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ATOMIC STRUCTURE CALCULATION OF
ENERGY LEVELS AND OSCILLATOR
STRENGTHS IN Ti ION, I

(3s-3p and 3p-3d TRANSITIONS IN Ti IX)

September 1983

Keishi ISHII*

日本原子力研究所
Japan Atomic Energy Research Institute

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Atomic Structure Calculation of Energy Levels
and Oscillator Strengths in Ti Ion, I
(3s - 3p and 3p - 3d transitions in Ti IX)

Keishi ISHII*

(Received August 31, 1983)

Energy levels and oscillator strengths are calculated for 3s-3p and 3p-3d transition arrays in Ti IX, isoelectronic to Si I. The energy levels are obtained by the Slater-Condon theory of atomic structure including explicitly the strong configuration interactions, and are given both in numerical tables and in diagrams. The calculated wavelengths, oscillator strengths and transition probabilities are presented in tables and are also displayed in figures, where the weighted oscillator strengths are plotted as a function of wavelength.

Keywords: Ti IX, Highly Ionized Atom, Wavelength, Energy Level, Oscillator Strength, Plasma Diagnostic, Cowan Program

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Tiイオンのエネルギー準位と振動子強度の計算・I.

(Ti IXの3s-3pおよび3p-3d遷移)

石井慶之*

(1983年8月31日受理)

核融合プラズマにおける不純物イオン問題解明のために必要とされる分光学的データに関する研究の一環として、Ti多価イオンの中でSi Iと等電子系列である Ti IXの電子配置 $3s^k 3p^q 3d^r$ のエネルギー準位およびそれらの間の $\Delta n = 0$ 電気双極子遷移の振動子強度の理論計算を行った。計算の基礎はHartree-HX波動関数と、Slater-Condon理論に基づいたCowanプログラムである。計算結果は表および図として収録されてある。文献調査による実験値は参考として表中に示した。

本報告は昭和58年度日本原子力研究所との協力研究の成果の一部である。

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1. INTRODUCTION

Knowledge of atomic structure in multiply charged ions, particularly of the structural material of the interior of the fusion devices, is important in the interpretation of spectral data from high temperature plasmas. The allowed $\Delta n=0$, $n=2-2$ transitions of $2s^2 2p^n - 2s2p^{n+1}$ and $2s2p^{n+1} - 2p^{n+2}$ in highly ionized atoms have been widely studied by a variety of experimental methods. The existing data have been compiled and published for the energy levels and the transition wavelengths¹⁾, and for the oscillator strengths²⁾. The latter was partly updated³⁾ by including the recent beam-foil measurements. Theoretical calculations are now available^{4,5)}, too. However, data on the $\Delta n=0$, $n=3-3$ transitions in M-shell are scarcer than those in L-shell, in spite of that the possible $\Delta n=0$ transitions in M-shell are much more abundant than those in L-shell.

The Ti IX, a member of Si I-isoelectronic sequence has been studied by Phillips⁶⁾ in 1939, Svensson and Ekberg⁷⁾, Ekberg and Svensson⁸⁾ and Fawcett⁹⁾. Smitt *et al.*¹⁰⁾ have improved the accuracy of the previous measurements by examining closely the recorded spectrograms again and by studying the intervals in the ground configuration $3s^2 3p^2$ along isoelectronic sequence. The configurations dealt with in the above all works are $3s^2 3p^2$, $3s3p^3$ and $3s^2 3p3d$.

In this report, the calculated energy levels of the lower lying eight of the twelve possible configurations of the general type $3s^k 3p^q 3d^r$ ($k+q+r=4$), and the wavelengths and the oscillator strengths for the electric dipole transitions among them are presented. The calculated energy levels and wavelengths are

listed and compared with the observed ones, where available. The calculated energy levels are also illustrated in diagrams. The calculated gf -values are plotted as a function of the calculated wavelength as well. The plotted line pattern may provide the helpful guidance to identify the missing lines. No experimental data are available at present for oscillator strengths and lifetimes of Ti IX.

2. METHOD OF CALCULATION

The method of calculation used in the present work consists of three steps. The first step is to calculate the radial integral values of the average energy of the configuration (E_{av}), the Slater radial integral (F^k , G^k), the spin-orbit integrals (ζ) and the configuration interaction integrals (R^k) by using the *ab initio* Hartree-XR program of Cowan¹¹⁾ and Cowan and Griffin¹²⁾.

The second step involves the adjustment of the radial parameters (E_{av} , F^k , G^k , ζ , R^k) by means of the least-squares optimization in order to minimize the differences between the computed and the observed energy levels. Strong configuration interactions are included explicitly.

The third step is to calculate the wavelengths and the weighted oscillator strengths (gf -values) for the electric dipole transitions between the configurations considered above. The programs used in the second and the third steps are also originally developed by Cowan¹¹⁻¹³⁾ and recently adapted to FACOM M-380 computer at Kyoto University with slight modification. A full explanation of this semi-empirical procedure is described by Wybourne¹⁴⁾, Bromage¹⁵⁾ and Cowan¹⁶⁾.

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The configurations considered in the present work are grouped into the following two sets according to the parity:

First $3s^2 3p^2 (\text{A}) + 3p^4 (\text{B}) + 3s3p^2 3d (\text{C}) + 3s^2 3d^2 (\text{D})$

Second $3s3p^3 (\text{A}) + 3s^2 3p3d (\text{B}) + 3s3p3d^2 (\text{C}) + 3p^3 3d (\text{D})$.

The eight of the possible twelve configurations of the general type $3s^k 3p^q 3d^r$ ($k+q+r=4$) are considered and the configuration interactions in each parity are explicitly included in the present calculation. The remaining four are discarded for being lying too highly.

3. RESULTS

The first step calculation gives the *ab initio* values of the single configuration integrals and configuration interaction integrals as shown in the second column "HXR" of Tables 1 and 2. In the second step calculation, the optimization cannot be satisfactory when the number of free parameters exceeds the number of measured energy levels, which is the case for the present one. The larger the number of free parameters is, the more time-consuming the calculation is. Therefore the optimization was reduced to manageable size by fixing ratio of F_k , G_k , ζ and R_k in each integrals¹⁷⁻¹⁹⁾. The accuracy of the optimization was measured by the root mean square deviation defined by

$$\Delta = \left[\sum_i (E_{\text{calc}}(i) - E_{\text{obs}}(i))^2 / (N_l - N_p) \right]^{1/2} , \quad (1)$$

The configurations considered in the present work are grouped into the following two sets according to the parity:

First $3s^2 3p^2$ (α) + $3p^4$ (β) + $3s3p^2 3d$ (γ) + $3s^2 3d^2$ (δ)

Second $3s3p^3$ (α) + $3s^2 3p3d$ (β) + $3s3p3d^2$ (γ) + $3p^3 3d$ (δ).

The eight of the possible twelve configurations of the general type $3s^k 3p^q 3d^r$ ($k+q+r=4$) are considered and the configuration interactions in each parity are explicitly included in the present calculation. The remaining four are discarded for being lying too highly.

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$$\Delta = \left(\sum_i (E_{calc}(i) - E_{obs}(i))^2 / (N_l - N_p) \right)^{1/2} , \quad (1)$$

where $E_{\text{calc}}(i)$ and $E_{\text{obs}}(i)$ are i -th calculated and observed levels, respectively, N_L is the number of observed energy levels and N_p is the number of adjustable parameters. The following five kinds of free parameters were used in the optimization:

one average energy	E_{av}
one scale factor	F^k
one scale factor	G^k
one scale factor	ζ
two scale factors	R^k .

The reduced electric dipole radial integrals were obtained from the *ab initio* HXR calculation (Table 12), and used in the third step calculation combined with the second step results.

3.1 Configurations $3s^23p^2$ (α), $3p^4$ (β), $3s3p^23d$ (γ) and $3s^23d^2$ (δ) of the first parity

None of the levels in the β , γ and δ configurations is observed. Therefore, the least-squares-fit calculation was performed for the configuration α , by adjusting three parameters; E_{av} , F^2 ($3p, 3p$) and ζ ($3p$). The fitted parameter values are given in the column "Fitted" in Table 1, and the ratio of "Fitted" to "HXR" in the column "Ratio". Whereas the difference between "Fitted" and "HXR" is given for E_{av} . The *rms* deviation Δ is $0.677 \times 10^3 \text{ cm}^{-1}$, which gives 1.1% of total energy range of the configuration (α). The same scaling factors, i.e. the values in "Ratio" for α , are applied to the remaining configurations (β , γ ,

and D). The parameter values G^k and R^k were scaled by the same factor obtained in the least-squares-fit calculation for the second parity configuration described below.

The calculated and observed energy levels are listed in Table 2 for the $3s^2 3p^2$ configuration (A), together with their differences ("C-O"). The level designations and its percentage compositions in LS-basis are also given. The corresponding energy level diagram is shown in Fig.1.

In Table 3, calculated energy levels belonging to $3p^4$ (B), $3s3p^2$ (C) and $3s^2 3d^2$ (D) configurations are shown, obtained by adopting the parameter values given in the column "Fitted(adopted)" in Table 1. The percentage compositions are listed from the largest two contributions in the same configuration and one from the other when over about 10%. The level designation in the column "Term" is given by the most significant component, although there are a few exceptions for the levels in configuration C, e.g. 603.146, 532.507 and 642.352 levels. The average LS-purities are 58%, 69% and 79% for A, B and C configurations, respectively. The calculated energy levels of total number of 70 are displayed in Fig.2.

3.2 Configurations $3s3p^3$ (A), $3s^2 3p3d$ (B) $3s3p3d^2$ (C) and $3p^3 3d$ (D) of the second parity

The similar procedure as described in 3.1. was applied to the second parity configuration (Table 4). The least-squares optimization was performed for the $3s3p^3$ (A) and $3s^2 3p3d$ (B) configurations, of which the seventeen levels are observed. The rms deviation Δ of $0.319 \times 10^3 \text{ cm}^{-1}$ was achieved, yielding to 0.12 %

of total energy level spread of configurations G and G . The calculated energy levels are given in Table 5, with the principal percentage compositions in LS-coupling basis and the observed energy levels for comparison. They are also represented graphically in Fig.3.

The calculated energy levels of $3s3p3d^2(\text{C})$, and $3p^33d(\text{D})$ configurations are given in Table 6, and are illustrated in Fig.4. None of level listed in Table 6 has been observed.

3.3 Wavelengths and Oscillator Strengths

The reduced electric dipole radial integrals were obtained from the ab initio Hartree-XR calculation (Table 12), and used in the third step calculation. The calculated wavelengths and the weighted gf -values for $3s^23p^2 - 3s3p^3$ transition array are listed in Table 7, and those for $3s^23p^2 - 3s^23p3d$ in Table 8, respectively. In both Tables, the observed wavelengths are included for comparison, with the difference between the calculated and observed ones. The agreement of the calculated wavelengths with the observed is excellent. The intercombination transitions are added, which either are observed or have relatively large gf -value. Two observed lines⁷⁾ with \dagger in Table 8 are tentatively classified. In Table 9, the calculated lifetimes of the levels in $3s3p^3(\text{G})$ and $3s^23p3d(\text{G})$ configurations are listed. In Figures 5 and 6, the line with wavelength longer than 520 Å were omitted, because the strong ones center in the region 210 to 450 Å.

In Table 10, the calculated wavelengths with $gf \geq 0.05$ for all the possible electric dipole transitions considered in the

present work are listed. The first column indicates just the numbering of the transition. Even when the listing is limited for those with $gf \geq 0.05$, the overall number of the lines becomes 841. Table 11 contains a part of the transitions in Table 10. The listed transitions are limited for those between three configurations of the first parity and two of the second parity.

Most of the energy levels of $3s3p^3(A)$ and $3s^23p3d(B)$ configurations have been observed, while none of $3s3p3d^2(C)$ and $3p^33d(D)$ have. Therefore, the absolute values of energy level in the latter two (C and D) are uncertain to some extent at present. However, a small change of E_{av} 's has no significant effect on the relative positions of the levels and it just shifts them up or down as a whole. The same is true for the configurations (B, C and D) in the first parity.

4. DISCUSSION

The LS-purity of $3s^23p^2(A)$ configuration is more than 95%, as is shown in Table 2. On the other hand, that of $3s3p^3(A)$ and $3s^23p3d(B)$ configurations in the second parity range from 36% to 99%, and the average is 82%. The purities vary from level to level in one configuration, and some of them have heavy admixtures from different configurations.

As it is seen in Table 7, all the lines with larger gf -value are observed, and they are in good agreement with the calculated ones. Thus, the classification for $3s^23p^2 - 3s3p^3$ transition is essentially established. The calculated line pattern is given in Fig.5, where the gf -value is plotted against wavelength.

For $3s^23p^2 - 3s^23p3d$ transition (Table 8.), a few lines with

present work are listed. The first column indicates just the numbering of the transition. Even when the listing is limited for those with $gf \geq 0.05$, the overall number of the lines becomes 841. Table 11 contains a part of the transitions in Table 10. The listed transitions are limited for those between three configurations of the first parity and two of the second parity.

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For $3s^23p^2 - 3s^23p3d$ transition (Table 8.), a few lines with

fairly large gf -value are not yet observed. The present calculation may provide helpful guidance for finding these missing lines, together with the calculated spectrum shown in Fig. 6.

The radial energy integrals were adjusted from their *ab initio* Hartree-XR values, while the radial electric dipole integrals were not. Therefore, the gf -values of transition between levels, of which at least one is subject to strong configuration interaction, are less accurate. However, the relative gf -values are fairly reliable, because the dipole integrals have a very little influence on them. The absolute gf -values can be determined only after the lifetimes are measured. In this context, Table 9 may be helpful for practical purpose of lifetime measurement.

The author would like to express his sincere thanks to Dr. Robert D. Cowan for making his programs available, and to Dr. Jan O. Ekberg for his kindest help to make MT copies of the programs and for his valuable discussions regarding the application of the program to the present work. He owes his thanks to Drs. K. Ozawa, Y. Nakai and T. Shirai of Japan Atomic Energy Research Institute for their valuable comments and for their arrangement of the publication of the report. Thanks are also due to the members at the Data Processing Center of Kyoto University for their help in adaptation of the programs to the FACOM computer.

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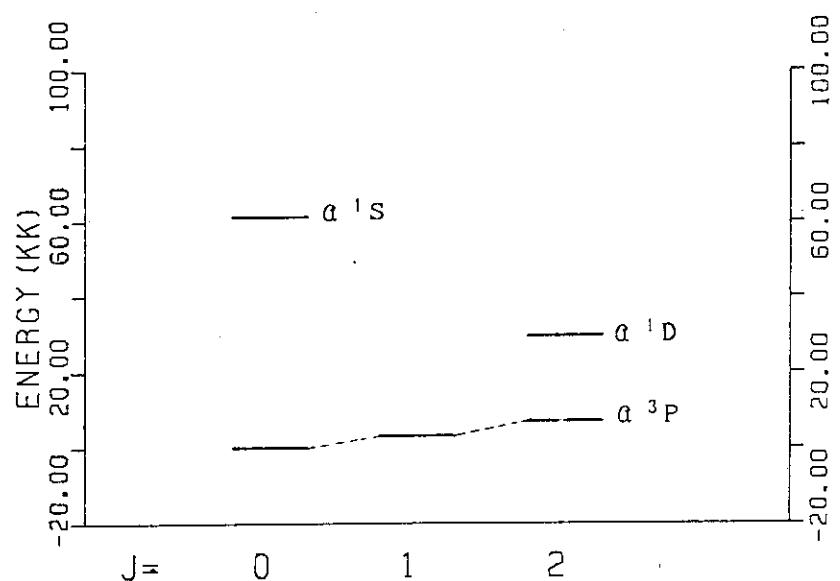


Fig. 1 Calculated energy level diagram of $3s^2 3p^2$ (α) configuration of the 1st parity. Energy is in 10^3 cm^{-1} .

