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Excitation Collision Strengths, Cross Sections and Rate Coefficients for OV, SiXI, FeXXIII, MoXXXIX by Electron Impact ($1s^22s^2$-$1s^22s2p$-$1s^22p^2$ Transitions)

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Abstract

Excitation collision strengths, cross sections and rate coefficients by electron impact are calculated for the transitions among the $1s^22s^2$, $1s^22p^2$, $1s^22s2p$ levels of Be-like system of OV, SiXI, FeXXIII and MoXXXIX ions by Coulomb-Born approximation with exchange including relativistic effect and configuration interactions. The theoretical method for calculation is described and the results are compared with the previous calculations. Numerical data and comparison are presented in Tables as well as in Figures. Two kinds of fitting formulae for cross sections and rate coefficients are discussed.

CONTENTS

1. Introduction

Cross sections, collision strengths, rate coefficients for excitations of highly charged ions by electron impact are necessary for the study of high temperature plasmas such as those of interest in astrophysics and fusion research. For ions with very high Z, relativistic effects play a very important role. Relativistic effects in excitation of ions arise from two sources: target atom wave functions and the interaction of the incident and bound electrons in the target ion. The former is more important.

In any case we can divide the calculation problem in excitation of ions into two parts. The collision problem itself, in which the fundamental role is played by electrostatic interaction of the external electron with the target ion. This problem can be solved without relativistic effects. Although, in principle, relativistic effects can affect even the interaction of an external electron with target ion, their influence on the overall cross section at the medium energies is small and will not be considered here. The role of these effects will be more significant in differential cross sections, polarized radiation and other cases.

In this article we consider the influence of relativistic effects and configuration interactions for Be-like atomic system ($1s^22s^2$, $1s^22p^2$, $1s^22s2p$) on the collision strengths, the excitation cross sections and the rate coefficients. For the collision problem we used the Coulomb-Born approximation with exchange in the orthogonalized function variant.

Many of the data for collision strengths (Ω), excitation cross sections (σ) and rate coefficients (R) were obtained in Ref.1 in fitting forms. For comparison with our data we calculated Ω, σ, R using fitting parameters from this article for ions with Z=8, 14, 26, 42, which are the elements frequently applied to the experimental study. Also, we compared our results with data by R-matrix method from Ref.2, 3 for ions of Z=8, 14.

2. General Formula

The calculation technique is significantly simplified if we make two assumptions:

1. the initial wave functions of atomic system are constructed from one-electron functions,
2. in the collision problem only channels with one type of transition of the atomic (optical) electron are considered simultaneously (for example, the

interactions of the s^2-sp and p^2-sp channels are considered, yet the interactions of the p^2-pd and p^2-ps channels are not).

With these approximations the excitation cross section σ for the transition between two levels a'J'-aJ can be expressed in a form[4]

$$\sigma(a'J' - aJ) = \sum_{\kappa} A'_{\kappa}\sigma'_{\kappa} + \sum_{\kappa} A''_{\kappa}\sigma''_{\kappa} \quad , \tag{1}$$

where,

$$\sigma'_{\kappa} = \sigma'_{\kappa}(n'l' - nl) = \sigma^{d}_{\kappa} - \sigma^{i}_{\kappa} \text{ and } \sigma''_{\kappa} = \sigma''_{\kappa}(n'l' - nl) = \sigma^{e}_{\kappa} \tag{2}$$

are the one-electron cross sections. σ_{κ}' includes the direct $\sigma_{\kappa}{}^{d}$ and the interference $\sigma_{\kappa}{}^{i}$ parts, and $\sigma_{\kappa}{}^{e}$ is the exchange part. The values of κ are from the interval $|l_0-l_1| : l_0+l_1$. In the first summation of Eq.(1) κ is multiplicity of direct and interference parts and takes the values of the same parity, whereas in the second sum κ takes values of any parity.

In Eq.(1) the dependences of the atomic parameters are concentrated in the factors A'_{κ} and A''_{κ}. We shall introduce the coefficients of intermediate coupling scheme $C_J(a, a_o)$ where aJ denotes the mixed state and a_oJ is the initial base state in the LS coupling scheme. (We shall discuss all these questions in the next paragraph).

Then A'_{κ} and A''_{κ} are presented as follows

$$A'_{\kappa}(a'J', aJ) = \frac{1}{2J'+1}\left|\sum_{a_1, a_2} C_{J'}(a', a_2)\, b_{\kappa}(a_2 J', a_1 J)\, C_J(a_1, a)\right|^2 , \tag{3}$$

and

$$A''_{\kappa}(a'J', aJ) = \frac{1}{4}A'_{\kappa}(a'J', aJ) + \frac{1}{2J'+1}\sum_{v}\left|\sum_{a_1, a_2} C_{J'}(a', a_2)\, b_{\kappa v}(a_2 J', a_1 J)\, C_J(a_1, a)\right|^2 . \tag{4}$$

Here coefficients b_{κ} and $b_{\kappa v}$ depend on the angular-momentum quantum numbers of the states aJ, a'J'. For any states a, a' in LS coupling scheme we have,

$$b_{\kappa}(a_2J_2\, ,\ a_1J_1) = (-1)^{J_1-S_1}\ \beta\, \delta(S_1\, ,\ S_2)\sqrt{(2J_1+1)(2J_2+1)}\begin{Bmatrix} \kappa & J_1 & J_2 \\ S_1 & L_2 & L_1 \end{Bmatrix} \tag{5}$$

$$b_{\kappa v}(a_2J_2\, ,\ a_1J_1) = (-1)^{L_2}\ \beta''\sqrt{(2J_1+1)(2J_2+1)(2v+1)3/2}\ \begin{Bmatrix} \kappa & J_1 & v \\ S_1 & L_2 & L_1 \end{Bmatrix}\begin{Bmatrix} v & J_2 & 1 \\ S_2 & S_1 & L_2 \end{Bmatrix} \tag{6}$$

The coefficients β and β''depend on the type of a_2-a_1 transition. For the transition without changing of the atomic core C, $a_2 = Cn_2l_2L_2S_2$, a = $Cn_1l_1L_1S_1$ and C = $C_0L_0C_0$, so that we have (7)

$$\beta = (-1)^{L_0} \sqrt{(2L_1+1)(2L_2+1)} \begin{Bmatrix} \kappa & L_1 & L_2 \\ L_0 & l_2 & l_1 \end{Bmatrix} \tag{8}$$

$$\beta'' = \beta\, (-1)^{S_0 - S_2 + 1/2} \sqrt{(2S_1+1)(2S_2+1)} \begin{Bmatrix} 1 & S_1 & S_2 \\ S_0 & 1/2 & 1/2 \end{Bmatrix} \tag{9}$$

3. Energy Levels and Mixing Coefficients

The energy matrix is taken as a sum of four parts[6]:

$$E\,(aLSJ, a'L'S'J) = (E^N + E^R + E^L)\,\delta(LS, L'S') + E^S \tag{10}$$

where E^N is the nonrelativistic part, E^R is the relativistic shift of term, E^S is the relativistic splitting which includes spin-orbital and spin-spin interactions. The values of E^R and E^S are calculated in the frame of the Breit operator[7]. The value E^L includes Lamb-shift and the highest order relativistic corrections. The 1/Z perturbation theory was used for calculation every part in Eq.(10). The result of these calculations can be written in a form:

$$E^N = \delta\,(a, a')E_0Z^2 + E_1Z + E_2 + E_3/Z \tag{11}$$

$$E^R = \frac{\alpha^2}{4}\,[\delta(a, a')E_0^R\,Z^4 + E_1^R\,Z^3] \tag{12}$$

$$E^S = \frac{\alpha^2}{4}\,[\varepsilon_0Q_1Z^4 + \varepsilon_1Q_1Z^3 + \varepsilon'Q_1Z^3 + \varepsilon^{ss}Q_2Z^3] \tag{13}$$

$$E^L = \frac{4}{3\pi}\,\alpha^3\,Z^3\,\Lambda + \alpha^4Z^6\,D\,, \quad \alpha^{-1} = 137.036 \tag{14}$$

$$Q_k = (-1)^{J+L+S} \begin{Bmatrix} L & S & J \\ S' & L' & k \end{Bmatrix} \tag{15}$$

In eqs.(11)-(13) E_k and ε_k (k = 0, 1, 2) are independent of Z but the parameters Λ and D in eq.(14) depend on Z. These coefficients were discussed in Ref.7.

For obtaining more precise theoretical result for energy it is better to add new coefficients, $E_{22}\alpha^2Z^2$, $E_{23}\alpha^2Z\cdots$, to E^R and E^S in eqs.(12) and (13). For calculation of E_{22}, E_{23} coefficients screening approximation[6] is useful. Thus we can rewrite E^R in a form:

$$E^R=\frac{\alpha^2}{4}(Z-\sigma^R)^3[\delta(a, a')ZE_0^R+R'], \tag{16}$$

where $\sigma^R=-E_1^R/3\ E_0^R$, and thus we add $\frac{\alpha^2}{4}\delta(a, a')\,E_0^R\times[\,3\,(\sigma^R)^2Z^2-(\sigma^R)^3\,Z\,]$ to E^R in Eq.(12). This additional term of screening approximation gives better agreement with experimental data for energy. By the same manner we rewrite E^S:

$$E^S=\frac{\alpha^2}{4}(Z-\sigma^s)^3[Z\varepsilon_0Q_1+\varepsilon'Q_1+\varepsilon^{ss}Q_2], \tag{17}$$

where $\sigma^s=-\varepsilon_1/3\varepsilon_0$.

Now we return to Eq.(10). After calculations of all the elements of the ener a'L'S'J'), we have to diagonalize it. We include quasidegenerate configurations ($2s^2+2p^2$) in the first order perturbation theory (E_1) and all other configurations (together with continuous ones) in the second and the third orders (E_2, E_3).

After diagnonalizing the energy matrix , we obtain C_J(aLS, a'L'S'), which are the coefficients for intermediate coupling scheme, and the energy eigen-values E_J(aLS). We used the same aLS- designations as before diagonalization (Since the mixing of configurations and the relativistic effects are not sometimes so significant, it is convenient to use aLS-designations).

Results of our calculations for Be-like ions are given in Tables. We use the designations for levels after Ref.8 : letters for designations of configurations are the following; E - $1s^22s^2$, F - $1s^22p^2$, C - $1s^22s2p$, S - $1s^22s$ and the numbers for levels : (2S+1)(2L+1)(2J+1). Table 1 gives ionization potential for $1s^22l2l'$LSJ levels. These data are used in ATOM program. For calculation of the excitation cross sections for $1s^22p^2$ state the ionization energy of 2p electron ($1s^22p^2$ - $1s^22p$) is to be known. For this case we add in Table 1 transition energy for $1s^22p$ - $1s^22s$ and use the following letters for configurations: P - $1s^22p$, S - $1s^22s$.

In order to demonstrate the accuracy of data in Table 1', we compare them with Edlen's experimental data[9] which are thought to be very reliable. Table 1' gives energy difference (cm^{-1}) between our data and those of Ref.9. We can see that differences are 10 - 500 cm^{-1} or less than 0.1% for ions with Z = 6 - 28.

Intermediate coupling coefficients are given in Table 2. We have three matrix: J = 0 ($2s^2\,{}^1S + 2p^2\,{}^3P + 2p^2\,{}^1S$), J = 2 ($2p^2\,{}^3P + 2p^2\,{}^1D$), J = 1 ($2s2p\,{}^1P + 2s2p\,{}^3P$). We obtain three blocks of the elements as,

$$J = 0 \quad \Psi(i) = C(i, 1)\,\Psi(2s^2\,{}^1S) + C(i, 2)\,\Psi(2p^2\,{}^3P) + C(i, 3)\,\Psi(2p^2\,{}^1S)$$

$$J = 2 \quad \Psi(k) = C(k, 4)\,\Psi(2p^2\,{}^3P) + C(k, 5)\,\Psi(2p^2\,{}^1D) \tag{18}$$

$$J = 1 \quad \Psi(l) = C(l, 6)\,\Psi(2s2p\,{}^1P) + C(l, 7)\,\Psi(2s2p\,{}^3P)$$

Table 2 gives the coefficients C(m, n) for Z = 6 - 54. We can see the influence of relativistic effects on C(m, n). The nondiagonal coefficients C(4, 5) and C(6, 7) [C(4, 5) = -C(5, 4), C(6, 7) = C(7, 6)] increase very rapidly with increasing Z, especially C(4, 5) coefficient. For Z = 35 the value of nondiagonal coefficient is equal to that of diagonal coefficient (C(4, 5) = C(4, 4)). In such case of Z = 35 and 36 it takes place the crossing of levels ${}^3P_2$ and ${}^1D_2$. But if we want to have the smooth curve for atomic characteristics we must change name of levels (${}^3P_2$ and ${}^1D_2$). About mixing of configurations (C(1, 3) and C(3, 1) coefficients) we can find from Table 2 that the values of C(1, 3) and C(3, 1) decrease with increasing Z. Relativistic effects suppress the part of interaction between quasi degenerate configurations.

