,4;1}$	$9_{6,3;3}$
$10_{4,6;-2}$	$10_{3,7;-4}$	46773	81732	52398	39466	32455	$10_{6,4;2}$	$10_{7,3;4}$
$11_{4,7;-3}$	$11_{3,8;-5}$	52273	89952	51626	39938	33106	$11_{7,4;3}$	$11_{8,3;5}$
$12_{4,8;-4}$	$12_{3,9;-6}$	57692	90961	51673	40360	33654	$12_{8,4;4}$	$12_{9,3;6}$

TABLE VI.—*Continued.*

Sub-branch $^{b,e}Q_{\bar{1},1}$	$^{b,e}Q_{1,\bar{1}}$	∓ 1	∓ 0.5	κ 0	± 0.5	± 1	Sub-branch $^{b,e}Q_{1,\bar{1}}$	$^{b,e}Q_{\bar{1},1}$
$5_{5,0;5}$	$5_{4,1;3}$	9167	10753	13413	20634	55000	$5_{0,5;-5}$	$5_{1,4;-3}$
$6_{5,1;4}$	$6_{4,2;2}$	17024	20356	26402	45529	30952	$6_{1,5;-4}$	$6_{2,4;-2}$
$7_{5,2;3}$	$7_{4,3;1}$	24107	29481	41862	58783	33482	$7_{2,5;-3}$	$7_{3,4;-1}$
$8_{5,3;2}$	$8_{4,4;0}$	30694	38601	60829	52950	35417	$8_{3,5;-2}$	$8_{4,4;0}$
$9_{5,4;1}$	$9_{4,5;-1}$	36944	48332	74882	48332	36944	$9_{4,5;-1}$	$9_{5,4;1}$
$10_{5,5;0}$	$10_{4,6;-2}$	42955	59745	75829	47998	38182	$10_{5,5;0}$	$10_{6,4;2}$
$11_{5,6;-1}$	$11_{4,7;-3}$	48788	73909	69690	48463	39205	$11_{6,5;1}$	$11_{7,4;3}$
$12_{5,7;-2}$	$12_{4,8;-4}$	54487	90148	65598	48989	40064	$12_{7,5;2}$	$12_{8,4;4}$
$6_{6,0;6}$	$6_{5,1;4}$	9286	10861	13484	19779	65000	$6_{0,6;-6}$	$6_{1,5;-4}$
$7_{6,1;5}$	$7_{5,2;3}$	17411	20670	26163	43602	36161	$7_{1,6;-5}$	$7_{2,5;-3}$
$8_{6,2;4}$	$8_{5,3;2}$	24792	29932	39333	66715	38958	$8_{2,6;-4}$	$8_{3,5;-2}$
$9_{6,3;3}$	$9_{5,4;1}$	31667	38960	55712	67954	41167	$9_{3,6;-3}$	$9_{4,5;-1}$
$10_{6,4;2}$	$10_{5,5;0}$	38182	47998	75829	59745	42955	$10_{4,6;-2}$	$10_{5,5;0}$
$11_{6,5;1}$	$11_{5,6;-1}$	44432	57343	90410	57343	44432	$11_{5,6;-1}$	$11_{6,5;1}$
$12_{6,6;0}$	$12_{5,7;-2}$	50481	67590	90893	57486	45673	$12_{6,6;-0}$	$12_{7,5;2}$
$7_{7,0;7}$	$7_{6,1;5}$	9375	10943	13559	19511	75000	$7_{0,7;-7}$	$7_{1,6;-5}$
$8_{7,1;6}$	$8_{6,2;4}$	17708	20926	26300	41002	41319	$8_{1,7;-6}$	$8_{2,6;-4}$
$9_{7,2;5}$	$9_{6,3;3}$	25333	30348	38859	68174	44333	$9_{2,7;-5}$	$9_{3,6;-3}$
$10_{7,3;4}$	$10_{6,4;2}$	32455	39466	52398	81732	46773	$10_{3,7;-4}$	$10_{4,6;-2}$
$11_{7,4;3}$	$11_{6,5;1}$	39205	48463	69690	73909	48788	$11_{4,7;-3}$	$11_{5,6;-1}$
$12_{7,5;2}$	$12_{6,6;0}$	45673	57486	90893	67590	50481	$12_{5,7;-2}$	$12_{6,6;0}$
$8_{8,0;8}$	$8_{7,1;6}$	9444	11008	13620	19487	85000	$8_{0,8;-8}$	$8_{1,7;-6}$
$9_{8,1;7}$	$9_{7,2;5}$	17944	21134	26465	39408	46444	$9_{1,8;-7}$	$9_{2,7;-5}$
$10_{8,2;6}$	$10_{7,3;4}$	25773	30705	38980	65282	49636	$10_{2,8;-6}$	$10_{3,7;-4}$
$11_{8,3;5}$	$11_{7,4;3}$	33106	39938	51626	89952	52273	$11_{3,8;-5}$	$11_{4,7;-3}$
$12_{8,4;4}$	$12_{7,5;2}$	40064	48989	65598	90148	54487	$12_{4,8;-4}$	$12_{5,7;-2}$
$9_{9,0;9}$	$9_{8,1;7}$	9500	11060	13669	19524	95000	$9_{0,9;-9}$	$9_{1,8;-7}$
$10_{9,1;8}$	$10_{8,2;6}$	18136	21307	26611	38815	51545	$10_{1,9;-8}$	$10_{2,8;-6}$
$11_{9,2;7}$	$11_{8,3;5}$	26136	31011	39182	61636	54886	$11_{2,9;-7}$	$11_{3,8;-5}$
$12_{9,3;6}$	$12_{8,4;4}$	33654	40360	51673	90961	57692	$12_{3,9;-6}$	$12_{4,8;-4}$
$10_{10,0;10}$	$10_{9,1;8}$	9545	11103	13710	19565	105000	$10_{0,10;-10}$	$10_{1,9;-8}$
$11_{10,1;9}$	$11_{9,2;7}$	18295	21452	26737	38701	56629	$11_{1,10;-9}$	$11_{2,9;-7}$
$12_{10,2;8}$	$12_{9,3;6}$	26442	31275	39377	59285	60096	$12_{2,10;-8}$	$12_{3,9;-6}$
$11_{11,0;11}$	$11_{10,1;9}$	9583	11139	13744	19604	115000	$11_{0,11;-11}$	$11_{1,10;-9}$
$12_{11,1;10}$	$12_{10,2;8}$	18429	21576	26846	38736	61699	$12_{1,11;-10}$	$12_{2,10;-8}$
$12_{12,0;12}$	$12_{11,1;10}$	9615	11170	13774	19633	125000	$12_{0,12;-12}$	$12_{1,11;-10}$
$^{b,o}Q_{\bar{1},1}$	$^{b,o}Q_{1,\bar{1}}$	∓ 1	∓ 0.5	0	± 0.5	± 1	$^{b,o}Q_{1,\bar{1}}$	$^{b,o}Q_{\bar{1},1}$
$2_{2,1;1}$	$2_{1,2;-1}$	8333	8333	8333	8333	8333	$2_{1,2;-1}$	$2_{2,1;1}$
$3_{2,2;0}$	$3_{1,3;-2}$	14583	13160	11667	10173	8750	$3_{2,2;0}$	$3_{3,1;2}$
$4_{2,3;-1}$	$4_{1,4;-3}$	20250	16126	12886	10584	9000	$4_{3,2;1}$	$4_{4,1;3}$
$5_{2,4;-2}$	$5_{1,5;-4}$	25667	17823	13300	10751	9167	$5_{4,2;2}$	$5_{5,1;4}$
$6_{2,5;-3}$	$6_{1,6;-5}$	30952	18716	13464	10860	9286	$6_{5,2;3}$	$6_{6,1;5}$
$7_{2,6;-4}$	$7_{1,7;-6}$	36161	19158	13555	10943	9375	$7_{6,2;4}$	$7_{7,1;6}$
$8_{2,7;-5}$	$8_{1,8;-7}$	41319	19374	13619	11008	9444	$8_{7,2;5}$	$8_{8,1;7}$
$9_{2,8;-6}$	$9_{1,9;-8}$	46444	19487	13669	11060	9500	$9_{8,2;6}$	$9_{9,1;8}$
$10_{2,9;-7}$	$10_{1,10;-9}$	51545	19553	13710	11103	9545	$10_{9,2;7}$	$10_{10,1;9}$
$11_{2,10;-8}$	$11_{1,11;-10}$	56629	19598	13744	11139	9583	$11_{10,2;8}$	$11_{11,1;10}$
$12_{2,11;-9}$	$12_{1,12;-11}$	61699	19632	13774	11170	9615	$12_{11,2;9}$	$12_{12,1;11}$
$3_{3,1;2}$	$3_{2,2;0}$	8750	10173	11667	13160	14583	$3_{1,3;-2}$	$3_{2,2;0}$
$4_{3,2;1}$	$4_{2,3;-1}$	15750	18280	19208	18280	15750	$4_{2,3;-1}$	$4_{3,2;1}$
$5_{3,3;0}$	$5_{2,4;-2}$	22000	24936	23333	19781	16500	$5_{3,3;0}$	$5_{4,2;2}$
$6_{3,4;-1}$	$6_{2,5;-3}$	27857	30089	25173	20331	17024	$6_{4,3;1}$	$6_{5,2;3}$
$7_{3,5;-2}$	$7_{2,6;-4}$	33482	33722	25914	20668	17411	$7_{5,3;2}$	$7_{6,2;4}$
$8_{3,6;-3}$	$8_{2,7;-5}$	38958	36030	26251	20926	17708	$8_{6,3;3}$	$8_{7,2;5}$
$9_{3,7;-4}$	$9_{2,8;-6}$	44333	37360	26455	21134	17944	$9_{7,3;4}$	$9_{8,2;6}$
$10_{3,8;-5}$	$10_{2,9;-7}$	49636	38072	26609	21307	18136	$10_{8,3;5}$	$10_{9,2;7}$
$11_{3,9;-6}$	$11_{2,10;-8}$	54886	38443	26737	21452	18295	$11_{9,3;6}$	$11_{10,2;8}$
$12_{3,10;-7}$	$12_{2,11;-9}$	60096	38646	26846	21576	18429	$12_{10,3;7}$	$12_{11,2;9}$