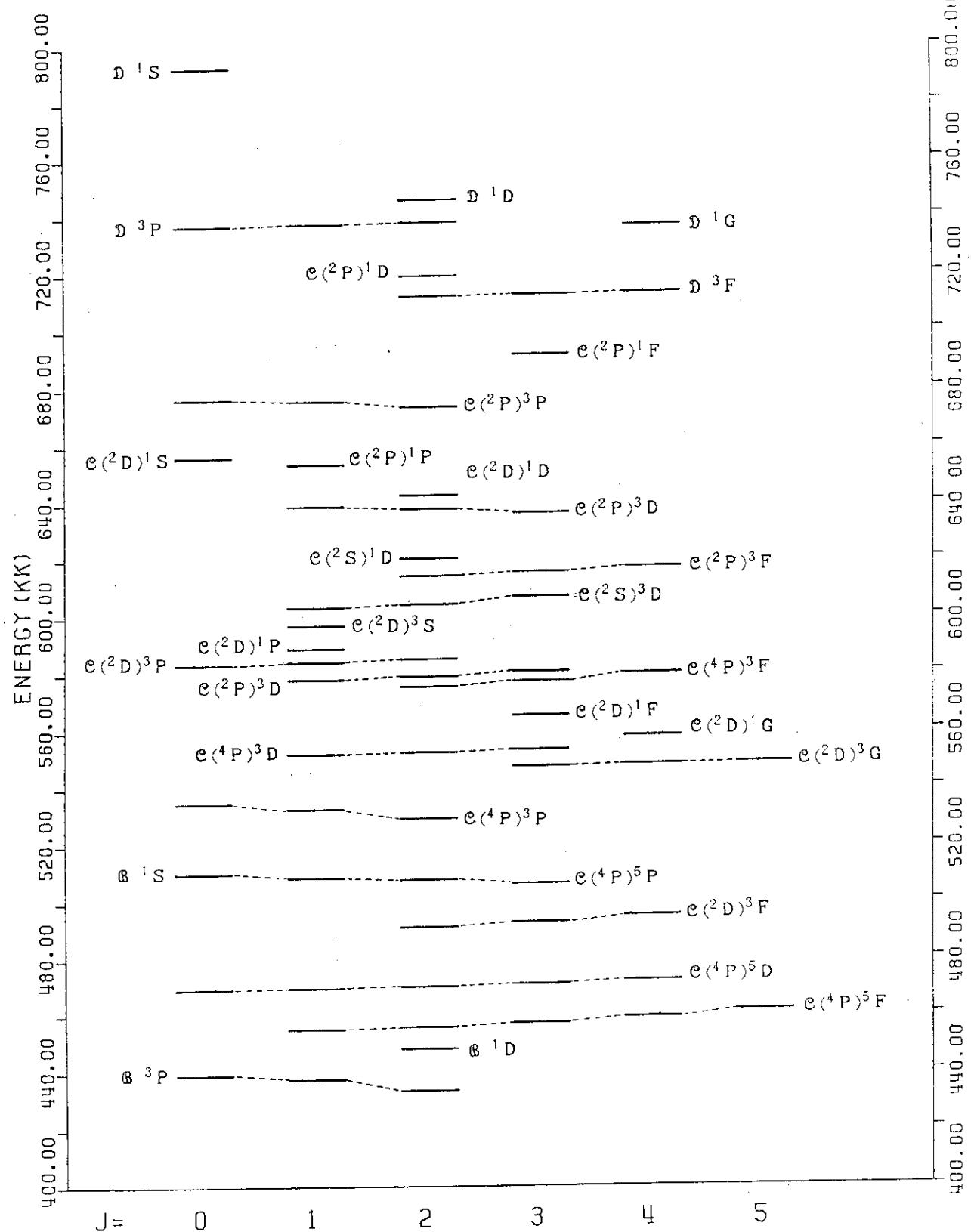


Fig. 2 Calculated energy level diagram of $3p^4$ (B), $3s3p^23d$ (C) and $3s^23d^2$ (D) configurations of the 1st parity.

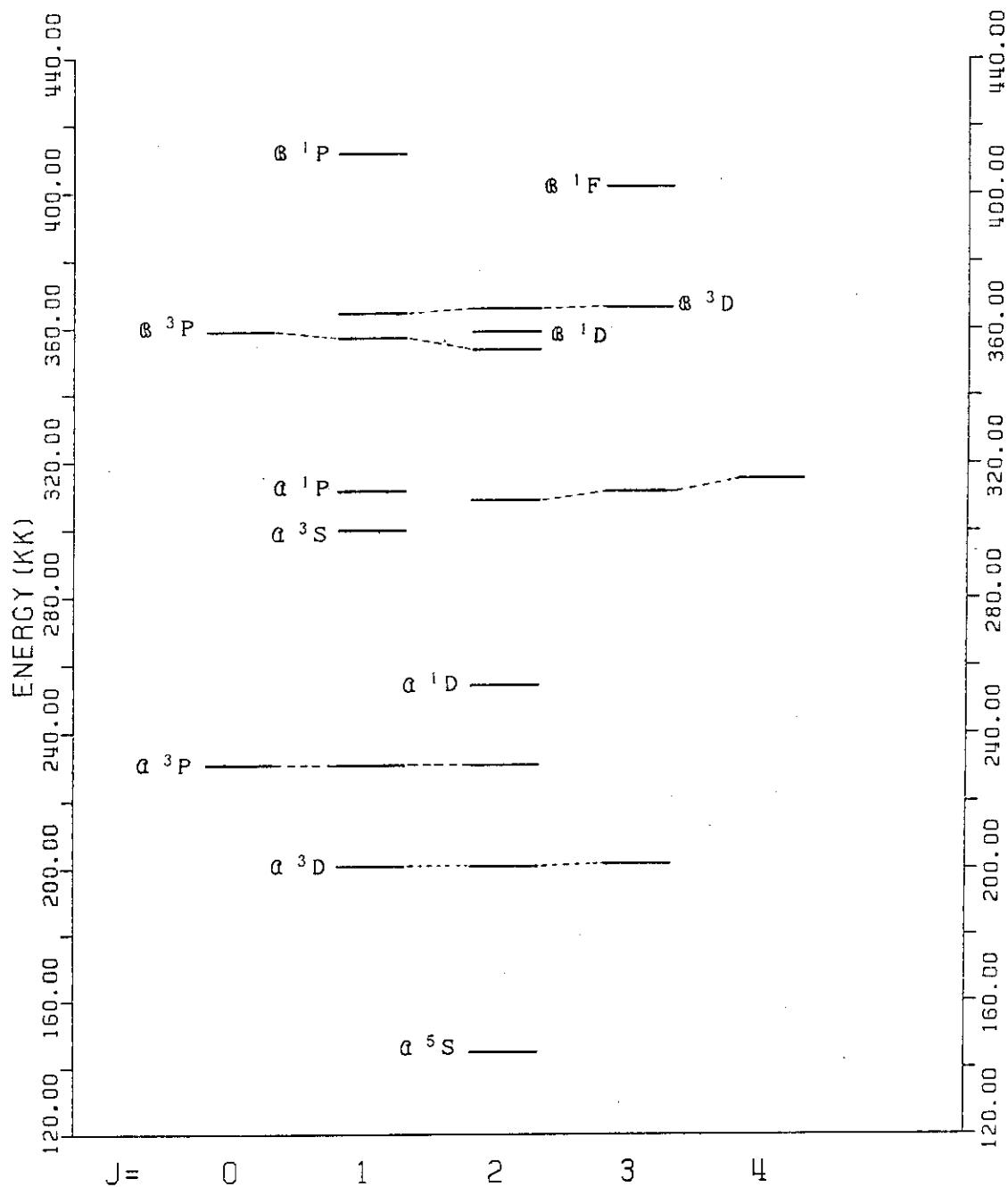


Fig. 3 Calculated energy level diagram of $3s3p^3$ (a) and $3s^2 3p3d$ (B) configurations of the 2nd parity.

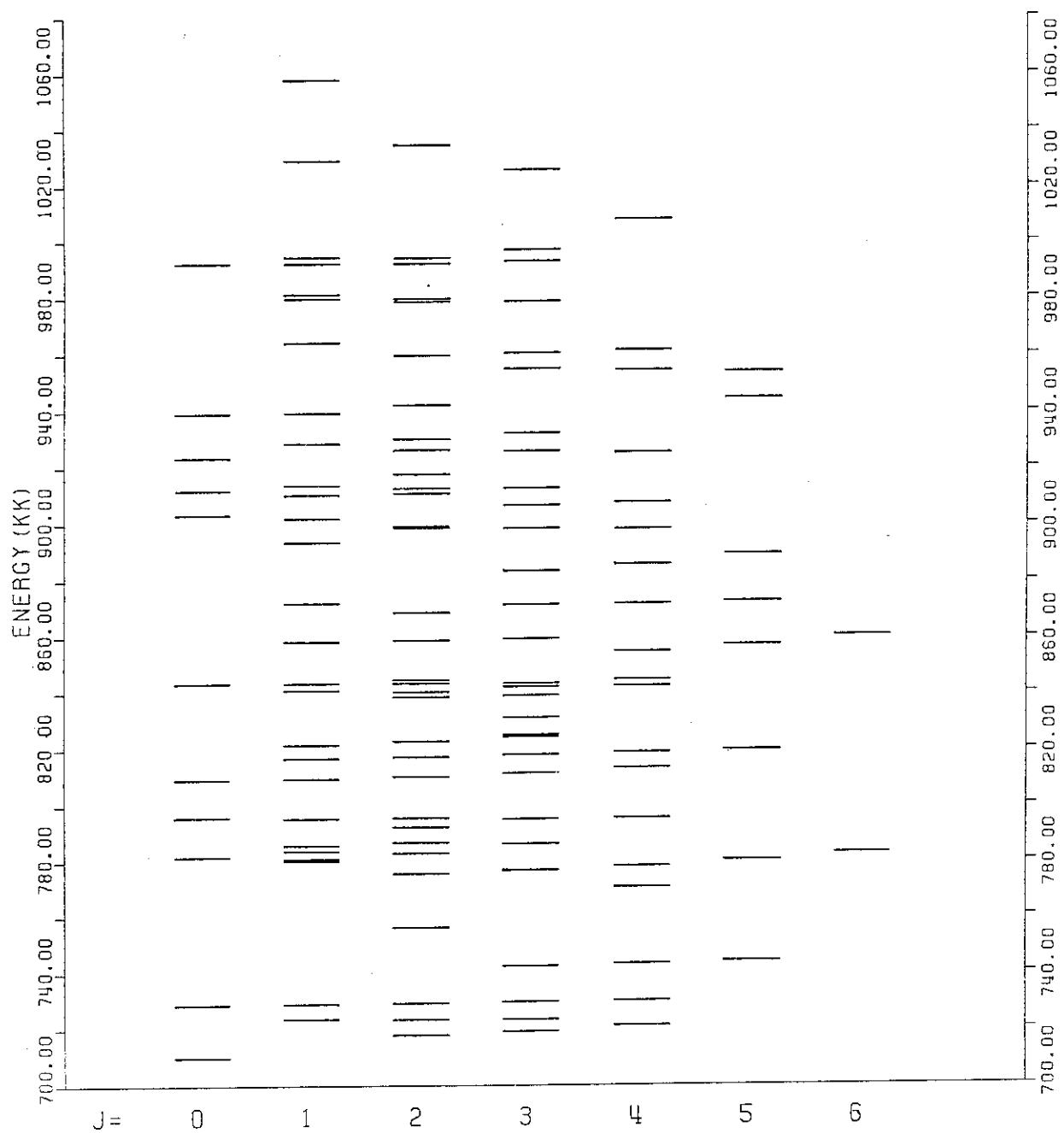


Fig. 4 Calculated energy level diagram of $3s3p3d^2$ (C), $3p^33d$ (D) configurations of the 2nd parity.

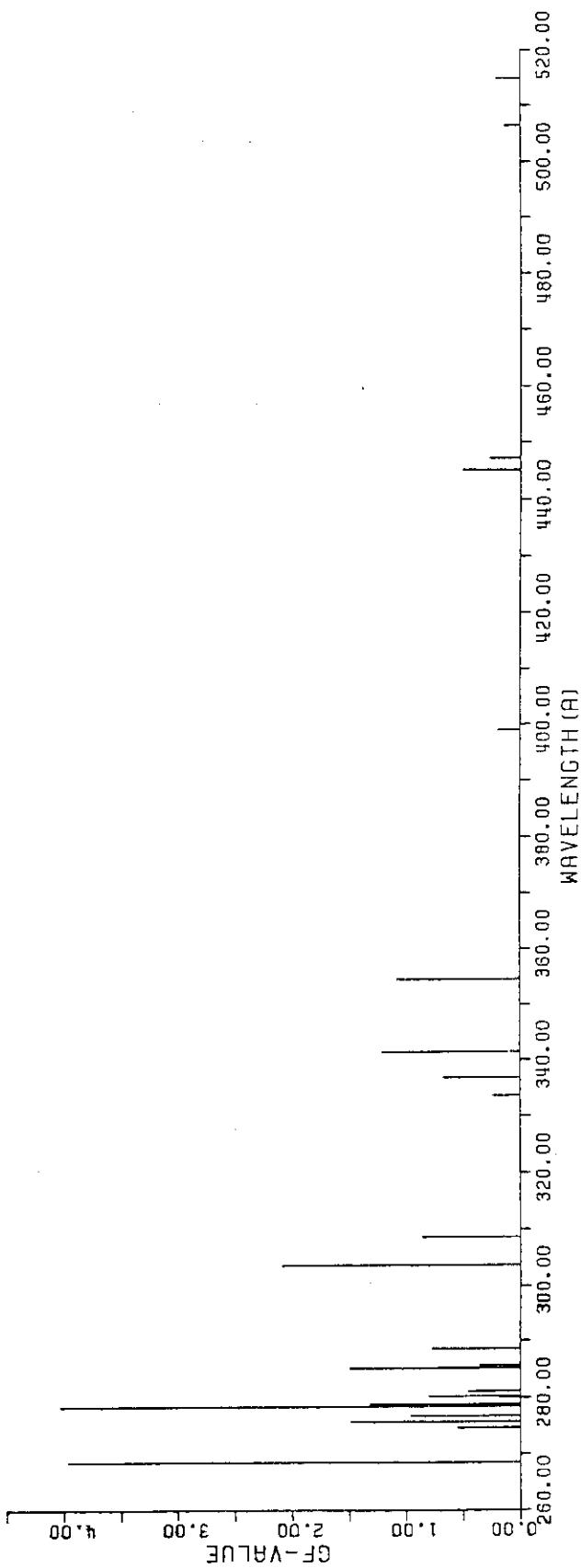


Fig. 5 Calculated line pattern for the transition between
 $3s^2 3p^2 (Q)$ of 1st parity and $3s3p^3 (R) + 3s^2 3p3d (G)$ of 2nd one.
 Wavelength in Å.

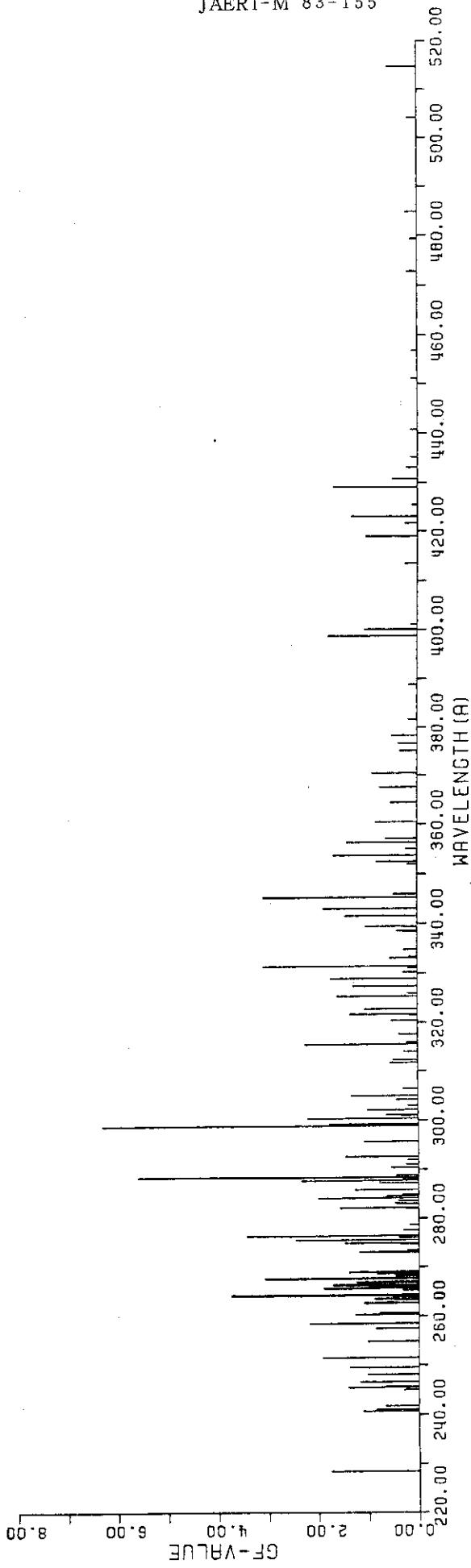


Fig. 6 Calculated line pattern for the transition between
 $(\text{G}+\text{C}+\text{D})$ configurations of 1st parity and $(\text{G}+\text{G})$ of 2nd parity.