4. Account for Relativistic Corrections and Configuration Interaction for Be-Like Ions

In this paper we consider the cross sections of dipole transitions ($\Delta\kappa = 1$) among $2s^2$, $2s2p$, $2p^2$ states of Be-like ions. This corresponds to the one-electron transition 2s-2p. In this particular case b_κ and $b_{\kappa v}$ are given from Eqs.(5) and (6) :

$$b_\kappa(2s^2\ {}^1s_0 - 2s2p\ {}^1p_1) = -b_\kappa(2s2p\ {}^1P_1 - 2s^2\ {}^1S_0) = -\ 2\,\delta(\kappa,\ 1) \tag{19}$$

$$b_\kappa\,(2s2p,L_2S_1J_2 - 2p^2\,L_1S_1J_1) = \delta\,(\kappa,\ 1)\,\delta\,(L_2,1)\,(-1)^{J_1L_1+1}\begin{Bmatrix} 1 & J_1 & J_2 \\ S_1 & 1 & L_1 \end{Bmatrix}(2J_1+1)(2J_2+1) \tag{20}$$

$$b_{kv}(2s2p\ \ {}^3P_J - 2s^2\,{}^1S_0) = d(k,\ 1)\ d(v,\ 1)\ (-1)^{J_2+1}\ \ (2J_2+1)/6 \tag{21}$$

$$b_{\kappa v}\,(2_s2_p,L_2S_2J_2 - 2p^2\,L_1S_1J_1) = \delta\,(\kappa,\ 1)\,\delta\,(L_2,1)\,\sqrt{(2J_1+1)(2J_2+1)(2v+1)}\ \times$$

$$(2S_1+1)(2S_2+1)(2L_1+1)\begin{Bmatrix} 1 & J_1 & v \\ S_1 & 1 & L_1 \end{Bmatrix}\begin{Bmatrix} v & J_2 & 1 \\ S_2 & S_1 & 1 \end{Bmatrix}\begin{Bmatrix} 1 & S_1 & S_2 \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{Bmatrix}(-1)^{L_1+1} \tag{22}$$

We used these coefficients for the calculations of A' and A" in Eqs.(3) and (4). All intermediate coupling coefficients - $C_J(a', a)$ are given on Table 2.

Results of calculations for Z = 6 - 54 are given in Table 3. We used the same designations for levels as before. Table 3 includes atomic data for all transitions among $2s^2$ - 2s2p - $2p^2$ for Z = 6 - 57. The values of A', A" coefficients are given in the two last columns. The other three columns we give also wavelengths in Angstrom, transition probabilities in units $10^{13}\ s^{-1}$ and oscillator strengths. For all the possible 24 transitions among $2s^2$ - 2s2p - $2p^2$ levels, the value of A" is not zero. For transitions with $\Delta J = 0$ and 2 the value of A' is zero. (there are 8 transitions for this type). The values of the transition probabilities and the oscillator strengths for $\Delta J = 0$ and 2 are also zero (A and F in Table 3).

The influence of relativistic effects on A' and A" is shown in Fig.1a and 1b. We choose the transitions with different behaviors of A' and A" from Z. For the transitions with levels $2p^2\ {}^3P_2$ and ${}^1D_2$, the relativistic effects are important. We can see the large variations for these transitions. But influence of configuration mixing is not so important for A" for 2s2p ${}^3P_0$ - $2s^2\ {}^1S_0$ and A' for $2p^2\ {}^3P_0$ - 2s2p ${}^3P_1$.

5. Excitation Cross Sections

The excitation cross section of the a'J' - aJ transition is determined by Eq.(1). One-electron transition cross sections are calculated in Coulomb-Born approximation with exchange. In contrast to the factors A' and A", in calculating σ_κ we did not use 1/Z perturbation theory, since the zero approximation is not sufficient and the estimate of the first approximation is connected with serious difficulties. Instead we used semiempirical atomic functions $P_{nl}(r|\varepsilon_a)$, that is the solution of the radial equation in the effective central field of the target for a given energy which is taken from MZ program (Table 1 in our case). The external electron is described by the Coulomb function $F_{\varepsilon l}(r)$ in the field - (Z - N)/r, where N is the number of electrons in the atom. To find the amplitude of the exchange excitations, orthogonalized functions are used

$$G_{\varepsilon l} = F_{\varepsilon l} - \langle F_{\varepsilon l} \mid P_{n'l} \rangle P_{n'l},\ G_{\varepsilon l'} = F_{\varepsilon l'} - \langle F_{\varepsilon l'} \mid P_{nl'} \rangle P_{nl'} \quad (23)$$

See Ref.4 for more detail. Using the different method to determine A_κ and σ_κ is not correct but this model gives the better result in our opinion. The calculation was carried out using the ATOM program.

The one-electron cross sections σ'_κ and σ''_κ are obtained using parameter $Z_s = Z - N + 1$, energies E_0 and E_1 of the initial and final states and effective central field . In order to calculate the one-electron (2s-2p) transition cross sections we use different energies for different transitions.

The collisional excitation rates were calculated from excitation cross sections assuming a Maxwellian distribution of electrons. The results of our calculations are given in Tables 4, 5 and 6 and Fig.2 for ions OV, SiXI, FeXXIII, MoXXXIX.

6. Collision Strengths and Excitation Cross Sections for OV and SiXI

Since our method includes relativistic mixing coefficients, it can be applied better for ions with high Z element. But we compared our results with data by Belfast group in Ref.2 and 3 where nonrelativistic R-matrix method was used. In this section we discuss OV for which relativistic effects are very small. Our method is simpler than R-matrix method.

Comparison is shown in Fig.2 for collision strength (Ω) and in Fig.3 for cross section (σ) with the data of Ref.2, 3 and 11. In Ref.2 the calculations at low energies (E< 57.8 eV) are given, whereas the energy is 59.8 - 163.2 eV in Ref.3. Our calculation gives data for wide energies from ΔE+0.2125 to ΔE+3482 eV intervals. For optical allowed transitions Eq.(1), (2) contained direct, interference (σ') and exchange (σ'') terms. In this case Ω is constant or slowly increasing at large energy. On the other hand transitions $\Delta J = 2$

and J = 0-0 are purely exchanged ($\sigma'=0$) and Ω are decreased with increasing of energy. In general case including of relativistic effects the behavior of Ω can be complicated.

Generally, the collision strengths for the optically allowed transitions agree well each other. But for $2s2p\,^1P$-$2p^2\,^1D$ and $2s2p\,^1P$-$2p^2\,^1S$, the discrepancies of 30% and 50% are found, respectively. For the optically forbidden $2s2p\ ^3P_0$ - $2p^2\ ^3P_2$ transition, the difference is about 50%. For spin exchange transitions of $2s2p\ ^3P$ - $2p^2\ ^1S$ and $2s2p\ ^1P$ - $2p^2\ ^3P$, the disagreement is about factor of 2. Especially for $2s^2\ ^1S$ - $2s2p\ ^3P$ and $2s2p\,^1P$ - $2p^2\ ^3P$, the resonance contributions by Refs.2 and 3 are large at low energies.

The ratio σ''/σ' decreases with energy as E^{-2} Therefore $A''\sigma''$ can became smaller than $A'\sigma'$ if A' is not too small. An example for SiXI A' is $6\,10^{-4}$ and relativistic mixture of the direct term to $2s^2\ ^1S$-$2s2p\ ^3P$ transition is important in the keV region.

7. Comparison of Two Calculations for High Z Ions

The comparison of our results with those from Ref.1. is given in Tables 4-6. We calculated the cross sections (σ) and the rate coefficient ($R=\langle V\sigma\rangle$) with the use of the fitting parameters in Ref.1. It is mentioned in Ref. 1 that the more correct data for energy give the better results. Then our transition energies were used instead of theirs. Table 7 shows the comparison of our data with those in Ref.1 for the transition energies ΔE for 24 transitions of four ions (z = 14, 26, 42, 54) in unit E/Z^2 Ryd. The large differences for low Z elements are found. As shown in Table 1', our results for energy of Be-like ions is in a good agreement with experimental results.

Tables 4a - 6a give the comparison for σ for the energies E = $(\Delta E Z^2+uZ_s^2)$ x 13.6 (eV) where u takes the value from 6.25 x 10^{-4} to 10.24 and ΔE in Z^2Ry units. This expression is useful since it is possible to compare the values for different ions. We also use the similar expression for the temperature T; T(eV) = 13.6 Z^2_s/β with β = 0.25 - 128. It is found the large differences for $2s^2\ ^1S_0$ - $2s2p\ ^3P_1$ transition as show in Fig.4. For SiXI ions, this discrepancy (70%) is related to the relativistic effects since the difference is large at high energies. The differences of 50% and 80% for Fe XXIII and Mo XXXIX at low energies might be due to the error of fitting parameters in Ref.1.

In conclusion we can say that agreement of two results is rather good for σ and R. The agreement is worse for the case with small values of σ. Sometimes the discrepancy changes in the different energy interval. This difference in some cases may be explained by the fitting formula in Ref.1. We give direct calculations for various E, since fitting formula is not always good for wide energy intervals.

8. Fitting Formula

There are different suggestions for fitting formula. In Ref.1 the following formula for σ is given

$$\sigma(a'J' - aJ) = \frac{\pi a_0^2}{Z^2 Z_{eff}^2 (2J'+1)\, \varepsilon \Delta E} \left\{ c_0 + \frac{c_1}{a+\varepsilon} + \frac{c_2}{(a+\varepsilon)^2} + \frac{5}{3} Z^2 S \ \ln\varepsilon \right\} \tag{24}$$

where a, c_o, c_1, c_2, and Z^2S are the fitting parameters, $Z_{eff} = Z - 2$ for Be-like ions. Transition energies ΔE are in units Z^2Ry (see Table 7). We used our data ΔE listed in the column b in Table 7 for the calculations of σ which are given in Tables 4a - 6a. The impact electron energy in threshold units ε is $\varepsilon Z^2 \Delta E = E$. The fitting parameters in Ref.1 have very complicated dependence on Z and this dependence is different for each parameter. In Ref.5 another fitting formula was suggested using the parameters with the smooth Z-dependence.

$$\sigma(a'J' - aJ) = \frac{\pi a_0^2}{Z_S^4 (2l'+1)} \left\{ A' \frac{c'}{u+\Delta\varepsilon c_1} \frac{u^2+a^2}{u^2+a^2+bu} \ln(u+\Delta\varepsilon)\, 4f^2 + A'' \frac{c''}{u+\Delta\varepsilon c_2} (u+0.4)^{-2} \right\} \tag{25}$$

where $\Delta\varepsilon Z_s^2 = \Delta E Z^2$ and ΔE are given in Table 7(b). There are four fitting parameters: c', c_1, c", c_2. The values of a, b and f are equal

$$a = -\Delta\varepsilon \ \ln\Delta\varepsilon, \quad b = 0.04\ a^3 / (\Delta\varepsilon)^2, \quad f = \varepsilon_0\, \varepsilon_1 / \Delta\varepsilon \tag{26}$$

where ε_o and ε_l are energies of the initial and final states (Table 1). They are in units Z_s^2 Ry.

The formula (25) looks more complicated than the formula (24), but all fitting parameters have weak dependence on Z (10% for all kind transitions for an ion and 10% - 20% for Z = 12 and Z = 26). This is rather convenient for estimation of σ for another ions. Relativistic and correlation effects are included in the A' and A" parameters in Eq.(25), and Z-dependence of these parameters is shown in Fig.1.

For excitation rate coefficient we have from Ref.1

$$R(a'J' - aJ) = A_0 \frac{1}{Z_{eff}^2 (2J'+1) \sqrt{T}} \left\{ c_0 e^{-y} + \frac{5}{3} Z^2 S E_1(y) + y e^{ay} \left[c_1 E_1(ay+y) + \frac{c_2}{a+1} E_2(ay+y) \right] \right\} \tag{27}$$

where $y = Z^2 \Delta E/kT$, $E_n(X)$ are exponential integrals, and $A_0 = \pi a_0^2 \, 8/\pi m$. The fitting parameters c_o, c_1, c_2, a, Z^2_s are the same as for σ in Eq.(24). We used these parameters and the values of ΔE in Table 7 for the calculations R by Eq.(27) and numerical values are given in Tables 4b - 6b.

In Ref.5 the other fitting formula was suggested for R

$$R(a'J'-aJ) = \frac{10^{-8}}{Z_s^3(2l'+1)} \bar{e}^{\beta\Delta\varepsilon} \sqrt{\beta} \left\{ A' \frac{A1}{\beta+\kappa'} (\beta+1) \ln\left(2f^2/\beta+f\right) + A'' \frac{A2}{\beta+\kappa''} \beta \right\} \tag{28}$$

where $\beta = Z^2_s$ (Ry)/T and A1, A2, κ' and κ'' are the fitting parameters. They change within 10 - 20% for different transitions and ions with Z = 12, 26. It is necessary to say that the exponents in Eqs.(28) and (27) (the first one) are the same, since $\beta\Delta\varepsilon = y$. Both fitting formula can give R within 1 - 3% in the best, but sometimes approximation formula do not work very well for all interval of energy (for σ) and temperature (for R) and in this case difference would be larger.

Fitting formulae (25) and (28) are divided in two parts according to σ' and σ'' in Eq.(1). They are direct and exchange parts.

Since A' and A" are the same order for $\Delta S=0$, the exchange part (σ'') can be neglected. In the case of $\Delta S \neq 0$, A' is small and exchange part prevails for low Z, whereas A' increases and $A'\sigma'$ became comparable with $A''\sigma''$ for high Z .