TABLE VI.—*Continued.*

Sub-branch ${}^{b,o}Q_{\bar{1},1}$	${}^{b,o}Q_{1,\bar{1}}$	κ ∓1	∓0.5	0	±0.5	±1	Sub-branch ${}^{b,o}Q_{1,\bar{1}}$	${}^{b,o}Q_{\bar{1},1}$
$4_{4,1;3}$	$4_{3,2;1}$	9000	10584	12886	16126	20250	$4_{1,4;-3}$	$4_{2,3;-1}$
$5_{4,2;2}$	$5_{3,3;0}$	16500	19781	23333	24936	22000	$5_{2,4;-2}$	$5_{3,3;0}$
$6_{4,3;1}$	$6_{3,4;-1}$	23214	28237	30910	28237	23214	$6_{3,4;-1}$	$6_{4,3;1}$
$7_{4,4;0}$	$7_{3,5;-2}$	29464	35974	35396	29347	24107	$7_{4,4;0}$	$7_{5,3;2}$
$8_{4,5;-1}$	$8_{3,6;-3}$	35417	42717	37550	29917	24792	$8_{5,4;1}$	$8_{6,3;3}$
$9_{4,6;-2}$	$9_{3,7;-4}$	41167	48149	38467	30347	25333	$9_{6,4;2}$	$9_{7,3;4}$
$10_{4,7;-3}$	$10_{3,8;-5}$	46773	52121	38896	30705	25773	$10_{7,4;3}$	$10_{8,3;5}$
$11_{4,8;-4}$	$11_{3,9;-6}$	52273	54738	39163	31011	26136	$11_{8,4;4}$	$11_{9,3;6}$
$12_{4,9;-5}$	$12_{3,10;-7}$	57692	56299	39373	31275	26442	$12_{9,4;5}$	$12_{10,3;7}$
$5_{5,1;4}$	$5_{4,2;2}$	9167	10751	13300	17823	25667	$5_{1,5;-4}$	$5_{2,4;-2}$
$6_{5,2;3}$	$6_{4,3;1}$	17024	20331	25173	30089	27857	$6_{2,5;-3}$	$6_{3,4;-1}$
$7_{5,3;2}$	$7_{4,4;0}$	24107	29347	35396	35974	29464	$7_{3,5;-2}$	$7_{4,4;0}$
$8_{5,4;1}$	$8_{4,5;-1}$	30694	38050	43064	38050	30694	$8_{4,5;-1}$	$8_{5,4;1}$
$9_{5,5;0}$	$9_{4,6;-2}$	36944	46432	47757	38893	31667	$9_{5,5;0}$	$9_{6,4;2}$
$10_{5,6;-1}$	$10_{4,7;-3}$	42955	54266	50083	39458	32455	$10_{6,5;1}$	$10_{7,4;3}$
$11_{5,7;-2}$	$11_{4,8;-4}$	48788	61181	51087	39937	33106	$11_{7,5;2}$	$11_{8,4;4}$
$12_{5,8;-3}$	$12_{4,9;-5}$	54487	66823	51551	40360	33654	$12_{8,5;3}$	$12_{9,4;5}$
$6_{6,1;5}$	$6_{5,2;3}$	9286	10860	13464	18716	30952	$6_{1,6;-5}$	$6_{2,5;-3}$
$7_{6,2;4}$	$7_{5,3;2}$	17411	20668	25914	33722	33482	$7_{2,6;-4}$	$7_{3,5;-2}$
$8_{6,3;3}$	$8_{5,4;1}$	24792	29917	37550	42717	35417	$8_{3,6;-3}$	$8_{4,5;-1}$
$9_{6,4;2}$	$9_{5,5;0}$	31667	38893	47757	46432	36944	$9_{4,6;-2}$	$9_{5,5;0}$
$10_{6,5;1}$	$10_{5,6;-1}$	38182	47745	55515	47745	38182	$10_{5,6;-1}$	$10_{6,5;1}$
$11_{6,6;0}$	$11_{5,7;-2}$	44432	56495	60341	48430	39205	$11_{6,6;0}$	$11_{7,5;2}$
$12_{6,7;-1}$	$12_{5,8;-3}$	50481	65013	62764	48985	40064	$12_{7,6;1}$	$12_{8,5;3}$
$7_{7,1;6}$	$7_{6,2;4}$	9375	10943	13555	19158	36161	$7_{1,7;-6}$	$7_{2,6;-4}$
$8_{7,2;5}$	$8_{6,3;3}$	17708	20926	26251	36030	38958	$8_{2,7;-5}$	$8_{3,6;-3}$
$9_{7,3;4}$	$9_{6,4;2}$	25333	30347	38467	48149	41167	$9_{3,7;-4}$	$9_{4,6;-2}$
$10_{7,4;3}$	$10_{6,5;1}$	32455	39458	50083	54266	42955	$10_{4,7;-3}$	$10_{5,6;-1}$
$11_{7,5;2}$	$11_{6,6;0}$	39205	48430	60341	56495	44432	$11_{5,7;-2}$	$11_{6,6;0}$
$12_{7,6;1}$	$12_{6,7;-1}$	45673	57370	68182	57370	45673	$12_{6,7;-1}$	$12_{7,6;1}$
$8_{8,1;7}$	$8_{7,2;5}$	9444	11008	13619	19374	41319	$8_{1,8;-7}$	$8_{2,7;-5}$
$9_{8,2;6}$	$9_{7,3;4}$	17944	21134	26455	37360	44333	$9_{2,8;-6}$	$9_{3,7;-4}$
$10_{8,3;5}$	$10_{7,4;3}$	25773	30705	38896	52121	46773	$10_{3,8;-5}$	$10_{4,7;-3}$
$11_{8,4;4}$	$11_{7,5;2}$	33106	39937	51087	61181	48788	$11_{4,8;-4}$	$11_{5,7;-2}$
$12_{8,5;3}$	$12_{7,6;1}$	40064	48985	62764	65013	50481	$12_{5,8;-3}$	$12_{6,7;-1}$
$9_{9,1;8}$	$9_{8,2;6}$	9500	11060	13669	19487	46444	$9_{1,9;-8}$	$9_{2,8;-6}$
$10_{9,2;7}$	$10_{8,3;5}$	18136	21307	26609	38072	49636	$10_{2,9;-7}$	$10_{3,8;-5}$
$11_{9,3;6}$	$11_{8,4;4}$	26136	31011	39163	54738	52273	$11_{3,9;-6}$	$11_{4,8;-4}$
$12_{9,4;5}$	$12_{8,5;3}$	33654	40360	51551	66823	54487	$12_{4,9;-5}$	$12_{5,8;-3}$
$10_{10,1;9}$	$10_{9,2;7}$	9545	11103	13710	19553	51545	$10_{1,10;-9}$	$10_{2,9;-7}$
$11_{10,2;8}$	$11_{9,3;6}$	18295	21452	26737	38443	54886	$11_{2,10;-8}$	$11_{3,9;-6}$
$12_{10,3;7}$	$12_{9,4;5}$	26442	31275	39373	56299	57692	$12_{3,10;-7}$	$12_{4,9;-5}$
$11_{11,1;10}$	$11_{10,2;8}$	9583	11139	13744	19598	56629	$11_{1,11;-10}$	$11_{2,10;-8}$
$12_{11,2;9}$	$12_{10,3;7}$	18429	21576	26846	38646	60096	$12_{2,11;-9}$	$12_{3,10;-7}$
$12_{12,1;11}$	$12_{11,2;9}$	9615	11170	13774	19632	61699	$12_{1,12;-11}$	$12_{2,11;-9}$
${}^{b,e}R_{1,1}$	${}^{b,o}P_{\bar{1},\bar{1}}$	∓1	∓0.5	0	±0.5	±1	${}^{b,e}R_{1,1}$	${}^{b,o}P_{\bar{1},\bar{1}}$
$0_{0,0;0}$	$1_{1,1;0}$	10000	10000	10000	10000	10000	$0_{0,0;0}$	$1_{1,1;0}$
$1_{1,0;1}$	$2_{2,1;1}$	15000	15000	15000	15000	15000	$1_{0,1;-1}$	$2_{1,2;-1}$
$2_{2,0;2}$	$3_{3,1;2}$	25000	24086	22847	21383	20000	$2_{0,2;-2}$	$3_{1,3;-2}$
$3_{3,0;3}$	$4_{4,1;3}$	35000	34083	32533	29584	25000	$3_{0,3;-3}$	$4_{1,4;-3}$
$4_{4,0;4}$	$5_{5,1;4}$	45000	44117	42585	39100	30000	$4_{0,4;-4}$	$5_{1,5;-4}$
$5_{5,0;5}$	$6_{6,1;5}$	55000	54140	52653	49126	35000	$5_{0,5;-5}$	$6_{1,6;-5}$
$6_{6,0;6}$	$7_{7,1;6}$	65000	64155	62702	59250	40000	$6_{0,6;-6}$	$7_{1,7;-6}$
$7_{7,0;7}$	$8_{8,1;7}$	75000	74165	72737	69364	45000	$7_{0,7;-7}$	$8_{1,8;-7}$
$8_{8,0;8}$	$9_{9,1;8}$	85000	84173	82763	79453	50000	$8_{0,8;-8}$	$9_{1,9;-8}$
$9_{9,0;9}$	$10_{10,1;9}$	95000	94179	92782	89522	55000	$9_{0,9;-9}$	$10_{1,10;-9}$
$10_{10,0;10}$	$11_{11,1;10}$	105000	104184	102798	99576	60000	$10_{0,10;-10}$	$11_{1,11;-10}$
$11_{11,0;11}$	$12_{12,1;11}$	115000	114188	112810	109620	65000	$11_{0,11;-11}$	$12_{1,12;-11}$

TABLE VI.—*Continued.*

Sub-branch ${}^{b,e}R_{1,1}$	${}^{b,o}P_{\bar{1},\bar{1}}$	∓ 1	∓ 0.5	κ 0	± 0.5	± 1	Sub-branch ${}^{b,e}R_{1,1}$	${}^{b,o}P_{\bar{1},\bar{1}}$
$1_{0,1;-1}$	$2_{1,2;-1}$	15000	15000	15000	15000	15000	$1_{1,0;1}$	$2_{2,1;1}$
$2_{1,1;0}$	$3_{2,2;0}$	16667	16667	16667	16667	16667	$2_{1,1;0}$	$3_{2,2;0}$
$3_{2,1;1}$	$4_{3,2;1}$	26250	23549	21079	19563	18750	$3_{1,2;-1}$	$4_{2,3;-1}$
$4_{3,1;2}$	$5_{4,2;2}$	36000	33165	28748	23919	21000	$4_{1,3;-2}$	$5_{2,4;-2}$
$5_{4,1;3}$	$6_{5,2;3}$	45833	43122	38409	30161	23333	$5_{1,4;-3}$	$6_{2,5;-3}$
$6_{5,1;4}$	$7_{6,2;4}$	55714	53091	48508	38383	25714	$6_{1,5;-4}$	$7_{2,6;-4}$
$7_{6,1;5}$	$8_{7,2;5}$	65625	63059	58609	48001	28125	$7_{1,6;-5}$	$8_{2,7;-5}$
$8_{7,1;6}$	$9_{8,2;6}$	75556	73030	68678	58192	30556	$8_{1,7;-6}$	$9_{2,8;-6}$
$9_{8,1;7}$	$10_{9,2;7}$	85500	83002	78720	68479	33000	$9_{1,8;-7}$	$10_{2,9;-7}$
$10_{9,1;8}$	$11_{10,2;8}$	95455	92979	88749	78723	35454	$10_{1,9;-8}$	$11_{2,10;-8}$
$11_{10,1;9}$	$12_{11,2;9}$	105416	102958	98767	88911	37917	$11_{1,10;-9}$	$12_{2,11;-9}$
$2_{0,2;-2}$	$3_{1,3;-2}$	20000	21383	22847	24086	25000	$2_{2,0;2}$	$3_{3,1;2}$
$3_{1,2;-1}$	$4_{2,3;-1}$	18750	19563	21079	23549	26250	$3_{2,1;1}$	$4_{3,2;1}$
$4_{2,2;0}$	$5_{3,3;0}$	28000	23609	22028	23609	28000	$4_{2,2;0}$	$5_{3,3;0}$
$5_{3,2;1}$	$6_{4,3;1}$	37500	32338	26305	24633	30000	$5_{2,3;-1}$	$6_{3,4;-1}$
$6_{4,2;2}$	$7_{5,3;2}$	47143	42259	34093	27060	32143	$6_{2,4;-2}$	$7_{3,5;-2}$
$7_{5,2;3}$	$8_{6,3;3}$	56875	52226	43935	31293	34375	$7_{2,5;-3}$	$8_{3,6;-3}$
$8_{6,2;4}$	$9_{7,3;4}$	66667	62172	54199	37664	36667	$8_{2,6;-4}$	$9_{3,7;-4}$
$9_{7,2;5}$	$10_{8,3;5}$	76500	72110	64411	46127	39000	$9_{2,7;-5}$	$10_{3,8;-5}$
$10_{8,2;6}$	$11_{9,3;6}$	86364	82050	74550	56030	41364	$10_{2,8;-6}$	$11_{3,9;-6}$
$11_{9,2;7}$	$12_{10,3;7}$	96250	91993	84638	66512	43750	$11_{2,9;-7}$	$12_{3,10;-7}$
$3_{0,3;-3}$	$4_{1,4;-3}$	25000	29584	32533	34083	35000	$3_{3,0;3}$	$4_{4,1;3}$
$4_{1,3;-2}$	$5_{2,4;-2}$	21000	23919	28748	33165	36000	$4_{3,1;2}$	$5_{4,2;2}$
$5_{2,3;-1}$	$6_{3,4;-1}$	30000	24633	26305	32338	37500	$5_{3,2;1}$	$6_{4,3;1}$
$6_{3,3;0}$	$7_{4,4;0}$	39286	31500	26801	31500	39286	$6_{3,3;0}$	$7_{4,4;0}$
$7_{4,3;1}$	$8_{5,4;1}$	48750	41277	31054	31018	41250	$7_{3,4;-1}$	$8_{4,5;-1}$
$8_{5,3;2}$	$9_{6,4;2}$	58333	51336	39046	31553	43333	$8_{3,5;-2}$	$9_{4,6;-2}$
$9_{6,3;3}$	$10_{7,4;3}$	68000	61325	49147	33704	45500	$9_{3,6;-3}$	$10_{4,7;-3}$
$10_{7,3;4}$	$11_{8,4;4}$	77727	71271	59638	37919	47727	$10_{3,7;-4}$	$11_{4,8;-4}$
$11_{8,3;5}$	$12_{9,4;5}$	87500	81200	70013	44472	50000	$11_{3,8;-5}$	$12_{4,9;-5}$
$4_{0,4;-4}$	$5_{1,5;-4}$	30000	39100	42585	44117	45000	$4_{4,0;4}$	$5_{5,1;4}$
$5_{1,4;-3}$	$6_{2,5;-3}$	23333	30161	38409	43122	45833	$5_{4,1;3}$	$6_{5,2;3}$
$6_{2,4;-2}$	$7_{3,5;-2}$	32143	27060	34093	42259	47143	$6_{4,2;2}$	$7_{5,3;2}$
$7_{3,4;-1}$	$8_{4,5;-1}$	41250	31018	31054	41277	48750	$7_{4,3;1}$	$8_{5,4;1}$
$8_{4,4;0}$	$9_{5,5;0}$	50556	40057	31211	40057	50556	$8_{4,4;0}$	$9_{5,5;0}$
$9_{5,4;1}$	$10_{6,5;1}$	60000	50269	35484	38709	52500	$9_{4,5;-1}$	$10_{5,6;-1}$
$10_{6,4;2}$	$11_{7,5;2}$	69546	60393	43709	37729	54546	$10_{4,6;-2}$	$11_{5,7;-2}$
$11_{7,4;3}$	$12_{8,5;3}$	79167	70407	54102	37878	56667	$11_{4,7;-3}$	$12_{5,8;-3}$
$5_{0,5;-5}$	$6_{1,6;-5}$	35000	49126	52653	54140	55000	$5_{5,0;5}$	$6_{6,1;5}$
$6_{1,5;-4}$	$7_{2,6;-4}$	25714	38383	48508	53091	55714	$6_{5,1;4}$	$7_{6,2;4}$
$7_{2,5;-3}$	$8_{3,6;-3}$	34375	31293	43935	52226	56875	$7_{5,2;3}$	$8_{6,3;3}$
$8_{3,5;-2}$	$9_{4,6;-2}$	43333	31553	39046	51336	58333	$8_{5,3;2}$	$9_{6,4;2}$
$9_{4,5;-1}$	$10_{5,6;-1}$	52500	38709	35484	50269	60000	$9_{5,4;1}$	$10_{6,5;1}$
$10_{5,5;0}$	$11_{6,6;0}$	61818	48913	35365	48913	61818	$10_{5,5;0}$	$11_{6,6;0}$
$11_{6,5;1}$	$12_{7,6;1}$	71250	59273	39679	47228	63750	$11_{5,6;-1}$	$12_{6,7;-1}$
$6_{0,6;-6}$	$7_{1,7;-6}$	40000	59250	62702	64155	65000	$6_{6,0;6}$	$7_{7,1;6}$
$7_{1,6;-5}$	$8_{2,7;-5}$	28125	48001	58609	63059	65625	$7_{6,1;5}$	$8_{7,2;5}$
$8_{2,6;-4}$	$9_{3,7;-4}$	36667	37664	54199	62172	66667	$8_{6,2;4}$	$9_{7,3;4}$
$9_{3,6;-3}$	$10_{4,7;-3}$	45500	33704	49147	61325	68000	$9_{6,3;3}$	$10_{7,4;3}$
$10_{4,6;-2}$	$11_{5,7;-2}$	54546	37729	43709	60393	69546	$10_{6,4;2}$	$11_{7,5;2}$
$11_{5,6;-1}$	$12_{6,7;-1}$	63750	47228	39679	59273	71250	$11_{6,5;1}$	$12_{7,6;1}$
$7_{0,7;-7}$	$8_{1,8;-7}$	45000	69364	72737	74165	75000	$7_{7,0;7}$	$8_{8,1;7}$
$8_{1,7;-6}$	$9_{2,8;-6}$	30556	58192	68678	73030	75556	$8_{7,1;6}$	$9_{8,2;6}$
$9_{2,7;-5}$	$10_{3,8;-5}$	39000	46127	64411	72110	76500	$9_{7,2;5}$	$10_{8,3;5}$
$10_{3,7;-4}$	$11_{4,8;-4}$	47727	37919	59638	71271	77727	$10_{7,3;4}$	$11_{8,4;4}$
$11_{4,7;-3}$	$12_{5,8;-3}$	56667	37878	54102	70407	79167	$11_{7,4;3}$	$12_{8,5;3}$
$8_{0,8;-8}$	$9_{1,9;-8}$	50000	79453	82763	84173	85000	$8_{8,0;8}$	$9_{9,1;8}$
$9_{1,8;-7}$	$10_{2,9;-7}$	33000	68479	78720	83002	85500	$9_{8,1;7}$	$10_{9,2;7}$
$10_{2,8;-6}$	$11_{3,9;-6}$	41364	56030	74550	82050	86364	$10_{8,2;6}$	$11_{9,3;6}$
$11_{3,8;-5}$	$12_{4,9;-5}$	50000	44472	70013	81200	87500	$11_{8,3;5}$	$12_{9,4;5}$