Table 1 Parameter values for the first parity configuration.

(A): $3s^2 3p^2$ (B): $3p^4$ (C): $3s 3p^2 3d$ (D): $3s^2 3d^2$

Parameter	HXR	Fitted	Ratio*	CI
$E_{av}(A)$	0.000	31.958	(+31.958)	
$F^2(3p, 3p)$	109.368	101.205	0.925	
$\zeta(3p)$	5.237	4.531	0.864	
Δ		0.677		
		Adopted		
$E_{av}(B)$	474.485	506.394	(+31.909)	
$F^2(3p, 3p)$	109.351	101.184	0.925	
$\zeta(3p)$	5.240	4.525	0.864	
$E_{av}(C)$	526.322	558.231	(+31.909)	
$F^2(3p, 3p)$	109.238	101.079	0.925	
$\zeta(3p)$	5.219	4.507	0.864	
$\zeta(3d)$	0.415	0.358	0.864	
$F^2(3p, 3d)$	107.810	99.759	0.925	
$G^1(3s, 3p)$	144.221	129.626	0.899	
$G^2(3s, 3d)$	99.569	89.493	0.899	
$G^1(3p, 3d)$	126.893	114.051	0.899	
$G^3(3p, 3d)$	81.355	73.122	0.899	
$E_{av}(D)$	664.787	696.696	(+31.909)	
$F^2(3d, 3d)$	111.581	103.248	0.925	
$F^4(3d, 3d)$	71.652	66.300	0.925	
$\zeta(3d)$	0.411	0.355	0.864	
$R^1(ss, pp)$	144.217	116.095	0.805	A*B
$R^1(sp, pd)$	132.856	106.949	0.805	A*C
$R^2(sp, pd)$	101.296	81.543	0.805	A*C
$R^1(pp, dd)$	126.539	101.864	0.805	A*D
$R^3(pp, dd)$	81.065	65.257	0.805	A*D
$R^1(pp, sd)$	132.906	121.915	0.917	B*C
$R^1(pp, sd)$	132.627	121.659	0.917	C*D

*Values in parentheses are (Fitted)-(HXR).

Table 2 Calculated and observed energy levels for the $3s^2 3p^2$ configuration (A) of the first parity.

J	Term	Energy level (in 10^3 cm^{-1})			Percentage composition
		Calc.	Obs.	C-O	
0	3P	0.053	0.000	0.053	97%
	1S	60.787	61.100	-0.313	95%
1	3P	2.928	3.119	-0.191	98%
2	3P	6.920	7.282	-0.362	96%
	1D	29.361	28.555	0.806	96%

Sources of observed energy levels: Smitt et al., ref.10.

Table 3 Calculated energy levels for $3p^4$ (\mathfrak{G}), $3s3p^23d$ (\mathfrak{C}) and $3s^23d^2$ (\mathfrak{D}) configurations of the first parity. Energy level is in 10^3 cm^{-1} .

J	Term	Energy	Percentage composition
$3p^4$ (\mathfrak{G})			
0	3P	439.036	55%, 40% $\mathfrak{C}(^4P)^3P$
	1S	509.810	62%, 34% $\mathfrak{C}(^2D)^1S$
1	3P	437.531	56%, 40% $\mathfrak{C}(^4P)^3P$
2	3P	433.319	54%, 38% $\mathfrak{C}(^4P)^3P$
	1D	448.232	62%, 29% $\mathfrak{C}(^2D)^1D$
$3s3p^23d$ (\mathfrak{C})			
0	$(^4P)^5D$	469.323	100%
	$(^2D)^3P$	583.026	48%, 26% $(^4P)^3P$, 15% \mathfrak{D}^3P
	$(^2P)^3P$	676.320	78%, 12% \mathfrak{G}^3P
	$(^4P)^3P$	534.485	26%, 30% $(^2D)^3P$, 13% $(^2P)^3P$, 26% \mathfrak{G}^3P
	$(^2D)^1S$	655.863	45%, 31% \mathfrak{G}^1S , 22% \mathfrak{D}^1S
1	$(^4P)^5F$	454.998	100%
	$(^4P)^5D$	469.570	99%
	$(^4P)^5P$	508.281	100%
	$(^4P)^3D$	551.836	48%, 26% $(^2S)^3D$, 25% $(^2D)^3D$
	$(^2D)^3D$	577.584	74%, 19% $(^4P)^3D$
	$(^2P)^3D$	638.552	55%, 27% $(^2S)^3D$, 18% $(^4P)^3D$
	$(^2S)^3D$	603.146	40%, 43% $(^2P)^3D$, 14% $(^4P)^3D$
	$(^4P)^3P$	532.507	27%, 29% $(^2D)^3P$, 14% $(^2P)^3P$, 26% \mathfrak{G}^3P
	$(^2D)^3P$	583.674	48%, 26% $(^4P)^3P$, 15% \mathfrak{D}^3P
	$(^2P)^3P$	675.358	79%, 12% \mathfrak{G}^3P
	$(^2D)^3S$	596.606	98%
	$(^2D)^1P$	588.485	45%, 51% $(^2P)^1P$
	$(^2P)^1P$	653.292	47%, 52% $(^2D)^1P$
2	$(^4P)^5F$	455.835	99%
	$(^4P)^5D$	470.061	99%
	$(^4P)^5P$	507.465	100%
	$(^4P)^3F$	575.147	44%, 20% $(^2D)^3F$, 19% $(^2P)^3F$
	$(^2D)^3F$	490.944	54%, 39% $(^4P)^3F$
	$(^2P)^3F$	614.113	72%, 9% $(^4P)^3F$
	$(^4P)^3D$	552.353	47%, 27% $(^2D)^3D$, 24% $(^2S)^3D$
	$(^2D)^3D$	578.637	63%, 19% $(^4P)^3D$
	$(^2P)^3D$	637.509	57%, 24% $(^2S)^3D$, 18% $(^4P)^3D$
	$(^2S)^3D$	604.050	45%, 39% $(^2P)^3D$, 13% $(^4P)^3D$
	$(^4P)^3P$	529.113	28%, 29% $(^2D)^3P$, 14% $(^2P)^3P$, 26% \mathfrak{G}^3P
	$(^2D)^3P$	584.917	49%, 26% $(^4P)^3P$, 24% \mathfrak{D}^3P
	$(^2P)^3P$	673.517	80%, 11% \mathfrak{G}^3P
	$(^2S)^1D$	620.020	41%, 28% $(^2D)^1D$, 16% \mathfrak{D}^1D
	$(^2D)^1D$	642.352	12%, 39% $(^2S)^1D$, 22% \mathfrak{G}^1D , 16% \mathfrak{D}^1D
	$(^2P)^1D$	718.846	83%, 11% $(^2S)^1D$

Table 3 continued

3	$(^4P)^5F$	457.125	99%
	$(^4P)^5D$	470.803	98%
	$(^4P)^5P$	506.168	100%
	$(^2D)^3G$	547.198	99%
	$(^4P)^3F$	576.862	44%, 18% $(^2D)^3F$, 16% $(^2P)^3F$, 12% $(^2D)^3D$
	$(^2D)^3F$	492.487	55%, 38% $(^4P)^3F$
	$(^2P)^3F$	615.376	77%, 8% $(^4P)^3F$
	$(^4P)^3D$	553.104	45%, 31% $(^2D)^3D$, 22% $(^2S)^3D$
	$(^2D)^3D$	580.305	54%, 21% $(^4P)^3D$
	$(^2P)^3D$	636.023	62%, 19% $(^2S)^3D$, 17% $(^4P)^3D$
	$(^2S)^3D$	606.603	51%, 32% $(^2P)^3D$, 14% $(^4P)^3D$
	$(^2D)^1F$	564.900	76%, 20% $(^2P)^1F$
	$(^2P)^1F$	691.522	79%, 21% $(^2D)^1F$
4	$(^4P)^5F$	458.909	99%
	$(^4P)^5D$	471.849	97%
	$(^2D)^3G$	574.664	100%
	$(^4P)^3F$	579.581	54%, 22% $(^2D)^3F$, 16% $(^2P)^3F$
	$(^2D)^3F$	494.696	55%, 37% $(^4P)^3F$
	$(^2P)^3F$	616.798	83%
	$(^2D)^1G$	557.535	85%, 14% D^1G
5	$(^4P)^5F$	461.219	100%
	$(^2D)^3G$	548.244	100%
 $3s^2 3d^2 (D)$			
0	3P	736.775	80%, 18% $\epsilon(^2D)^3P$
	1S	792.274	76%, 20% $\epsilon(^2D)^1S$
1	3P	737.074	80%, 18% $\epsilon(^2D)^3P$
2	3F	711.732	80%, 16% $\epsilon(^2D)^3F$
	3P	737.662	80%, 18% $\epsilon(^2D)^3P$
	1D	745.574	64%, 29% $\epsilon(^2D)^1D$
3	3F	712.250	81%, 17% $\epsilon(^2D)^3F$
4	3F	712.738	81%, 17% $\epsilon(^2D)^3F$
	1G	736.483	86%, 14% $\epsilon(^2D)^1G$

Table 4 Parameter values for the first parity configuration.

(A): $3s3p^3$ (B): $3s^23p3d$ (C): $3s3p3d^3$ (D): $3p^33d$

Parameter	HXR	Fitted	Ratio*	CI
$E_{av}(A)$	217.254	251.006	(+33.752)	
$F^2(3p,3p)$	109.355	101.982	0.933	
$\zeta(3p)$	5.237	4.923	0.940	
$G^1(3s,3p)$	144.366	129.757	0.899	
$E_{av}(B)$	326.587	353.081	(+26.494)	
$\zeta(3p)$	5.239	4.925	0.940	
$\zeta(3d)$	0.415	0.390	0.940	
$F^2(3p,3d)$	108.013	100.738	0.933	
$G^1(3p,3d)$	127.028	114.174	0.899	
$G^3(3p,3d)$	81.507	73.259	0.899	
Δ		0.319		
		adopted		
$E_{av}(C)$	846.781	879.395	(+32.614)	
$F^2(3d,3d)$	111.613	104.096	0.933	
$F^4(3d,3d)$	71.672	66.845	0.933	
$\zeta(3p)$	5.225	4.911	0.940	
$\zeta(3d)$	0.411	0.386	0.940	
$F^2(3p,3d)$	107.521	94.957	0.933	
$G^1(3s,3p)$	144.409	129.797	0.899	
$G^2(3s,3d)$	99.165	89.130	0.899	
$G^1(3p,3d)$	126.661	113.845	0.899	
$G^3(3p,3d)$	81.160	72.948	0.899	
$E_{av}(D)$	765.870	798.484	(+32.614)	
$F^2(3d,3d)$	109.232	101.876	0.933	
$\zeta(3p)$	5.221	4.908	0.940	
$\zeta(3d)$	0.416	0.391	0.940	
$F^2(3p,3d)$	107.828	100.566	0.933	
$G^1(3p,3d)$	126.878	114.040	0.899	
$G^3(3p,3d)$	81.355	73.123	0.899	
$R^1(pp, sd)$	132.853	121.860	0.917	A*B
$R^1(pp, dd)$	126.514	101.839	0.805	A*C
$R^3(pp, dd)$	81.055	65.246	0.805	A*C
$R^1(sp, pd)$	132.900	106.979	0.805	A*D
$R^2(sp, pd)$	101.323	81.561	0.805	A*D
$R^1(sp, pd)$	132.809	106.906	0.805	B*C
$R^2(sp, pd)$	101.270	81.518	0.805	B*C
$R^2(sd, dd)$	101.463	81.673	0.805	B*C
$R^1(ss, pp)$	144.068	115.959	0.805	B*D
$R^1(sd, pp)$	132.677	121.699	0.917	C*D

*Values in parentheses are (Fitted)-(HXR).

Table 5 Calculated and observed energy levels for the $3s3p^3(\text{Q})$
and $3s^23p3d(\text{G})$ configurations of the second parity.

Conf	J	Term	Energy level (in 10^3 cm^{-1})			Percentage composition
			Calc.	Obs.	C-O	
$3s3p^3(\text{Q})$						
0	3P	230.313	230.524	-0.211	88%, 10%	G^3P
1	3D	200.345	200.209	0.130	86%, 11%	G^3D
	3P	230.461	230.645	-0.184	87%, 10%	G^3P
	3S	299.831	299.944	-0.113	86%, 10%	G^1P
	1P	311.439	311.087	0.352	76%, 11%	3S , 11% G^1P
2	5S	144.613			99%	
	3D	200.404	200.293	0.111	86%, 11%	G^3D
	3P	230.485	230.754	-0.269	85%, 10%	G^3P
	1D	253.954	254.028	-0.074	55%, 42%	G^1D
3	3D	201.158	201.000	0.158	88%, 11%	G^3D
$3s^23p3d(\text{G})$						
0	3P	358.527	358.432	0.095	87%, 10%	G^3P
1	3D	364.122	364.415	-0.293	77%, 9%	3P , 10% G^3D
	3P	356.936	356.963	-0.027	78%, 9%	3D , 10% G^3P
	1P	411.407	411.817	-0.410	86%, 10%	G^1P
2	3F	308.577			98%	
	3D	365.457	365.617	-0.160	79%, 10%	G^3D
	3P	353.385	352.635	0.747	52%, 19%	1D , 15% G^1D
	1D	358.656			36%, 28%	3P , 26% G^1D
3	3F	311.312			98%	
	3D	366.045	366.081	-0.036	86%, 11%	G^3D
	1F	401.936	401.771	0.165	97%	
4	3F	315.172			98%	

Sources of observed energy level data:

$3s3p^3$ configuration(Q); Smitt et al., ref. 10.

$3s^23p3d$ configuration(G); Ekberg and Svensson, ref. 8.

Table 6 Calculated energy levels for $3s3p3d^2$ (\mathcal{C}) and $3p^33d$ (\mathcal{D}) configurations of the second parity.

No	Energy	No	Energy	No	Energy
J=0		6	782.696	20	906.361
1	709.843	7	786.547	21	912.582
2	728.677	8	791.966	22	925.757
3	781.378	9	795.322	23	931.940
4	795.689	10	810.149	24	954.560
5	809.083	11	817.204	25	960.319
6	843.454	12	822.930	26	978.612
7	903.058	13	838.470	27	992.828
8	911.724	14	840.221	28	996.754
9	923.436	15	843.322	29	1025.540
10	938.866	16	844.686		
11	991.930	17	858.610	J=4	
		18	868.594	1	720.985
J=1		19	898.424	2	729.877
1	723.551	20	899.120	3	742.935
2	728.789	21	910.766	4	770.205
3	779.815	22	912.500	5	777.977
4	780.536	23	917.521	6	795.098
5	783.404	24	926.173	7	813.088
6	785.418	25	930.001	8	818.779
7	795.165	26	942.025	9	842.442
8	809.424	27	959.346	10	844.557
9	816.733	28	978.451	11	854.497
10	821.536	29	979.639	12	871.698
11	840.809	30	991.871	13	885.612
12	843.408	31	994.010	14	898.086
13	858.142	32	1034.350	15	907.386
14	871.711			16	925.261
15	893.471	J=3		17	954.193
16	901.696	1	719.039	18	961.275
17	910.144	2	723.371	19	1007.754
18	913.573	3	729.491		
19	928.577	4	742.206	J=5	
20	939.262	5	776.464	1	743.850
21	964.010	6	785.921	2	779.908
22	979.480	7	794.948	3	819.557
23	981.028	8	811.328	4	856.854
24	991.891	9	817.903	5	872.279
25	994.318	10	824.252	6	889.015
26	1028.802	11	825.008	7	944.302
27	1057.783	12	831.119	8	953.738
		13	839.139		
J=2		14	842.069	J=6	
1	717.672	15	843.396	1	782.301
2	723.199	16	859.192	2	860.147
3	729.059	17	871.241		
4	756.110	18	883.233		
5	775.348	19	898.267		

Table 7 Calculated and observed wavelengths for $3s^2 3p^2 - 3s 3p^3$ transition with calculated weighted oscillator strengths ($gf \geq 0.01$).