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Table 1. Ionization potential for Be-like ions (10^4 cm^-1)
Notations: E-2s2s, F-2p2p, C-2s2p, P-1s1s2p, S=1s1s2s: Numbers after letter: (2S+1)(2L+1)(2J+1)

Z	E 111 -S 212	F 331 -S 212	F 333 -S 212	F 335 -S 212	F 155 -S 212	F 111 -S 212	C 133 -S 212	C 331 -S 212	C 333 -S 212	C 335 -S 212	Z
6	38.6383	24.9029	24.8997	24.8947	24.0607	20.3766	28.3813	33.4011	33.3984	33.3918	6
7	62.4996	44.9470	44.9391	44.9262	43.6118	38.9631	49.4308	55.7796	55.7727	55.7567	7
8	91.8796	70.5299	70.5134	70.4858	68.7008	63.0878	76.0084	83.6846	83.6700	83.6371	8
9	126.7758	101.6335	101.6027	101.5508	99.3035	92.7282	108.1019	117.1111	117.0838	117.0230	9
10	167.1913	138.2495	138.1965	138.1070	135.4059	127.8703	145.7061	156.0600	156.0131	155.9095	10
11	213.1324	180.3747	180.2888	180.1447	176.9984	168.5049	188.8192	200.5356	200.4602	200.2943	11
12	264.6069	228.0090	227.8760	227.6564	224.0735	214.6244	237.4419	250.5444	250.4294	250.1764	12
13	321.6243	281.1549	280.9563	280.6361	276.6249	266.2229	291.5761	306.0953	305.9272	305.5560	13
14	384.1956	339.8166	339.5289	339.0791	334.6466	323.2945	351.2244	367.1983	366.9610	366.4339	14
15	452.3326	404.0004	403.5938	402.9816	398.1317	385.8329	416.3907	433.8651	433.5402	432.8114	15
16	526.0489	473.7149	473.1518	472.3413	467.0727	453.8317	487.0785	506.1088	505.6751	504.6904	16
17	605.3591	548.9694	548.2034	547.1570	541.4604	527.2826	563.2927	583.9435	583.3777	582.0726	17
18	690.2791	629.7770	628.7507	627.4299	621.2838	606.1772	645.0375	667.3851	666.6609	664.9605	18
19	780.8253	716.1514	714.7946	713.1624	706.5293	690.5039	732.3171	756.4500	755.5397	753.3571	19
20	877.0168	808.1099	806.3381	804.3594	797.1814	780.2514	825.1367	851.1567	850.0305	847.2650	20
21	978.8731	905.6714	903.3829	901.0279	893.2219	875.4054	923.5004	951.5246	950.1512	946.6874	21
22	1086.4147	1008.8577	1005.9316	1003.1768	994.6299	975.9493	1027.4125	1057.5740	1055.9211	1051.6279	22
23	1199.6642	1117.6919	1113.9873	1110.8158	1101.3833	1081.8656	1136.8768	1169.3270	1167.3622	1162.0901	23
24	1318.6454	1232.2004	1227.5535	1223.9558	1213.4586	1193.1351	1251.8977	1286.8071	1284.4979	1278.0778	24
25	1443.3829	1352.4109	1346.6328	1342.6058	1330.8325	1309.7360	1372.4778	1410.0386	1407.3528	1399.5956	25
26	1573.9034	1478.3541	1471.2290	1466.7760	1453.4821	1431.6460	1498.6211	1539.0472	1535.9540	1526.6472	26
27	1710.2349	1610.0596	1601.3462	1596.4733	1581.3839	1558.8413	1630.3296	1673.8610	1670.3306	1659.2378	27
28	1852.4056	1747.5613	1736.9885	1731.7053	1714.5162	1691.2986	1767.6062	1814.5071	1810.5131	1797.3713	28
29	2000.4470	1890.8920	1878.1595	1872.4769	1852.8561	1828.9900	1910.4534	1961.0170	1956.5332	1941.0542	29
30	2154.3923	2040.0869	2024.8647	2018.7949	1996.3828	1971.8918	2058.8743	2113.4214	2108.4268	2090.2905	30
31	2314.2739	2195.1814	2177.1074	2170.6628	2145.0720	2119.9766	2212.8701	2271.7532	2266.2280	2245.0862	31
32	2480.1282	2356.2131	2334.8948	2328.0854	2298.9019	2273.2163	2372.4448	2436.0474	2429.9744	2405.4465	32
33	2651.9912	2523.2192	2498.2297	2491.0679	2457.8474	2431.5835	2537.6006	2606.3396	2599.7056	2571.3789	33
34	2829.9023	2696.2397	2667.1191	2659.6152	2621.8840	2595.0510	2708.3413	2782.6677	2775.4622	2742.8864	34
35	3013.9006	2875.3108	2841.5681	2833.7310	2790.9839	2763.5874	2884.6694	2965.0686	2957.2834	2919.9807	35
36	3204.0293	3060.4780	3021.5813	2965.1221	3013.4216	2937.1655	3066.5898	3153.5862	3145.2148	3102.6633	36
37	3400.3291	3251.7805	3207.1670	3144.2688	3198.6929	3115.7520	3254.1089	3348.2620	3339.2998	3290.9431	37
38	3602.8489	3449.2649	3398.3298	3328.3931	3389.5491	3299.3154	3447.2268	3549.1382	3539.5850	3484.8267	38
39	3811.6333	3652.9739	3595.0769	3517.4641	3585.9976	3487.8237	3645.9526	3756.2629	3746.1169	3684.3220	39
40	4026.7324	3862.9573	3797.4155	3711.4502	3788.0435	3681.2422	3850.2922	3969.6833	3958.9470	3889.4363	40
41	4248.1948	4079.2610	4005.3494	3910.3147	3995.6934	3879.5337	4060.2488	4189.4478	4178.1230	4100.1763	41
42	4476.0752	4301.9370	4218.8896	4114.0239	4208.9556	4082.6655	4275.8340	4415.6089	4403.7002	4316.5518	42
43	4710.4268	4531.0381	4438.0420	4322.5405	4427.8350	4290.5977	4497.0513	4646.2197	4635.7310	4538.5693	43
44	4951.3066	4766.6162	4662.8140	4535.8232	4652.3403	4503.2896	4723.9097	4887.3364	4874.2710	4766.2383	44
45	5198.7739	5008.7290	4893.2129	4753.8330	4882.4780	4720.6997	4956.4165	5133.0151	5119.3799	4999.5659	45
46	5452.8887	5257.4351	5129.2480	4976.5288	5118.2563	4942.7871	5194.5801	5385.3159	5371.1157	5238.5630	46
47	5713.7144	5512.7959	5370.9248	5203.8638	5359.6836	5169.5068	5438.4092	5644.3027	5629.5425	5483.2373	47
48	5981.3154	5774.8701	5618.2559	5435.7920	5606.7666	5400.8125	5687.9126	5910.0361	5894.7236	5733.5981	48
49	6255.7588	6043.7290	5871.2451	5672.2681	5859.5146	5636.6543	5943.1001	6182.5845	6166.7256	5989.6553	49
50	6537.1167	6319.4341	6129.9023	5913.2417	6117.9365	5876.9824	6203.9814	6462.0200	6445.6172	6251.4189	50
51	6825.4614	6602.0586	6394.2402	6158.6563	6382.0396	6121.7461	6470.5625	6748.4092	6731.4717	6518.8975	51
52	7120.8647	6891.6748	6664.2646	6408.4609	6651.8350	6370.8901	6742.8594	7041.8281	7024.3628	6792.1040	52
53	7423.4077	7188.3574	6939.9834	6662.5991	6927.3301	6624.3560	7020.8755	7342.3530	7324.3633	7071.0459	53
54	7733.1724	7492.1846	7221.4111	6921.0127	7208.5342	6882.0859	7304.6294	7650.0645	7631.5591	7355.7349	54

Table 1 (continued)

Z	P 234 -S 212	F 232 -S 212	Z
6	6.4592	6.4476	6
7	8.0738	8.0463	7
8	9.6927	9.6372	8
9	11.3263	11.2256	9
10	12.9832	12.8139	10
11	14.6722	14.4041	11
12	16.4024	15.9977	12
13	18.1840	17.5963	13
14	20.0277	19.2004	14
15	21.9445	20.8107	15
16	23.9466	22.4286	16
17	26.0477	24.0541	17
18	28.2613	25.6881	18
19	30.6032	27.3320	19
20	33.0884	28.9851	20
21	35.7347	30.6485	21
22	38.5602	32.3246	22
23	41.5842	34.0111	23
24	44.8259	35.7103	24
25	48.3074	37.4216	25
26	52.0502	39.1476	26
27	56.0782	40.8864	27
28	60.4170	42.6419	28
29	65.0907	44.4108	29
30	70.1295	46.1971	30
31	75.5560	47.9988	31
32	81.4059	49.8179	32
33	87.7058	51.6544	33
34	94.4906	53.5097	34
35	101.7926	55.3851	35
36	109.6477	57.2793	36
37	118.0909	59.1922	37
38	127.1611	61.1278	38
39	136.8996	63.0849	39
40	147.3455	65.0661	40
41	158.5415	67.0688	41
42	170.5305	69.0942	42
43	183.3635	71.1464	43
44	197.0859	73.2200	44
45	211.7487	75.3258	45
46	227.4055	77.4530	46
47	244.1044	79.6097	47
48	261.9044	81.7959	48
49	280.8645	84.0062	49
50	301.0490	86.2540	50
51	322.5167	88.5312	51
52	345.3267	90.8379	52
53	369.5620	93.1822	53
54	395.2788	95.5585	54

Table 1'. Comparison theoretical E(PT) and experimental E^{9}_{exp} data for energy Be-like ions: ($E(PT)-E^{9}_{exp}$) in cm^{-1}

Z	2s2p				2p2p				
	$^3P_0$	$^3P_1$	$^3P_2$	$^1P_1$	$^3P_0$	$^3P_1$	$^3P_2$	$^1D_2$	$^1S_0$
6	4	7	17	222	-82	-78	-76	-101	92
7	-8	-1	13	-2	-12	-5	-1	-2	-4
8	9	20	43	-79	38	48	54	75	13
9	37	49	80	-99	75	91	99	135	59
10	67	82	125	-92	109	130	140	185	111
11	96	114	180	-68	138	143	177	230	165
12	126	148	217	-36	162	195	213	271	219
13	153	180	265	2	180	222	246	306	272
14	180	210	312	43	193	244	276	337	322
15	201	236	357	84	198	260	300	363	368
16	220	262	401	124	194	271	316	384	408
17	236	284	442	150	178	274	321	402	441
18	250	301	481	194	148	265	309	415	469
19	259	312	516	220	102	244	279	423	483
20	264	317	548	240	38	210	220	422	486
21	261	313	517	251	-47	158	156	407	469
22	253	301	585	249	-152	87	70	367	433
23	238	279	595	234	-279	-5	-21	291	368
24	217	249	594	204	-425	-119	-102	154	269
25	188	208	583	157	-592	-258	-154	-67	130
26	154	158	564	90	-766	-423	-151	-397	-61
27	110	98	532	-3	-951	-612	14	-362	-314
28	64	37	492	-124	-1138	-821	101	-1486	-633
29	14	-31	441	-212	-1323	-1069	388	-2293	-1034
30	-45	-97	379	-454	-1498	-1337	806	-3311	-1532
31	-110	-163	303	-693	-1716	-1634	1369	-4552	-2141
32	-160	-219	219	-977	-1782	-1951	2098	-6046	-2866
33	-180	-269	122	-1310	-1880	-2289	3015	-7795	-3120
34	-243	-299	21	-1694	-1920	-2640	4141	-9811	-4103
35	-307	-305	-96	-2131	-1901	-3002	5501	-12133	-5841
36	-418	-281	-211	-2650	-1813	-3375	7113	-14798	-7155

Table 2. Mixing coefficients for Be-like ions
$2s^2\ ^1S_0 + 2p^2\ ^3P_0 + 2p^2\ ^1S_0$, $^3P_2 + {}^1D_2$ (2p2), $^1P_1 + {}^3P_1$ (2s2p)

Z=6

0.961227	-0.000645	-0.275757	0.000000	0.000000	0.000000	0.000000
0.000148	0.999998	-0.001823	0.000000	0.000000	0.000000	0.000000
0.275758	0.001711	0.961226	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.999988	0.004942	0.000000	0.000000
0.000000	0.000000	0.000000	-0.004942	0.999988	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000948
0.000000	0.000000	0.000000	0.000000	0.000000	-0.000948	1.000000

Z=7

0.964219	-0.001182	-0.265105	0.000000	0.000000	0.000000	0.000000
0.000282	0.999994	-0.003434	0.000000	0.000000	0.000000	0.000000
0.265108	0.003236	0.964213	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.999968	0.008051	0.000000	0.000000
0.000000	0.000000	0.000000	-0.008051	0.999968	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999998	0.001816
0.000000	0.000000	0.000000	0.000000	0.000000	-0.001816	0.999998

Z=8

0.966161	-0.001955	-0.257932	0.000000	0.000000	0.000000	0.000000
0.000479	0.999983	-0.005784	0.000000	0.000000	0.000000	0.000000
0.257939	0.005465	0.966146	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.999922	0.012518	0.000000	0.000000
0.000000	0.000000	0.000000	-0.012518	0.999922	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999995	0.003096
0.000000	0.000000	0.000000	0.000000	0.000000	-0.003096	0.999995

Z= 9

0.967548	-0.003002	-0.252669	0.000000	0.000000	0.000000	0.000000
0.000750	0.999959	-0.009008	0.000000	0.000000	0.000000	0.000000
0.252685	0.008526	0.967511	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.999828	0.018567	0.000000	0.000000
0.000000	0.000000	0.000000	-0.018567	0.999828	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999988	0.004863
0.000000	0.000000	0.000000	0.000000	0.000000	-0.004863	0.999988

Z=10

0.968613	-0.004361	-0.248536	0.000000	0.000000	0.000000	0.000000
0.001107	0.999912	-0.013232	0.000000	0.000000	0.000000	0.000000
0.248572	0.012542	0.968532	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.999650	0.026451	0.000000	0.000000
0.000000	0.000000	0.000000	-0.026451	0.999650	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999974	0.007193
0.000000	0.000000	0.000000	0.000000	0.000000	-0.007193	0.999974

Z=11

0.969479	-0.006067	-0.245098	0.000000	0.000000	0.000000	0.000000
0.001560	0.999826	-0.018578	0.000000	0.000000	0.000000	0.000000
0.245168	0.017629	0.969320	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.999336	0.036442	0.000000	0.000000
0.000000	0.000000	0.000000	-0.036442	0.999336	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999948	0.010158
0.000000	0.000000	0.000000	0.000000	0.000000	-0.010158	0.999948