TABLE VI.—*Continued.*

Sub-branch ${}^{b,e}R_{1,1}$	${}^{b,o}P_{\bar{1},\bar{1}}$	∓1	∓0.5	κ 0	±0.5	±1	Sub-branch ${}^{b,e}R_{1,1}$	${}^{b,o}P_{\bar{1},\bar{1}}$
$9_{0,9;-9}$	$10_{1,10;-9}$	55000	89522	92782	94179	95000	$9_{9,0;9}$	$10_{10,1;9}$
$10_{1,9;-8}$	$11_{2,10;-8}$	35454	78723	88749	92979	95455	$10_{9,1;8}$	$11_{10,2;8}$
$11_{2,9;-7}$	$12_{3,10;-7}$	43750	66512	84638	91993	96250	$11_{9,2;7}$	$12_{10,3;7}$
$10_{0,10;-10}$	$11_{1,11;-10}$	60000	99576	102798	104184	105000	$10_{10,0;10}$	$11_{11,1;10}$
$11_{1,10;-9}$	$12_{2,11;-9}$	37917	88911	98767	102958	105416	$11_{10,1;9}$	$12_{11,2;9}$
$11_{0,11;-11}$	$12_{1,12;-11}$	65000	109620	112810	114188	115000	$11_{11,0;11}$	$12_{12,1;11}$
${}^{b,o}R_{\bar{1},1}$	${}^{b,e}P_{1,\bar{1}}$	∓1	∓0.5	0	±0.5	±1	${}^{b,o}R_{1,\bar{1}}$	${}^{b,e}P_{\bar{1},1}$
$1_{1,1;0}$	$2_{0,2;-2}$	5000	7226	10000	12774	15000	$1_{1,1;0}$	$2_{2,0;2}$
$2_{1,2;-1}$	$3_{0,3;-3}$	10000	16667	21498	23874	25000	$2_{2,1;1}$	$3_{3,0;3}$
$3_{1,3;-2}$	$4_{0,4;-4}$	15000	27406	32266	34065	35000	$3_{3,1;2}$	$4_{4,0;4}$
$4_{1,4;-3}$	$5_{0,5;-5}$	20000	38266	42535	44115	45000	$4_{4,1;3}$	$5_{5,0;5}$
$5_{1,5;-4}$	$6_{0,6;-6}$	25000	48829	52643	54140	55000	$5_{5,1;4}$	$6_{6,0;6}$
$6_{1,6;-5}$	$7_{0,7;-7}$	30000	59146	62700	64155	65000	$6_{6,1;5}$	$7_{7,0;7}$
$7_{1,7;-6}$	$8_{0,8;-8}$	35000	69327	72736	74165	75000	$7_{7,1;6}$	$8_{8,0;8}$
$8_{1,8;-7}$	$9_{0,9;-9}$	40000	79440	82762	84173	85000	$8_{8,1;7}$	$9_{9,0;9}$
$9_{1,9;-8}$	$10_{0,10;-10}$	45000	89517	92782	94179	95000	$9_{9,1;8}$	$10_{10,0;10}$
$10_{1,10;-9}$	$11_{0,11;-11}$	50000	99574	102798	104184	105000	$10_{10,1;9}$	$11_{11,0;11}$
$11_{1,11;-10}$	$12_{0,12;-12}$	55000	109619	112810	114188	115000	$11_{11,1;10}$	$12_{12,0;12}$
$2_{2,1;1}$	$3_{1,2;-1}$	1667	2792	5168	10000	16667	$2_{1,2;-1}$	$3_{2,1;1}$
$3_{2,2;0}$	$4_{1,3;-2}$	3750	7602	15000	22398	26250	$3_{2,2;0}$	$4_{3,1;2}$
$4_{2,3;-1}$	$5_{1,4;-3}$	6000	14796	26797	33039	36000	$4_{3,2;1}$	$5_{4,1;3}$
$5_{2,4;-2}$	$6_{1,5;-4}$	8333	24389	37946	43109	45833	$5_{4,2;2}$	$6_{5,1;4}$
$6_{2,5;-3}$	$7_{1,6;-5}$	10714	35443	48405	53090	55714	$6_{5,2;3}$	$7_{6,1;5}$
$7_{2,6;-4}$	$8_{1,7;-6}$	13125	46736	58587	63059	65625	$7_{6,2;4}$	$8_{7,1;6}$
$8_{2,7;-5}$	$9_{1,8;-7}$	15556	57689	68672	73029	75556	$8_{7,2;5}$	$9_{8,1;7}$
$9_{2,8;-6}$	$10_{1,9;-8}$	18000	68283	78719	83002	85500	$9_{8,2;6}$	$10_{9,1;8}$
$10_{2,9;-7}$	$11_{1,10;-9}$	20455	78648	88749	92979	95455	$10_{9,2;7}$	$11_{10,1;9}$
$11_{2,10;-8}$	$12_{1,11;-10}$	22917	88882	98767	102958	105416	$11_{10,2;8}$	$12_{11,1;10}$
$3_{3,1;2}$	$4_{2,2;0}$	1250	1537	2692	6941	18750	$3_{1,3;-2}$	$4_{2,2;0}$
$4_{3,2;1}$	$5_{2,3;-1}$	3000	4022	8877	19900	28000	$4_{2,3;-1}$	$5_{3,2;1}$
$5_{3,3;0}$	$6_{2,4;-2}$	5000	7698	19335	31792	37500	$5_{3,3;0}$	$6_{4,2;2}$
$6_{3,4;-1}$	$7_{2,5;-3}$	7143	13138	31685	42193	47143	$6_{4,3;1}$	$7_{5,2;3}$
$7_{3,5;-2}$	$8_{2,6;-4}$	9375	20912	43306	52219	56875	$7_{5,3;2}$	$8_{6,2;4}$
$8_{3,6;-3}$	$9_{2,7;-5}$	11667	31041	54046	62172	66667	$8_{6,3;3}$	$9_{7,2;5}$
$9_{3,7;-4}$	$10_{2,8;-6}$	14000	42620	64375	72111	76500	$9_{7,3;4}$	$10_{8,2;6}$
$10_{3,8;-5}$	$11_{2,9;-7}$	16364	54434	74542	82050	86364	$10_{8,3;5}$	$11_{9,2;7}$
$11_{3,9;-6}$	$12_{2,10;-8}$	18750	65840	84638	91993	96250	$11_{9,3;6}$	$12_{10,2;8}$
$4_{4,1;3}$	$5_{3,2;1}$	1000	1162	1666	4522	21000	$4_{1,4;-3}$	$5_{2,3;-1}$
$5_{4,2;2}$	$6_{3,3;0}$	2500	2920	5238	16127	30000	$5_{2,4;-2}$	$6_{3,3;0}$
$6_{4,3;1}$	$7_{3,4;-1}$	4286	5148	12183	29700	39286	$6_{3,4;-1}$	$7_{4,3;1}$
$7_{4,4;0}$	$8_{3,5;-2}$	6250	8062	23299	41022	48750	$7_{4,4;0}$	$8_{5,3;2}$
$8_{4,5;-1}$	$9_{3,6;-3}$	8333	12161	36249	51302	58333	$8_{5,4;1}$	$9_{6,3;3}$
$9_{4,6;-2}$	$10_{3,7;-4}$	10500	18094	48371	61321	68000	$9_{6,4;2}$	$10_{7,3;4}$
$10_{4,7;-3}$	$11_{3,8;-5}$	12727	26418	59438	71271	77727	$10_{7,4;3}$	$11_{8,3;5}$
$11_{4,8;-4}$	$12_{3,9;-6}$	15000	37104	69962	81200	87500	$11_{8,4;4}$	$12_{9,3;6}$
$5_{5,1;4}$	$6_{4,2;2}$	833	966	1253	2984	23333	$5_{1,5;-4}$	$6_{2,4;-2}$
$6_{5,2;3}$	$7_{4,3;1}$	2143	2475	3549	11918	32143	$6_{2,5;-3}$	$7_{3,4;-1}$
$7_{5,3;2}$	$8_{4,4;0}$	3750	4309	7685	26263	41250	$7_{3,5;-2}$	$8_{4,4;0}$
$8_{5,4;1}$	$9_{4,5;-1}$	5556	6389	15266	39231	50556	$8_{4,5;-1}$	$9_{5,4;1}$
$9_{5,5;0}$	$10_{4,6;-2}$	7500	8819	27015	50150	60000	$9_{5,5;0}$	$10_{6,4;2}$
$10_{5,6;-1}$	$11_{4,7;-3}$	9545	11954	40562	60377	69546	$10_{6,5;1}$	$11_{7,4;3}$
$11_{5,7;-2}$	$12_{4,8;-4}$	11667	16365	53190	70405	79167	$11_{7,5;2}$	$12_{8,4;4}$
$6_{6,1;5}$	$7_{5,2;3}$	714	829	1052	2102	25714	$6_{1,6;-5}$	$7_{2,5;-3}$
$7_{6,2;4}$	$8_{5,3;2}$	1875	2170	2825	8386	34375	$7_{2,6;-4}$	$8_{3,5;-2}$
$8_{6,3;3}$	$9_{5,4;1}$	3333	3839	5485	21522	43333	$8_{3,6;-3}$	$9_{4,5;-1}$
$9_{6,4;2}$	$10_{5,5;0}$	5000	5717	10057	36378	52500	$9_{4,6;-2}$	$10_{5,5;0}$
$10_{6,5;1}$	$11_{5,6;-1}$	6818	7736	18198	48537	61818	$10_{5,6;-1}$	$11_{6,5;1}$
$11_{6,6;0}$	$12_{5,7;-2}$	8750	9912	30549	59217	71250	$11_{6,6;0}$	$12_{7,5;2}$

TABLE VI.—*Continued.*

Sub-branch ${}^{b,o}R\bar{1},1$	${}^{b,e}P1,\bar{1}$	κ ∓1	∓0.5	0	±0.5	±1	Sub-branch ${}^{b,o}R1,\bar{1}$	${}^{b,e}P\bar{1},1$
$7_{7,1;6}$	$8_{6,2;4}$	625	726	918	1615	28125	$7_{1,7;-6}$	$8_{2,6;-4}$
$8_{7,2;5}$	$9_{6,3;3}$	1667	1932	2461	5953	36667	$8_{2,7;-5}$	$9_{3,6;-3}$
$9_{7,3;4}$	$10_{6,4;2}$	3000	3467	4517	16387	45500	$9_{3,7;-4}$	$10_{4,6;-2}$
$10_{7,4;3}$	$11_{6,5;1}$	4545	5226	7432	32088	54546	$10_{4,7;-3}$	$11_{5,6;-1}$
$11_{7,5;2}$	$12_{6,6;0}$	6250	7134	12369	46152	63750	$11_{5,7;-2}$	$12_{6,6;0}$
$8_{8,1;7}$	$9_{7,2;5}$	556	645	816	1342	30556	$8_{1,8;-7}$	$9_{2,7;-5}$
$9_{8,2;6}$	$10_{7,3;4}$	1500	1741	2210	4454	39000	$9_{2,8;-6}$	$10_{3,7;-4}$
$10_{8,3;5}$	$11_{7,4;3}$	2727	3158	4030	12003	47727	$10_{3,8;-5}$	$11_{4,7;-3}$
$11_{8,4;4}$	$12_{7,5;2}$	4167	4808	6264	26503	56667	$11_{4,8;-4}$	$12_{5,7;-2}$
$9_{9,1;8}$	$10_{8,2;6}$	500	581	734	1176	33000	$9_{1,9;-8}$	$10_{2,8;-6}$
$10_{9,2;7}$	$11_{8,3;5}$	1364	1583	2009	3581	41364	$10_{2,9;-7}$	$11_{3,8;-5}$
$11_{9,3;6}$	$12_{8,4;4}$	2500	2898	3688	8874	50000	$11_{3,9;-6}$	$12_{4,8;-4}$
$10_{10,1;9}$	$11_{9,2;7}$	455	528	667	1059	35454	$10_{1,10;-9}$	$11_{2,9;-7}$
$11_{10,2;8}$	$12_{9,3;6}$	1250	1452	1841	3076	43750	$11_{2,10;-8}$	$12_{3,9;-6}$
$11_{11,1;10}$	$12_{10,2;8}$	417	484	611	967	37917	$11_{1,11;-10}$	$12_{2,10;-8}$