Term	J-J	Wavelength (Å)			
		Calc.	Obs.	C-O	gf
$^3P - ^3D$	2-3	514.83	516.215	-1.39	0.209
	2-2	516.84	518.100	-1.26	0.016
	1-2	506.39	507.174	-0.78	0.140
	2-1	517.00			< 0.01
	1-1	506.54	507.365	-0.83	0.029
	0-1	499.27	499.479	-0.21	0.064
$^3P - ^3P$	2-2	447.30	447.484	-0.18	0.268
	1-2	439.45	439.302	0.15	0.056
	2-1	447.35	447.701	0.35	0.063
	1-1	439.50	439.513	0.01	0.073
	0-1	434.01	433.567	0.44	0.063
	1-0	439.78	439.745	0.03	< 0.01
$^3P - ^3S$	2-1	341.40	341.691	-0.29	1.202
	1-1	336.81	336.895	-0.09	0.668
	0-1	333.58	333.385	0.19	0.237
$^1D - ^1D$	2-2	445.25	443.512	1.74	0.489
$^1D - ^1P$	2-1	354.51	353.942	0.57	1.070
$^1S - ^1P$	0-1	398.96	400.041	-1.08	0.192
$^3P - ^1D$	2-2	404.80	405.272	-0.47	< 0.01
$^3P - ^1P$	2-1	328.39	329.159	-0.77	0.051
	1-1	324.14	324.712	-0.57	0.092
	0-1	321.14			0.019
$^1D - ^3D$	2-3	582.08	579.896	2.08	< 0.01
$^1D - ^3S$	2-1	369.73	368.482	1.25	0.042
$^1S - ^3S$	0-1	418.33			0.014

Sources of observed wavelength data: Smitt et al., ref.10.

Table 8 Calculated and observed wavelengths for $3s^2 3p^2 - 3s^2 3p3d$
 transition with calculated weighted oscillator strengths
 $(gf \geq 0.01)$.

Transition		Wavelength (Å)			
Term	J-J	Calc.	Obs.	C-O	gf
$^3P - ^3D$	2-3	278.45	278.713	-0.26	4.023
	2-2	278.91	279.074	-0.16	1.314
	1-2	275.84	275.867	-0.03	1.483
	2-1	279.95			0.185
	1-1	276.86	276.785	0.07	0.960
	0-1	274.67	274.411	0.26	0.551
$^3P - ^3P$	2-2	288.63	289.579	-0.95	0.769
	1-2	285.34	286.112	-0.77	0.712
	2-1	285.70	285.981	-0.28	0.353
	1-1	282.48	282.613	-0.13	0.050
	0-1	280.20	280.141	0.06	0.796
	1-0	281.22	281.446	-0.23	0.384
$^1D - ^1F$	2-3	268.40	267.941	0.46	3.964
$^1D - ^1D$	2-2	303.68	303.891 [†]	-0.21	2.083
$^1D - ^1P$	2-1	261.75	260.916	0.83	< 0.01
$^1S - ^1P$	0-1	285.21	285.128	0.08	1.490
$^3P - ^1F$	2-3	253.15			0.032
$^3P - ^1D$	2-2	284.30			0.098
	1-2	281.11	281.193 [†]	-0.08	0.439
$^1D - ^3D$	2-3	297.01			0.030
	2-2	297.53			0.043
$^1D - ^3P$	2-2	308.62	308.568	0.05	0.851
	2-1	305.27	304.498 [†]	0.77	< 0.01

Sources of observed wavelength data: Ekberg and Svensson, ref.8.
[†]Svensson and Ekberg, ref.7, and see text for detail.

Table 9 Calculated lifetimes (in nsec) for the levels of
 $3s3p^3$ (Q) and $3s^23p3d$ (G) configurations of the second parity.

Configuration	J	Term	Lifetime
$3s3p^3$ (Q)	0	3P	4.30(-1)
	1	3D	1.22
		3P	4.37(-1)
		3S	2.40(-2)
		1P	4.00(-2)
	2	5S	----
		3D	1.24
		3P	4.60(-1)
		1D	3.04(-1)
		3D	1.33
$3s^23p3d$ (G)	0	3P	3.09(-2)
	1	3D	2.03(-2)
		3P	2.98(-2)
		1P	2.46(-2)
	2	3F	----
		3D	2.03(-2)
		3P	2.79(-2)
		1D	2.53(-2)
	3	3F	----
		3D	2.01(-2)
	4	1F	1.89(-2)
		3F	----

Figures in parentheses are the power of 10 by which the preceding number should be multiplied.

Table 10 Calculated wavelengths with $gf \geq 0.05$ for transitions between levels of $(\text{A}+\text{B}+\text{C}+\text{D})$ configurations in the 1st parity and those of $(\text{A}+\text{B}+\text{C}+\text{D})$ in the 2nd parity. E in 10^3 cm^{-1} .

no	1st parity		2nd parity		WL(Å)	gf	gA (sec ⁻¹)
	E(kK)	J	E(kK)	J			
1	691.522	3	770.205	4	1270.920	0.0581	0.2400E+09
2	653.292	1	756.110	2	972.601	0.0653	0.4604E+09
3	615.376	3	719.038	3	964.675	0.0615	0.4408E+09
4	616.798	4	720.985	4	959.810	0.0837	0.6062E+09
5	718.846	2	824.251	3	948.717	0.1210	0.8967E+09
6	673.517	2	780.536	1	934.413	0.0595	0.4549E+09
7	673.517	2	786.547	2	884.723	0.0567	0.4831E+09
8	673.517	2	791.966	2	844.249	0.0583	0.5458E+09
9	588.485	1	709.842	0	824.012	0.0654	0.6420E+09
10	718.846	2	844.685	2	794.664	0.0787	0.8310E+09
11	616.798	4	743.850	5	787.076	0.5092	0.5482E+10
12	615.376	3	742.935	4	783.955	0.3766	0.4087E+10
13	614.113	2	742.206	3	780.684	0.2746	0.3005E+10
14	433.319	2	299.831	1	749.133	0.1121	0.1332E+10
15	448.232	2	311.439	1	731.033	0.0798	0.9958E+09
16	437.531	1	299.831	1	726.218	0.0671	0.8481E+09
17	691.522	3	831.119	3	716.348	0.2609	0.3391E+10
18	577.584	1	717.672	2	713.836	0.0805	0.1054E+10
19	578.637	2	719.038	3	712.245	0.1315	0.1729E+10
20	580.305	3	720.985	4	710.833	0.1954	0.2579E+10
21	579.581	4	720.985	4	707.193	0.1993	0.2657E+10
22	576.862	3	719.038	3	703.353	0.1830	0.2468E+10
23	575.147	2	717.672	2	701.631	0.1580	0.2141E+10
24	691.522	3	844.685	2	652.897	0.0768	0.1201E+10
25	557.535	4	401.936	3	642.677	0.1170	0.1890E+10
26	638.552	1	795.322	2	637.881	0.2317	0.3797E+10
27	637.509	2	794.948	3	635.168	0.3394	0.5612E+10
28	636.023	3	795.098	4	628.634	0.5188	0.8756E+10
29	712.250	3	871.698	4	627.165	0.1669	0.2829E+10
30	711.732	2	871.241	3	626.924	0.1243	0.2109E+10
31	712.738	4	872.279	5	626.796	0.2215	0.3760E+10
32	745.574	2	906.360	3	621.942	0.2357	0.4064E+10
33	675.358	1	838.470	2	613.076	0.0915	0.1624E+10
34	579.581	4	743.850	5	608.756	0.1736	0.3125E+10
35	673.517	2	839.139	3	603.784	0.2177	0.3983E+10
36	576.862	3	742.935	4	602.146	0.1407	0.2588E+10
37	745.574	2	912.499	2	599.069	0.0881	0.1637E+10
38	575.147	2	742.206	3	598.592	0.1161	0.2161E+10
39	615.376	3	782.696	2	597.659	0.1065	0.1989E+10
40	588.485	1	756.110	2	596.571	0.1896	0.3552E+10

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
41	616.798	4	785.921	3	591.284	0.1443	0.2753E+10
42	553.104	3	723.371	3	587.313	0.1392	0.2691E+10
43	552.353	2	723.199	2	585.323	0.0878	0.1709E+10
44	736.483	4	907.386	4	585.127	0.2619	0.5103E+10
45	711.732	2	883.233	3	583.085	0.1576	0.3091E+10
46	792.274	0	964.010	1	582.290	0.0870	0.1711E+10
47	712.250	3	885.612	4	576.829	0.2125	0.4259E+10
48	718.846	2	893.471	1	572.656	0.3808	0.7745E+10
49	712.738	4	889.014	5	567.289	0.2914	0.6040E+10
50	616.798	4	795.098	4	560.851	0.3459	0.7334E+10
51	606.603	3	785.921	3	557.667	0.1452	0.3114E+10
52	494.696	4	315.172	4	557.030	0.1138	0.2446E+10
53	615.376	3	794.948	3	556.881	0.1739	0.3741E+10
54	492.487	3	311.312	3	551.951	0.0887	0.1941E+10
55	614.113	2	795.322	2	551.850	0.1126	0.2467E+10
56	606.603	3	791.966	2	539.482	0.2303	0.5278E+10
57	673.517	2	859.192	3	538.577	0.0937	0.2156E+10
58	596.606	1	783.404	1	535.340	0.1032	0.2401E+10
59	553.104	3	366.045	3	534.590	0.1105	0.2580E+10
60	606.603	3	795.098	4	530.517	0.1284	0.3043E+10
61	792.274	0	981.028	1	529.792	0.1290	0.3064E+10
62	642.352	2	831.119	3	529.755	0.2704	0.6427E+10
63	596.606	1	786.547	2	526.481	0.1360	0.3273E+10
64	532.507	1	723.199	2	524.405	0.1788	0.4337E+10
65	604.050	2	794.948	3	523.841	0.1352	0.3286E+10
66	564.900	3	756.110	2	522.985	0.5187	0.1265E+11
67	603.146	1	795.322	2	520.357	0.1097	0.2702E+10
68	6.920	2	201.158	3	514.832	0.2093	0.5267E+10
69	529.113	2	723.371	3	514.780	0.3464	0.8718E+10
70	737.662	2	931.940	3	514.727	0.1425	0.3587E+10
71	448.232	2	253.954	2	514.725	0.5819	0.1465E+11
72	547.198	3	742.206	3	512.800	0.4309	0.1093E+11
73	547.664	4	742.935	4	512.109	0.5398	0.1373E+11
74	596.606	1	791.966	2	511.878	0.1295	0.3297E+10
75	548.244	5	743.850	5	511.232	0.7641	0.1950E+11
76	584.917	2	780.536	1	511.196	0.0941	0.2402E+10
77	588.485	1	785.418	1	507.786	0.1345	0.3478E+10
78	2.928	1	200.404	2	506.391	0.1396	0.3631E+10
79	509.810	0	311.439	1	504.106	0.1903	0.4995E+10
80	583.674	1	782.696	2	502.458	0.1192	0.3149E+10
81	712.738	4	912.582	3	500.390	0.0995	0.2651E+10
82	584.917	2	785.921	3	497.501	0.1745	0.4703E+10
83	580.305	3	782.696	2	494.093	0.1446	0.3951E+10
84	620.020	2	824.251	3	489.640	0.5728	0.1594E+11
85	737.662	2	942.024	2	489.327	0.0988	0.2751E+10

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
86	637.509	2	842.069	3	488.855	0.1341	0.3741E+10
87	564.900	3	770.205	4	487.080	1.7738	0.4987E+11
88	580.305	3	785.921	3	486.343	0.2199	0.6199E+10
89	564.900	3	358.656	2	484.862	0.2319	0.6579E+10
90	579.581	4	785.921	3	484.636	0.1302	0.3696E+10
91	736.483	4	944.302	5	481.189	0.3101	0.8933E+10
92	636.023	3	844.556	4	479.539	0.1602	0.4647E+10
93	620.020	2	411.407	1	479.358	0.1409	0.4091E+10
94	620.020	2	831.119	3	473.711	0.2135	0.6345E+10
95	564.900	3	353.382	2	472.774	0.1987	0.5928E+10
96	580.305	3	791.966	2	472.454	0.1692	0.5056E+10
97	557.535	4	770.205	4	470.211	1.5973	0.4818E+11
98	580.305	3	794.948	3	465.890	0.1245	0.3827E+10
99	580.305	3	795.098	4	465.564	0.1618	0.4980E+10
100	691.522	3	906.360	3	465.466	0.7703	0.2371E+11
101	579.581	4	795.098	4	464.000	0.4913	0.1522E+11
102	578.637	2	795.164	1	461.836	0.1208	0.3777E+10
103	576.862	3	794.948	3	458.535	0.2666	0.8458E+10
104	584.917	2	366.045	3	456.889	0.1073	0.3427E+10
105	575.147	2	795.322	2	454.185	0.2421	0.7828E+10
106	508.281	1	728.677	0	453.728	0.1183	0.3833E+10
107	508.281	1	728.789	1	453.498	0.2520	0.8174E+10
108	508.281	1	729.059	2	452.943	0.1751	0.5694E+10
109	637.509	2	858.610	2	452.283	0.1332	0.4344E+10
110	507.465	2	729.059	2	451.276	0.3443	0.1128E+11
111	580.305	3	358.656	2	451.163	0.1224	0.4012E+10
112	507.465	2	729.491	3	450.398	0.4612	0.1516E+11
113	616.798	4	839.139	3	449.758	0.3162	0.1043E+11
114	615.376	3	838.470	2	448.243	0.2488	0.8259E+10
115	636.023	3	859.192	3	448.091	0.2675	0.8885E+10
116	506.168	3	729.491	3	447.782	0.3000	0.9981E+10
117	6.920	2	230.485	2	447.297	0.2681	0.8938E+10
118	506.168	3	729.877	4	447.009	0.9131	0.3048E+11
119	494.696	4	719.038	3	445.747	0.1560	0.5237E+10
120	29.361	2	253.954	2	445.251	0.4890	0.1645E+11
121	620.020	2	844.685	2	445.106	0.3674	0.1237E+11
122	492.487	3	717.672	2	444.079	0.1168	0.3951E+10
123	494.696	4	720.985	4	441.913	0.7085	0.2420E+11
124	492.487	3	719.038	3	441.401	0.4197	0.1437E+11
125	614.113	2	840.808	1	441.120	0.1918	0.6575E+10
126	490.944	2	717.672	2	441.056	0.3214	0.1102E+11
127	580.305	3	353.382	2	440.679	0.1227	0.4214E+10
128	494.696	4	723.371	3	437.302	0.4692	0.1636E+11
129	588.485	1	358.656	2	435.105	0.1369	0.4823E+10
130	492.487	3	723.199	2	433.441	0.3297	0.1170E+11

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
131	492.487	3	723.371	3	433.118	0.1366	0.4858E+10
132	642.352	2	411.407	1	433.004	0.2177	0.7746E+10
133	433.319	2	201.158	3	430.736	0.4880	0.1754E+11
134	606.603	3	839.139	3	430.040	0.2359	0.8508E+10
135	490.944	2	723.551	1	429.910	0.2579	0.9308E+10
136	548.244	5	315.172	4	429.052	1.6561	0.6000E+11
137	604.050	2	838.470	2	426.586	0.1251	0.4586E+10
138	588.485	1	353.382	2	425.346	0.1146	0.4225E+10
139	603.146	1	838.470	2	424.946	0.1319	0.4870E+10
140	745.574	2	981.028	1	424.711	0.7221	0.2670E+11
141	606.603	3	842.069	3	424.689	0.1362	0.5035E+10
142	547.664	4	311.312	3	423.097	1.3099	0.4881E+11
143	437.531	1	200.404	2	421.714	0.2429	0.9111E+10
144	655.863	0	893.471	1	420.861	0.3054	0.1150E+11
145	603.146	1	840.808	1	420.765	0.1166	0.4393E+10
146	606.603	3	844.556	4	420.250	0.2018	0.7621E+10
147	604.050	2	842.069	3	420.135	0.1276	0.4822E+10
148	547.198	3	308.577	2	419.076	1.0094	0.3833E+11
149	553.104	3	791.966	2	418.652	0.3201	0.1218E+11
150	653.292	1	893.471	1	416.357	0.3969	0.1527E+11
151	737.662	2	978.451	2	415.302	0.2284	0.8832E+10
152	737.662	2	978.612	3	415.024	3.4272	0.1327E+12
153	712.738	4	953.737	5	414.938	6.3520	0.2461E+12
154	737.074	1	978.451	2	414.289	0.8885	0.3453E+11
155	712.738	4	954.193	4	414.156	0.1302	0.5063E+10
156	653.292	1	411.407	1	413.419	0.2376	0.9273E+10
157	712.250	3	954.193	4	413.322	5.1098	0.1995E+12
158	737.662	2	979.639	2	413.263	0.2134	0.8335E+10
159	553.104	3	795.098	4	413.233	0.8034	0.3138E+11
160	712.250	3	954.559	3	412.696	0.1376	0.5389E+10
161	737.074	1	979.479	1	412.531	0.5116	0.2005E+11
162	737.074	1	979.639	2	412.260	1.1280	0.4427E+11
163	552.353	2	794.948	3	412.209	0.6375	0.2502E+11
164	736.775	0	979.479	1	412.024	0.8617	0.3386E+11
165	552.353	2	795.164	1	411.842	0.2016	0.7926E+10
166	711.732	2	954.559	3	411.814	3.9033	0.1535E+12
167	551.836	1	795.322	2	410.702	0.4300	0.1700E+11
168	548.244	5	795.098	4	405.098	1.2933	0.5257E+11
169	712.250	3	959.346	2	404.701	0.2116	0.8618E+10
170	745.574	2	992.828	3	404.442	0.1183	0.4824E+10
171	547.664	4	794.948	3	404.393	0.9854	0.4019E+11
172	712.738	4	960.318	3	403.908	0.2233	0.9129E+10
173	711.732	2	959.346	2	403.854	1.4736	0.6026E+11
174	712.250	3	960.318	3	403.115	2.2117	0.9078E+11
175	547.198	3	795.322	2	403.024	0.7427	0.3050E+11