Z=12

0.970221	-0.008147	-0.242086	0.000000	0.000000	0.000000	0.000000
0.002118	0.999681	-0.025155	0.000000	0.000000	0.000000	0.000000
0.242214	0.023894	0.969929	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.998807	0.048832	0.000000	0.000000
0.000000	0.000000	0.000000	-0.048832	0.998807	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999904	0.013828
0.000000	0.000000	0.000000	0.000000	0.000000	-0.013828	0.999904

Table 2 (continued)

Z=13

0.970882	-0.010626	-0.239324	0.000000	0.000000	0.000000	0.000000
0.002789	0.999449	-0.033060	0.000000	0.000000	0.000000	0.000000
0.239543	0.031429	0.970377	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.997955	0.063923	0.000000	0.000000
0.000000	0.000000	0.000000	-0.063923	0.997955	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999833	0.018267
0.000000	0.000000	0.000000	0.000000	0.000000	-0.018267	0.999833

Z=14

0.971492	-0.013520	-0.236686	0.000000	0.000000	0.000000	0.000000
0.003582	0.999096	-0.042370	0.000000	0.000000	0.000000	0.000000
0.237045	0.040314	0.970662	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.996630	0.082024	0.000000	0.000000
0.000000	0.000000	0.000000	-0.082024	0.996630	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999723	0.023533
0.000000	0.000000	0.000000	0.000000	0.000000	-0.023533	0.999723

Z=15

0.972072	-0.016838	-0.234078	0.000000	0.000000	0.000000	0.000000
0.004500	0.998577	-0.053142	0.000000	0.000000	0.000000	0.000000
0.234640	0.050605	0.970764	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.994637	0.103431	0.000000	0.000000
0.000000	0.000000	0.000000	-0.103431	0.994637	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999559	0.029680
0.000000	0.000000	0.000000	0.000000	0.000000	-0.029680	0.999559

Z=16

0.972635	-0.020579	-0.231427	0.000000	0.000000	0.000000	0.000000
0.005549	0.997843	-0.065407	0.000000	0.000000	0.000000	0.000000
0.232274	0.062333	0.970651	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.991722	0.128401	0.000000	0.000000
0.000000	0.000000	0.000000	-0.128401	0.991722	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.999325	0.036750
0.000000	0.000000	0.000000	0.000000	0.000000	-0.036750	0.999325

Z=17

0.973190	-0.024732	-0.228670	0.000000	0.000000	0.000000	0.000000
0.006732	0.996839	-0.079163	0.000000	0.000000	0.000000	0.000000
0.229905	0.075501	0.970280	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.987581	0.157109	0.000000	0.000000
0.000000	0.000000	0.000000	-0.157109	0.987581	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.998997	0.044779
0.000000	0.000000	0.000000	0.000000	0.000000	-0.044779	0.998997

Z=18

0.973744	-0.029273	-0.225758	0.000000	0.000000	0.000000	0.000000
0.008048	0.995505	-0.094370	0.000000	0.000000	0.000000	0.000000
0.227506	0.090076	0.969602	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.981863	0.189590	0.000000	0.000000
0.000000	0.000000	0.000000	-0.189590	0.981863	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.998552	0.053787
0.000000	0.000000	0.000000	0.000000	0.000000	-0.053787	0.998552

Z=19

0.974300	-0.034169	-0.222647	0.000000	0.000000	0.000000	0.000000
0.009498	0.993781	-0.110951	0.000000	0.000000	0.000000	0.000000
0.225054	0.105985	0.968565	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.974203	0.225674	0.000000	0.000000
0.000000	0.000000	0.000000	-0.225674	0.974203	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.997964	0.063784
0.000000	0.000000	0.000000	0.000000	0.000000	-0.063784	0.997964

Table 2 (continued)

Z=20

0.974862	-0.039373	-0.219304	0.000000	0.000000	0.000000	0.000000
0.011078	0.991611	-0.128785	0.000000	0.000000	0.000000	0.000000
0.222535	0.123118	0.967119	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.964268	0.264929	0.000000	0.000000
0.000000	0.000000	0.000000	-0.264929	0.964268	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.997201	0.074764
0.000000	0.000000	0.000000	0.000000	0.000000	-0.074764	0.997201

Z=21

0.975429	-0.044827	-0.215704	0.000000	0.000000	0.000000	0.000000
0.012784	0.988948	-0.147711	0.000000	0.000000	0.000000	0.000000
0.219941	0.141324	0.965222	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.951835	0.306611	0.000000	0.000000
0.000000	0.000000	0.000000	-0.306611	0.951835	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.996234	0.086704
0.000000	0.000000	0.000000	0.000000	0.000000	-0.086704	0.996234

Z=22

0.976003	-0.050465	-0.211829	0.000000	0.000000	0.000000	0.000000
0.014610	0.985759	-0.167527	0.000000	0.000000	0.000000	0.000000
0.217266	0.160413	0.962841	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.936861	0.349703	0.000000	0.000000
0.000000	0.000000	0.000000	-0.349703	0.936861	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.995031	0.099564
0.000000	0.000000	0.000000	0.000000	0.000000	-0.099564	0.995031

Z=23

0.976582	-0.056215	-0.207673	0.000000	0.000000	0.000000	0.000000
0.016548	0.982028	-0.188008	0.000000	0.000000	0.000000	0.000000
0.214510	0.180169	0.959961	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.919534	0.393009	0.000000	0.000000
0.000000	0.000000	0.000000	-0.393009	0.919534	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.993563	0.113285
0.000000	0.000000	0.000000	0.000000	0.000000	-0.113285	0.993563

Z=24

0.977164	-0.062001	-0.203240	0.000000	0.000000	0.000000	0.000000
0.018589	0.977760	-0.208903	0.000000	0.000000	0.000000	0.000000
0.211672	0.200354	0.956584	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.900283	0.435306	0.000000	0.000000
0.000000	0.000000	0.000000	-0.435306	0.900283	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.991801	0.127791
0.000000	0.000000	0.000000	0.000000	0.000000	-0.127791	0.991801

Z=25

0.977747	-0.067748	-0.198545	0.000000	0.000000	0.000000	0.000000
0.020723	0.972981	-0.229952	0.000000	0.000000	0.000000	0.000000
0.208759	0.220720	0.952734	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.879713	0.475506	0.000000	0.000000
0.000000	0.000000	0.000000	-0.475506	0.879713	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.989725	0.142986
0.000000	0.000000	0.000000	0.000000	0.000000	-0.142986	0.989725

Z=26

0.978330	-0.073386	-0.193608	0.000000	0.000000	0.000000	0.000000
0.022939	0.967740	-0.250903	0.000000	0.000000	0.000000	0.000000
0.205775	0.241025	0.948453	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.858512	0.512794	0.000000	0.000000
0.000000	0.000000	0.000000	-0.512794	0.858512	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.987317	0.158763
0.000000	0.000000	0.000000	0.000000	0.000000	-0.158763	0.987317

Table 2. (continued)

Z=27						
0.978910	-0.078852	-0.188461	0.000000	0.000000	0.000000	0.000000
0.025224	0.962102	-0.271520	0.000000	0.000000	0.000000	0.000000
0.202729	0.261040	0.943800	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.837338	0.546685	0.000000	0.000000
0.000000	0.000000	0.000000	-0.546685	0.837338	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.984569	0.174999
0.000000	0.000000	0.000000	0.000000	0.000000	-0.174999	0.984569
Z=28						
0.979484	-0.084091	-0.183140	0.000000	0.000000	0.000000	0.000000
0.027567	0.956145	-0.291593	0.000000	0.000000	0.000000	0.000000
0.199629	0.280562	0.938847	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.816747	0.576995	0.000000	0.000000
0.000000	0.000000	0.000000	-0.576995	0.816747	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.981480	0.191563
0.000000	0.000000	0.000000	0.000000	0.000000	-0.191563	0.981480
Z=29						
0.980049	-0.089063	-0.177683	0.000000	0.000000	0.000000	0.000000
0.029953	0.949955	-0.310949	0.000000	0.000000	0.000000	0.000000
0.196485	0.299423	0.933670	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.797146	0.603787	0.000000	0.000000
0.000000	0.000000	0.000000	-0.603787	0.797146	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.978061	0.208319
0.000000	0.000000	0.000000	0.000000	0.000000	-0.208319	0.978061
Z=30						
0.980604	-0.093735	-0.172131	0.000000	0.000000	0.000000	0.000000
0.032370	0.943619	-0.329448	0.000000	0.000000	0.000000	0.000000
0.193307	0.317486	0.928351	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.778795	0.627278	0.000000	0.000000
0.000000	0.000000	0.000000	-0.627278	0.778795	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.974328	0.225132
0.000000	0.000000	0.000000	0.000000	0.000000	-0.225132	0.974328
Z=31						
0.981146	-0.098089	-0.166524	0.000000	0.000000	0.000000	0.000000
0.034805	0.937222	-0.346993	0.000000	0.000000	0.000000	0.000000
0.190106	0.334655	0.922966	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.761832	0.647775	0.000000	0.000000
0.000000	0.000000	0.000000	-0.647775	0.761832	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.970309	0.241869
0.000000	0.000000	0.000000	0.000000	0.000000	-0.241869	0.970309
Z=32						
0.981674	-0.102115	-0.160900	0.000000	0.000000	0.000000	0.000000
0.037245	0.930841	-0.363521	0.000000	0.000000	0.000000	0.000000
0.186893	0.350867	0.917586	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.746291	0.665619	0.000000	0.000000
0.000000	0.000000	0.000000	-0.665619	0.746291	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.966036	0.258407
0.000000	0.000000	0.000000	0.000000	0.000000	-0.258407	0.966036
Z=33						
0.982185	-0.105812	-0.155292	0.000000	0.000000	0.000000	0.000000
0.039679	0.924545	-0.379002	0.000000	0.000000	0.000000	0.000000
0.183678	0.366088	0.912273	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.732145	0.681148	0.000000	0.000000
0.000000	0.000000	0.000000	-0.681148	0.732145	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.961549	0.274633
0.000000	0.000000	0.000000	0.000000	0.000000	-0.274633	0.961549

Table 2 (continued)

Z=34						
0.982679	-0.109186	-0.149733	0.000000	0.000000	0.000000	0.000000
0.042095	0.918390	-0.393431	0.000000	0.000000	0.000000	0.000000
0.180470	0.380313	0.907079	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.719323	0.694676	0.000000	0.000000
0.000000	0.000000	0.000000	-0.694676	0.719323	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.956890	0.290451
0.000000	0.000000	0.000000	0.000000	0.000000	-0.290451	0.956890
Z=35						
0.983154	-0.112249	-0.144248	0.000000	0.000000	0.000000	0.000000
0.044484	0.912422	-0.406826	0.000000	0.000000	0.000000	0.000000
0.177281	0.393556	0.902045	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.707730	0.706483	0.000000	0.000000
0.000000	0.000000	0.000000	-0.706483	0.707730	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.952103	0.305777
0.000000	0.000000	0.000000	0.000000	0.000000	-0.305777	0.952103
Z=36						
0.983610	-0.115014	-0.138861	0.000000	0.000000	0.000000	0.000000
0.046834	0.906675	-0.419222	0.000000	0.000000	0.000000	0.000000
0.174118	0.405848	0.897201	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.716817	-0.697262	0.000000	0.000000
0.000000	0.000000	0.000000	0.697262	0.716817	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.947233	0.320547
0.000000	0.000000	0.000000	0.000000	0.000000	-0.320547	0.947233
Z=37						
0.984047	-0.117498	-0.133589	0.000000	0.000000	0.000000	0.000000
0.049138	0.901173	-0.430665	0.000000	0.000000	0.000000	0.000000
0.170989	0.417230	0.892570	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.725887	-0.687814	0.000000	0.000000
0.000000	0.000000	0.000000	0.687814	0.725887	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.942321	0.334710
0.000000	0.000000	0.000000	0.000000	0.000000	-0.334710	0.942321
Z=38						
0.984463	-0.119721	-0.128448	0.000000	0.000000	0.000000	0.000000
0.051388	0.895933	-0.441206	0.000000	0.000000	0.000000	0.000000
0.167903	0.427750	0.888166	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.733876	-0.679283	0.000000	0.000000
0.000000	0.000000	0.000000	0.679283	0.733876	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.937408	0.348233
0.000000	0.000000	0.000000	0.000000	0.000000	-0.348233	0.937408
Z=39						
0.984860	-0.121700	-0.123450	0.000000	0.000000	0.000000	0.000000
0.053578	0.890963	-0.450903	0.000000	0.000000	0.000000	0.000000
0.164864	0.437462	0.883995	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.740935	-0.671576	0.000000	0.000000
0.000000	0.000000	0.000000	0.671576	0.740935	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.932529	0.361095
0.000000	0.000000	0.000000	0.000000	0.000000	-0.361095	0.932529
Z=40						
0.985237	-0.123455	-0.118602	0.000000	0.000000	0.000000	0.000000
0.055701	0.886266	-0.459816	0.000000	0.000000	0.000000	0.000000
0.161880	0.446421	0.880058	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.747195	-0.664605	0.000000	0.000000
0.000000	0.000000	0.000000	0.664605	0.747195	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.927716	0.373287
0.000000	0.000000	0.000000	0.000000	0.000000	-0.373287	0.927716

Table 2 (continued)

Z=41

0.985595	-0.125004	-0.113912	0.000000	0.000000	0.000000	0.000000
0.057754	0.881838	-0.468002	0.000000	0.000000	0.000000	0.000000
0.158954	0.454682	0.876355	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.752763	-0.658291	0.000000	0.000000
0.000000	0.000000	0.000000	0.658291	0.752763	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.922995	0.384812
0.000000	0.000000	0.000000	0.000000	0.000000	-0.384812	0.922995