D. b prolate-or-oblate sub-branches.

${}^{b,e}R\bar{1},3$	${}^{b,o}P1,\bar{3}$	∓1	∓0.5	0	±0.5	±1	${}^{b,e}R3,\bar{1}$	${}^{b,o}P\bar{3},1$
$2_{2,0;2}$	$3_{1,3;-2}$	1667	1097	486	101		$2_{0,2;-2}$	$3_{3,1;2}$
$3_{2,1;1}$	$4_{1,4;-3}$	3750	1452	297	32		$3_{1,2;-1}$	$4_{4,1;3}$
$4_{2,2;0}$	$5_{1,5;-4}$	6000	1159	140	14		$4_{2,2;0}$	$5_{5,1;4}$
$5_{2,3;-1}$	$6_{1,6;-5}$	8333	758	77	9		$5_{3,2;1}$	$6_{6,1;5}$
$6_{2,4;-2}$	$7_{1,7;-6}$	10714	481	54	7		$6_{4,2;2}$	$7_{7,1;6}$
$7_{2,5;-3}$	$8_{1,8;-7}$	13125	323	42	6		$7_{5,2;3}$	$8_{8,1;7}$
$8_{2,6;-4}$	$9_{1,9;-8}$	15556	238	35	5		$8_{6,2;4}$	$9_{9,1;8}$
$9_{2,7;-5}$	$10_{1,10;-9}$	18000	191	30	4		$9_{7,2;5}$	$10_{10,1;9}$
$10_{2,8;-6}$	$11_{1,11;-10}$	20455	163	27	4		$10_{8,2;6}$	$11_{11,1;10}$
$11_{2,9;-7}$	$12_{1,12;-11}$	22917	144	24	3		$11_{9,2;7}$	$12_{12,1;11}$
$3_{3,0;3}$	$4_{2,3;-1}$	1250	1323	1091	416		$3_{0,3;-3}$	$4_{3,2;1}$
$4_{3,1;2}$	$5_{2,4;-2}$	3000	2753	1252	163		$4_{1,3;-2}$	$5_{4,2;2}$
$5_{3,2;1}$	$6_{2,5;-3}$	5000	3538	737	62		$5_{2,3;-1}$	$6_{5,2;3}$
$6_{3,3;0}$	$7_{2,6;-4}$	7143	3362	375	35		$6_{3,3;0}$	$7_{6,2;4}$
$7_{3,4;-1}$	$8_{2,7;-5}$	9375	2573	219	26		$7_{4,3;1}$	$8_{7,2;5}$
$8_{3,5;-2}$	$9_{2,8;-6}$	11667	1754	155	20		$8_{5,3;2}$	$9_{8,2;6}$
$9_{3,6;-3}$	$10_{2,9;-7}$	14000	1174	124	17		$9_{6,3;3}$	$10_{9,2;7}$
$10_{3,7;-4}$	$11_{2,10;-8}$	16364	826	104	14		$10_{7,3;4}$	$11_{10,2;8}$
$11_{3,8;-5}$	$12_{2,11;-9}$	18750	628	90	12		$11_{8,3;5}$	$12_{11,2;9}$
$4_{4,0;4}$	$5_{3,3;0}$	1000	1144	1259	855		$4_{0,4;-4}$	$5_{3,3;0}$
$5_{4,1;3}$	$6_{3,4;-1}$	2500	2771	2305	514		$5_{1,4;-3}$	$6_{4,3;1}$
$6_{4,2;2}$	$7_{3,5;-2}$	4286	4433	2107	189		$6_{2,4;-2}$	$7_{5,3;2}$
$7_{4,3;1}$	$8_{3,6;-3}$	6250	5663	1258	92		$7_{3,4;-1}$	$8_{6,3;3}$
$8_{4,4;0}$	$9_{3,7;-4}$	8333	6007	676	62		$8_{4,4;0}$	$9_{7,3;4}$
$9_{4,5;-1}$	$10_{3,8;-5}$	10500	5335	411	47		$9_{5,4;1}$	$10_{8,3;5}$
$10_{4,6;-2}$	$11_{3,9;-6}$	12727	4082	298	38		$10_{6,4;2}$	$11_{9,3;6}$
$11_{4,7;-3}$	$12_{3,10;-7}$	15000	2866	241	32		$11_{7,4;3}$	$12_{10,3;7}$
$5_{5,0;5}$	$6_{4,3;1}$	833	965	1174	1186		$5_{0,5;-5}$	$6_{3,4;-1}$
$6_{5,1;4}$	$7_{4,4;0}$	2143	2461	2707	1158		$6_{1,5;-4}$	$7_{4,4;0}$
$7_{5,2;3}$	$8_{4,5;-1}$	3750	4229	3560	488		$7_{2,5;-3}$	$8_{5,4;1}$
$8_{5,3;2}$	$9_{4,6;-2}$	5556	6040	3008	209		$8_{3,5;-2}$	$9_{6,4;2}$
$9_{5,4;1}$	$10_{4,7;-3}$	7500	7603	1831	125		$9_{4,5;-1}$	$10_{7,4;3}$
$10_{5,5;0}$	$11_{4,8;-4}$	9545	8531	1026	92		$10_{5,5;0}$	$11_{8,4;4}$
$11_{5,6;-1}$	$12_{4,9;-5}$	11667	8452	644	73		$11_{6,5;1}$	$12_{9,4;5}$
$6_{6,0;6}$	$7_{5,3;2}$	714	829	1039	1321		$6_{0,6;-6}$	$7_{3,5;-2}$
$7_{6,1;5}$	$8_{5,4;1}$	1875	2169	2640	1942		$7_{1,6;-5}$	$8_{4,5;-1}$
$8_{6,2;4}$	$9_{5,5;0}$	3333	3830	4213	1086		$8_{2,6;-4}$	$9_{5,5;0}$
$9_{6,3;3}$	$10_{5,6;-1}$	5000	5676	4833	447		$9_{3,6;-3}$	$10_{6,5;1}$
$10_{6,4;2}$	$11_{5,7;-2}$	6818	7575	3937	234		$10_{4,6;-2}$	$11_{7,5;2}$
$11_{6,5;1}$	$12_{5,8;-3}$	8750	9349	2441	161		$11_{5,6;-1}$	$12_{8,5;3}$

TABLE VI.—*Continued.*

Sub-branch ${}^{b,e}R\bar{1},3$	${}^{b,o}P1,\bar{3}$	∓ 1	∓ 0.5	κ 0	± 0.5	± 1	Sub-branch ${}^{b,e}R3,\bar{1}$	${}^{b,o}P\bar{3},1$
$7_{7,0;7}$	$8_{6,3;3}$	625	726	916	1313		$7_{0,7;-7}$	$8_{3,6;-3}$
$8_{7,1;6}$	$9_{6,4;2}$	1667	1932	2426	2561		$8_{1,7;-6}$	$9_{4,6;-2}$
$9_{7,2;5}$	$10_{6,5;1}$	3000	3466	4214	2032		$9_{2,7;-5}$	$10_{5,6;-1}$
$10_{7,3;4}$	$11_{6,6;0}$	4545	5221	5738	917		$10_{3,7;-4}$	$11_{6,6;0}$
$11_{7,4;3}$	$12_{6,7;-1}$	6250	7114	6113	427		$11_{4,7;-3}$	$12_{7,6;1}$
$8_{8,0;8}$	$9_{7,3;4}$	556	645	816	1238		$8_{0,8;-8}$	$9_{3,7;-4}$
$9_{8,1;7}$	$10_{7,4;3}$	1500	1741	2204	2870		$9_{1,8;-7}$	$10_{4,7;-3}$
$10_{8,2;6}$	$11_{7,5;2}$	2727	3158	3967	3126		$10_{2,8;-6}$	$11_{5,7;-2}$
$11_{8,3;5}$	$12_{7,6;1}$	4167	4807	5836	1752		$11_{3,8;-5}$	$12_{6,7;-1}$
$9_{9,0;9}$	$10_{8,3;5}$	500	581	734	1143		$9_{0,9;-9}$	$10_{3,8;-5}$
$10_{9,1;8}$	$11_{8,4;4}$	1364	1583	2008	2924		$10_{1,9;-8}$	$11_{4,8;-4}$
$11_{9,2;7}$	$12_{8,5;3}$	2500	2898	3676	4014		$11_{2,9;-7}$	$12_{5,8;-3}$
$10_{10,0;10}$	$11_{9,3;6}$	455	528	667	1049		$10_{0,10;-10}$	$11_{3,9;-6}$
$11_{10,1;9}$	$12_{9,4;5}$	1250	1452	1841	2831		$11_{1,10;-9}$	$12_{4,9;-5}$
$11_{11,0;11}$	$12_{10,3;7}$	417	484	611	964		$11_{0,11;-11}$	$12_{3,10;-7}$

TABLE VII. Forbidden sub-branches.

A. *a* and *c* sub-branches.

Sub-branch ${}^{c,o}Q\bar{3},2$	${}^{c,e}Q3,\bar{2}$	∓ 1	∓ 0.5	κ 0	± 0.5	± 1	Sub-branch ${}^{a,o}Q2,\bar{3}$	${}^{a,e}Q\bar{2},3$
$3_{3,1;2}$	$3_{0,3;-3}$		104	169	69		$3_{1,3;-2}$	$3_{3,0;3}$
$4_{3,2;1}$	$4_{0,4;-4}$		356	283	68		$4_{2,3;-1}$	$4_{4,0;4}$
$5_{3,3;0}$	$5_{0,5;-5}$		621	286	53		$5_{3,3;0}$	$5_{5,0;5}$
$6_{3,4;-1}$	$6_{0,6;-6}$		773	250	43		$6_{4,3;1}$	$6_{6,0;6}$
$7_{3,5;-2}$	$7_{0,7;-7}$		809	213	35		$7_{5,3;2}$	$7_{7,0;7}$
$8_{3,6;-3}$	$8_{0,8;-8}$		774	183	30		$8_{6,3;3}$	$8_{8,0;8}$
$9_{3,7;-4}$	$9_{0,9;-9}$		712	160	26		$9_{7,3;4}$	$9_{9,0;9}$
$10_{3,8;-5}$	$10_{0,10;-10}$		645	141	23		$10_{8,3;5}$	$10_{10,0;10}$
$11_{3,9;-6}$	$11_{0,11;-11}$		584	127	21		$11_{9,3;6}$	$11_{11,0;11}$
$12_{3,10;-7}$	$12_{0,12;-12}$		531	115	19		$12_{10,3;7}$	$12_{12,0;12}$
$4_{4,1;3}$	$4_{1,3;-2}$		31	164	153		$4_{1,4;-3}$	$4_{3,1;2}$
$5_{4,2;2}$	$5_{1,4;-3}$		174	504	193		$5_{2,4;-2}$	$5_{4,1;3}$
$6_{4,3;1}$	$6_{1,5;-4}$		527	708	163		$6_{3,4;-1}$	$6_{5,1;4}$
$7_{4,4;0}$	$7_{1,6;-5}$		1057	716	131		$7_{4,4;0}$	$7_{6,1;5}$
$8_{4,5;-1}$	$8_{1,7;-6}$		1557	642	108		$8_{5,4;1}$	$8_{7,1;6}$
$9_{4,6;-2}$	$9_{1,8;-7}$		1855	559	92		$9_{6,4;2}$	$9_{8,1;7}$
$10_{4,7;-3}$	$10_{1,9;-8}$		1940	489	80		$10_{7,4;3}$	$10_{9,1;8}$
$11_{4,8;-4}$	$11_{1,10;-9}$		1888	432	71		$11_{8,4;4}$	$11_{10,1;9}$
$12_{4,9;-5}$	$12_{1,11;-10}$		1770	387	64		$12_{9,4;5}$	$12_{11,1;10}$
$5_{5,1;4}$	$5_{2,3;-1}$		9	79	191		$5_{1,5;-4}$	$5_{3,2;1}$
$6_{5,2;3}$	$6_{2,4;-2}$		52	413	342		$6_{2,5;-3}$	$6_{4,2;2}$
$7_{5,3;2}$	$7_{2,5;-3}$		187	919	325		$7_{3,5;-2}$	$7_{5,2;3}$
$8_{5,4;1}$	$8_{2,6;-4}$		515	1216	268		$8_{4,5;-1}$	$8_{6,2;4}$
$9_{5,5;0}$	$9_{2,7;-5}$		1123	1236	222		$9_{5,5;0}$	$9_{7,2;5}$
$10_{5,6;-1}$	$10_{2,8;-6}$		1924	1128	188		$10_{6,5;1}$	$10_{8,2;6}$
$11_{5,7;-2}$	$11_{2,9;-7}$		2650	999	163		$11_{7,5;2}$	$11_{9,2;7}$
$12_{5,8,-3}$	$12_{2,10;-8}$		3098	885	144		$12_{8,5;3}$	$12_{10,2;8}$
$6_{6,1;5}$	$6_{3,3;0}$		4	33	168		$6_{1,6;-5}$	$6_{3,3;0}$
$7_{6,2;4}$	$7_{3,4;-1}$		22	212	457		$7_{2,6;-4}$	$7_{4,3;1}$
$8_{6,3;3}$	$8_{3,5;-2}$		68	714	524		$8_{3,6;-3}$	$8_{5,3;2}$
$9_{6,4;2}$	$9_{3,6;-3}$		184	1385	456		$9_{4,6;-2}$	$9_{6,3;3}$
$10_{6,5;1}$	$10_{3,7;-4}$		445	1777	379		$10_{5,6;-1}$	$10_{7,3;4}$
$11_{6,6;0}$	$11_{3,8;-5}$		971	1816	320		$11_{6,6;0}$	$11_{8,3;5}$
$12_{6,7;-1}$	$12_{3,9;-6}$		1829	1681	277		$12_{7,6;1}$	$12_{9,3;6}$