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
176	712.738	4	961.275	4	402.354	3.1486	0.1297E+12
177	494.696	4	743.850	5	401.358	0.7426	0.3075E+11
178	615.376	3	366.045	3	401.072	0.1219	0.5056E+10
179	615.376	3	365.457	2	400.129	1.0335	0.4306E+11
180	614.113	2	364.122	1	400.014	0.7016	0.2925E+11
181	492.487	3	742.935	4	399.285	0.5812	0.2431E+11
182	60.787	0	311.439	1	398.958	0.1922	0.8055E+10
183	616.798	4	366.045	3	398.799	1.7656	0.7404E+11
184	745.574	2	996.753	3	398.121	2.0617	0.8676E+11
185	490.944	2	742.206	3	397.991	0.4512	0.1900E+11
186	588.485	1	840.221	2	397.242	0.1849	0.7814E+10
187	737.662	2	991.871	2	393.377	2.3365	0.1007E+12
188	737.662	2	991.891	1	393.346	0.7465	0.3218E+11
189	675.358	1	930.001	2	392.706	0.1926	0.8330E+10
190	737.074	1	991.871	2	392.469	0.5551	0.2404E+11
191	737.074	1	991.891	1	392.438	0.5118	0.2216E+11
192	737.074	1	991.930	0	392.378	0.5953	0.2579E+11
193	736.775	0	991.891	1	391.979	0.5065	0.2199E+11
194	616.798	4	872.279	5	391.418	2.1034	0.9157E+11
195	588.485	1	844.685	2	390.319	0.5949	0.2604E+11
196	615.376	3	871.698	4	390.135	1.6726	0.7329E+11
197	614.113	2	871.241	3	388.911	1.3227	0.5833E+11
198	614.113	2	356.936	1	388.837	0.1583	0.6985E+10
199	653.292	1	910.766	2	388.389	0.2854	0.1262E+11
200	471.849	4	729.491	3	388.135	0.4649	0.2058E+11
201	471.849	4	729.877	4	387.554	1.3365	0.5935E+11
202	470.803	3	729.059	2	387.213	0.5572	0.2479E+11
203	673.517	2	931.940	3	386.963	0.4313	0.1921E+11
204	470.803	3	729.491	3	386.566	0.5387	0.2405E+11
205	470.061	2	728.789	1	386.506	0.4434	0.1980E+11
206	470.061	2	729.059	2	386.104	0.1761	0.7880E+10
207	470.803	3	729.877	4	385.990	0.3551	0.1590E+11
208	469.570	1	728.677	0	385.941	0.2341	0.1048E+11
209	653.292	1	912.499	2	385.792	0.7059	0.3163E+11
210	564.900	3	824.251	3	385.576	0.4703	0.2110E+11
211	470.061	2	729.491	3	385.461	0.4350	0.1953E+11
212	532.507	1	791.966	2	385.417	0.1867	0.8383E+10
213	469.323	0	728.789	1	385.407	0.2137	0.9596E+10
214	469.570	1	729.059	2	385.373	0.3716	0.1669E+11
215	579.581	4	839.139	3	385.270	0.4918	0.2210E+11
216	638.552	1	898.423	2	384.806	0.2382	0.1073E+11
217	736.483	4	996.753	3	384.216	2.1750	0.9827E+11
218	534.485	0	795.164	1	383.614	0.1465	0.6639E+10
219	637.509	2	898.266	3	383.499	0.3876	0.1758E+11
220	576.862	3	838.470	2	382.252	0.2204	0.1006E+11

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
221	615.376	3	353.382	2	381.688	0.1687	0.7725E+10
222	636.023	3	898.086	4	381.587	0.5976	0.2737E+11
223	529.113	2	791.966	2	380.442	0.6112	0.2817E+11
224	642.352	2	906.360	3	378.776	3.0476	0.1417E+12
225	579.581	4	315.172	4	378.203	0.4872	0.2272E+11
226	579.581	4	844.556	4	377.393	0.1314	0.6155E+10
227	576.862	3	842.069	3	377.064	0.1604	0.7523E+10
228	792.274	0	1057.783	1	376.636	1.5915	0.7483E+11
229	576.862	3	311.312	3	376.576	0.3706	0.1743E+11
230	575.147	2	840.808	1	376.419	0.1736	0.8172E+10
231	712.738	4	978.612	3	376.117	0.6744	0.3180E+11
232	712.250	3	978.451	2	375.656	0.1460	0.6901E+10
233	575.147	2	308.577	2	375.136	0.3381	0.1602E+11
234	557.535	4	824.251	3	374.929	0.4920	0.2335E+11
235	712.250	3	979.639	2	373.988	0.3720	0.1774E+11
236	711.732	2	979.479	1	373.486	0.3199	0.1529E+11
237	642.352	2	910.766	2	372.559	0.2405	0.1155E+11
238	461.219	5	729.877	4	372.220	2.3898	0.1150E+12
239	614.113	2	883.233	3	371.581	0.2680	0.1295E+11
240	636.023	3	366.045	3	370.401	0.8781	0.4269E+11
241	642.352	2	912.499	2	370.168	0.5416	0.2636E+11
242	615.376	3	885.612	4	370.048	0.3712	0.1808E+11
243	458.909	4	729.491	3	369.574	1.4519	0.7090E+11
244	458.909	4	729.877	4	369.047	0.5138	0.2516E+11
245	736.483	4	1007.753	4	368.636	3.1832	0.1562E+12
246	457.125	3	729.059	2	367.736	0.8975	0.4427E+11
247	637.509	2	365.457	2	367.577	0.7358	0.3632E+11
248	616.798	4	889.014	5	367.354	0.4994	0.2468E+11
249	457.125	3	729.491	3	367.153	0.6013	0.2975E+11
250	455.835	2	728.789	1	366.363	0.5336	0.2652E+11
251	455.835	2	729.059	2	366.000	0.5094	0.2536E+11
252	557.535	4	831.119	3	365.518	1.2332	0.6157E+11
253	454.998	1	728.677	0	365.391	0.2851	0.1424E+11
254	584.917	2	858.610	2	365.372	0.3501	0.1749E+11
255	454.998	1	728.789	1	365.241	0.3300	0.1650E+11
256	584.917	2	859.192	3	364.597	1.9914	0.9992E+11
257	638.552	1	364.122	1	364.391	0.5166	0.2595E+11
258	583.674	1	858.141	1	364.342	0.3406	0.1711E+11
259	583.674	1	858.610	2	363.721	1.0542	0.5315E+11
260	583.026	0	858.141	1	363.483	0.4605	0.2325E+11
261	509.810	0	785.418	1	362.834	0.1616	0.8186E+10
262	636.023	3	358.656	2	360.533	0.8275	0.4246E+11
263	718.846	2	996.753	3	359.832	0.6637	0.3419E+11
264	553.104	3	831.119	3	359.693	0.1307	0.6738E+10
265	580.305	3	858.610	2	359.318	0.3688	0.1905E+11

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
266	580.305	3	859.192	3	358.568	0.6260	0.3247E+11
267	578.637	2	858.141	1	357.776	0.2471	0.1287E+11
268	579.581	4	859.192	3	357.640	0.7603	0.3965E+11
269	564.900	3	844.685	2	357.417	0.3678	0.1920E+11
270	745.574	2	1025.540	3	357.186	2.5281	0.1322E+12
271	578.637	2	858.610	2	357.178	0.3189	0.1667E+11
272	638.552	1	358.527	0	357.110	0.6202	0.3244E+11
273	712.738	4	992.828	3	357.028	2.8218	0.1477E+12
274	578.637	2	859.192	3	356.437	0.1363	0.7156E+10
275	577.584	1	858.141	1	356.433	0.2878	0.1511E+11
276	637.509	2	356.936	1	356.413	1.3974	0.7337E+11
277	712.250	3	992.828	3	356.408	0.2816	0.1478E+11
278	616.798	4	898.086	4	355.507	0.2740	0.1446E+11
279	638.552	1	356.936	1	355.093	0.2291	0.1212E+11
280	576.862	3	858.610	2	354.927	0.3139	0.1662E+11
281	712.250	3	994.010	2	354.912	1.9883	0.1053E+12
282	29.361	2	311.439	1	354.512	1.0704	0.5681E+11
283	711.732	2	994.010	2	354.260	0.2626	0.1396E+11
284	576.862	3	859.192	3	354.196	0.3071	0.1633E+11
285	711.732	2	994.318	1	353.874	1.3434	0.7155E+11
286	636.023	3	353.382	2	353.806	1.6639	0.8866E+11
287	615.376	3	898.266	3	353.494	0.1684	0.8990E+10
288	575.147	2	858.141	1	353.364	0.2479	0.1324E+11
289	575.147	2	858.610	2	352.780	0.1765	0.9459E+10
290	642.352	2	358.656	2	352.489	0.8078	0.4337E+11
291	712.738	4	996.753	3	352.093	0.1411	0.7589E+10
292	637.509	2	353.382	2	351.955	0.1878	0.1011E+11
293	439.036	0	723.551	1	351.475	0.1379	0.7447E+10
294	437.531	1	723.199	2	350.057	0.3095	0.1685E+11
295	553.104	3	839.139	3	349.607	0.8148	0.4446E+11
296	552.353	2	838.470	2	349.507	0.4904	0.2678E+11
297	620.020	2	906.360	3	349.234	0.2213	0.1210E+11
298	584.917	2	871.711	1	348.682	0.2438	0.1338E+11
299	638.552	1	926.173	2	347.680	1.4886	0.8214E+11
300	583.674	1	871.711	1	347.178	0.1633	0.9035E+10
301	637.509	2	925.756	3	346.925	2.0852	0.1156E+12
302	551.836	1	840.221	2	346.759	0.2638	0.1463E+11
303	637.509	2	926.173	2	346.424	0.3289	0.1828E+11
304	745.574	2	1034.350	2	346.289	3.4465	0.1917E+12
305	490.944	2	779.815	1	346.175	0.4086	0.2274E+11
306	642.352	2	353.382	2	346.057	0.4669	0.2600E+11
307	551.836	1	840.808	1	346.054	0.3266	0.1819E+11
308	736.483	4	1025.540	3	345.953	2.0014	0.1115E+12
309	636.023	3	925.261	4	345.736	2.8189	0.1573E+12
310	553.104	3	842.442	4	345.616	0.1623	0.9061E+10

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
311	691.522	3	401.936	3	345.320	3.0547	0.1709E+12
312	552.353	2	842.069	3	345.166	0.4137	0.2316E+11
313	636.023	3	925.756	3	345.145	0.3410	0.1909E+11
314	433.319	2	723.371	3	344.766	0.5528	0.3102E+11
315	492.487	3	782.696	2	344.579	0.6394	0.3592E+11
316	620.020	2	910.766	2	343.942	0.3208	0.1809E+11
317	737.662	2	1028.802	1	343.478	0.7517	0.4250E+11
318	494.696	4	785.921	3	343.377	1.0152	0.5743E+11
319	580.305	3	871.698	4	343.179	0.2120	0.1201E+11
320	606.603	3	315.172	4	343.135	1.8611	0.1054E+12
321	553.104	3	844.556	4	343.109	0.4947	0.2803E+11
322	737.074	1	1028.802	1	342.785	0.4440	0.2521E+11
323	736.775	0	1028.802	1	342.434	0.1472	0.8373E+10
324	620.020	2	912.499	2	341.904	0.7835	0.4470E+11
325	579.581	4	872.279	5	341.649	1.3043	0.7453E+11
326	604.050	2	311.312	3	341.601	1.4297	0.8172E+11
327	6.920	2	299.831	1	341.400	1.2018	0.6877E+11
328	547.198	3	840.221	2	341.270	0.6066	0.3474E+11
329	548.244	5	842.442	4	339.907	0.3630	0.2096E+11
330	547.664	4	842.069	3	339.668	0.7148	0.4132E+11
331	603.146	1	308.577	2	339.479	1.0308	0.5965E+11
332	653.292	1	358.656	2	339.401	0.2682	0.1553E+11
333	576.862	3	871.698	4	339.172	0.8176	0.4740E+11
334	606.603	3	311.312	3	338.649	0.4060	0.2361E+11
335	604.050	2	308.577	2	338.440	0.2937	0.1710E+11
336	616.798	4	912.582	3	338.084	0.2735	0.1596E+11
337	575.147	2	871.241	3	337.731	0.7011	0.4099E+11
338	548.244	5	844.556	4	337.482	0.8034	0.4705E+11
339	2.928	1	299.831	1	336.810	0.6678	0.3926E+11
340	529.113	2	230.485	2	334.865	0.2582	0.1536E+11
341	0.053	0	299.831	1	333.579	0.2367	0.1419E+11
342	653.292	1	353.382	2	333.433	0.1587	0.9519E+10
343	615.376	3	315.172	4	333.106	0.5428	0.3263E+11
344	494.696	4	795.098	4	332.887	0.1865	0.1123E+11
345	691.522	3	992.828	3	331.888	0.1514	0.9170E+10
346	616.798	4	315.172	4	331.537	3.0528	0.1852E+12
347	529.113	2	831.119	3	331.120	0.1607	0.9778E+10
348	532.507	1	230.485	2	331.102	0.1821	0.1108E+11
349	596.606	1	899.120	2	330.564	0.6881	0.4200E+11
350	614.113	2	311.312	3	330.250	0.2838	0.1735E+11
351	507.465	2	811.328	3	329.096	0.1577	0.9715E+10
352	615.376	3	311.312	3	328.877	1.7243	0.1063E+12
353	578.637	2	883.233	3	328.304	0.2231	0.1381E+11
354	588.485	1	893.471	1	327.884	0.3946	0.2448E+11
355	596.606	1	901.696	1	327.772	0.4695	0.2915E+11

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
356	691.522	3	996.753	3	327.620	3.2878	0.2043E+12
357	580.305	3	885.612	4	327.539	0.4643	0.2886E+11
358	616.798	4	311.312	3	327.347	0.2213	0.1378E+11
359	614.113	2	308.577	2	327.294	1.2862	0.8009E+11
360	532.507	1	838.470	2	326.837	0.4833	0.3018E+11
361	553.104	3	859.192	3	326.704	0.1574	0.9836E+10
362	552.353	2	858.610	2	326.523	0.1482	0.9271E+10
363	534.485	0	840.808	1	326.453	0.2592	0.1622E+11
364	596.606	1	903.058	0	326.316	0.1744	0.1093E+11
365	718.846	2	1025.540	3	326.058	5.6019	0.3514E+12
366	615.376	3	308.577	2	325.946	0.1822	0.1144E+11
367	506.168	3	813.088	4	325.818	0.4715	0.2963E+11
368	547.198	3	854.496	4	325.416	2.5638	0.1615E+12
369	718.846	2	411.407	1	325.268	1.4552	0.9174E+11
370	673.517	2	366.045	3	325.233	1.6019	0.1010E+12
371	448.232	2	756.110	2	324.804	0.4218	0.2667E+11
372	575.147	2	883.233	3	324.584	1.6861	0.1067E+12
373	655.863	0	964.010	1	324.520	1.0079	0.6383E+11
374	532.507	1	840.808	1	324.357	0.1663	0.1054E+11
375	616.798	4	925.261	4	324.188	0.8915	0.5658E+11
376	576.862	3	885.612	4	323.887	2.0069	0.1276E+12
377	547.664	4	856.854	5	323.425	3.1958	0.2038E+12
378	579.581	4	889.014	5	323.171	3.2932	0.2103E+12
379	604.050	2	913.573	1	323.078	0.1507	0.9630E+10
380	675.358	1	365.457	2	322.684	1.0464	0.6703E+11
381	529.113	2	839.139	3	322.554	0.9407	0.6030E+11
382	615.376	3	925.756	3	322.186	0.6861	0.4409E+11
383	653.292	1	964.010	1	321.835	0.5122	0.3298E+11
384	606.603	3	917.521	2	321.628	0.3249	0.2095E+11
385	564.900	3	253.954	2	321.599	1.3474	0.8689E+11
386	675.358	1	364.122	1	321.299	0.1489	0.9620E+10
387	548.244	5	860.147	6	320.613	3.8009	0.2466E+12
388	614.113	2	926.173	2	320.451	0.5489	0.3565E+11
389	676.320	0	364.122	1	320.309	0.5124	0.3331E+11
390	745.574	2	1057.783	1	320.298	0.2184	0.1420E+11
391	529.113	2	842.069	3	319.534	0.2106	0.1376E+11
392	584.917	2	899.120	2	318.265	0.6721	0.4425E+11
393	614.113	2	928.577	1	318.001	0.4656	0.3071E+11
394	615.376	3	930.001	2	317.839	0.7259	0.4792E+11
395	673.517	2	358.656	2	317.600	0.3657	0.2418E+11
396	616.798	4	931.940	3	317.317	0.9004	0.5964E+11
397	583.674	1	899.120	2	317.012	0.1886	0.1252E+11
398	718.846	2	1034.350	2	316.953	2.4636	0.1636E+12
399	691.522	3	1007.753	4	316.224	9.3521	0.6238E+12
400	673.517	2	356.936	1	315.875	0.2125	0.1421E+11