Z=42

0.985935	-0.126363	-0.109383	0.000000	0.000000	0.000000	0.000000
0.059732	0.877675	-0.475520	0.000000	0.000000	0.000000	0.000000
0.156091	0.462298	0.872878	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.757735	-0.652562	0.000000	0.000000
0.000000	0.000000	0.000000	0.652562	0.757735	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.918389	0.395680
0.000000	0.000000	0.000000	0.000000	0.000000	-0.395680	0.918389

Z=43

0.986257	-0.127549	-0.105018	0.000000	0.000000	0.000000	0.000000
0.061632	0.873768	-0.482423	0.000000	0.000000	0.000000	0.000000
0.153294	0.469320	0.869620	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.762187	-0.647357	0.000000	0.000000
0.000000	0.000000	0.000000	0.647357	0.762187	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.913914	0.405907
0.000000	0.000000	0.000000	0.000000	0.000000	-0.405907	0.913914

Z=44

0.986562	-0.128577	-0.100816	0.000000	0.000000	0.000000	0.000000
0.063453	0.870106	-0.488763	0.000000	0.000000	0.000000	0.000000
0.150564	0.475798	0.866572	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.766187	-0.642618	0.000000	0.000000
0.000000	0.000000	0.000000	0.642618	0.766187	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.909585	0.415517
0.000000	0.000000	0.000000	0.000000	0.000000	-0.415517	0.909585

Z=45

0.986851	-0.129460	-0.096778	0.000000	0.000000	0.000000	0.000000
0.065192	0.866679	-0.494589	0.000000	0.000000	0.000000	0.000000
0.147905	0.481776	0.863722	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.769790	-0.638297	0.000000	0.000000
0.000000	0.000000	0.000000	0.638297	0.769790	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.905412	0.424534
0.000000	0.000000	0.000000	0.000000	0.000000	-0.424534	0.905412

Z=46

0.987124	-0.130213	-0.092901	0.000000	0.000000	0.000000	0.000000
0.066850	0.863473	-0.499946	0.000000	0.000000	0.000000	0.000000
0.145317	0.487298	0.861060	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.773046	-0.634350	0.000000	0.000000
0.000000	0.000000	0.000000	0.634350	0.773046	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.901401	0.432986
0.000000	0.000000	0.000000	0.000000	0.000000	-0.432986	0.901401

Z=47

0.987383	-0.130845	-0.089183	0.000000	0.000000	0.000000	0.000000
0.068426	0.860477	-0.504873	0.000000	0.000000	0.000000	0.000000
0.142800	0.492401	0.858574	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.775996	-0.630737	0.000000	0.000000
0.000000	0.000000	0.000000	0.630737	0.775996	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.897555	0.440903
0.000000	0.000000	0.000000	0.000000	0.000000	-0.440903	0.897555

Table 2 (continued)

Z=48						
0.987629	-0.131369	-0.085621	0.000000	0.000000	0.000000	0.000000
0.069921	0.857678	-0.509411	0.000000	0.000000	0.000000	0.000000
0.140356	0.497122	0.856253	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.778676	-0.627427	0.000000	0.000000
0.000000	0.000000	0.000000	0.627427	0.778676	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.893875	0.448315
0.000000	0.000000	0.000000	0.000000	0.000000	-0.448315	0.893875
Z=49						
0.987862	-0.131793	-0.082210	0.000000	0.000000	0.000000	0.000000
0.071335	0.855064	-0.513592	0.000000	0.000000	0.000000	0.000000
0.137983	0.501494	0.854087	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.781116	-0.624386	0.000000	0.000000
0.000000	0.000000	0.000000	0.624386	0.781116	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.890363	0.455252
0.000000	0.000000	0.000000	0.000000	0.000000	-0.455252	0.890363
Z=50						
0.988084	-0.132126	-0.078947	0.000000	0.000000	0.000000	0.000000
0.072669	0.852623	-0.517449	0.000000	0.000000	0.000000	0.000000
0.135681	0.505546	0.852065	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.783343	-0.621590	0.000000	0.000000
0.000000	0.000000	0.000000	0.621590	0.783343	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.887014	0.461743
0.000000	0.000000	0.000000	0.000000	0.000000	-0.461743	0.887014
Z=51						
0.988295	-0.132377	-0.075827	0.000000	0.000000	0.000000	0.000000
0.073925	0.850344	-0.521010	0.000000	0.000000	0.000000	0.000000
0.133448	0.509306	0.850176	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.785381	-0.619013	0.000000	0.000000
0.000000	0.000000	0.000000	0.619013	0.785381	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.883825	0.467817
0.000000	0.000000	0.000000	0.000000	0.000000	-0.467817	0.883825
Z=52						
0.988496	-0.132553	-0.072844	0.000000	0.000000	0.000000	0.000000
0.075105	0.848215	-0.524301	0.000000	0.000000	0.000000	0.000000
0.131285	0.512798	0.848412	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.787249	-0.616636	0.000000	0.000000
0.000000	0.000000	0.000000	0.616636	0.787249	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.880793	0.473502
0.000000	0.000000	0.000000	0.000000	0.000000	-0.473502	0.880793
Z=53						
0.988687	-0.132659	-0.069995	0.000000	0.000000	0.000000	0.000000
0.076210	0.846226	-0.527345	0.000000	0.000000	0.000000	0.000000
0.129189	0.516045	0.846763	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.788965	-0.614438	0.000000	0.000000
0.000000	0.000000	0.000000	0.614438	0.788965	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.877912	0.478822
0.000000	0.000000	0.000000	0.000000	0.000000	-0.478822	0.877912
Z=54						
0.988870	-0.132703	-0.067273	0.000000	0.000000	0.000000	0.000000
0.077244	0.844369	-0.530165	0.000000	0.000000	0.000000	0.000000
0.127158	0.519068	0.845221	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.790544	-0.612405	0.000000	0.000000
0.000000	0.000000	0.000000	0.612405	0.790544	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.875176	0.483805
0.000000	0.000000	0.000000	0.000000	0.000000	-0.483805	0.875176

TABLE 3. Wavelengths WL(A), transition probabilities A in units $10^{13} s^{-1}$, oscillator strengths F, constants for calculations of exitation cross sections A',A"

Designations: E-$2s^2$, C-2s2p, F-$2p^2$

Numbers after letter: (2S+1)(2L+1)(2J+1)

Z= 6

TRANSITION	WL	A	F	A'	A"
F 111-C 331	767.78	0.00E+00	0.00E+00	0.00E+00	1.08E-02
F 111-C 333	767.94	1.18E-10	3.49E-08	5.42E-08	1.08E-02
F 111-C 335	768.33	0.00E+00	0.00E+00	0.00E+00	1.10E-02
C 133-E 111	974.94	1.21E-04	1.73E-01	1.23E+00	3.08E-01
F 155-C 331	1070.6	0.00E+00	0.00E+00	0.00E+00	2.76E-01
F 155-C 333	1070.9	4.96E-10	1.42E-06	3.80E-06	2.77E-01
F 155-C 335	1071.7	3.38E-09	5.81E-06	1.60E-05	2.79E-01
F 335-C 331	1175.6	0.00E+00	0.00E+00	0.00E+00	1.41E-01
F 335-C 333	1176.0	2.66E-05	9.17E-02	2.78E-01	2.09E-01
F 333-C 331	1176.3	3.54E-05	2.20E-01	6.67E-01	2.50E-01
F 333-C 333	1176.6	2.65E-05	5.50E-02	1.67E-01	2.08E-01
F 331-C 331	1176.7	0.00E+00	0.00E+00	0.00E+00	1.11E-01
F 335-C 335	1176.9	7.95E-05	1.65E-01	5.00E-01	3.46E-01
F 331-C 333	1177.1	1.06E-04	7.33E-02	2.22E-01	8.35E-02
F 333-C 335	1177.6	4.41E-05	5.50E-02	1.67E-01	1.25E-01
F 331-C 335	1178.0	0.00E+00	0.00E+00	0.00E+00	2.77E-02
F 111-C 133	1249.3	1.74E-04	1.36E-01	4.78E-01	1.20E-01
C 335-E 111	1906.0	0.00E+00	0.00E+00	0.00E+00	1.06E+00
C 333-E 111	1908.4	1.20E-11	6.52E-08	9.04E-07	6.34E-01
C 331-E 111	1909.4	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 155-C 133	2314.5	1.31E-05	1.76E-01	1.11E+00	2.78E-01
F 335-C 133	2868.1	1.84E-10	3.77E-06	2.97E-05	2.78E-01
F 333-C 133	2872.2	1.76E-12	2.18E-08	1.61E-07	1.67E-01
F 331-C 133	2874.9	2.83E-11	1.17E-07	9.71E-07	5.55E-02

Z= 7

TRANSITION	WL	A	F	A'	A"
F 111-C 331	594.66	0.00E+00	0.00E+00	0.00E+00	1.25E-02
F 111-C 333	594.90	5.62E-10	9.94E-08	1.77E-07	1.27E-02
F 111-C 335	595.46	0.00E+00	0.00E+00	0.00E+00	1.29E-02
C 133-E 111	765.18	1.78E-04	1.56E-01	1.28E+00	3.20E-01
F 155-C 331	821.85	0.00E+00	0.00E+00	0.00E+00	2.74E-01
F 155-C 333	822.31	1.35E-09	2.29E-06	6.79E-06	2.76E-01
F 155-C 335	823.39	1.20E-08	1.22E-05	3.75E-05	2.79E-01
F 335-C 331	921.37	0.00E+00	0.00E+00	0.00E+00	1.42E-01
F 335-C 333	921.96	3.78E-05	8.03E-02	2.78E-01	2.10E-01
F 333-C 331	922.47	5.04E-05	1.93E-01	6.67E-01	2.50E-01
F 333-C 333	923.06	3.77E-05	4.81E-02	1.67E-01	2.09E-01
F 331-C 331	923.14	0.00E+00	0.00E+00	0.00E+00	1.11E-01
F 335-C 335	923.32	1.13E-04	1.44E-01	5.00E-01	3.46E-01
F 331-C 333	923.73	1.51E-04	6.41E-02	2.22E-01	8.36E-02
F 333-C 335	924.41	6.26E-05	4.81E-02	1.67E-01	1.25E-01
F 331-C 335	925.09	0.00E+00	0.00E+00	0.00E+00	2.77E-02
F 111-C 133	955.32	2.60E-04	1.19E-01	4.62E-01	1.15E-01
C 335-E 111	1483.0	0.00E+00	0.00E+00	0.00E+00	1.05E+00
C 333-E 111	1486.6	6.53E-11	2.16E-07	3.43E-06	6.28E-01
C 331-E 111	1488.1	0.00E+00	0.00E+00	0.00E+00	2.10E-01
F 155-C 133	1718.5	2.22E-05	1.64E-01	1.11E+00	2.78E-01
F 335-C 133	2220.0	6.12E-10	7.53E-06	6.65E-05	2.78E-01
F 333-C 133	2226.3	9.30E-12	6.91E-08	5.77E-07	1.66E-01
F 331-C 133	2230.3	1.33E-10	3.29E-07	3.07E-06	5.54E-02

Z= 8

TRANSITION	WL	A	F	A'	A"
F 111-C 331	485.51	0.00E+00	0.00E+00	0.00E+00	1.36E-02
F 111-C 333	485.86	1.99E-09	2.34E-07	4.74E-07	1.38E-02
F 111-C 335	486.63	0.00E+00	0.00E+00	0.00E+00	1.43E-02
C 133-E 111	630.07	2.35E-04	1.40E-01	1.31E+00	3.28E-01
F 155-C 331	667.39	0.00E+00	0.00E+00	0.00E+00	2.73E-01
F 155-C 333	668.04	3.51E-09	3.91E-06	1.29E-05	2.75E-01
F 155-C 335	669.51	3.70E-08	2.49E-05	8.60E-05	2.80E-01
F 335-C 331	757.65	0.00E+00	0.00E+00	0.00E+00	1.44E-01
F 335-C 333	758.48	4.94E-05	7.09E-02	2.78E-01	2.10E-01
F 333-C 331	759.23	6.56E-05	1.70E-01	6.67E-01	2.50E-01
F 333-C 333	760.07	4.91E-05	4.25E-02	1.67E-01	2.09E-01
F 331-C 331	760.18	0.00E+00	0.00E+00	0.00E+00	1.11E-01
F 335-C 335	760.38	1.47E-04	1.27E-01	5.00E-01	3.45E-01
F 331-C 333	761.03	1.95E-04	5.65E-02	2.22E-01	8.37E-02
F 333-C 335	761.98	8.12E-05	4.23E-02	1.67E-01	1.25E-01
F 331-C 335	762.94	0.00E+00	0.00E+00	0.00E+00	2.76E-02
F 111-C 133	773.96	3.50E-04	1.05E-01	4.51E-01	1.13E-01
C 335-E 111	1213.2	0.00E+00	0.00E+00	0.00E+00	1.04E+00
C 333-E 111	1218.1	2.54E-10	5.64E-07	1.02E-05	6.25E-01
C 331-E 111	1220.3	0.00E+00	0.00E+00	0.00E+00	2.08E-01
F 155-C 133	1368.4	3.21E-05	1.50E-01	1.11E+00	2.78E-01
F 335-C 133	1810.8	1.83E-09	1.50E-05	1.48E-04	2.78E-01
F 333-C 133	1819.8	3.54E-11	1.76E-07	1.65E-06	1.66E-01
F 331-C 133	1825.3	4.68E-10	7.79E-07	8.13E-06	5.53E-02