TABLE VII.—*Continued.*

Sub-branch $^{c,o}Q\bar{3},2$	Sub-branch $^{c,e}Q3,\bar{2}$	∓1	∓0.5	κ 0	±0.5	±1	Sub-branch $^{a,o}Q2,\bar{3}$	Sub-branch $^{a,e}Q\bar{2},3$
$7_{7,1;6}$	$7_{4,3;1}$		3	17	114		$7_{1,7;-6}$	$7_{3,4;-1}$
$8_{7,2;5}$	$8_{4,4;0}$		13	98	480		$8_{2,7;-5}$	$8_{4,4;0}$
$9_{7,3;4}$	$9_{4,5;-1}$		36	385	714		$9_{3,7;-4}$	$9_{5,4;1}$
$10_{7,4;3}$	$10_{4,6;-2}$		84	1053	686		$10_{4,7;-3}$	$10_{6,4;2}$
$11_{7,5;2}$	$11_{4,7;-3}$		183	1885	584		$11_{5,7;-2}$	$11_{7,4;3}$
$12_{7,6;1}$	$12_{4,8;-4}$		384	2375	493		$12_{6,7;-1}$	$12_{8,4;4}$
$8_{8,1;7}$	$8_{5,3;2}$		2	10	69		$8_{1,8;-7}$	$8_{3,5;-2}$
$9_{8,2;6}$	$9_{5,4;1}$		8	52	403		$9_{2,8;-6}$	$9_{4,5;-1}$
$10_{8,3;5}$	$10_{5,5;0}$		23	190	830		$10_{3,8;-5}$	$10_{5,5;0}$
$11_{8,4;4}$	$11_{5,6;-1}$		52	588	931		$11_{4,8;-4}$	$11_{6,5;1}$
$12_{8,5;3}$	$12_{5,7;-2}$		102	1419	832		$12_{5,8;-3}$	$12_{7,5;2}$
$9_{9,1;8}$	$9_{6,3;3}$		1	7	41		$9_{1,9;-8}$	$9_{3,6;-3}$
$10_{9,2;7}$	$10_{6,4;2}$		6	34	282		$10_{2,9;-7}$	$10_{4,6;-2}$
$11_{9,3;6}$	$11_{6,5;1}$		17	106	817		$11_{3,9;-6}$	$11_{5,6;-1}$
$12_{9,4;5}$	$12_{6,6;0}$		36	304	1141		$12_{4,9;-5}$	$12_{6,6;0}$
$10_{10,1;9}$	$10_{7,3;4}$		1	5	25		$10_{1,10;-9}$	$10_{3,7;-4}$
$11_{10,2;8}$	$11_{7,4;3}$		5	24	180		$11_{2,10;-8}$	$11_{4,7;-3}$
$12_{10,3;7}$	$12_{7,5;2}$		12	70	677		$12_{3,10;-7}$	$12_{5,7;-2}$
$11_{11,1;10}$	$11_{8,3;5}$		1	4	17		$11_{1,11;-10}$	$11_{3,8;-5}$
$12_{11,2;9}$	$12_{8,4;4}$		4	19	112		$12_{2,11;-9}$	$12_{4,8;-4}$
$12_{12,1;11}$	$12_{9,3;6}$		0	3	13		$12_{1,12;-11}$	$12_{3,9;-6}$
$^{c,e}Q\bar{3},4$	$^{c,o}Q3,\bar{4}$	∓1	∓0.5	0	±0.5	±1	$^{a,e}Q4,\bar{3}$	$^{a,o}Q\bar{4},3$
$4_{4,0;4}$	$4_{1,4;-3}$		8	10	2		$4_{0,4;-4}$	$4_{4,1;3}$
$5_{4,1;3}$	$5_{1,5;-4}$		24	14	1		$5_{1,4;-3}$	$5_{5,1;4}$
$6_{4,2;2}$	$6_{1,6;-5}$		42	9	0		$6_{2,4;-2}$	$6_{6,1;5}$
$7_{4,3;1}$	$7_{1,7;-6}$		51	2	0		$7_{3,4;-1}$	$7_{7,1;6}$
$8_{4,4;0}$	$8_{1,8;-7}$		48	1	0		$8_{4,4;0}$	$8_{8,1;7}$
$9_{4,5;-1}$	$9_{1,9;-8}$		35	1	0		$9_{5,4;1}$	$9_{9,1;8}$
$10_{4,6;-2}$	$10_{1,10;-9}$		22	0	0		$10_{6,4;2}$	$10_{10,1;9}$
$11_{4,7;-3}$	$11_{1,11;-10}$		12	0	0		$11_{7,4;3}$	$11_{11,1;10}$
$12_{4,8;-4}$	$12_{1,12;-11}$		7	0	0		$12_{8,4;4}$	$12_{12,1;11}$
$5_{5,0;5}$	$5_{2,4;-2}$		7	17	7		$5_{0,5;-5}$	$5_{4,2;2}$
$6_{5,1;4}$	$6_{2,5;-3}$		27	39	4		$6_{1,5;-4}$	$6_{5,2;3}$
$7_{5,2;3}$	$7_{2,6;-4}$		62	44	1		$7_{2,5;-3}$	$7_{6,2;4}$
$8_{5,3;2}$	$8_{2,7;-5}$		106	28	0		$8_{3,5;-2}$	$8_{7,2;5}$
$9_{5,4;1}$	$9_{2,8;-6}$		142	13	0		$9_{4,5;-1}$	$9_{8,2;6}$
$10_{5,5;0}$	$10_{2,9;-7}$		154	5	0		$10_{5,5;0}$	$10_{9,2;7}$
$11_{5,6;-1}$	$11_{2,10;-8}$		137	3	0		$11_{6,5;1}$	$11_{10,2;8}$
$12_{5,7;-2}$	$12_{2,11;-9}$		102	1	0		$12_{7,5;2}$	$12_{11,2;9}$
$6_{6,0;6}$	$6_{3,4;-1}$		4	16	14		$6_{0;6;-6}$	$6_{4,3;1}$
$7_{6,1;5}$	$7_{3,5;-2}$		19	53	15		$7_{1,6;-5}$	$7_{5,3;2}$
$8_{6,2;4}$	$8_{3,6;-3}$		50	88	5		$8_{2,6;-4}$	$8_{6,3;3}$
$9_{6,3;3}$	$9_{3,7;-4}$		102	88	2		$9_{3,6;-3}$	$9_{7,3;4}$
$10_{6,4;2}$	$10_{3,8;-5}$		170	56	1		$10_{4,6;-2}$	$10_{8,3;5}$
$11_{6,5;1}$	$11_{3,9;-6}$		240	27	0		$11_{5,6;-1}$	$11_{9,3;6}$
$12_{6,6;0}$	$12_{3,10;-7}$		289	12	0		$12_{6,6;0}$	$12_{10,3;7}$
$7_{7,0;7}$	$7_{4,4;0}$		3	13	19		$7_{0,7;-7}$	$7_{4,4;0}$
$8_{7,1;6}$	$8_{4,5;-1}$		12	51	30		$8_{1,7;-6}$	$8_{5,4;1}$
$9_{7,2;5}$	$9_{4,6;-2}$		34	108	17		$9_{2,7;-5}$	$9_{6,4;2}$
$10_{7,3;4}$	$10_{4,7;-3}$		74	152	5		$10_{3,7;-4}$	$10_{7,4;3}$
$11_{7,4;3}$	$11_{4,8;-4}$		137	144	2		$11_{4,7;-3}$	$11_{8,4;4}$
$12_{7,5;2}$	$12_{4,9;-5}$		223	93	1		$12_{5,7;-2}$	$12_{9,4;5}$
$8_{8,0;8}$	$8_{5,4;1}$		2	10	20		$8_{0,8;-8}$	$8_{4,5;-1}$
$9_{8,1;7}$	$9_{5,5;0}$		8	41	46		$9_{1,8;-7}$	$9_{5,5;0}$
$10_{8,2;6}$	$10_{5,6;-1}$		23	102	39		$10_{2,8;-6}$	$10_{6,5;1}$
$11_{8,3;5}$	$11_{5,7;-2}$		51	179	15		$11_{3,8;-5}$	$11_{7,5;2}$
$12_{8,4;4}$	$12_{5,8;-3}$		97	229	5		$12_{4,8;-4}$	$12_{8,5;3}$

TABLE VII.—*Continued.*

Sub-branch ${}^{c,c}Q\bar{3},4$	${}^{c,o}Q3,\bar{4}$	∓ 1	∓ 0.5	κ 0	± 0.5	± 1	Sub-branch ${}^{a,c}Q4,\bar{3}$	${}^{a,o}Q\bar{4},3$
$9_{9,0;9}$	$9_{6,4;2}$		1	7	19		$9_{0,9;-9}$	$9_{4,6;-2}$
$10_{9,1;8}$	$10_{6,5;1}$		6	32	56		$10_{1,9;-8}$	$10_{5,6;-1}$
$11_{9,2;7}$	$11_{6,6;0}$		17	84	67		$11_{2,9;-7}$	$11_{6,6;0}$
$12_{9,3;6}$	$12_{6,7;-1}$		36	169	37		$12_{3,9;-6}$	$12_{7,6;1}$
$10_{10,0;10}$	$10_{7,4;3}$		1	5	17		$10_{0,10;-10}$	$10_{4,7;-3}$
$11_{10,1;9}$	$11_{7,5;2}$		5	24	59		$11_{1,10;-9}$	$11_{5,7;-2}$
$12_{10,2;8}$	$12_{7,6;1}$		12	66	93		$12_{2,10;-8}$	$12_{6,7;-1}$
$11_{11,0;11}$	$11_{8,4;4}$		1	4	14		$11_{0,11;-11}$	$11_{4,8;-4}$
$12_{11,1;10}$	$12_{8,5;3}$		4	19	57		$12_{1,11;-10}$	$12_{5,8;-3}$
$12_{12,0;12}$	$12_{9,4;5}$		0	3	12		$12_{0,12;-12}$	$12_{4,9;-5}$
${}^{c,c}R3,\bar{2}$	${}^{c,e}P\bar{3},2$	∓ 1	∓ 0.5	0	± 0.5	± 1	${}^{a,e}R\bar{2},3$	${}^{a,e}P2,\bar{3}$
$2_{0,2;-2}$	$3_{3,0;3}$		75	215	138		$2_{2,0;2}$	$3_{0,3,-3}$
$3_{0,3;-3}$	$4_{3,1;2}$		294	313	51		$3_{3,0;3}$	$4_{1,3;-2}$
$4_{0,4;-4}$	$5_{3,2;1}$		528	176	17		$4_{4,0;4}$	$5_{2,3;-1}$
$5_{0,5,-5}$	$6_{3,3;0}$		558	79	9		$5_{5,0;5}$	$6_{3,3;0}$
$6_{0,6;-6}$	$7_{3,4;-1}$		418	41	5		$6_{6,0;6}$	$7_{4,3;1}$
$7_{0,7;-7}$	$8_{3,5;-2}$		263	26	4		$7_{7,0;7}$	$8_{5,3;2}$
$8_{0,8;-8}$	$9_{3,6;-3}$		159	19	3		$8_{8,0;8}$	$9_{6,3;3}$
$9_{0,9;-9}$	$10_{3,7;-4}$		102	14	2		$9_{9,0;9}$	$10_{7,3;4}$
$10_{0,10;-10}$	$11_{3,8;-5}$		70	11	2		$10_{10,0;10}$	$11_{8,3;5}$
$11_{0,11;-11}$	$12_{3,9;-6}$		53	9	1		$11_{11,0;11}$	$12_{9,3;6}$
$3_{1,2;-1}$	$4_{4,0;4}$		24	146	272		$3_{2,1;1}$	$4_{0,4;-4}$
$4_{1,3;-2}$	$5_{4,1;3}$		122	538	212		$4_{3,1;2}$	$5_{1,4;-3}$
$5_{1,4;-3}$	$6_{4,2;2}$		377	665	76		$5_{4,1;3}$	$6_{2,4;-2}$
$6_{1,5;-4}$	$7_{4,3;1}$		803	409	34		$6_{5,1;4}$	$7_{3,4;-1}$
$7_{1,6;-5}$	$8_{4,4;0}$		1171	206	21		$7_{6,1;5}$	$8_{4,4;0}$
$8_{1,7;-6}$	$9_{4,5;-1}$		1200	115	15		$8_{7,1;6}$	$9_{5,4;1}$
$9_{1,8;-7}$	$10_{4,6;-2}$		938	76	11		$9_{8,1;7}$	$10_{6,4;2}$
$10_{1,9;-8}$	$11_{4,7;-3}$		631	57	9		$10_{9,1;8}$	$11_{7,4;3}$
$11_{1,10;-9}$	$12_{4,8;-4}$		409	45	7		$11_{10,1;9}$	$12_{8,4;4}$
$4_{2,2;0}$	$5_{5,0;5}$		11	70	262		$4_{2,2;0}$	$5_{0,5;-5}$
$5_{2,3;-1}$	$6_{5,1;4}$		46	359	464		$5_{3,2;1}$	$6_{1,5;-4}$
$6_{2,4;-2}$	$7_{5,2;3}$		142	894	220		$6_{4,2;2}$	$7_{2,5;-3}$
$7_{2,5;-3}$	$8_{5,3;2}$		364	1038	92		$7_{5,2;3}$	$8_{3,5;-2}$
$8_{2,6;-4}$	$9_{5,4;1}$		793	675	52		$8_{6,2;4}$	$9_{4,5;-1}$
$9_{2,7;-5}$	$10_{5,5;0}$		1395	365	36		$9_{7,2;5}$	$10_{5,5;0}$
$10_{2,8;-6}$	$11_{5,6;-1}$		1869	215	27		$10_{8,2;6}$	$11_{6,5;1}$
$11_{2,9;-7}$	$12_{5,7;-2}$		1887	148	21		$11_{9,2;7}$	$12_{7,5;2}$
$5_{3,2;1}$	$6_{6,0;6}$		7	39	184		$5_{2,3;-1}$	$6_{0,6;-6}$
$6_{3,3;0}$	$7_{6,1;5}$		27	187	624		$6_{3,3;0}$	$7_{1,6;-5}$
$7_{3,4;-1}$	$8_{6,2;4}$		69	610	487		$7_{4,3;1}$	$8_{2,6;-4}$
$8_{3,5;-2}$	$9_{6,3;3}$		157	1272	210		$8_{5,3;2}$	$9_{3,6;-3}$
$9_{3,6;-3}$	$10_{6,4;2}$		336	1426	108		$9_{6,3;3}$	$10_{4,6;-2}$
$10_{3,7;-4}$	$11_{6,5;1}$		684	963	71		$10_{7,3;4}$	$11_{5,6;-1}$
$11_{3,8;-5}$	$12_{6,6;0}$		1276	548	53		$11_{8,3;5}$	$12_{6,6;0}$
$6_{4,2;2}$	$7_{7,0;7}$		5	27	119		$6_{2,4;-2}$	$7_{0,7;-7}$
$7_{4,3;1}$	$8_{7,1;6}$		19	110	574		$7_{3,4;-1}$	$8_{1,7;-6}$
$8_{4,4;0}$	$9_{7,2;5}$		46	338	816		$8_{4,4;0}$	$9_{2,7;-5}$
$9_{4,5;-1}$	$10_{7,3;4}$		94	887	435		$9_{5,4;1}$	$10_{3,7;-4}$
$10_{4,6;-2}$	$11_{7,4;3}$		176	1662	205		$10_{6,4;2}$	$11_{4,7;-3}$
$11_{4,7;-3}$	$12_{7,5;2}$		321	1825	126		$11_{7,4;3}$	$12_{5,7;-2}$
$7_{5,2;3}$	$8_{8,0;8}$		4	21	81		$7_{2,5;-3}$	$8_{0,8;-8}$
$8_{5,3;2}$	$9_{8,1;7}$		15	78	424		$8_{3,5;-2}$	$9_{1,8;-7}$
$9_{5,4;1}$	$10_{8,2;6}$		36	206	995		$9_{4,5;-1}$	$10_{2,8;-6}$
$10_{5,5;0}$	$11_{8,3;5}$		69	514	790		$10_{5,5;0}$	$11_{3,8;-5}$
$11_{5,6;-1}$	$12_{8,4;4}$		121	1183	381		$11_{6,5;1}$	$12_{4,8;-4}$