Table 10 *continued*

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
401	584.917	2	901.696	1	315.677	0.2307	0.1544E+11
402	675.358	1	358.527	0	315.626	0.1642	0.1099E+11
403	718.846	2	401.936	3	315.546	2.2504	0.1507E+12
404	580.305	3	898.086	4	314.682	2.0090	0.1353E+12
405	676.320	0	994.318	1	314.467	1.6601	0.1120E+12
406	675.358	1	356.936	1	314.048	0.2694	0.1822E+11
407	579.581	4	898.086	4	313.966	0.8234	0.5571E+11
408	675.358	1	994.010	2	313.822	3.6785	0.2491E+12
409	606.603	3	925.261	4	313.816	2.0729	0.1404E+12
410	675.358	1	994.318	1	313.519	1.2221	0.8292E+11
411	458.909	4	777.977	4	313.413	0.1664	0.1130E+11
412	673.517	2	992.828	3	313.175	6.4503	0.4387E+12
413	457.125	3	776.464	3	313.146	0.1843	0.1253E+11
414	578.637	2	898.266	3	312.863	1.8371	0.1252E+12
415	673.517	2	353.382	2	312.368	0.4742	0.3242E+11
416	454.998	1	775.348	2	312.158	0.6021	0.4122E+11
417	673.517	2	994.010	2	312.019	1.1368	0.7788E+11
418	455.835	2	776.464	3	311.887	0.8468	0.5806E+11
419	638.552	1	959.346	2	311.727	1.0789	0.7405E+11
420	577.584	1	898.423	2	311.682	1.3939	0.9570E+11
421	636.023	3	315.172	4	311.672	0.5371	0.3688E+11
422	457.125	3	777.977	4	311.670	1.1568	0.7943E+11
423	458.909	4	779.908	5	311.527	1.5256	0.1048E+12
424	461.219	5	782.301	6	311.447	1.9569	0.1346E+12
425	576.862	3	898.086	4	311.309	0.3568	0.2456E+11
426	576.862	3	898.266	3	311.135	0.9329	0.6428E+11
427	604.050	2	925.756	3	310.843	1.3242	0.9140E+11
428	637.509	2	960.318	3	309.781	1.7015	0.1183E+12
429	603.146	1	926.173	2	309.572	0.8669	0.6033E+11
430	673.517	2	996.753	3	309.371	0.3940	0.2745E+11
431	575.147	2	898.423	2	309.333	0.7260	0.5060E+11
432	29.361	2	353.382	2	308.622	0.8508	0.5958E+11
433	547.664	4	871.698	4	308.610	2.3505	0.1646E+12
434	548.244	5	872.279	5	308.609	3.2961	0.2308E+12
435	547.198	3	871.241	3	308.601	1.7390	0.1218E+12
436	604.050	2	928.577	1	308.141	0.1565	0.1100E+11
437	653.292	1	978.451	2	307.542	0.9792	0.6905E+11
438	636.023	3	961.275	4	307.454	2.5282	0.1784E+12
439	606.603	3	931.940	3	307.373	2.6455	0.1868E+12
440	603.146	1	928.577	1	307.285	0.9824	0.6939E+11
441	604.050	2	930.001	2	306.794	1.5892	0.1126E+12
442	532.507	1	858.610	2	306.651	0.1630	0.1156E+11
443	637.509	2	311.312	3	306.562	0.2917	0.2070E+11
444	653.292	1	979.639	2	306.423	0.7162	0.5088E+11
445	603.146	1	930.001	2	305.946	0.2469	0.1759E+11

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
446	580.305	3	907.386	4	305.734	0.2303	0.1643E+11
447	653.292	1	981.028	1	305.124	1.0491	0.7516E+11
448	604.050	2	931.940	3	304.981	0.2726	0.1955E+11
449	529.113	2	201.158	3	304.919	1.3369	0.9590E+11
450	583.674	1	911.724	0	304.832	0.1918	0.1377E+11
451	584.917	2	913.573	1	304.269	0.2075	0.1495E+11
452	529.113	2	200.404	2	304.220	0.4228	0.3047E+11
453	29.361	2	358.656	2	303.679	2.0833	0.1507E+12
454	638.552	1	308.577	2	303.053	0.1998	0.1451E+11
455	529.113	2	859.192	3	302.958	0.2146	0.1559E+11
456	583.026	0	913.573	1	302.529	0.1901	0.1385E+11
457	642.352	2	311.439	1	302.194	1.0084	0.7365E+11
458	448.232	2	779.815	1	301.583	0.1961	0.1438E+11
459	532.507	1	200.404	2	301.111	0.6349	0.4670E+11
460	532.507	1	200.345	1	301.058	0.3407	0.2507E+11
461	584.917	2	917.521	2	300.657	0.5922	0.4370E+11
462	691.522	3	358.656	2	300.421	2.1949	0.1622E+12
463	579.581	4	912.582	3	300.300	1.7954	0.1328E+12
464	564.900	3	898.086	4	300.132	0.2390	0.1770E+11
465	583.674	1	917.521	2	299.538	0.2167	0.1611E+11
466	576.862	3	910.766	2	299.487	0.5848	0.4349E+11
467	691.522	3	1025.540	3	299.385	0.3462	0.2576E+11
468	577.584	1	911.724	0	299.276	0.2876	0.2142E+11
469	534.485	0	200.345	1	299.275	0.3079	0.2293E+11
470	745.574	2	411.407	1	299.252	1.7754	0.1322E+12
471	588.485	1	253.954	2	298.926	1.2702	0.9481E+11
472	736.483	4	401.936	3	298.911	6.2882	0.4694E+12
473	507.465	2	842.069	3	298.861	0.3463	0.2586E+11
474	578.637	2	913.573	1	298.565	0.6384	0.4777E+11
475	588.485	1	923.436	0	298.551	1.0800	0.8082E+11
476	575.147	2	910.144	1	298.510	0.6839	0.5119E+11
477	508.281	1	843.322	2	298.471	0.9703	0.7265E+11
478	508.281	1	843.407	1	298.395	1.1923	0.8931E+11
479	448.232	2	783.404	1	298.354	0.4069	0.3049E+11
480	508.281	1	843.454	0	298.354	0.5201	0.3897E+11
481	604.050	2	939.262	1	298.319	1.3750	0.1031E+12
482	606.603	3	942.024	2	298.132	2.3700	0.1778E+12
483	576.862	3	912.499	2	297.941	0.3635	0.2731E+11
484	576.862	3	912.582	3	297.868	0.2230	0.1676E+11
485	603.146	1	938.866	0	297.867	0.6246	0.4695E+11
486	507.465	2	843.322	2	297.745	1.4621	0.1100E+12
487	507.465	2	843.396	3	297.680	2.1764	0.1638E+12
488	507.465	2	843.407	1	297.670	0.3612	0.2719E+11
489	577.584	1	913.573	1	297.629	0.2045	0.1540E+11
490	547.198	3	883.233	3	297.588	1.1451	0.8624E+11

Table 10 *continued*

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
491	642.352	2	978.451	2	297.531	0.5405	0.4073E+11
492	603.146	1	939.262	1	297.516	0.3053	0.2300E+11
493	506.168	3	842.442	4	297.376	3.3001	0.2489E+12
494	616.798	4	953.737	5	296.789	3.2595	0.2468E+12
495	448.232	2	785.418	1	296.572	0.7260	0.5505E+11
496	580.305	3	917.521	2	296.546	1.0150	0.7698E+11
497	534.485	0	871.711	1	296.537	0.2342	0.1777E+11
498	506.168	3	843.396	3	296.535	0.9504	0.7209E+11
499	642.352	2	979.639	2	296.484	0.6029	0.4575E+11
500	616.798	4	954.193	4	296.388	0.4981	0.3782E+11
501	547.664	4	885.612	4	295.904	1.3568	0.1034E+12
502	604.050	2	942.024	2	295.881	0.2549	0.1942E+11
503	691.522	3	353.382	2	295.736	1.0758	0.8204E+11
504	506.168	3	844.556	4	295.518	1.4237	0.1087E+12
505	642.352	2	981.028	1	295.268	0.8678	0.6639E+11
506	615.376	3	954.193	4	295.145	2.2935	0.1756E+12
507	578.637	2	917.521	2	295.086	0.1774	0.1359E+11
508	718.846	2	1057.783	1	295.040	3.0396	0.2329E+12
509	615.376	3	954.559	3	294.826	0.4673	0.3586E+11
510	532.507	1	871.711	1	294.808	0.7287	0.5592E+11
511	614.113	2	954.559	3	293.732	1.6508	0.1276E+12
512	470.803	3	811.328	3	293.664	0.2784	0.2153E+11
513	469.570	1	810.148	2	293.618	0.2651	0.2051E+11
514	548.244	5	889.014	5	293.453	1.6249	0.1258E+12
515	638.552	1	979.479	1	293.318	0.5297	0.4106E+11
516	637.509	2	978.451	2	293.305	0.4976	0.3858E+11
517	637.509	2	978.612	3	293.167	0.2424	0.1881E+11
518	471.849	4	813.088	4	293.049	0.3830	0.2974E+11
519	470.061	2	811.328	3	293.026	0.3394	0.2637E+11
520	564.900	3	906.360	3	292.859	0.8424	0.6551E+11
521	439.036	0	780.536	1	292.825	0.1671	0.1299E+11
522	653.292	1	311.439	1	292.523	1.4533	0.1133E+12
523	637.509	2	979.479	1	292.423	0.1892	0.1476E+11
524	637.509	2	979.639	2	292.287	0.3687	0.2878E+11
525	470.803	3	813.088	4	292.154	0.3161	0.2470E+11
526	564.900	3	907.386	4	291.982	1.8473	0.1445E+12
527	642.352	2	299.831	1	291.953	0.2115	0.1655E+11
528	636.023	3	978.612	3	291.895	1.7028	0.1333E+12
529	529.113	2	871.711	1	291.888	1.2630	0.9888E+11
530	596.606	1	939.262	1	291.838	0.3870	0.3031E+11
531	691.522	3	1034.350	2	291.691	2.5683	0.2013E+12
532	437.531	1	780.536	1	291.541	0.3906	0.3065E+11
533	616.798	4	960.318	3	291.103	0.3932	0.3095E+11
534	745.574	2	401.936	3	291.004	0.2334	0.1839E+11
535	615.376	3	959.346	2	290.723	0.3698	0.2918E+11

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
536	620.020	2	964.010	1	290.706	0.5729	0.4521E+11
537	655.863	0	311.439	1	290.340	0.5391	0.4265E+11
538	494.696	4	839.139	3	290.323	0.3318	0.2625E+11
539	616.798	4	961.275	4	290.295	4.7059	0.3725E+12
540	615.376	3	960.318	3	289.904	3.1799	0.2524E+12
541	580.305	3	925.261	4	289.892	1.2194	0.9678E+11
542	553.104	3	898.086	4	289.870	0.9148	0.7262E+11
543	614.113	2	959.346	2	289.659	2.4438	0.1943E+12
544	596.606	1	942.024	2	289.504	0.7070	0.5626E+11
545	579.581	4	925.261	4	289.285	0.5061	0.4034E+11
546	564.900	3	910.766	2	289.129	0.7027	0.5607E+11
547	615.376	3	961.275	4	289.102	0.2510	0.2003E+11
548	552.353	2	898.266	3	289.089	0.5775	0.4609E+11
549	492.487	3	838.470	2	289.032	0.2134	0.1704E+11
550	553.104	3	899.120	2	289.004	0.4492	0.3587E+11
551	712.250	3	366.045	3	288.846	0.4429	0.3541E+11
552	614.113	2	960.318	3	288.846	0.3372	0.2696E+11
553	711.732	2	365.457	2	288.788	0.4204	0.3362E+11
554	583.674	1	930.001	2	288.744	0.2971	0.2377E+11
555	6.920	2	353.382	2	288.632	0.7694	0.6160E+11
556	551.836	1	898.423	2	288.528	0.3678	0.2947E+11
557	492.487	3	839.139	3	288.474	0.2635	0.2112E+11
558	712.738	4	366.045	3	288.440	5.5808	0.4474E+12
559	552.353	2	899.120	2	288.378	0.2106	0.1689E+11
560	712.250	3	365.457	2	288.356	3.5818	0.2873E+12
561	471.849	4	818.779	4	288.242	0.2551	0.2048E+11
562	584.917	2	931.940	3	288.165	0.6156	0.4945E+11
563	470.803	3	817.903	3	288.101	0.3295	0.2648E+11
564	578.637	2	925.756	3	288.085	0.7987	0.6419E+11
565	577.584	1	230.461	1	288.082	0.1915	0.1539E+11
566	470.061	2	817.204	2	288.065	0.2842	0.2284E+11
567	469.570	1	816.733	1	288.049	0.1784	0.1434E+11
568	433.319	2	780.536	1	288.004	0.3650	0.2935E+11
569	577.584	1	230.313	0	287.959	0.3266	0.2627E+11
570	494.696	4	842.069	3	287.875	0.2283	0.1838E+11
571	490.944	2	838.470	2	287.748	0.2419	0.1949E+11
572	564.900	3	912.499	2	287.687	0.8148	0.6566E+11
573	711.732	2	364.122	1	287.679	2.3390	0.1885E+12
574	469.570	1	817.204	2	287.659	0.3166	0.2552E+11
575	471.849	4	819.557	5	287.597	1.7439	0.1406E+12
576	494.696	4	842.442	4	287.566	0.6351	0.5122E+11
577	470.061	2	817.903	3	287.487	0.5708	0.4606E+11
578	470.803	3	818.779	4	287.376	0.9776	0.7895E+11
579	578.637	2	230.461	1	287.210	0.7806	0.6312E+11
580	576.862	3	925.261	4	287.028	0.2001	0.1620E+11