Z= 9

TRANSITION	WL	A	F	A'	A"
F 111-C 331	410.12	0.00E+00	0.00E+00	0.00E+00	1.41E-02
F 111-C 333	410.58	5.75E-09	4.84E-07	1.11E-06	1.45E-02
F 111-C 335	411.61	0.00E+00	0.00E+00	0.00E+00	1.53E-02
C 133-E 111	535.51	2.94E-04	1.26E-01	1.33E+00	3.33E-01
F 155-C 331	561.56	0.00E+00	0.00E+00	0.00E+00	2.70E-01
F 155-C 333	562.42	8.35E-09	6.59E-06	2.42E-05	2.74E-01
F 155-C 335	564.35	1.00E-07	4.78E-05	1.84E-04	2.82E-01
F 335-C 331	642.66	0.00E+00	0.00E+00	0.00E+00	1.46E-01
F 335-C 333	643.79	6.12E-05	6.33E-02	2.78E-01	2.11E-01
F 333-C 331	644.81	8.12E-05	1.52E-01	6.67E-01	2.50E-01
F 333-C 333	645.95	6.06E-05	3.78E-02	1.67E-01	2.09E-01
F 331-C 331	646.09	0.00E+00	0.00E+00	0.00E+00	1.12E-01
F 335-C 335	646.32	1.81E-04	1.13E-01	5.00E-01	3.43E-01
F 331-C 333	647.24	2.41E-04	5.04E-02	2.22E-01	8.40E-02
F 333-C 335	648.50	9.97E-05	3.77E-02	1.67E-01	1.25E-01
F 331-C 335	649.79	0.00E+00	0.00E+00	0.00E+00	2.75E-02
F 111-C 133	650.46	4.43E-04	9.36E-02	4.44E-01	1.11E-01
C 335-E 111	1025.3	0.00E+00	0.00E+00	0.00E+00	1.04E+00
C 333-E 111	1031.8	7.87E-10	1.25E-06	2.54E-05	6.22E-01
C 331-E 111	1034.7	0.00E+00	0.00E+00	0.00E+00	2.08E-01
F 155-C 133	1136.6	4.26E-05	1.37E-01	1.11E+00	2.78E-01
F 335-C 133	1526.4	4.88E-09	2.84E-05	3.11E-04	2.79E-01
F 333-C 133	1538.6	1.09E-10	3.85E-07	4.04E-06	1.66E-01
F 331-C 133	1546.0	1.36E-09	1.62E-06	1.88E-05	5.52E-02

TABLE 3 (coninued)

Z=10

TRANSITION	WL	A	F	A'	A''
F 111-C 331	354.74	0.00E+00	0.00E+00	0.00E+00	1.44E-02
F 111-C 333	355.33	1.44E-08	9.07E-07	2.33E-06	1.50E-02
F 111-C 335	356.64	0.00E+00	0.00E+00	0.00E+00	1.61E-02
C 133-E 111	465.43	3.53E-04	1.15E-01	1.35E+00	3.37E-01
F 155-C 331	484.17	0.00E+00	0.00E+00	0.00E+00	2.67E-01
F 155-C 333	485.27	1.85E-08	1.09E-05	4.39E-05	2.72E-01
F 155-C 335	487.72	2.42E-07	8.64E-05	3.67E-04	2.83E-01
F 335-C 331	557.01	0.00E+00	0.00E+00	0.00E+00	1.50E-01
F 335-C 333	558.47	7.33E-05	5.71E-02	2.78E-01	2.12E-01
F 333-C 331	559.80	9.71E-05	1.37E-01	6.67E-01	2.50E-01
F 111-C 133	560.67	5.38E-04	8.44E-02	4.39E-01	1.10E-01
F 333-C 333	561.28	7.22E-05	3.41E-02	1.67E-01	2.09E-01
F 331-C 331	561.47	0.00E+00	0.00E+00	0.00E+00	1.12E-01
F 335-C 335	561.72	2.16E-04	1.02E-01	5.00E-01	3.42E-01
F 331-C 333	562.95	2.86E-04	4.53E-02	2.22E-01	8.43E-02
F 333-C 335	564.56	1.18E-04	3.39E-02	1.67E-01	1.25E-01
F 331-C 335	566.25	0.00E+00	0.00E+00	0.00E+00	2.74E-02
C 335-E 111	886.38	0.00E+00	0.00E+00	0.00E+00	1.03E+00
C 333-E 111	894.59	2.08E-09	2.49E-06	5.62E-05	6.21E-01
C 331-E 111	898.36	0.00E+00	0.00E+00	0.00E+00	2.07E-01
F 155-C 133	970.86	5.37E-05	1.26E-01	1.11E+00	2.78E-01
F 335-C 133	1315.9	1.18E-08	5.10E-05	6.12E-04	2.79E-01
F 333-C 133	1331.6	2.85E-10	7.58E-07	8.79E-06	1.66E-01
F 331-C 133	1341.1	3.42E-09	3.08E-06	3.92E-05	5.50E-02

Z=11

TRANSITION	WL	A	F	A'	A''
F 111-C 331	312.20	0.00E+00	0.00E+00	0.00E+00	1.45E-02
F 111-C 333	312.94	3.22E-08	1.58E-06	4.48E-06	1.53E-02
F 111-C 335	314.57	0.00E+00	0.00E+00	0.00E+00	1.69E-02
C 133-E 111	411.30	4.13E-04	1.05E-01	1.36E+00	3.40E-01
F 155-C 331	424.86	0.00E+00	0.00E+00	0.00E+00	2.63E-01
F 155-C 333	426.22	3.84E-08	1.74E-05	7.71E-05	2.70E-01
F 155-C 335	429.26	5.36E-07	1.48E-04	6.89E-04	2.85E-01
F 335-C 331	490.42	0.00E+00	0.00E+00	0.00E+00	1.54E-01
F 335-C 333	492.24	8.60E-05	5.21E-02	2.78E-01	2.14E-01
F 111-C 133	492.26	6.35E-04	7.69E-02	4.35E-01	1.09E-01
F 333-C 331	493.91	1.14E-04	1.25E-01	6.67E-01	2.50E-01
F 333-C 333	495.75	8.42E-05	3.10E-02	1.67E-01	2.10E-01
F 331-C 331	496.01	0.00E+00	0.00E+00	0.00E+00	1.12E-01
F 335-C 335	496.29	2.52E-04	9.28E-02	4.99E-01	3.40E-01
F 331-C 333	497.87	3.33E-04	4.12E-02	2.22E-01	8.47E-02
F 333-C 335	499.86	1.37E-04	3.08E-02	1.67E-01	1.25E-01
F 331-C 335	502.02	0.00E+00	0.00E+00	0.00E+00	2.72E-02
C 335-E 111	778.93	0.00E+00	0.00E+00	0.00E+00	1.03E+00
C 333-E 111	789.12	4.88E-09	4.55E-06	1.13E-04	6.19E-01
C 331-E 111	793.85	0.00E+00	0.00E+00	0.00E+00	2.07E-01
F 155-C 133	845.96	6.53E-05	1.17E-01	1.11E+00	2.78E-01
F 335-C 133	1152.8	2.63E-08	8.73E-05	1.14E-03	2.80E-01
F 333-C 133	1172.3	6.68E-10	1.37E-06	1.75E-05	1.65E-01
F 331-C 133	1184.2	7.71E-09	5.40E-06	7.52E-05	5.47E-02

Z=12

TRANSITION	WL	A	F	A'	A''
F 111-C 331	278.40	0.00E+00	0.00E+00	0.00E+00	1.44E-02
F 111-C 333	279.29	6.62E-08	2.58E-06	8.06E-06	1.54E-02
F 111-C 335	281.28	0.00E+00	0.00E+00	0.00E+00	1.76E-02
C 133-E 111	368.12	4.75E-04	9.65E-02	1.37E+00	3.43E-01
F 155-C 331	377.77	0.00E+00	0.00E+00	0.00E+00	2.58E-01
F 155-C 333	379.42	7.61E-08	2.73E-05	1.31E-04	2.67E-01
F 155-C 335	383.10	1.10E-06	2.43E-04	1.23E-03	2.88E-01
F 335-C 331	436.91	0.00E+00	0.00E+00	0.00E+00	1.59E-01
F 111-C 133	438.26	7.36E-04	7.06E-02	4.32E-01	1.08E-01
F 335-C 333	439.12	9.94E-05	4.79E-02	2.78E-01	2.16E-01
F 333-C 331	441.14	1.31E-04	1.14E-01	6.67E-01	2.50E-01
F 333-C 333	443.39	9.66E-05	2.84E-02	1.67E-01	2.10E-01
F 331-C 331	443.75	0.00E+00	0.00E+00	0.00E+00	1.13E-01
F 335-C 335	444.05	2.88E-04	8.50E-02	4.99E-01	3.37E-01
F 331-C 333	446.02	3.80E-04	3.77E-02	2.22E-01	8.52E-02
F 333-C 335	448.42	1.56E-04	2.81E-02	1.67E-01	1.25E-01
F 331-C 335	451.11	0.00E+00	0.00E+00	0.00E+00	2.70E-02
C 335-E 111	692.97	0.00E+00	0.00E+00	0.00E+00	1.03E+00
C 333-E 111	705.34	1.04E-08	7.77E-06	2.11E-04	6.18E-01
C 331-E 111	711.11	0.00E+00	0.00E+00	0.00E+00	2.06E-01
F 155-C 133	748.03	7.77E-05	1.09E-01	1.11E+00	2.78E-01
F 335-C 133	1021.9	5.51E-08	1.44E-04	2.02E-03	2.80E-01
F 333-C 133	1045.4	1.43E-09	2.34E-06	3.23E-05	1.65E-01
F 331-C 133	1060.1	1.59E-08	8.92E-06	1.35E-04	5.44E-02

Z=13

TRANSITION	WL	A	F	A'	A''
F 111-C 331	250.80	0.00E+00	0.00E+00	0.00E+00	1.41E-02
F 111-C 333	251.86	1.27E-07	4.02E-06	1.37E-05	1.54E-02
F 111-C 335	254.24	0.00E+00	0.00E+00	0.00E+00	1.84E-02
C 133-E 111	332.80	5.39E-04	8.95E-02	1.38E+00	3.45E-01
F 155-C 331	339.32	0.00E+00	0.00E+00	0.00E+00	2.52E-01
F 155-C 333	341.27	1.45E-07	4.21E-05	2.18E-04	2.64E-01
F 155-C 335	345.65	2.14E-06	3.82E-04	2.09E-03	2.91E-01
F 335-C 331	392.78	0.00E+00	0.00E+00	0.00E+00	1.65E-01
F 111-C 133	394.43	8.39E-04	6.52E-02	4.29E-01	1.07E-01
F 335-C 333	395.40	1.14E-04	4.44E-02	2.78E-01	2.18E-01
F 333-C 331	397.79	1.49E-04	1.06E-01	6.67E-01	2.50E-01
F 333-C 333	400.47	1.09E-04	2.63E-02	1.67E-01	2.10E-01
F 331-C 331	400.95	0.00E+00	0.00E+00	0.00E+00	1.13E-01
F 335-C 335	401.29	3.25E-04	7.84E-02	4.98E-01	3.34E-01
F 331-C 333	403.68	4.27E-04	3.48E-02	2.22E-01	8.58E-02
F 333-C 335	406.51	1.74E-04	2.59E-02	1.67E-01	1.25E-01
F 331-C 335	409.82	0.00E+00	0.00E+00	0.00E+00	2.67E-02
C 335-E 111	622.34	0.00E+00	0.00E+00	0.00E+00	1.02E+00
C 333-E 111	637.06	2.07E-08	1.26E-05	3.70E-04	6.17E-01
C 331-E 111	643.96	0.00E+00	0.00E+00	0.00E+00	2.06E-01
F 155-C 133	668.84	9.08E-05	1.01E-01	1.11E+00	2.78E-01
F 335-C 133	914.08	1.09E-07	2.28E-04	3.43E-03	2.81E-01
F 333-C 133	941.63	2.84E-09	3.77E-06	5.62E-05	1.65E-01
F 331-C 133	959.58	3.04E-08	1.40E-05	2.28E-04	5.41E-02

Z=14

TRANSITION	WL	A	F	A'	A''
F 111-C 331	227.77	0.00E+00	0.00E+00	0.00E+00	1.37E-02
F 111-C 333	229.01	2.29E-07	5.99E-06	2.20E-05	1.53E-02
F 111-C 335	231.81	0.00E+00	0.00E+00	0.00E+00	1.91E-02
C 133-E 111	303.30	6.06E-04	8.35E-02	1.39E+00	3.47E-01
F 155-C 331	307.20	0.00E+00	0.00E+00	0.00E+00	2.44E-01
F 155-C 333	309.46	2.66E-07	6.36E-05	3.54E-04	2.60E-01
F 155-C 335	314.59	3.94E-06	5.84E-04	3.43E-03	2.94E-01
F 335-C 331	355.63	0.00E+00	0.00E+00	0.00E+00	1.72E-01
F 111-C 133	358.04	9.47E-04	6.06E-02	4.26E-01	1.07E-01
F 335-C 333	358.66	1.29E-04	4.15E-02	2.78E-01	2.22E-01
F 333-C 331	361.41	1.68E-04	9.87E-02	6.67E-01	2.50E-01
F 333-C 333	364.54	1.23E-04	2.44E-02	1.67E-01	2.11E-01
F 331-C 331	365.21	0.00E+00	0.00E+00	0.00E+00	1.14E-01
F 335-C 335	365.57	3.63E-04	7.27E-02	4.97E-01	3.31E-01
F 331-C 333	368.40	4.77E-04	3.23E-02	2.22E-01	8.66E-02
F 333-C 335	371.68	1.93E-04	2.40E-02	1.67E-01	1.25E-01
F 331-C 335	375.69	0.00E+00	0.00E+00	0.00E+00	2.64E-02
C 335-E 111	563.01	0.00E+00	0.00E+00	0.00E+00	1.02E+00
C 333-E 111	580.23	3.87E-08	1.95E-05	6.19E-04	6.16E-01
C 331-E 111	588.33	0.00E+00	0.00E+00	0.00E+00	2.06E-01
F 155-C 133	603.22	1.05E-04	9.52E-02	1.11E+00	2.79E-01
F 335-C 133	823.36	2.08E-07	3.52E-04	5.61E-03	2.81E-01
F 333-C 133	855.03	5.32E-09	5.83E-06	9.31E-05	1.64E-01
F 331-C 133	876.59	5.48E-08	2.10E-05	3.68E-04	5.36E-02