TABLE VII.—*Continued.*

Sub-branch $^{c,e}R3,\bar{2}$	$^{c,e}P\bar{3},2$	∓1	∓0.5	κ 0	±0.5	±1	Sub-branch $^{a,e}R\bar{2},3$	$^{a,e}P2,\bar{3}$
$8_{6,2;4}$	$9_{9,0;9}$		4	18	60		$8_{2,6;-4}$	$9_{0,9;-9}$
$9_{6,3;3}$	$10_{9,1;8}$		13	62	292		$9_{3,6;-3}$	$10_{1,9;-8}$
$10_{6,4;2}$	$11_{9,2;7}$		29	149	910		$10_{4,6;-2}$	$11_{2,9;-7}$
$11_{6,5;1}$	$12_{9,3;6}$		55	324	1182		$11_{5,6;-1}$	$12_{3,9;-6}$
$9_{7,2;5}$	$10_{10,0;10}$		3	15	48		$9_{2,7;-5}$	$10_{0,10;-10}$
$10_{7,3;4}$	$11_{10,1;9}$		11	52	207		$10_{3,7;-4}$	$11_{1,10;-9}$
$11_{7,4;3}$	$12_{10,2;8}$		24	121	694		$11_{4,7;-3}$	$12_{2,10;-8}$
$10_{8,2;6}$	$11_{11,0;11}$		3	13	41		$10_{2,8;-6}$	$11_{0,11;-11}$
$11_{8,3;5}$	$12_{11,1;10}$		9	45	158		$11_{3,8;-5}$	$12_{1,11;-10}$
$11_{9,2;7}$	$12_{12,0;12}$		2	12	36		$11_{2,9;-7}$	$12_{0,12;-12}$
$^{c,o}R3,\bar{2}$	$^{c,o}P\bar{3},2$	∓1	∓0.5	0	±0.5	±1	$^{a,o}R\bar{2},3$	$^{a,o}P2,\bar{3}$
$3_{1,3;-2}$	$4_{4,1;3}$		10	21	13		$3_{3,1;2}$	$4_{1,4;-3}$
$4_{1,4;-3}$	$5_{4,2;2}$		31	38	12		$4_{4,1;3}$	$5_{2,4;-2}$
$5_{1,5;-4}$	$6_{4,3;1}$		56	39	8		$5_{5,1;4}$	$6_{3,4;-1}$
$6_{1,6;-5}$	$7_{4,4;0}$		73	32	5		$6_{6,1;5}$	$7_{4,4;0}$
$7_{1,7;-6}$	$8_{4,5;-1}$		80	24	4		$7_{7,1;6}$	$8_{5,4;1}$
$8_{1,8;-7}$	$9_{4,6;-2}$		77	18	3		$8_{8,1;7}$	$9_{6,4;2}$
$9_{1,9;-8}$	$10_{4,7;-3}$		68	14	2		$9_{9,1;8}$	$10_{7,4;3}$
$10_{1,10;-9}$	$11_{4,8;-4}$		58	11	2		$10_{10,1;9}$	$11_{8,4;4}$
$11_{1,11;-10}$	$12_{4,9;-5}$		49	9	1		$11_{11,1;10}$	$12_{9,4;5}$
$4_{2,3;-1}$	$5_{5,1;4}$		9	31	32		$4_{3,2;1}$	$5_{1,5;-4}$
$5_{2,4;-2}$	$6_{5,2;3}$		33	79	39		$5_{4,2;2}$	$6_{2,5;-3}$
$6_{2,5;-3}$	$7_{5,3;2}$		73	108	30		$6_{5,2;3}$	$7_{3,5;-2}$
$7_{2,6;-4}$	$8_{5,4;1}$		124	108	21		$7_{6,2;4}$	$8_{4,5;-1}$
$8_{2,7;-5}$	$9_{5,5;0}$		172	91	15		$8_{7,2;5}$	$9_{5,5;0}$
$9_{2,8;-6}$	$10_{5,6;-1}$		205	72	11		$9_{8,2;6}$	$10_{6,5;1}$
$10_{2,9;-7}$	$11_{5,7;-2}$		216	56	9		$10_{9,2;7}$	$11_{7,5;2}$
$11_{2,10;-8}$	$12_{5,8;-3}$		209	45	7		$11_{10,2;8}$	$12_{8,5;3}$
$5_{3,3;0}$	$6_{6,1;5}$		7	30	46		$5_{3,3;0}$	$6_{1,6;-5}$
$6_{3,4;-1}$	$7_{6,2;4}$		25	92	76		$6_{4,3;1}$	$7_{2,6;-4}$
$7_{3,5;-2}$	$8_{6,3;3}$		60	163	67		$7_{5,3;2}$	$8_{3,6;-3}$
$8_{3,6;-3}$	$9_{6,4;2}$		115	202	50		$8_{6,3;3}$	$9_{4,6;-2}$
$9_{3,7;-4}$	$10_{6,5;1}$		187	199	36		$9_{7,3;4}$	$10_{5,6;-1}$
$10_{3,8;-5}$	$11_{6,6;0}$		267	171	27		$10_{8,3;5}$	$11_{6,6;0}$
$11_{3,9;-6}$	$12_{6,7;-1}$		337	139	21		$11_{9,3;6}$	$12_{7,6;1}$
$6_{4,3;1}$	$7_{7,1;6}$		5	25	53		$6_{3,4;-1}$	$7_{1,7;-6}$
$7_{4,4;0}$	$8_{7,2;5}$		19	86	110		$7_{4,4;0}$	$8_{2,7;-5}$
$8_{4,5;-1}$	$9_{7,3;4}$		46	177	118		$8_{5,4;1}$	$9_{3,7;-4}$
$9_{4,6;-2}$	$10_{7,4;3}$		89	268	94		$9_{6,4;2}$	$10_{4,7;-3}$
$10_{4,7;-3}$	$11_{7,5;2}$		154	316	70		$10_{7,4;3}$	$11_{5,7;-2}$
$11_{4,8;-4}$	$12_{7,6;1}$		241	309	53		$11_{8,4;4}$	$12_{6,7;-1}$
$7_{5,3;2}$	$8_{8,1;7}$		4	21	53		$7_{3,5;-2}$	$8_{1,8;-7}$
$8_{5,4;1}$	$9_{8,2;6}$		15	73	134		$8_{4,5;-1}$	$9_{2,8;-6}$
$9_{5,5;0}$	$10_{8,3;5}$		35	163	173		$9_{5,5;0}$	$10_{3,8;-5}$
$10_{5,6;-1}$	$11_{8,4;4}$		69	281	155		$10_{6,5;1}$	$11_{4,8;-4}$
$11_{5,7;-2}$	$12_{8,5;3}$		119	390	120		$11_{7,5;2}$	$12_{5,8;-3}$
$8_{6,3;3}$	$9_{9,1;8}$		4	18	49		$8_{3,6;-3}$	$9_{1,9;-8}$
$9_{6,4;2}$	$10_{9,2;7}$		13	61	143		$9_{4,6;-2}$	$10_{2,9;-7}$
$10_{6,5;1}$	$11_{9,3;6}$		29	140	219		$10_{5,6;-1}$	$11_{3,9;-6}$
$11_{6,6;0}$	$12_{9,4;5}$		54	258	224		$11_{6,6;0}$	$12_{4,9;-5}$
$9_{7,3;4}$	$10_{10,1;9}$		3	15	44		$9_{3,7;-4}$	$10_{1,10;-9}$
$10_{7,4;3}$	$11_{10,2;8}$		11	52	140		$10_{4,7;-3}$	$11_{2,10;-8}$
$11_{7,5;2}$	$12_{10,3;7}$		24	119	249		$11_{5,7;-2}$	$12_{3,10;-7}$
$10_{8,3;5}$	$11_{11,1;10}$		3	13	40		$10_{3,8;-5}$	$11_{1,11;-10}$
$11_{8,4;4}$	$12_{11,2;9}$		9	45	131		$11_{4,8;-4}$	$12_{2,11;-9}$
$11_{9,3;6}$	$12_{12,1;11}$		2	12	36		$11_{3,9;-6}$	$12_{1,12;-11}$

TABLE VII.—*Continued.*

Sub-branch $^{c,e}R\bar{3},4$	$^{c,e}P3,\bar{4}$	κ ∓ 1	∓ 0.5	0	± 0.5	± 1	Sub-branch $^{a,e}R4,\bar{3}$	$^{a,e}P\bar{4},3$
$3_{3,0;3}$	$4_{0,4;-4}$		28	18	2		$3_{0,3;-3}$	$4_{4,0;4}$
$4_{3,1;2}$	$5_{0,5;-5}$		78	17	0		$4_{1,3;-2}$	$5_{5,0;5}$
$5_{3,2;1}$	$6_{0,6;-6}$		107	8	0		$5_{2,3;-1}$	$6_{6,0;6}$
$6_{3,3;0}$	$7_{0,7;-7}$		96	3	0		$6_{3,3;0}$	$7_{7,0;7}$
$7_{3,4;-1}$	$8_{0,8;-8}$		65	2	0		$7_{4,3;1}$	$8_{8,0;8}$
$8_{3,5;-2}$	$9_{0,9;-9}$		39	1	0		$8_{5,3;2}$	$9_{9,0;9}$
$9_{3,6;-3}$	$10_{0,10;-10}$		23	1	0		$9_{6,3;3}$	$10_{10,0;10}$
$10_{3,7;-4}$	$11_{0,11,-11}$		14	1	0		$10_{7,3;4}$	$11_{11,0;11}$
$11_{3,8;-5}$	$12_{0,12,-12}$		9	0	0		$11_{8,3;5}$	$12_{12,0;12}$
$4_{4,0;4}$	$5_{1,4;-3}$		11	31	7		$4_{0,4;-4}$	$5_{4,1;3}$
$5_{4,1;3}$	$6_{1,5;-4}$		58	62	3		$5_{1,4;-3}$	$6_{5,1;4}$
$6_{4,2;2}$	$7_{1,6;-5}$		152	51	1		$6_{2,4;-2}$	$7_{6,1;5}$
$7_{4,3;1}$	$8_{1,7;-6}$		252	25	0		$7_{3,4;-1}$	$8_{7,1;6}$
$8_{4,4;0}$	$9_{1,8;-7}$		290	11	0		$8_{4,4;0}$	$9_{8,1;7}$
$9_{4,5;-1}$	$10_{1,9;-8}$		250	6	0		$9_{5,4;1}$	$10_{9,1;8}$
$10_{4,6;-2}$	$11_{1,10;-9}$		175	4	0		$10_{6,4;2}$	$11_{10,1;9}$
$11_{4,7;-3}$	$12_{1,11;-10}$		109	3	0		$11_{7,4;3}$	$12_{11,1;10}$
$5_{5,0;5}$	$6_{2,4;-2}$		3	21	15		$5_{0;5;-5}$	$6_{4,2;2}$
$6_{5,1;4}$	$7_{2,5;-3}$		17	83	12		$6_{1,5;-4}$	$7_{5,2;3}$
$7_{5,2;3}$	$8_{2,6;-4}$		65	124	4		$7_{2,5;-3}$	$8_{6,2;4}$
$8_{5,3;2}$	$9_{2,7;-5}$		173	96	1		$8_{3,5;-2}$	$9_{7,2;5}$
$9_{5,4;1}$	$10_{2,8;-6}$		335	50	1		$9_{4,5;-1}$	$10_{8,2;6}$
$10_{5,5;0}$	$11_{2,9;-7}$		477	23	0		$10_{5,5;0}$	$11_{9,2;7}$
$11_{5,6;-1}$	$12_{2,10;-8}$		517	13	0		$11_{6,5;1}$	$12_{10,2;8}$
$6_{6,0;6}$	$7_{3,4;-1}$		1	9	21		$6_{0,6;-6}$	$7_{4,3;1}$
$7_{6,1;5}$	$8_{3,5;-2}$		5	59	28		$7_{1,6;-5}$	$8_{5,3;2}$
$8_{6,2;4}$	$9_{3,6;-3}$		20	151	12		$8_{2,6;-4}$	$9_{6,3;3}$
$9_{6,3;3}$	$10_{3,7;-4}$		60	198	4		$9_{3,6;-3}$	$10_{7,3;4}$
$10_{6,4;2}$	$11_{3,8;-5}$		155	151	2		$10_{4,6;-2}$	$11_{8,3;5}$
$11_{6,5;1}$	$12_{3,9;-6}$		329	81	1		$11_{5,6;-1}$	$12_{9,3;6}$
$7_{7,0;7}$	$8_{4,4;0}$		0	4	20		$7_{0,7;-7}$	$8_{4,4;0}$
$8_{7,1;6}$	$9_{4,5;-1}$		2	26	46		$8_{1,7;-6}$	$9_{5,4;1}$
$9_{7,2;5}$	$10_{4,6;-2}$		8	107	31		$9_{2,7;-5}$	$10_{6,4;2}$
$10_{7,3;4}$	$11_{4,7;-3}$		22	230	11		$10_{3,7;-4}$	$11_{7,4;3}$
$11_{7,4;3}$	$12_{4,8;-4}$		55	282	4		$11_{4,7;-3}$	$12_{8,4;4}$
$8_{8,0;8}$	$9_{5,4;1}$		0	2	15		$8_{0,8;-8}$	$9_{4,5;-1}$
$9_{8,1;7}$	$10_{5,5;0}$		1	12	56		$9_{1,8;-7}$	$10_{5,5;0}$
$10_{8,2;6}$	$11_{5,6;-1}$		4	54	59		$10_{2,8;-6}$	$11_{6,5;1}$
$11_{8,3;5}$	$12_{5,7;-2}$		11	165	27		$11_{3,8;-5}$	$12_{7,5;2}$
$9_{9,0;9}$	$10_{6,4;2}$		0	1	10		$9_{0,9;-9}$	$10_{4,6;-2}$
$10_{9,1;8}$	$11_{6,5;1}$		1	6	53		$10_{1,9;-8}$	$11_{5,6;-1}$
$11_{9,2;7}$	$12_{6,6;0}$		3	25	87		$11_{2,9;-7}$	$12_{6,6;0}$
$10_{10,0;10}$	$11_{7,4;3}$		0	1	5		$10_{0,10;-10}$	$11_{4,7;-3}$
$11_{10,1;9}$	$12_{7,5;2}$		1	4	41		$11_{1,10;-9}$	$12_{5,7;-2}$
$11_{11,0;11}$	$12_{8,4;4}$		0	0	3		$11_{0,11;-11}$	$12_{4,8;-4}$
$^{c,o}R\bar{3},4$	$^{c,o}P3,\bar{4}$	∓ 1	∓ 0.5	0	± 0.5	± 1	$^{a,o}R4,\bar{3}$	$^{a,o}P\bar{4},3$
$4_{4,1;3}$	$5_{1,5;-4}$		2	1	0		$4_{1,4;-3}$	$5_{5,1;4}$
$5_{4,2;2}$	$6_{1,6;-5}$		5	2	0		$5_{2,4;-2}$	$6_{6,1;5}$
$6_{4,3;1}$	$7_{1,7;-6}$		8	2	0		$6_{3,4;-1}$	$7_{7,1;6}$
$7_{4,4;0}$	$8_{1,8;-7}$		11	1	0		$7_{4,4;0}$	$8_{8,1;7}$
$8_{4,5;-1}$	$9_{1,9;-8}$		12	1	0		$8_{5,4;1}$	$9_{9,1;8}$
$9_{4,6;-2}$	$10_{1,10;-9}$		11	1	0		$9_{6,4;2}$	$10_{10,1;9}$
$10_{4,7;-3}$	$11_{1,11;-10}$		9	1	0		$10_{7,4;3}$	$11_{11,1;10}$
$11_{4,8;-4}$	$12_{1,12;-11}$		8	0	0		$11_{8,4;4}$	$12_{12,1;11}$