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
581	577.584	1	926.173	2	286.871	0.4787	0.3880E+11
582	576.862	3	925.756	3	286.620	0.5051	0.4101E+11
583	437.531	1	786.547	2	286.520	0.4483	0.3643E+11
584	490.944	2	840.221	2	286.306	0.6231	0.5070E+11
585	552.353	2	901.696	1	286.251	0.2525	0.2055E+11
586	433.319	2	782.696	2	286.224	0.2145	0.1746E+11
587	492.487	3	842.069	3	286.056	0.7485	0.6101E+11
588	580.305	3	930.001	2	285.962	0.1866	0.1522E+11
589	580.305	3	230.485	2	285.861	1.2672	0.1034E+12
590	548.244	5	898.086	4	285.844	0.1715	0.1400E+11
591	557.535	4	907.386	4	285.835	3.6746	0.3000E+12
592	551.836	1	901.696	1	285.829	0.2199	0.1795E+11
593	494.696	4	844.556	4	285.828	0.9049	0.7387E+11
594	490.944	2	840.808	1	285.825	0.3071	0.2507E+11
595	6.920	2	356.936	1	285.701	0.3526	0.2881E+11
596	433.319	2	783.404	1	285.645	0.4493	0.3673E+11
597	2.928	1	353.382	2	285.344	0.7116	0.5829E+11
598	60.787	0	411.407	1	285.208	1.4897	0.1222E+12
599	575.147	2	926.173	2	284.879	0.3732	0.3067E+11
600	552.353	2	201.158	3	284.742	0.3217	0.2646E+11
601	551.836	1	903.058	0	284.720	0.1829	0.1505E+11
602	551.836	1	200.404	2	284.550	0.2789	0.2297E+11
603	470.061	2	821.535	1	284.516	0.3551	0.2926E+11
604	551.836	1	200.345	1	284.502	0.6321	0.5209E+11
605	580.305	3	931.940	3	284.386	0.2958	0.2439E+11
606	461.219	5	813.088	4	284.196	0.7714	0.6370E+11
607	553.104	3	201.158	3	284.134	1.9912	0.1645E+12
608	552.353	2	200.404	2	284.132	0.9731	0.8039E+11
609	469.570	1	821.535	1	284.119	0.4274	0.3532E+11
610	552.353	2	200.345	1	284.084	0.2760	0.2281E+11
611	433.319	2	785.418	1	284.010	0.3144	0.2600E+11
612	470.803	3	822.930	2	283.988	0.9238	0.7640E+11
613	492.487	3	844.685	2	283.931	0.1732	0.1433E+11
614	469.323	0	821.535	1	283.920	0.1903	0.1575E+11
615	579.581	4	931.940	3	283.802	0.3165	0.2621E+11
616	458.909	4	811.328	3	283.753	0.5112	0.4234E+11
617	676.320	0	1028.802	1	283.702	0.6283	0.5207E+11
618	583.026	0	230.461	1	283.635	0.4099	0.3398E+11
619	553.104	3	200.404	2	283.527	0.2983	0.2475E+11
620	470.061	2	822.930	2	283.391	0.5281	0.4386E+11
621	457.125	3	810.148	2	283.267	0.3671	0.3052E+11
622	471.849	4	825.008	3	283.158	1.7014	0.1415E+12
623	583.674	1	230.485	2	283.135	0.4619	0.3843E+11
624	583.674	1	230.461	1	283.115	0.3432	0.2855E+11
625	433.319	2	786.547	2	283.103	1.2003	0.9989E+11

Table 10 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
626	638.552	1	991.891	1	283.014	0.5719	0.4762E+11
627	583.674	1	230.313	0	282.997	0.4280	0.3564E+11
628	638.552	1	991.930	0	282.983	0.6030	0.5023E+11
629	675.358	1	1028.802	1	282.930	1.9211	0.1601E+12
630	653.292	1	299.831	1	282.916	0.3369	0.2808E+11
631	455.835	2	809.424	1	282.814	0.2532	0.2111E+11
632	458.909	4	813.088	4	282.343	0.4423	0.3700E+11
633	457.125	3	811.328	3	282.324	0.3876	0.3243E+11
634	470.803	3	825.008	3	282.323	0.4099	0.3430E+11
635	455.835	2	810.148	2	282.236	0.2911	0.2438E+11
636	637.509	2	991.871	2	282.197	0.6772	0.5671E+11
637	637.509	2	991.891	1	282.181	1.2298	0.1030E+12
638	642.352	2	996.753	3	282.166	0.5748	0.4815E+11
639	454.998	1	809.424	1	282.146	0.1833	0.1536E+11
640	584.917	2	230.485	2	282.142	1.5559	0.1304E+12
641	437.531	1	791.966	2	282.139	0.2016	0.1689E+11
642	584.917	2	230.461	1	282.122	0.4916	0.4120E+11
643	606.603	3	961.275	4	281.950	0.2103	0.1764E+11
644	711.732	2	356.936	1	281.852	0.2544	0.2136E+11
645	673.517	2	1028.802	1	281.464	3.2357	0.2724E+12
646	2.928	1	358.527	0	281.215	0.3836	0.3235E+11
647	2.928	1	358.656	2	281.114	0.4588	0.3873E+11
648	636.023	3	991.871	2	281.019	2.2681	0.1916E+12
649	439.036	0	795.164	1	280.797	0.3806	0.3220E+11
650	637.509	2	994.010	2	280.504	0.2091	0.1773E+11
651	636.023	3	992.828	3	280.265	0.6251	0.5308E+11
652	0.053	0	356.936	1	280.204	0.7964	0.6766E+11
653	584.917	2	942.024	2	280.027	0.3786	0.3220E+11
654	6.920	2	364.122	1	279.954	0.1847	0.1572E+11
655	461.219	5	818.779	4	279.673	0.8388	0.7153E+11
656	437.531	1	795.164	1	279.616	0.3949	0.3369E+11
657	553.104	3	910.766	2	279.593	0.3493	0.2980E+11
658	552.353	2	910.144	1	279.493	0.5726	0.4889E+11
659	636.023	3	994.010	2	279.339	0.3079	0.2632E+11
660	437.531	1	795.689	0	279.206	0.4389	0.3755E+11
661	551.836	1	910.144	1	279.090	0.9665	0.8276E+11
662	461.219	5	819.557	5	279.066	4.6987	0.4024E+12
663	552.353	2	910.766	2	279.007	1.0533	0.9025E+11
664	620.020	2	978.451	2	278.993	1.0168	0.8713E+11
665	6.920	2	365.457	2	278.911	1.3145	0.1127E+12
666	433.319	2	791.966	2	278.826	0.7552	0.6479E+11
667	712.250	3	353.382	2	278.654	0.1724	0.1481E+11
668	551.836	1	910.766	2	278.606	0.2922	0.2511E+11
669	458.909	4	817.903	3	278.556	0.9947	0.8550E+11
670	6.920	2	366.045	3	278.455	4.0232	0.3461E+12

Table 10 *continued*

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
671	553.104	3	912.499	2	278.245	0.2847	0.2453E+11
672	553.104	3	912.582	3	278.181	3.2760	0.2824E+12
673	620.020	2	979.639	2	278.072	0.7088	0.6114E+11
674	458.909	4	818.779	4	277.878	2.8764	0.2485E+12
675	457.125	3	817.204	2	277.716	0.8717	0.7538E+11
676	552.353	2	912.499	2	277.665	0.5145	0.4451E+11
677	718.846	2	358.656	2	277.631	0.2986	0.2584E+11
678	552.353	2	912.582	3	277.601	0.5349	0.4629E+11
679	508.281	1	868.593	2	277.537	1.2167	0.1054E+12
680	458.909	4	819.557	5	277.279	0.2589	0.2246E+11
681	551.836	1	912.499	2	277.267	0.1717	0.1490E+11
682	457.125	3	817.903	3	277.178	1.8468	0.1603E+12
683	455.835	2	816.733	1	277.087	0.5415	0.4704E+11
684	507.465	2	868.593	2	276.910	2.0436	0.1778E+12
685	2.928	1	364.122	1	276.859	0.9604	0.8357E+11
686	455.835	2	817.204	2	276.725	1.1893	0.1036E+12
687	506.168	3	144.613	2	276.583	3.4104	0.2973E+12
688	457.125	3	818.779	4	276.507	0.4231	0.3691E+11
689	580.305	3	942.024	2	276.457	0.2404	0.2098E+11
690	454.998	1	816.733	1	276.445	0.9394	0.8198E+11
691	616.798	4	978.612	3	276.385	0.8635	0.7540E+11
692	433.319	2	795.164	1	276.361	0.2243	0.1959E+11
693	455.835	2	817.903	3	276.191	0.4826	0.4220E+11
694	673.517	2	311.439	1	276.184	0.4095	0.3581E+11
695	454.998	1	817.204	2	276.085	0.3709	0.3246E+11
696	506.168	3	868.593	2	275.919	2.8601	0.2506E+12
697	2.928	1	365.457	2	275.840	1.4835	0.1300E+12
698	507.465	2	144.613	2	275.594	2.4456	0.2148E+12
699	615.376	3	978.451	2	275.426	0.2411	0.2120E+11
700	508.281	1	144.613	2	274.976	1.4736	0.1300E+12
701	675.358	1	311.439	1	274.787	0.3653	0.3227E+11
702	0.053	0	364.122	1	274.673	0.5514	0.4875E+11
703	615.376	3	979.639	2	274.527	0.4397	0.3891E+11
704	553.104	3	917.521	2	274.411	0.2047	0.1813E+11
705	494.696	4	859.192	3	274.351	0.4558	0.4039E+11
706	614.113	2	979.479	1	273.698	0.3917	0.3488E+11
707	718.846	2	353.382	2	273.625	0.2206	0.1966E+11
708	620.020	2	253.954	2	273.175	1.1789	0.1054E+12
709	596.606	1	230.485	2	273.133	0.6318	0.5649E+11
710	492.487	3	858.610	2	273.132	0.2760	0.2468E+11
711	596.606	1	230.461	1	273.115	0.3369	0.3012E+11
712	532.507	1	899.120	2	272.767	0.5117	0.4587E+11
713	534.485	0	901.696	1	272.323	0.4099	0.3686E+11
714	532.507	1	901.696	1	270.864	0.5098	0.4634E+11
715	529.113	2	899.120	2	270.266	2.2093	0.2017E+12

Table 10 continued

no	E1 (kK)	J	E2 (kK)	J	WLA	gf	gA (sec ⁻¹)
716	532.507	1	903.058	0	269.868	0.4468	0.4092E+11
717	471.849	4	842.442	4	269.837	1.4057	0.1288E+12
718	471.849	4	843.396	3	269.145	0.4789	0.4410E+11
719	737.074	1	365.457	2	269.094	0.3180	0.2929E+11
720	737.662	2	366.045	3	269.094	1.3947	0.1285E+12
721	470.803	3	842.442	4	269.078	0.2858	0.2633E+11
722	737.662	2	365.457	2	268.669	0.8361	0.7726E+11
723	470.803	3	843.322	2	268.443	0.6694	0.6196E+11
724	29.361	2	401.936	3	268.403	3.9639	0.3670E+12
725	529.113	2	901.696	1	268.397	0.5650	0.5231E+11
726	470.803	3	843.396	3	268.389	0.9503	0.8799E+11
727	471.849	4	844.556	4	268.307	0.9014	0.8351E+11
728	603.146	1	230.313	0	268.217	0.2457	0.2278E+11
729	737.074	1	364.122	1	268.131	0.4731	0.4389E+11
730	470.061	2	843.322	2	267.909	0.3689	0.3428E+11
731	470.061	2	843.396	3	267.856	0.4838	0.4497E+11
732	470.061	2	843.407	1	267.848	0.5604	0.5210E+11
733	604.050	2	230.461	1	267.673	0.5161	0.4804E+11
734	673.517	2	299.831	1	267.604	3.0612	0.2851E+12
735	469.570	1	843.322	2	267.557	0.4955	0.4617E+11
736	469.570	1	843.454	0	267.463	0.3117	0.2906E+11
737	580.305	3	954.193	4	267.460	0.2093	0.1952E+11
738	469.323	0	843.407	1	267.319	0.2890	0.2698E+11
739	579.581	4	953.737	5	267.268	1.6855	0.1574E+12
740	575.147	2	200.404	2	266.849	0.5943	0.5566E+11
741	575.147	2	200.345	1	266.807	1.2440	0.1166E+12
742	588.485	1	964.010	1	266.294	0.5458	0.5133E+11
743	675.358	1	299.831	1	266.292	1.7079	0.1606E+12
744	534.485	0	910.144	1	266.199	0.3336	0.3140E+11
745	576.862	3	201.158	3	266.167	0.7607	0.7162E+11
746	448.232	2	824.251	3	265.944	1.6180	0.1526E+12
747	616.798	4	992.828	3	265.936	0.1859	0.1753E+11
748	606.603	3	230.485	2	265.874	0.9920	0.9360E+11
749	576.862	3	200.404	2	265.633	1.8842	0.1781E+12
750	676.320	0	299.831	1	265.612	0.5464	0.5166E+11
751	620.020	2	996.753	3	265.439	0.4432	0.4195E+11
752	577.584	1	200.345	1	265.084	0.3311	0.3143E+11
753	576.862	3	954.193	4	265.020	0.9906	0.9408E+11
754	494.696	4	872.279	5	264.842	0.6424	0.6109E+11
755	578.637	2	200.404	2	264.387	0.2264	0.2160E+11
756	532.507	1	910.766	2	264.369	0.5025	0.4795E+11
757	578.637	2	200.345	1	264.346	0.3364	0.3211E+11
758	737.074	1	358.656	2	264.258	0.4542	0.4338E+11
759	579.581	4	201.158	3	264.255	3.7260	0.3559E+12
760	737.074	1	358.527	0	264.168	0.6305	0.6026E+11

Table 10 continued

no	E1 (kK)	J	E2 (kK)	J	WLA	gf	gA (sec ⁻¹)
761	737.662	2	358.656	2	263.848	0.5181	0.4964E+11
762	580.305	3	201.158	3	263.750	0.2150	0.2061E+11
763	492.487	3	871.698	4	263.705	0.5291	0.5074E+11
764	575.147	2	954.559	3	263.565	0.7775	0.7466E+11
765	736.775	0	356.936	1	263.269	0.8831	0.8498E+11
766	580.305	3	200.404	2	263.226	0.4875	0.4693E+11
767	737.074	1	356.936	1	263.062	0.2473	0.2383E+11
768	490.944	2	871.241	3	262.952	0.4015	0.3873E+11
769	737.662	2	356.936	1	262.656	0.6383	0.6172E+11
770	792.274	0	411.407	1	262.559	1.0896	0.1054E+12
771	579.581	4	961.275	4	261.990	0.7374	0.7166E+11
772	448.232	2	831.119	3	261.174	1.1307	0.1106E+12
773	642.352	2	1025.540	3	260.969	0.3161	0.3096E+11
774	576.862	3	960.318	3	260.786	0.4737	0.4645E+11
775	529.113	2	912.582	3	260.778	0.9241	0.9063E+11
776	509.810	0	893.471	1	260.647	1.1604	0.1139E+12
777	737.074	1	353.382	2	260.626	0.7718	0.7578E+11
778	575.147	2	959.346	2	260.282	0.3924	0.3864E+11
779	737.662	2	353.382	2	260.227	1.2647	0.1246E+12
780	606.603	3	992.828	3	258.916	0.8019	0.7978E+11
781	557.535	4	944.302	5	258.553	3.3764	0.3369E+12
782	745.574	2	358.656	2	258.452	2.1652	0.2162E+12
783	642.352	2	253.954	2	257.468	0.8525	0.8577E+11
784	604.050	2	994.010	2	256.437	0.4746	0.4813E+11
785	448.232	2	839.139	3	255.815	0.5041	0.5138E+11
786	603.146	1	994.318	1	255.642	0.3467	0.3538E+11
787	448.232	2	840.221	2	255.109	0.2016	0.2066E+11
788	642.352	2	1034.350	2	255.103	1.4319	0.1468E+12
789	745.574	2	353.382	2	254.978	1.0108	0.1037E+12
790	588.485	1	981.028	1	254.749	0.6930	0.7122E+11
791	492.487	3	885.612	4	254.372	0.2129	0.2195E+11
792	584.917	2	978.612	3	254.004	0.4402	0.4551E+11
793	494.696	4	889.014	5	253.602	0.2908	0.3016E+11
794	596.606	1	991.871	2	252.995	0.6877	0.7166E+11
795	596.606	1	991.891	1	252.982	0.3911	0.4076E+11
796	448.232	2	844.685	2	252.236	0.9368	0.9820E+11
797	712.738	4	315.172	4	251.531	1.9141	0.2018E+12
798	433.319	2	831.119	3	251.383	0.4502	0.4752E+11
799	580.305	3	978.612	3	251.063	0.7950	0.8412E+11
800	578.637	2	978.451	2	250.116	0.2787	0.2972E+11
801	437.531	1	838.470	2	249.415	0.5538	0.5938E+11
802	712.250	3	311.312	3	249.415	1.3811	0.1481E+12
803	578.637	2	979.639	2	249.376	0.2198	0.2358E+11
804	439.036	0	840.808	1	248.897	0.3053	0.3287E+11
805	577.584	1	979.479	1	248.821	0.3369	0.3630E+11

Table 10 continued

no	E1 (kK)	J	E2 (kK)	J	WLA	gf	gA (sec ⁻¹)
806	655.863	0	1057.783	1	248.806	0.5580	0.6012E+11
807	711.732	2	308.577	2	248.044	1.0157	0.1101E+12
808	437.531	1	840.808	1	247.968	0.2212	0.2400E+11
809	494.696	4	898.086	4	247.899	1.2157	0.1319E+12
810	653.292	1	1057.783	1	247.225	0.5784	0.6312E+11
811	433.319	2	838.470	2	246.822	0.2314	0.2533E+11
812	548.244	5	953.737	5	246.613	0.9426	0.1034E+12
813	636.023	3	230.485	2	246.586	1.1695	0.1283E+12
814	492.487	3	898.266	3	246.439	0.8759	0.9619E+11
815	433.319	2	839.139	3	246.414	0.8331	0.9151E+11
816	547.664	4	954.193	4	245.985	0.7861	0.8665E+11
817	584.917	2	991.871	2	245.728	0.4862	0.5370E+11
818	637.509	2	230.485	2	245.686	0.2583	0.2854E+11
819	637.509	2	230.461	1	245.671	0.6634	0.7331E+11
820	547.198	3	954.559	3	245.482	0.6524	0.7221E+11
821	718.846	2	311.439	1	245.455	1.4042	0.1555E+12
822	490.944	2	898.423	2	245.411	0.6801	0.7532E+11
823	638.552	1	230.461	1	245.043	0.2440	0.2711E+11
824	638.552	1	230.313	0	244.954	0.3077	0.3420E+11
825	433.319	2	842.069	3	244.648	0.1990	0.2217E+11
826	614.113	2	200.345	1	241.681	0.6561	0.7492E+11
827	620.020	2	1034.350	2	241.353	0.3449	0.3949E+11
828	615.376	3	200.404	2	240.980	0.8465	0.9723E+11
829	616.798	4	201.158	3	240.593	1.1182	0.1288E+12
830	439.036	0	858.141	1	238.603	0.2205	0.2584E+11
831	437.531	1	858.610	2	237.485	0.4344	0.5138E+11
832	433.319	2	859.192	3	234.812	0.6267	0.7581E+11
833	494.696	4	925.261	4	232.253	0.2583	0.3194E+11
834	564.900	3	996.753	3	231.560	0.5629	0.7002E+11
835	691.522	3	253.954	2	228.536	1.7453	0.2229E+12
836	564.900	3	1007.753	4	225.808	0.2232	0.2919E+11
837	588.485	1	1034.350	2	224.283	0.3922	0.5201E+11
838	557.535	4	1007.753	4	222.114	0.2614	0.3534E+11
839	448.232	2	906.360	3	218.279	0.3547	0.4965E+11
840	494.696	4	953.737	5	217.845	0.2730	0.3837E+11
841	564.900	3	1025.540	3	217.089	0.3099	0.4386E+11

Table 11 Calculated wavelengths for the transitions between the levels of ($\text{G}+\text{C}+\text{D}$) configurations in the 1st parity and those of ($\text{G}+\text{G}$) in the 2nd parity. Energy in 10^3 cm^{-1} .