Z=15

TRANSITION	WL	A	F	A'	A''
F 111-C 331	208.19	0.00E+00	0.00E+00	0.00E+00	1.31E-02
F 111-C 333	209.61	3.92E-07	8.60E-06	3.40E-05	1.52E-02
F 111-C 335	212.86	0.00E+00	0.00E+00	0.00E+00	2.00E-02
C 133-E 111	278.23	6.75E-04	7.83E-02	1.39E+00	3.49E-01
F 155-C 331	279.85	0.00E+00	0.00E+00	0.00E+00	2.36E-01
F 155-C 333	282.42	4.76E-07	9.47E-05	5.63E-04	2.55E-01
F 155-C 335	288.35	6.95E-06	8.66E-04	5.44E-03	2.99E-01
F 335-C 331	323.80	0.00E+00	0.00E+00	0.00E+00	1.81E-01
F 335-C 333	327.24	1.46E-04	3.90E-02	2.78E-01	2.25E-01
F 111-C 133	327.25	1.06E-03	5.67E-02	4.23E-01	1.06E-01
F 333-C 331	330.35	1.89E-04	9.26E-02	6.67E-01	2.50E-01
F 333-C 333	333.93	1.37E-04	2.29E-02	1.67E-01	2.12E-01
F 331-C 331	334.84	0.00E+00	0.00E+00	0.00E+00	1.14E-01
F 335-C 335	335.23	4.02E-04	6.77E-02	4.95E-01	3.26E-01
F 331-C 333	338.53	5.27E-04	3.02E-02	2.22E-01	8.74E-02
F 333-C 335	342.26	2.12E-04	2.23E-02	1.67E-01	1.25E-01
F 331-C 335	347.09	0.00E+00	0.00E+00	0.00E+00	2.61E-02
C 335-E 111	512.26	0.00E+00	0.00E+00	0.00E+00	1.02E+00
C 333-E 111	532.13	6.87E-08	2.91E-05	9.90E-04	6.16E-01
C 331-E 111	541.49	0.00E+00	0.00E+00	0.00E+00	2.06E-01
F 155-C 133	547.68	1.20E-04	8.98E-02	1.10E+00	2.80E-01
F 335-C 133	745.76	3.82E-07	5.30E-04	8.89E-03	2.82E-01
F 333-C 133	781.44	9.50E-09	8.69E-06	1.48E-04	1.63E-01
F 331-C 133	807.08	9.35E-08	3.04E-05	5.70E-04	5.31E-02

TABLE 3 (cotinued)

Z=16

TRANSITION	WL	A	F	A'	A''
F 111-C 331	191.29	0.00E+00	0.00E+00	0.00E+00	1.25E-02
F 111-C 333	192.89	6.43E-07	1.19E-05	5.04E-05	1.49E-02
F 111-C 335	196.62	0.00E+00	0.00E+00	0.00E+00	2.09E-02
F 155-C 331	256.17	0.00E+00	0.00E+00	0.00E+00	2.25E-01
C 133-E 111	256.61	7.49E-04	7.39E-02	1.40E+00	3.51E-01
F 155-C 333	259.05	8.29E-07	1.39E-04	8.75E-04	2.49E-01
F 155-C 335	265.83	1.18E-05	1.25E-03	8.36E-03	3.04E-01
F 335-C 331	296.14	0.00E+00	0.00E+00	0.00E+00	1.92E-01
F 335-C 333	300.00	1.64E-04	3.69E-02	2.78E-01	2.30E-01
F 111-C 133	300.78	1.18E-03	5.32E-02	4.20E-01	1.05E-01
F 333-C 331	303.43	2.11E-04	8.74E-02	6.67E-01	2.50E-01
F 333-C 333	307.47	1.52E-04	2.15E-02	1.66E-01	2.13E-01
F 331-C 331	308.70	0.00E+00	0.00E+00	0.00E+00	1.15E-01
F 335-C 335	309.13	4.42E-04	6.33E-02	4.92E-01	3.21E-01
F 331-C 333	312.89	5.79E-04	2.83E-02	2.23E-01	8.84E-02
F 333-C 335	317.07	2.31E-04	2.09E-02	1.67E-01	1.25E-01
F 331-C 335	322.84	0.00E+00	0.00E+00	0.00E+00	2.56E-02
C 335-E 111	468.20	0.00E+00	0.00E+00	0.00E+00	1.02E+00
C 333-E 111	490.83	1.17E-07	4.22E-05	1.53E-03	6.15E-01
F 155-C 133	499.85	1.36E-04	8.50E-02	1.10E+00	2.80E-01
C 331-E 111	501.50	0.00E+00	0.00E+00	0.00E+00	2.06E-01
F 335-C 133	678.56	6.77E-07	7.78E-04	1.37E-02	2.82E-01
F 333-C 133	718.05	1.63E-08	1.26E-05	2.27E-04	1.62E-01
F 331-C 133	748.30	1.52E-07	4.25E-05	8.49E-04	5.25E-02

Z=17

TRANSITION	WL	A	F	A'	A''
F 111-C 331	176.49	0.00E+00	0.00E+00	0.00E+00	1.17E-02
F 111-C 333	178.27	1.01E-06	1.61E-05	7.20E-05	1.46E-02
F 111-C 335	182.52	0.00E+00	0.00E+00	0.00E+00	2.19E-02
F 155-C 331	235.39	0.00E+00	0.00E+00	0.00E+00	2.13E-01
C 133-E 111	237.72	6.27E-04	7.00E-02	1.41E+00	3.53E-01
F 155-C 333	238.56	1.41E-06	2.00E-04	1.33E-03	2.41E-01
F 155-C 335	246.23	1.95E-05	1.77E-03	1.25E-02	3.10E-01
F 335-C 331	271.84	0.00E+00	0.00E+00	0.00E+00	2.04E-01
F 335-C 333	276.09	1.84E-04	3.51E-02	2.78E-01	2.36E-01
F 111-C 133	277.70	1.30E-03	5.02E-02	4.17E-01	1.05E-01
F 333-C 331	279.80	2.36E-04	8.30E-02	6.67E-01	2.50E-01
F 333-C 333	284.30	1.68E-04	2.04E-02	1.66E-01	2.14E-01
F 331-C 331	285.93	0.00E+00	0.00E+00	0.00E+00	1.16E-01
F 335-C 335	286.41	4.82E-04	5.93E-02	4.88E-01	3.15E-01
F 331-C 333	290.63	6.33E-04	2.67E-02	2.23E-01	8.96E-02
F 333-C 335	295.25	2.51E-04	1.97E-02	1.67E-01	1.25E-01
F 331-C 335	302.09	0.00E+00	0.00E+00	0.00E+00	2.51E-02
C 335-E 111	429.43	0.00E+00	0.00E+00	0.00E+00	1.01E+00
C 333-E 111	454.93	1.92E-07	5.94E-05	2.28E-03	6.15E-01
F 155-C 133	458.04	1.54E-04	8.08E-02	1.09E+00	2.82E-01
C 331-E 111	466.95	0.00E+00	0.00E+00	0.00E+00	2.06E-01
F 335-C 133	619.75	1.17E-06	1.12E-03	2.05E-02	2.82E-01
F 333-C 133	662.73	2.68E-08	1.77E-05	3.36E-04	1.61E-01
F 331-C 133	698.17	2.36E-07	5.75E-05	1.22E-03	5.18E-02

Z=18

TRANSITION	WL	A	F	A'	A''
F 111-C 331	163.38	0.00E+00	0.00E+00	0.00E+00	1.09E-02
F 111-C 333	165.33	1.54E-06	2.11E-05	9.95E-05	1.41E-02
F 111-C 335	170.12	0.00E+00	0.00E+00	0.00E+00	2.30E-02
F 155-C 331	216.91	0.00E+00	0.00E+00	0.00E+00	1.99E-01
F 155-C 333	220.38	2.34E-06	2.84E-04	1.98E-03	2.33E-01
C 133-E 111	221.04	9.10E-04	6.66E-02	1.41E+00	3.55E-01
F 155-C 335	228.95	3.10E-05	2.44E-03	1.82E-02	3.17E-01
F 335-C 331	250.28	0.00E+00	0.00E+00	0.00E+00	2.17E-01
F 335-C 333	254.90	2.07E-04	3.35E-02	2.78E-01	2.43E-01
F 111-C 133	257.33	1.44E-03	4.76E-02	4.14E-01	1.04E-01
F 333-C 331	258.84	2.63E-04	7.91E-02	6.67E-01	2.50E-01
F 333-C 333	263.78	1.86E-04	1.94E-02	1.66E-01	2.15E-01
F 331-C 331	265.90	0.00E+00	0.00E+00	0.00E+00	1.16E-01
F 335-C 335	266.45	5.22E-04	5.56E-02	4.82E-01	3.08E-01
F 331-C 333	271.12	6.88E-04	2.53E-02	2.23E-01	9.09E-02
F 333-C 335	276.17	2.70E-04	1.85E-02	1.67E-01	1.25E-01
F 331-C 335	284.22	0.00E+00	0.00E+00	0.00E+00	2.45E-02
C 335-E 111	394.97	0.00E+00	0.00E+00	0.00E+00	1.01E+00
F 155-C 133	420.99	1.74E-04	7.69E-02	1.08E+00	2.84E-01
C 333-E 111	423.40	3.04E-07	8.17E-05	3.31E-03	6.14E-01
C 331-E 111	436.80	0.00E+00	0.00E+00	0.00E+00	2.06E-01
F 335-C 133	567.94	1.95E-06	1.57E-03	2.98E-02	2.82E-01
F 333-C 133	614.00	4.29E-08	2.42E-05	4.85E-04	1.60E-01
F 331-C 133	655.29	3.53E-07	7.57E-05	1.71E-03	5.10E-02

Z=19

TRANSITION	WL	A	F	A'	A''
F 111-C 331	151.64	0.00E+00	0.00E+00	0.00E+00	9.97E-03
F 111-C 333	153.76	2.27E-06	2.68E-05	1.33E-04	1.36E-02
F 111-C 335	159.10	0.00E+00	0.00E+00	0.00E+00	2.42E-02
F 155-C 331	200.32	0.00E+00	0.00E+00	0.00E+00	1.84E-01
F 155-C 333	204.04	3.80E-06	3.95E-04	2.88E-03	2.23E-01
C 133-E 111	206.15	1.00E-03	6.37E-02	1.42E+00	3.57E-01
F 155-C 335	213.55	4.81E-05	3.29E-03	2.57E-02	3.25E-01
F 335-C 331	231.01	0.00E+00	0.00E+00	0.00E+00	2.33E-01
F 335-C 333	235.98	2.31E-04	3.22E-02	2.78E-01	2.51E-01
F 111-C 133	239.16	1.58E-03	4.52E-02	4.11E-01	1.04E-01
F 333-C 331	240.07	2.93E-04	7.58E-02	6.67E-01	2.50E-01
F 333-C 333	245.43	2.05E-04	1.85E-02	1.66E-01	2.16E-01
F 331-C 331	248.15	0.00E+00	0.00E+00	0.00E+00	1.17E-01
F 335-C 335	248.79	5.61E-04	5.21E-02	4.74E-01	3.00E-01
F 331-C 333	253.88	7.46E-04	2.40E-02	2.23E-01	9.24E-02
F 333-C 335	259.32	2.90E-04	1.75E-02	1.67E-01	1.25E-01
F 331-C 335	268.78	0.00E+00	0.00E+00	0.00E+00	2.39E-02
C 335-E 111	364.06	0.00E+00	0.00E+00	0.00E+00	1.01E+00
F 155-C 133	387.78	1.95E-04	7.34E-02	1.07E+00	2.86E-01
C 333-E 111	395.48	4.69E-07	1.10E-04	4.69E-03	6.13E-01
C 331-E 111	410.25	0.00E+00	0.00E+00	0.00E+00	2.06E-01
F 335-C 133	522.07	3.17E-06	2.16E-03	4.23E-02	2.82E-01
F 333-C 133	570.70	6.68E-08	3.26E-05	6.81E-04	1.59E-01
F 331-C 133	618.60	5.07E-07	9.69E-05	2.32E-03	5.01E-02

Z=20

TRANSITION	WL	A	F	A'	A''
F 111-C 331	141.03	0.00E+00	0.00E+00	0.00E+00	9.02E-03
F 111-C 333	143.31	3.24E-06	3.32E-05	1.72E-04	1.30E-02
F 111-C 335	149.22	0.00E+00	0.00E+00	0.00E+00	2.55E-02
F 155-C 331	185.27	0.00E+00	0.00E+00	0.00E+00	1.67E-01
F 155-C 333	189.22	6.00E-06	5.37E-04	4.05E-03	2.11E-01
C 133-E 111	192.75	1.10E-03	6.11E-02	1.42E+00	3.59E-01
F 155-C 335	199.67	7.25E-05	4.33E-03	3.54E-02	3.33E-01
F 335-C 331	213.69	0.00E+00	0.00E+00	0.00E+00	2.49E-01
F 335-C 333	218.96	2.59E-04	3.10E-02	2.78E-01	2.61E-01
F 111-C 133	222.79	1.74E-03	4.31E-02	4.07E-01	1.03E-01
F 333-C 331	223.12	3.26E-04	7.30E-02	6.67E-01	2.50E-01
F 333-C 333	228.87	2.25E-04	1.77E-02	1.66E-01	2.17E-01
F 331-C 331	232.31	0.00E+00	0.00E+00	0.00E+00	1.18E-01
F 335-C 335	233.07	5.98E-04	4.87E-02	4.65E-01	2.92E-01
F 331-C 333	238.55	8.05E-04	2.29E-02	2.24E-01	9.40E-02
F 333-C 335	244.34	3.10E-04	1.67E-02	1.67E-01	1.25E-01
F 331-C 335	255.39	0.00E+00	0.00E+00	0.00E+00	2.32E-02
C 335-E 111	336.11	0.00E+00	0.00E+00	0.00E+00	1.01E+00
F 155-C 133	357.71	2.19E-04	7.01E-02	1.05E+00	2.89E-01
C 333-E 111	370.56	7.05E-07	1.45E-04	6.48E-03	6.13E-01
C 331-E 111	386.70	0.00E+00	0.00E+00	0.00E+00	2.06E-01
F 335-C 133	481.29	5.00E-06	2.89E-03	5.83E-02	2.81E-01
F 333-C 133	531.95	1.01E-07	4.29E-05	9.35E-04	1.58E-01
F 331-C 133	587.31	7.01E-07	1.21E-04	3.06E-03	4.90E-02