TABLE VII.—*Continued.*

Sub-branch ${}^{c,o}R\bar{3},4$	${}^{c,o}P3,\bar{4}$	∓1	∓0.5	κ 0	±0.5	±1	Sub-branch ${}^{a,o}R4,\bar{3}$	${}^{a,o}P\bar{4},3$
$5_{5,1;4}$	$6_{2,5;-3}$		1	2	0		$5_{1,5;-4}$	$6_{5,2;3}$
$6_{5,2;3}$	$7_{2,6;-4}$		6	5	0		$6_{2,5;-3}$	$7_{6,2;4}$
$7_{5,3;2}$	$8_{2,7;-5}$		14	6	0		$7_{3,5;-2}$	$8_{7,2;5}$
$8_{5,4;1}$	$9_{2,8;-6}$		23	6	0		$8_{4,5;-1}$	$9_{8,2;6}$
$9_{5,5;0}$	$10_{2,9;-7}$		32	4	0		$9_{5,5;0}$	$10_{9,2;7}$
$10_{5,6;-1}$	$11_{2,10;-8}$		36	3	0		$10_{6,5;1}$	$11_{10,2;8}$
$11_{5,7;-2}$	$12_{2,11;-9}$		37	3	0		$11_{7,5;2}$	$12_{11,2;9}$
$6_{6,1;5}$	$7_{3,5;-2}$		1	2	1		$6_{1,6;-5}$	$7_{5,3;2}$
$7_{6,2;4}$	$8_{3,6;-3}$		4	8	1		$7_{2,6;-4}$	$8_{6,3;3}$
$8_{6,3;3}$	$9_{3,7;-4}$		11	13	1		$8_{3,6;-3}$	$9_{7,3;4}$
$9_{6,4;2}$	$10_{3,8;-5}$		23	14	1		$9_{4,6;-2}$	$10_{8,3;5}$
$10_{6,5;1}$	$11_{3,9;-6}$		39	13	0		$10_{5,6;-1}$	$11_{9,3;6}$
$11_{6,6;0}$	$12_{3,10;-7}$		56	10	0		$11_{6,6;0}$	$12_{10,3;7}$
$7_{7,1;6}$	$8_{4,5;-1}$		0	2	2		$7_{1,7;-6}$	$8_{5,4;1}$
$8_{7,2;5}$	$9_{4,6;-2}$		2	8	3		$8_{2,7;-5}$	$9_{6,4;2}$
$9_{7,3;4}$	$10_{4,7;-3}$		7	17	2		$9_{3,7;-4}$	$10_{7,4;3}$
$10_{7,4;3}$	$11_{4,8;-4}$		16	24	1		$10_{4,7;-3}$	$11_{8,4;4}$
$11_{7,5;2}$	$12_{4,9;-5}$		32	25	1		$11_{5,7;-2}$	$12_{9,4;5}$
$8_{8,1;7}$	$9_{5,5;0}$		0	1	2		$8_{1,8;-7}$	$9_{5,5;0}$
$9_{8,2;6}$	$10_{5,6;-1}$		1	6	4		$9_{2,8;-6}$	$10_{6,5;1}$
$10_{8,3;5}$	$11_{5,7;-2}$		4	17	4		$10_{3,8;-5}$	$11_{7,5;2}$
$11_{8,4;4}$	$12_{5,8;-3}$		10	29	3		$11_{4,8;-4}$	$12_{8,5;3}$
$9_{9,1;8}$	$10_{6,5;1}$		0	1	2		$9_{1,9;-8}$	$10_{5,6;-1}$
$10_{9,2;7}$	$11_{6,6;0}$		1	5	5		$10_{2,9;-7}$	$11_{6,6;0}$
$11_{9,3;6}$	$12_{6,7;-1}$		3	14	7		$11_{3,9;-6}$	$12_{7,6;1}$
$10_{10,1;9}$	$11_{7,5;2}$		0	1	2		$10_{1,10;-9}$	$11_{5,7;-2}$
$11_{10,2;8}$	$12_{7,6;1}$		1	3	6		$11_{2,10;-8}$	$12_{6,7;-1}$
$11_{11,1;10}$	$12_{8,5;3}$		0	0	2		$11_{1,11;-10}$	$12_{5,8;-3}$

B. *b* sub-branches.

${}^{b,e}Q\bar{3},3$	${}^{b,e}Q3,\bar{3}$	∓1	∓0.5	0	±0.5	±1	${}^{b,e}Q3,\bar{3}$	${}^{b,e}Q\bar{3},3$
$3_{3,0;3}$	$3_{0,3;-3}$		138	297	138		$3_{0,3;-3}$	$3_{3,0;3}$
$4_{3,1;2}$	$4_{0,4;-4}$		445	319	41		$4_{1,3;-2}$	$4_{4,0;4}$
$5_{3,2;1}$	$5_{0,5;-5}$		674	158	13		$5_{2,3;-1}$	$5_{5,0;5}$
$6_{3,3;0}$	$6_{0,6;-6}$		640	67	6		$6_{3,3;0}$	$6_{6,0;6}$
$7_{3,4;-1}$	$7_{0,7;-7}$		450	33	4		$7_{4,3;1}$	$7_{7,0;7}$
$8_{3,5;-2}$	$8_{0,8;-8}$		273	21	3		$8_{5,3;2}$	$8_{8,0;8}$
$9_{3,6;-3}$	$9_{0,9;-9}$		162	15	2		$9_{6,3;3}$	$9_{9,0;9}$
$10_{3,7;-4}$	$10_{0,10;-10}$		101	11	1		$10_{7,3;4}$	$10_{10,0;10}$
$11_{3,8;-5}$	$11_{0,11;-11}$		69	9	1		$11_{8,3;5}$	$11_{11,0;11}$
$12_{3,9;-6}$	$12_{0,12;-12}$		52	7	1		$12_{9,3;6}$	$12_{12,0;12}$
$4_{4,0;4}$	$4_{1,3;-2}$		41	319	445		$4_{0,4;-4}$	$4_{3,1;2}$
$5_{4,1;3}$	$5_{1,4;-3}$		230	846	230		$5_{1,4;-3}$	$5_{4,1;3}$
$6_{4,2;2}$	$6_{1,5;-4}$		684	793	70		$6_{2,4;-2}$	$6_{5,1;4}$
$7_{4,3;1}$	$7_{1,6;-5}$		1287	422	29		$7_{3,4;-1}$	$7_{6,1;5}$
$8_{4,4;0}$	$8_{1,7;-6}$		1640	197	17		$8_{4,4;0}$	$8_{7,1;6}$
$9_{4,5;-1}$	$9_{1,8;-7}$		1513	105	11		$9_{5,4;1}$	$9_{8,1;7}$
$10_{4,6;-2}$	$10_{1,9;-8}$		1105	67	8		$10_{6,4;2}$	$10_{9,1;8}$
$11_{4,7;-3}$	$11_{1,10;-9}$		713	49	6		$11_{7,4;3}$	$11_{10,1;9}$
$12_{4,8;-4}$	$12_{1,11;-10}$		449	38	5		$12_{8,4;4}$	$12_{11,1;10}$
$5_{5,0;5}$	$5_{2,3;-1}$		13	158	674		$5_{0,5;-5}$	$5_{3,2;1}$
$6_{5,1;4}$	$6_{2,4;-2}$		70	793	684		$6_{1,5;-4}$	$6_{4,2;2}$
$7_{5,2;3}$	$7_{2,5;-3}$		248	1513	248		$7_{2,5;-3}$	$7_{5,2;3}$
$8_{5,3;2}$	$8_{2,6;-4}$		681	1360	91		$8_{3,5;-2}$	$8_{6,2;4}$
$9_{5,4;1}$	$9_{2,7;-5}$		1444	763	48		$9_{4,5;-1}$	$9_{7,2;5}$
$10_{5,5;0}$	$10_{2,8;-6}$		2306	380	31		$10_{5,5;0}$	$10_{8,2;6}$
$11_{5,6;-1}$	$11_{2,9;-7}$		2749	212	22		$11_{6,5;1}$	$11_{9,2;7}$
$12_{5,7;-2}$	$12_{2,10;-8}$		2519	141	16		$12_{7,5;2}$	$12_{10,2;8}$

TABLE VII.—*Continued.*

Sub-branch				κ			Sub-branch	
${}^{b,e}Q\bar{3},3$	${}^{b,e}Q3,\bar{3}$	∓1	∓0.5	0	±0.5	±1	${}^{b,e}Q3,\bar{3}$	${}^{b,e}Q\bar{3},3$
$6_{6,0;6}$	$6_{3,3;0}$		6	67	640		$6_{0,6;-6}$	$6_{3,3;0}$
$7_{6,1;5}$	$7_{3,4;-1}$		29	422	1287		$7_{1,6;-5}$	$7_{4,3;1}$
$8_{6,2;4}$	$8_{3,5;-2}$		91	1360	681		$8_{2,6;-4}$	$8_{5,3;2}$
$9_{6,3;3}$	$9_{3,6;-3}$		245	2252	245		$9_{3,6;-3}$	$9_{6,3;3}$
$10_{6,4;2}$	$10_{3,7;-4}$		592	1993	112		$10_{4,6;-2}$	$10_{7,3;4}$
$11_{6,5;1}$	$11_{3,8;-5}$		1278	1165	69		$11_{5,6;-1}$	$11_{8,3;5}$
$12_{6,6;0}$	$12_{3,9;-6}$		2337	609	48		$12_{6,6;0}$	$12_{9,3;6}$
$7_{7,0;7}$	$7_{4,3;1}$		4	33	450		$7_{0,7;-7}$	$7_{3,4;-1}$
$8_{7,1;6}$	$8_{4,4;0}$		17	197	1640		$8_{1,7;-6}$	$8_{4,4;0}$
$9_{7,2;5}$	$9_{4,5;-1}$		48	763	1444		$9_{2,7;-5}$	$9_{5,4;1}$
$10_{7,3;4}$	$10_{4,6;-2}$		112	1993	592		$10_{3,7;-4}$	$10_{6,4;2}$
$11_{7,4;3}$	$11_{4,7;-3}$		244	3040	244		$11_{4,7;-3}$	$11_{7,4;3}$
$12_{7,5;2}$	$12_{4,8;-4}$		512	2675	136		$12_{5,7;-2}$	$12_{8,4;4}$
$8_{8,0;8}$	$8_{5,3;2}$		3	21	273		$8_{0,8;-8}$	$8_{3,5;-2}$
$9_{8,1;7}$	$9_{5,4;1}$		11	105	1513		$9_{1,8;-7}$	$9_{4,5;-1}$
$10_{8,2;6}$	$10_{5,5;0}$		31	380	2306		$10_{2,8;-6}$	$10_{5,5;0}$
$11_{8,3;5}$	$11_{5,6;-1}$		69	1165	1278		$11_{3,8;-5}$	$11_{6,5;1}$
$12_{8,4;4}$	$12_{5,7;-2}$		136	2675	512		$12_{4,8;-4}$	$12_{7,5;2}$
$9_{9,0;9}$	$9_{6,3;3}$		2	15	162		$9_{0,9;-9}$	$9_{3,6;-3}$
$10_{9,1;8}$	$10_{6,4;2}$		8	67	1105		$10_{1,9;-8}$	$10_{4,6;-2}$
$11_{9,2;7}$	$11_{6,5;1}$		22	212	2749		$11_{2,9;-7}$	$11_{5,6;-1}$
$12_{9,3;6}$	$12_{6,6;0}$		48	609	2337		$12_{3,9;-6}$	$12_{6,6;-0}$
$10_{10,0;10}$	$10_{7,3;4}$		1	11	101		$10_{0,10;-10}$	$10_{3,7;-4}$
$11_{10,1;9}$	$11_{7,4;3}$		6	49	713		$11_{1,10;-9}$	$11_{4,7;-3}$
$12_{10,2;8}$	$12_{7,5;2}$		16	141	2519		$12_{2,10;-8}$	$12_{5,7;-2}$
$11_{11,0;11}$	$11_{8,3;5}$		1	9	69		$11_{0,11;-11}$	$11_{3,8;-5}$
$12_{11,1;10}$	$12_{8,4;4}$		5	38	449		$12_{1,11;-10}$	$12_{4,8;-4}$
$12_{12,0;12}$	$12_{9,3;6}$		1	7	52		$12_{0,12;-12}$	$12_{3,9;-6}$
${}^{b,o}Q\bar{3},3$	${}^{b,o}Q3,\bar{3}$	∓1	∓0.5	0	±0.5	±1	${}^{b,o}Q3,\bar{3}$	${}^{b,o}Q\bar{3},3$
$4_{4,1;3}$	$4_{1,4;-3}$		10	20	10		$4_{1,4;-3}$	$4_{4,1;3}$
$5_{4,2;2}$	$5_{1,5;-4}$		34	33	9		$5_{2,4;-2}$	$5_{5,1;4}$
$6_{4,3;1}$	$6_{1,6;-5}$		58	33	6		$6_{3,4;-1}$	$6_{6,1;5}$
$7_{4,4;0}$	$7_{1,7;-6}$		76	26	4		$7_{4,4;0}$	$7_{7,1;6}$
$8_{4,5;-1}$	$8_{1,8;-7}$		82	19	3		$8_{5,4;1}$	$8_{8,1;7}$
$9_{4,6;-2}$	$9_{1,9;-8}$		77	14	2		$9_{6,4;2}$	$9_{9,1;8}$
$10_{4,7;-3}$	$10_{1,10;-9}$		68	11	1		$10_{7,4;3}$	$10_{10,1;9}$
$11_{4,8;-4}$	$11_{1,11;-10}$		58	9	1		$11_{8,4;4}$	$11_{11,1;10}$
$12_{4,9;-5}$	$12_{1,12;-11}$		48	7	1		$12_{9,4;5}$	$12_{12,1;11}$
$5_{5,1;4}$	$5_{2,4;-2}$		9	33	34		$5_{1,5;-4}$	$5_{4,2;2}$
$6_{5,2;3}$	$6_{2,5;-3}$		36	83	36		$6_{2,5;-3}$	$6_{5,2;3}$
$7_{5,3;2}$	$7_{2,6;-4}$		84	108	25		$7_{3,5;-2}$	$7_{6,2;4}$
$8_{5,4;1}$	$8_{2,7;-5}$		144	102	16		$8_{4,5;-1}$	$8_{7,2;5}$
$9_{5,5;0}$	$9_{2,8;-6}$		199	83	11		$9_{5,5;0}$	$9_{8,2;6}$
$10_{5,6;-1}$	$10_{2,9;-7}$		233	63	8		$10_{6,5;1}$	$10_{9,2;7}$
$11_{5,7;-2}$	$11_{2,10;-8}$		241	48	6		$11_{7,5;2}$	$11_{10,2;8}$
$12_{5,8;-3}$	$12_{2,11;-9}$		228	38	5		$12_{8,5;3}$	$12_{11,2;9}$
$6_{6,1;5}$	$6_{3,4;-1}$		6	33	58		$6_{1,6;-5}$	$6_{4,3;1}$
$7_{6,2;4}$	$7_{3,5;-2}$		25	108	84		$7_{2,6;-4}$	$7_{5,3;2}$
$8_{6,3;3}$	$8_{3,6;-3}$		67	187	67		$8_{3,6;-3}$	$8_{6,3;3}$
$9_{6,4;2}$	$9_{3,7;-4}$		136	221	45		$9_{4,6;-2}$	$9_{7,3;4}$
$10_{6,5;1}$	$10_{3,8;-5}$		228	206	31		$10_{5,6;-1}$	$10_{8,3;5}$
$11_{6,6;0}$	$11_{3,9;-6}$		328	169	22		$11_{6,6;0}$	$11_{9,3;6}$
$12_{6,7;-1}$	$12_{3,10;-7}$		410	132	16		$12_{7,6;1}$	$12_{10,3;7}$