Line no	1st parity		2nd parity		WL (Å)	gf	$gA (\text{sec}^{-1})$
	E(kK)	J	E(kK)	J			
1	433.319	2	299.831	1	749.133	0.1121	0.1332E+10
2	448.232	2	311.439	1	731.033	0.0798	0.9958E+09
3	437.531	1	299.831	1	726.218	0.0671	0.8481E+09
4	557.535	4	401.936	3	642.677	0.1170	0.1890E+10
5	494.696	4	315.172	4	557.030	0.1138	0.2446E+10
6	492.487	3	311.312	3	551.951	0.0887	0.1941E+10
7	553.104	3	366.045	3	534.590	0.1105	0.2580E+10
8	448.232	2	253.954	2	514.725	0.5819	0.1465E+11
9	509.810	0	311.439	1	504.106	0.1903	0.4995E+10
10	564.900	3	358.656	2	484.862	0.2319	0.6579E+10
11	620.020	2	411.407	1	479.358	0.1409	0.4091E+10
12	564.900	3	353.382	2	472.774	0.1987	0.5928E+10
13	584.917	2	366.045	3	456.889	0.1073	0.3427E+10
14	580.305	3	358.656	2	451.163	0.1224	0.4012E+10
15	580.305	3	353.382	2	440.679	0.1227	0.4214E+10
16	588.485	1	358.656	2	435.105	0.1369	0.4823E+10
17	642.352	2	411.407	1	433.004	0.2177	0.7746E+10
18	433.319	2	201.158	3	430.736	0.4880	0.1754E+11
19	548.244	5	315.172	4	429.052	1.6561	0.6000E+11
20	588.485	1	353.382	2	425.346	0.1146	0.4225E+10
21	547.664	4	311.312	3	423.097	1.3099	0.4881E+11
22	437.531	1	200.404	2	421.714	0.2429	0.9111E+10
23	547.198	3	308.577	2	419.076	1.0094	0.3833E+11
24	653.292	1	411.407	1	413.419	0.2376	0.9273E+10
25	615.376	3	366.045	3	401.072	0.1219	0.5056E+10
26	615.376	3	365.457	2	400.129	1.0335	0.4306E+11
27	614.113	2	364.122	1	400.014	0.7016	0.2925E+11
28	616.798	4	366.045	3	398.799	1.7656	0.7404E+11
29	614.113	2	356.936	1	388.837	0.1583	0.6985E+10
30	615.376	3	353.382	2	381.688	0.1687	0.7725E+10
31	579.581	4	315.172	4	378.203	0.4872	0.2272E+11
32	576.862	3	311.312	3	376.576	0.3706	0.1743E+11
33	575.147	2	308.577	2	375.136	0.3381	0.1602E+11
34	636.023	3	366.045	3	370.401	0.8781	0.4269E+11
35	637.509	2	365.457	2	367.577	0.7358	0.3632E+11
36	638.552	1	364.122	1	364.391	0.5166	0.2595E+11
37	636.023	3	358.656	2	360.533	0.8275	0.4246E+11
38	638.552	1	358.527	0	357.110	0.6202	0.3244E+11
39	637.509	2	356.936	1	356.413	1.3974	0.7337E+11
40	638.552	1	356.936	1	355.093	0.2291	0.1212E+11

Table 11 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
41	636.023	3	353.382	2	353.806	1.6639	0.8866E+11
42	642.352	2	358.656	2	352.489	0.8078	0.4337E+11
43	637.509	2	353.382	2	351.955	0.1878	0.1011E+11
44	642.352	2	353.382	2	346.057	0.4669	0.2600E+11
45	606.603	3	315.172	4	343.135	1.8611	0.1054E+12
46	604.050	2	311.312	3	341.601	1.4297	0.8172E+11
47	603.146	1	308.577	2	339.479	1.0308	0.5965E+11
48	653.292	1	358.656	2	339.401	0.2682	0.1553E+11
49	606.603	3	311.312	3	338.649	0.4060	0.2361E+11
50	604.050	2	308.577	2	338.440	0.2937	0.1710E+11
51	529.113	2	230.485	2	334.865	0.2582	0.1536E+11
52	653.292	1	353.382	2	333.433	0.1587	0.9519E+10
53	615.376	3	315.172	4	333.106	0.5428	0.3263E+11
54	616.798	4	315.172	4	331.537	3.0528	0.1852E+12
55	532.507	1	230.485	2	331.102	0.1821	0.1108E+11
56	614.113	2	311.312	3	330.250	0.2838	0.1735E+11
57	615.376	3	311.312	3	328.877	1.7243	0.1063E+12
58	616.798	4	311.312	3	327.347	0.2213	0.1378E+11
59	614.113	2	308.577	2	327.294	1.2862	0.8009E+11
60	615.376	3	308.577	2	325.946	0.1822	0.1144E+11
61	718.846	2	411.407	1	325.268	1.4552	0.9174E+11
62	673.517	2	366.045	3	325.233	1.6019	0.1010E+12
63	675.358	1	365.457	2	322.684	1.0464	0.6703E+11
64	564.900	3	253.954	2	321.599	1.3474	0.8689E+11
65	675.358	1	364.122	1	321.299	0.1489	0.9620E+10
66	676.320	0	364.122	1	320.309	0.5124	0.3331E+11
67	673.517	2	358.656	2	317.600	0.3657	0.2418E+11
68	673.517	2	356.936	1	315.875	0.2125	0.1421E+11
69	675.358	1	358.527	0	315.626	0.1642	0.1099E+11
70	718.846	2	401.936	3	315.546	2.2504	0.1507E+12
71	675.358	1	356.936	1	314.048	0.2694	0.1822E+11
72	673.517	2	353.382	2	312.368	0.4742	0.3242E+11
73	636.023	3	315.172	4	311.672	0.5371	0.3688E+11
74	637.509	2	311.312	3	306.562	0.2917	0.2070E+11
75	529.113	2	201.158	3	304.919	1.3369	0.9590E+11
76	529.113	2	200.404	2	304.220	0.4228	0.3047E+11
77	638.552	1	308.577	2	303.053	0.1998	0.1451E+11
78	642.352	2	311.439	1	302.194	1.0084	0.7365E+11
79	532.507	1	200.404	2	301.111	0.6349	0.4670E+11
80	532.507	1	200.345	1	301.058	0.3407	0.2507E+11
81	691.522	3	358.656	2	300.421	2.1949	0.1622E+12
82	534.485	0	200.345	1	299.275	0.3079	0.2293E+11
83	745.574	2	411.407	1	299.252	1.7754	0.1322E+12
84	588.485	1	253.954	2	298.926	1.2702	0.9481E+11
85	736.483	4	401.936	3	298.911	6.2882	0.4694E+12

Table 11 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
86	691.522	3	353.382	2	295.736	1.0758	0.8204E+11
87	653.292	1	311.439	1	292.523	1.4533	0.1133E+12
88	642.352	2	299.831	1	291.953	0.2115	0.1655E+11
89	745.574	2	401.936	3	291.004	0.2334	0.1839E+11
90	655.863	0	311.439	1	290.340	0.5391	0.4265E+11
91	712.250	3	366.045	3	288.846	0.4429	0.3541E+11
92	711.732	2	365.457	2	288.788	0.4204	0.3362E+11
93	712.738	4	366.045	3	288.440	5.5808	0.4474E+12
94	712.250	3	365.457	2	288.356	3.5818	0.2873E+12
95	577.584	1	230.461	1	288.082	0.1915	0.1539E+11
96	577.584	1	230.313	0	287.959	0.3266	0.2627E+11
97	711.732	2	364.122	1	287.679	2.3390	0.1885E+12
98	578.637	2	230.461	1	287.210	0.7806	0.6312E+11
99	580.305	3	230.485	2	285.861	1.2672	0.1034E+12
100	552.353	2	201.158	3	284.742	0.3217	0.2646E+11
101	551.836	1	200.404	2	284.550	0.2789	0.2297E+11
102	551.836	1	200.345	1	284.502	0.6321	0.5209E+11
103	553.104	3	201.158	3	284.134	1.9912	0.1645E+12
104	552.353	2	200.404	2	284.132	0.9731	0.8039E+11
105	552.353	2	200.345	1	284.084	0.2760	0.2281E+11
106	583.026	0	230.461	1	283.635	0.4099	0.3398E+11
107	553.104	3	200.404	2	283.527	0.2983	0.2475E+11
108	583.674	1	230.485	2	283.135	0.4619	0.3843E+11
109	583.674	1	230.461	1	283.115	0.3432	0.2855E+11
110	583.674	1	230.313	0	282.997	0.4280	0.3564E+11
111	638.552	1	991.930	0	282.983	0.6030	0.5023E+11
112	653.292	1	299.831	1	282.916	0.3369	0.2808E+11
113	584.917	2	230.485	2	282.142	1.5559	0.1304E+12
114	584.917	2	230.461	1	282.122	0.4916	0.4120E+11
115	711.732	2	356.936	1	281.852	0.2544	0.2136E+11
116	712.250	3	353.382	2	278.654	0.1724	0.1481E+11
117	718.846	2	358.656	2	277.631	0.2986	0.2584E+11
118	506.168	3	144.613	2	276.583	3.4104	0.2973E+12
119	673.517	2	311.439	1	276.184	0.4095	0.3581E+11
120	507.465	2	144.613	2	275.594	2.4456	0.2148E+12
121	508.281	1	144.613	2	274.976	1.4736	0.1300E+12
122	675.358	1	311.439	1	274.787	0.3653	0.3227E+11
123	718.846	2	353.382	2	273.625	0.2206	0.1966E+11
124	620.020	2	253.954	2	273.175	1.1789	0.1054E+12
125	596.606	1	230.485	2	273.133	0.6318	0.5649E+11
126	596.606	1	230.461	1	273.115	0.3369	0.3012E+11
127	737.074	1	365.457	2	269.094	0.3180	0.2929E+11
128	737.662	2	366.045	3	269.094	1.3947	0.1285E+12
129	737.662	2	365.457	2	268.669	0.8361	0.7726E+11
130	603.146	1	230.313	0	268.217	0.2457	0.2278E+11

Table 11 continued

no	E(kK)	J	E(kK)	J	WL(Å)	gf	gA(sec ⁻¹)
131	737.074	1	364.122	1	268.131	0.4731	0.4389E+11
132	604.050	2	230.461	1	267.673	0.5161	0.4804E+11
133	673.517	2	299.831	1	267.604	3.0612	0.2851E+12
134	575.147	2	200.404	2	266.849	0.5943	0.5566E+11
135	575.147	2	200.345	1	266.807	1.2440	0.1166E+12
136	675.358	1	299.831	1	266.292	1.7079	0.1606E+12
137	576.862	3	201.158	3	266.167	0.7607	0.7162E+11
138	606.603	3	230.485	2	265.874	0.9920	0.9360E+11
139	576.862	3	200.404	2	265.633	1.8842	0.1781E+12
140	676.320	0	299.831	1	265.612	0.5464	0.5166E+11
141	577.584	1	200.345	1	265.084	0.3311	0.3143E+11
142	578.637	2	200.404	2	264.387	0.2264	0.2160E+11
143	578.637	2	200.345	1	264.346	0.3364	0.3211E+11
144	737.074	1	358.656	2	264.258	0.4542	0.4338E+11
145	579.581	4	201.158	3	264.255	3.7260	0.3559E+12
146	737.074	1	358.527	0	264.168	0.6305	0.6026E+11
147	737.662	2	358.656	2	263.848	0.5181	0.4964E+11
148	580.305	3	201.158	3	263.750	0.2150	0.2061E+11
149	736.775	0	356.936	1	263.269	0.8831	0.8498E+11
150	580.305	3	200.404	2	263.226	0.4875	0.4693E+11
151	737.074	1	356.936	1	263.062	0.2473	0.2383E+11
152	737.662	2	356.936	1	262.656	0.6383	0.6172E+11
153	792.274	0	411.407	1	262.559	1.0896	0.1054E+12
154	737.074	1	353.382	2	260.626	0.7718	0.7578E+11
155	737.662	2	353.382	2	260.227	1.2647	0.1246E+12
156	745.574	2	358.656	2	258.452	2.1652	0.2162E+12
157	642.352	2	253.954	2	257.468	0.8525	0.8577E+11
158	745.574	2	353.382	2	254.978	1.0108	0.1037E+12
159	712.738	4	315.172	4	251.531	1.9141	0.2018E+12
160	712.250	3	311.312	3	249.415	1.3811	0.1481E+12
161	711.732	2	308.577	2	248.044	1.0157	0.1101E+12
162	636.023	3	230.485	2	246.586	1.1695	0.1283E+12
163	637.509	2	230.485	2	245.686	0.2583	0.2854E+11
164	637.509	2	230.461	1	245.671	0.6634	0.7331E+11
165	718.846	2	311.439	1	245.455	1.4042	0.1555E+12
166	638.552	1	230.461	1	245.043	0.2440	0.2711E+11
167	638.552	1	230.313	0	244.954	0.3077	0.3420E+11
168	614.113	2	200.345	1	241.681	0.6561	0.7492E+11
169	615.376	3	200.404	2	240.980	0.8465	0.9723E+11
170	616.798	4	201.158	3	240.593	1.1182	0.1288E+12
171	691.522	3	253.954	2	228.536	1.7453	0.2229E+12

Table 12 Calculated reduced electric dipole radial integrals
(in atomic units)..

Transition		Reduced E1 integral
$3s^2 3p^2$	- $3s3p^3$	$(3s:R1:3d) = 0.9052$
	- $3s^2 3p3d$	$(3p:R1:3d) = 1.2371$
$3p^4$	- $3s3p^3$	$(3p:R1:3s) = -0.9036$
	- $3p^3 3d$	$(3p:R1:3d) = 1.2362$
$3s3p^2 3d$	- $3s3p^3$	$(3d:R1:3p) = -1.2367$
	- $3s^2 3p3d$	$(3p:R1:3s) = -0.9063$
	- $3s3p3d^2$	$(3p:R1:3d) = 1.2429$
	- $3p^3 3d$	$(3s:R1:3p) = 0.9048$
$3s^2 3d^2$	- $3s^2 3p3d$	$(3d:R1:3p) = -1.2407$
	- $3s3p3d^2$	$(3s:R1:3p) = 0.9062$