TABLE VII.—*Continued.*

Sub-branch				κ			Sub-branch	
${}^{b,o}Q_{\bar{3},3}$	${}^{b,o}Q_{3,\bar{3}}$	∓1	∓0.5	0	±0.5	±1	${}^{b,o}Q_{3,\bar{3}}$	${}^{b,o}Q_{\bar{3},3}$
$7_{7,1;6}$	$7_{4,4;0}$		4	26	76		$7_{1,7;-6}$	$7_{4,4;0}$
$8_{7,2;5}$	$8_{4,5;-1}$		16	102	144		$8_{2,7;-5}$	$8_{5,4;1}$
$9_{7,3;4}$	$9_{4,6;-2}$		45	221	136		$9_{3,7;-4}$	$9_{6,4;2}$
$10_{7,4;3}$	$10_{4,7;-3}$		98	327	98		$10_{4,7;-3}$	$10_{7,4;3}$
$11_{7,5;2}$	$11_{4,8;-4}$		183	367	68		$11_{5,7;-2}$	$11_{8,4;4}$
$12_{7,6;1}$	$12_{4,9;-5}$		299	340	48		$12_{6,7;-1}$	$12_{9,4;5}$
$8_{8,1;7}$	$8_{5,4;1}$		3	19	82		$8_{1,8;-7}$	$8_{4,5;-1}$
$9_{8,2;6}$	$9_{5,5;0}$		11	83	199		$9_{2,8;-6}$	$9_{5,5;0}$
$10_{8,3;5}$	$10_{5,6;-1}$		31	206	228		$10_{3,8;-5}$	$10_{6,5;1}$
$11_{8,4;4}$	$11_{5,7;-2}$		68	367	183		$11_{4,8;-4}$	$11_{7,5;2}$
$12_{8,5;3}$	$12_{5,8;-3}$		129	498	129		$12_{5,8;-3}$	$12_{8,5;3}$
$9_{9,1;8}$	$9_{6,4;2}$		2	14	77		$9_{1,9;-8}$	$9_{4,6;-2}$
$10_{9,2;7}$	$10_{6,5;1}$		8	63	233		$10_{2,9;-7}$	$10_{5,6;-1}$
$11_{9,3;6}$	$11_{6,6;0}$		22	169	328		$11_{3,9;-6}$	$11_{6,6;0}$
$12_{9,4;5}$	$12_{6,7;-1}$		48	340	299		$12_{4,9;-5}$	$12_{7,6;1}$
$10_{10,1;9}$	$10_{7,4;3}$		1	11	68		$10_{1,10;-9}$	$10_{4,7;-3}$
$11_{10,2;8}$	$11_{7,5;2}$		6	48	241		$11_{2,10;-8}$	$11_{5,7;-2}$
$12_{10,3;7}$	$12_{7,6;1}$		16	132	410		$12_{3,10;-7}$	$12_{6,7;-1}$
$11_{11,1;10}$	$11_{8,4;4}$		1	9	58		$11_{1,11;-10}$	$11_{4,8;-4}$
$12_{11,2;9}$	$12_{8,5;3}$		5	38	228		$12_{2,11;-9}$	$12_{5,8;-3}$
$12_{12,1;11}$	$12_{9,4;5}$		1	7	48		$12_{1,12;-11}$	$12_{4,9;-5}$
${}^{b,o}R_{\bar{3},3}$	${}^{b,e}P_{3,\bar{3}}$	∓1	∓0.5	0	±0.5	±1	${}^{b,o}R_{3,\bar{3}}$	${}^{b,e}P_{\bar{3},3}$
$3_{3,1;2}$	$4_{0,4;-4}$		38	41	13		$3_{1,3;-2}$	$4_{4,0;4}$
$4_{3,2;1}$	$5_{0,5;-5}$		111	62	12		$4_{2,3;-1}$	$5_{5,0;5}$
$5_{3,3;0}$	$6_{0,6;-6}$		175	59	9		$5_{3,3;0}$	$6_{6,0;6}$
$6_{3,4;-1}$	$7_{0,7;-7}$		206	50	7		$6_{4,3;1}$	$7_{7,0;7}$
$7_{3,5;-2}$	$8_{0,8;-8}$		209	42	6		$7_{5,3;2}$	$8_{8,0;8}$
$8_{3,6;-3}$	$9_{0,9;-9}$		195	35	5		$8_{6,3;3}$	$9_{9,0;9}$
$9_{3,7;-4}$	$10_{0,10;-10}$		177	30	4		$9_{7,3;4}$	$10_{10,0;10}$
$10_{3,8;-5}$	$11_{0,11;-11}$		158	27	4		$10_{8,3;5}$	$11_{11,0;11}$
$11_{3,9;-6}$	$12_{0,12;-12}$		142	24	3		$11_{9,3;6}$	$12_{12,0;12}$
$4_{4,1;3}$	$5_{1,4;-3}$		14	63	41		$4_{1,4;-3}$	$5_{4,1;3}$
$5_{4,2;2}$	$6_{1,5;-4}$		77	149	44		$5_{2,4;-2}$	$6_{5,1;4}$
$6_{4,3;1}$	$7_{1,6;-5}$		209	182	34		$6_{3,4;-1}$	$7_{6,1;5}$
$7_{4,4;0}$	$8_{1,7;-6}$		370	170	26		$7_{4,4;0}$	$8_{7,1;6}$
$8_{4,5;-1}$	$9_{1,8;-7}$		493	146	20		$8_{5,4;1}$	$9_{8,1;7}$
$9_{4,6;-2}$	$10_{1,9;-8}$		549	122	17		$9_{6,4;2}$	$10_{9,1;8}$
$10_{4,7;-3}$	$11_{1,10;-9}$		550	104	14		$10_{7,4;3}$	$11_{10,1;9}$
$11_{4,8;-4}$	$12_{1,11;-10}$		519	90	12		$11_{8,4;4}$	$12_{11,1;10}$
$5_{5,1;4}$	$6_{2,4;-2}$		3	43	71		$5_{1,5;-4}$	$6_{4,2;2}$
$6_{5,2;3}$	$7_{2,5;-3}$		23	175	97		$6_{2,5;-3}$	$7_{5,2;3}$
$7_{5,3;2}$	$8_{2,6;-4}$		87	305	80		$7_{3,5;-2}$	$8_{6,2;4}$
$8_{5,4;1}$	$9_{2,7;-5}$		234	347	61		$8_{4,5;-1}$	$9_{7,2;5}$
$9_{5,5;0}$	$10_{2,8;-6}$		466	324	47		$9_{5,5;0}$	$10_{8,2;6}$
$10_{5,6;-1}$	$11_{2,9;-7}$		715	279	38		$10_{6,5;1}$	$11_{9,2;7}$
$11_{5,7;-2}$	$12_{2,10;-8}$		896	237	32		$11_{7,5;2}$	$12_{10,2;8}$
$6_{6,1;5}$	$7_{3,4;-1}$		1	19	87		$6_{1,6;-5}$	$7_{4,3;1}$
$7_{6,2;4}$	$8_{3,5;-2}$		7	118	162		$7_{2,6;-4}$	$8_{5,3;2}$
$8_{6,3;3}$	$9_{3,6;-3}$		26	321	153		$8_{3,6;-3}$	$9_{6,3;3}$
$9_{6,4;2}$	$10_{3,7;-4}$		80	495	119		$9_{4,6;-2}$	$10_{7,3;4}$
$10_{6,5;1}$	$11_{3,8;-5}$		208	547	91		$10_{5,6;-1}$	$11_{8,3;5}$
$11_{6,6;0}$	$12_{3,9;-6}$		446	511	73		$11_{6,6;0}$	$12_{9,3;6}$
$7_{7,1;6}$	$8_{4,4;0}$		1	7	82		$7_{1,7;-6}$	$8_{4,4;0}$
$8_{7,2;5}$	$9_{4,5;-1}$		3	55	218		$8_{2,7;-5}$	$9_{5,4;1}$
$9_{7,3;4}$	$10_{4,6;-2}$		11	218	247		$9_{3,7;-4}$	$10_{6,4;2}$
$10_{7,4;3}$	$11_{4,7;-3}$		29	492	205		$10_{4,7;-3}$	$11_{7,4;3}$
$11_{7,5;2}$	$12_{4,8;-4}$		73	711	158		$11_{5,7;-2}$	$12_{8,4;4}$

TABLE VII.—*Continued.*

Sub-branch $^{b,o}R\bar{3},3$	$^{b,e}P3,\bar{3}$	∓ 1	∓ 0.5	κ 0	± 0.5	± 1	Sub-branch $^{b,o}R3,\bar{3}$	$^{b,e}P\bar{3},3$
$8_{8,1;7}$	$9_{5,4;1}$		0	4	62		$8_{1,8;-7}$	$9_{4,5;-1}$
$9_{8,2;6}$	$10_{5,5;0}$		2	24	241		$9_{2,8;-6}$	$10_{5,5;0}$
$10_{8,3;5}$	$11_{5,6;-1}$		6	108	346		$10_{3,8;-5}$	$11_{6,5;1}$
$11_{8,4;4}$	$12_{5,7;-2}$		14	336	319		$11_{4,8;-4}$	$12_{7,5;2}$
$9_{9,1;8}$	$10_{6,4;2}$		0	2	38		$9_{1,9;-8}$	$10_{4,6;-2}$
$10_{9,2;7}$	$11_{6,5;1}$		1	12	219		$10_{2,9;-7}$	$11_{5,6;-1}$
$11_{9,3;6}$	$12_{6,6;0}$		4	50	420		$11_{3,9;-6}$	$12_{6,6;0}$
$10_{10,1;9}$	$11_{7,4;3}$		0	1	22		$10_{1,10;-9}$	$11_{4,7;-3}$
$11_{10,2;8}$	$12_{7,5;2}$		1	7	165		$11_{2,10;-8}$	$12_{5,7;-2}$
$11_{11,1;10}$	$12_{8,4;4}$		0	1	12		$11_{1,11;-10}$	$12_{4,8;-4}$
$^{b,e}R\bar{3},5$	$^{b,o}P3,\bar{5}$	∓ 1	∓ 0.5	0	± 0.5	± 1	$^{b,e}R5,\bar{3}$	$^{b,o}P\bar{5},3$
$4_{4,0;4}$	$5_{1,5;-4}$		2	2	0		$4_{0,4;-4}$	$5_{5,1;4}$
$5_{4,1;3}$	$6_{1,6;-5}$		6	3	0		$5_{1,4;-3}$	$6_{6,1;5}$
$6_{4,2;2}$	$7_{1,7;-6}$		11	2	0		$6_{2,4;-2}$	$7_{7,1;6}$
$7_{4,3;1}$	$8_{1,8;-7}$		13	1	0		$7_{3,4;-1}$	$8_{8,1;7}$
$8_{4,4;0}$	$9_{1,9;-8}$		12	0	0		$8_{4,4;0}$	$9_{9,1;8}$
$9_{4,5;-1}$	$10_{1,10;-9}$		9	0	0		$9_{5,4;1}$	$10_{10,1;9}$
$10_{4,6;-2}$	$11_{1,11;-10}$		5	0	0		$10_{6,4;2}$	$11_{11,1;10}$
$11_{4,7;-3}$	$12_{1,12;-11}$		3	0	0		$11_{7,4;3}$	$12_{12,1;11}$
$5_{5,0;5}$	$6_{2,5;-3}$		2	4	2		$5_{0,5;-5}$	$6_{5,2;3}$
$6_{5,1;4}$	$7_{2,6;-4}$		8	9	1		$6_{1,5;-4}$	$7_{6,2;4}$
$7_{5,2;3}$	$8_{2,7;-5}$		18	10	0		$7_{2,5;-3}$	$8_{7,2;5}$
$8_{5,3;2}$	$9_{2,8;-6}$		30	6	0		$8_{3,5;-2}$	$9_{8,2;6}$
$9_{5,4;1}$	$10_{2,9;-7}$		40	3	0		$9_{4,5;-1}$	$10_{9,2;7}$
$10_{5,5;0}$	$11_{2,10;-8}$		43	1	0		$10_{5,5;0}$	$11_{10,2;8}$
$11_{5,6;-1}$	$12_{2,11;-9}$		37	1	0		$11_{6,5;1}$	$12_{11,2;9}$
$6_{6,0;6}$	$7_{3,5;-2}$		1	5	4		$6_{0,6;-6}$	$7_{5,3;2}$
$7_{6,1;5}$	$8_{3,6;-3}$		5	15	4		$7_{1,6;-5}$	$8_{6,3;3}$
$8_{6,2;4}$	$9_{3,7;-4}$		15	24	1		$8_{2,6;-4}$	$9_{7,3;4}$
$9_{6,3;3}$	$10_{3,8;-5}$		31	23	0		$9_{3,6;-3}$	$10_{8,3;5}$
$10_{6,4;2}$	$11_{3,9;-6}$		52	14	0		$10_{4,6;-2}$	$11_{9,3;6}$
$11_{6,5;1}$	$12_{3,10;-7}$		73	6	0		$11_{5,6;-1}$	$12_{10,3;7}$
$7_{7,0;7}$	$8_{4,5;-1}$		1	4	6		$7_{0,7;-7}$	$8_{5,4;1}$
$8_{7,1;6}$	$9_{4,6;-2}$		3	16	9		$8_{1,7;-6}$	$9_{6,4;2}$
$9_{7,2;5}$	$10_{4,7;-3}$		9	33	4		$9_{2,7;-5}$	$10_{7,4;3}$
$10_{7,3;4}$	$11_{4,8;-4}$		22	44	1		$10_{3,7;-4}$	$11_{8,4;4}$
$11_{7,4;3}$	$12_{4,9;-5}$		42	39	0		$11_{4,7;-3}$	$12_{9,4;5}$
$8_{8,0;8}$	$9_{5,5;0}$		0	3	7		$8_{0,8;-8}$	$9_{5,5;0}$
$9_{8,1;7}$	$10_{5,6;-1}$		2	13	15		$9_{1,8;-7}$	$10_{6,5;1}$
$10_{8,2;6}$	$11_{5,7;-2}$		6	33	11		$10_{2,8;-6}$	$11_{7,5;2}$
$11_{8,3;5}$	$12_{5,8;-3}$		14	57	4		$11_{3,8;-5}$	$12_{8,5;3}$
$9_{9,0;9}$	$10_{6,5;1}$		0	2	8		$9_{0,9;-9}$	$10_{5,6;-1}$
$10_{9,1;8}$	$11_{6,6;0}$		1	9	21		$10_{1,9;-8}$	$11_{6,6;0}$
$11_{9,2;7}$	$12_{6,7;-1}$		4	28	22		$11_{2,9;-7}$	$12_{7,6;1}$
$10_{10,0;10}$	$11_{7,5;2}$		0	1	7		$10_{0,10;-10}$	$11_{5,7;-2}$
$11_{10,1;9}$	$12_{7,6;1}$		1	7	24		$11_{1,10;-9}$	$12_{6,7;-1}$
$11_{11,0;11}$	$12_{8,5;3}$		0	1	6		$11_{0,11;-11}$	$12_{5,8;-3}$