Z=21

TRANSITION	WL	A	F	A'	A''
F 111-C 331	131.37	0.00E+00	0.00E+00	0.00E+00	8.06E-03
F 111-C 333	133.79	4.49E-06	4.01E-05	2.16E-04	1.24E-02
F 111-C 335	140.29	0.00E+00	0.00E+00	0.00E+00	2.68E-02
F 155-C 331	171.52	0.00E+00	0.00E+00	0.00E+00	1.50E-01
F 155-C 333	175.66	9.21E-06	7.09E-04	5.54E-03	1.99E-01
C 133-E 111	180.59	1.20E-03	5.88E-02	1.43E+00	3.61E-01
F 155-C 335	187.04	1.06E-04	5.56E-03	4.73E-02	3.42E-01
F 335-C 331	198.03	0.00E+00	0.00E+00	0.00E+00	2.67E-01
F 335-C 333	203.57	2.90E-04	3.00E-02	2.79E-01	2.71E-01
F 333-C 331	207.72	3.64E-04	7.05E-02	6.67E-01	2.50E-01
F 111-C 133	207.92	1.91E-03	4.12E-02	4.04E-01	1.03E-01
F 333-C 333	213.82	2.48E-04	1.70E-02	1.65E-01	2.18E-01
F 331-C 331	218.09	0.00E+00	0.00E+00	0.00E+00	1.19E-01
F 335-C 335	219.01	6.32E-04	4.54E-02	4.53E-01	2.83E-01
F 331-C 333	224.82	8.67E-04	2.19E-02	2.24E-01	9.58E-02
F 333-C 335	230.92	3.31E-04	1.59E-02	1.67E-01	1.25E-01
F 331-C 335	243.81	0.00E+00	0.00E+00	0.00E+00	2.25E-02
C 335-E 111	310.70	0.00E+00	0.00E+00	0.00E+00	1.00E+00
F 155-C 133	330.27	2.46E-04	6.70E-02	1.03E+00	2.93E-01
C 333-E 111	348.17	1.03E-06	1.88E-04	8.77E-03	6.12E-01
C 331-E 111	365.65	0.00E+00	0.00E+00	0.00E+00	2.07E-01
F 335-C 133	444.99	7.62E-06	3.77E-03	7.81E-02	2.79E-01
F 333-C 133	497.08	1.50E-07	5.56E-05	1.26E-03	1.57E-01
F 331-C 133	560.88	9.33E-07	1.47E-04	3.93E-03	4.79E-02

TABLE 3 (cotinued)

Z=22

TRANSITION	WL	A	F	A'	A''
F 111-C 331	122.51	0.00E+00	0.00E+00	0.00E+00	7.09E-03
F 111-C 333	125.04	6.05E-06	4.73E-05	2.63E-04	1.17E-02
F 111-C 335	132.14	0.00E+00	0.00E+00	0.00E+00	2.83E-02
F 155-C 331	158.87	0.00E+00	0.00E+00	0.00E+00	1.32E-01
F 155-C 333	163.16	1.37E-05	9.10E-04	7.31E-03	1.85E-01
C 133-E 111	169.49	1.32E-03	5.69E-02	1.43E+00	3.64E-01
F 155-C 335	175.44	1.51E-04	6.97E-03	6.15E-02	3.51E-01
F 335-C 331	183.83	0.00E+00	0.00E+00	0.00E+00	2.85E-01
F 335-C 333	189.59	3.25E-04	2.92E-02	2.79E-01	2.82E-01
F 333-C 331	193.64	4.06E-04	6.84E-02	6.67E-01	2.50E-01
F 111-C 133	194.31	2.10E-03	3.95E-02	3.99E-01	1.02E-01
F 333-C 333	200.04	2.74E-04	1.64E-02	1.65E-01	2.20E-01
F 331-C 331	205.27	0.00E+00	0.00E+00	0.00E+00	1.20E-01
F 335-C 335	206.39	6.62E-04	4.22E-02	4.39E-01	2.74E-01
F 331-C 333	212.48	9.32E-04	2.10E-02	2.25E-01	9.77E-02
F 333-C 335	218.84	3.52E-04	1.51E-02	1.67E-01	1.25E-01
F 331-C 335	233.81	0.00E+00	0.00E+00	0.00E+00	2.16E-02
C 335-E 111	287.47	0.00E+00	0.00E+00	0.00E+00	1.00E+00
F 155-C 133	305.04	2.76E-04	6.40E-02	1.00E+00	2.98E-01
C 333-E 111	327.94	1.48E-06	2.39E-04	1.16E-02	6.11E-01
C 331-E 111	346.73	0.00E+00	0.00E+00	0.00E+00	2.07E-01
F 335-C 133	412.61	1.13E-05	4.78E-03	1.02E-01	2.77E-01
F 333-C 133	465.53	2.18E-07	7.08E-05	1.66E-03	1.55E-01
F 331-C 133	538.95	1.20E-06	1.74E-04	4.94E-03	4.66E-02

Z=23

TRANSITION	WL	A	F	A'	A''
F 111-C 331	114.34	0.00E+00	0.00E+00	0.00E+00	6.15E-03
F 111-C 333	116.96	7.95E-06	5.43E-05	3.11E-04	1.09E-02
F 111-C 335	124.65	0.00E+00	0.00E+00	0.00E+00	2.98E-02
F 155-C 331	147.18	0.00E+00	0.00E+00	0.00E+00	1.14E-01
F 155-C 333	151.56	1.97E-05	1.13E-03	9.29E-03	1.71E-01
C 133-E 111	159.27	1.45E-03	5.51E-02	1.44E+00	3.66E-01
F 155-C 335	164.73	2.09E-04	8.51E-03	7.76E-02	3.60E-01
F 335-C 331	170.91	0.00E+00	0.00E+00	0.00E+00	3.03E-01
F 335-C 333	176.85	3.65E-04	2.85E-02	2.79E-01	2.94E-01
F 333-C 331	180.70	4.54E-04	6.66E-02	6.67E-01	2.50E-01
F 111-C 133	181.78	2.31E-03	3.80E-02	3.95E-01	1.02E-01
F 333-C 333	187.35	3.02E-04	1.59E-02	1.65E-01	2.21E-01
F 331-C 331	193.67	0.00E+00	0.00E+00	0.00E+00	1.20E-01
F 335-C 335	195.03	6.87E-04	3.91E-02	4.22E-01	2.65E-01
F 331-C 333	201.33	9.99E-04	2.02E-02	2.25E-01	9.97E-02
F 333-C 335	207.89	3.73E-04	1.45E-02	1.67E-01	1.25E-01
F 331-C 335	225.23	0.00E+00	0.00E+00	0.00E+00	2.08E-02
C 335-E 111	266.14	0.00E+00	0.00E+00	0.00E+00	9.97E-01
F 155-C 133	281.74	3.09E-04	6.12E-02	9.72E-01	3.03E-01
C 333-E 111	309.58	2.09E-06	3.00E-04	1.52E-02	6.10E-01
C 331-E 111	329.63	0.00E+00	0.00E+00	0.00E+00	2.07E-01
F 335-C 133	383.71	1.60E-05	5.89E-03	1.28E-01	2.74E-01
F 333-C 133	436.88	3.10E-07	8.87E-05	2.14E-03	1.54E-01
F 331-C 133	521.24	1.48E-06	2.00E-04	6.06E-03	4.53E-02

Z=24

TRANSITION	WL	A	F	A'	A''
F 111-C 331	106.76	0.00E+00	0.00E+00	0.00E+00	5.26E-03
F 111-C 333	109.45	1.02E-05	6.08E-05	3.56E-04	1.01E-02
F 111-C 335	117.73	0.00E+00	0.00E+00	0.00E+00	3.14E-02
F 155-C 331	136.34	0.00E+00	0.00E+00	0.00E+00	9.72E-02
F 155-C 333	140.77	2.75E-05	1.36E-03	1.14E-02	1.57E-01
C 133-E 111	149.82	1.59E-03	5.36E-02	1.44E+00	3.69E-01
F 155-C 335	154.75	2.82E-04	1.01E-02	9.51E-02	3.68E-01
F 335-C 331	159.11	0.00E+00	0.00E+00	0.00E+00	3.19E-01
F 335-C 333	165.17	4.10E-04	2.79E-02	2.80E-01	3.06E-01
F 333-C 331	168.77	5.09E-04	6.51E-02	6.67E-01	2.50E-01
F 111-C 133	170.18	2.54E-03	3.67E-02	3.90E-01	1.01E-01
F 333-C 333	175.61	3.33E-04	1.54E-02	1.64E-01	2.23E-01
F 331-C 331	183.13	0.00E+00	0.00E+00	0.00E+00	1.21E-01
F 335-C 335	184.77	7.07E-04	3.61E-02	4.05E-01	2.57E-01
F 331-C 333	191.21	1.07E-03	1.95E-02	2.26E-01	1.02E-01
F 333-C 335	197.92	3.94E-04	1.39E-02	1.67E-01	1.25E-01
F 331-C 335	217.97	0.00E+00	0.00E+00	0.00E+00	1.99E-02
C 335-E 111	246.50	0.00E+00	0.00E+00	0.00E+00	9.94E-01
F 155-C 133	260.15	3.47E-04	5.86E-02	9.41E-01	3.09E-01
C 333-E 111	292.85	2.88E-06	3.70E-04	1.95E-02	6.09E-01
C 331-E 111	314.09	0.00E+00	0.00E+00	0.00E+00	2.07E-01
F 335-C 133	357.88	2.21E-05	7.05E-03	1.56E-01	2.71E-01
F 333-C 133	410.77	4.33E-07	1.10E-04	2.73E-03	1.52E-01
F 331-C 133	507.69	1.75E-06	2.26E-04	7.27E-03	4.38E-02

Z=25

TRANSITION	WL	A	F	A'	A''
F 111-C 331	99.698	0.00E+00	0.00E+00	0.00E+00	4.43E-03
F 111-C 333	102.44	1.27E-05	6.64E-05	3.97E-04	9.33E-03
F 111-C 335	111.28	0.00E+00	0.00E+00	0.00E+00	3.30E-02
F 155-C 331	126.25	0.00E+00	0.00E+00	0.00E+00	8.18E-02
F 155-C 333	130.68	3.70E-05	1.58E-03	1.34E-02	1.43E-01
C 133-E 111	141.03	1.75E-03	5.22E-02	1.44E+00	3.72E-01
F 155-C 335	145.43	3.72E-04	1.18E-02	1.13E-01	3.76E-01
F 335-C 331	148.30	0.00E+00	0.00E+00	0.00E+00	3.35E-01
F 335-C 333	154.45	4.61E-04	2.75E-02	2.81E-01	3.17E-01
F 333-C 331	157.71	5.71E-04	6.39E-02	6.67E-01	2.50E-01
F 111-C 133	159.38	2.80E-03	3.55E-02	3.85E-01	1.01E-01
F 333-C 333	164.69	3.69E-04	1.50E-02	1.63E-01	2.24E-01
F 331-C 331	173.53	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 335-C 335	175.47	7.22E-04	3.33E-02	3.87E-01	2.49E-01
F 331-C 333	182.01	1.14E-03	1.88E-02	2.27E-01	1.04E-01
F 333-C 335	188.81	4.16E-04	1.33E-02	1.67E-01	1.25E-01
F 331-C 335	211.93	0.00E+00	0.00E+00	0.00E+00	1.90E-02
C 335-E 111	228.38	0.00E+00	0.00E+00	0.00E+00	9.90E-01
F 155-C 133	240.12	3.91E-04	5.62E-02	9.09E-01	3.15E-01
C 333-E 111	277.55	3.91E-06	4.51E-04	2.45E-02	6.08E-01
C 331-E 111	299.90	0.00E+00	0.00E+00	0.00E+00	2.07E-01
F 335-C 133	334.76	2.93E-05	8.20E-03	1.85E-01	2.67E-01
F 333-C 133	386.92	5.95E-07	1.33E-04	3.41E-03	1.51E-01
F 331-C 133	498.34	2.00E-06	2.48E-04	8.54E-03	4.22E-02

Z=26

TRANSITION	WL	A	F	A'	A''
F 111-C 331	93.109	0.00E+00	0.00E+00	0.00E+00	3.67E-03
F 111-C 333	95.870	1.54E-05	7.09E-05	4.30E-04	8.53E-03
F 111-C 335	105.26	0.00E+00	0.00E+00	0.00E+00	3.47E-02
F 155-C 331	116.87	0.00E+00	0.00E+00	0.00E+00	6.81E-02
F 155-C 333	121.25	4.85E-05	1.78E-03	1.52E-02	1.29E-01
C 133-E 111	132.83	1.93E-03	5.10E-02	1.45E+00	3.75E-01
F 155-C 335	136.68	4.79E-04	1.34E-02	1.32E-01	3.83E-01
F 335-C 331	138.37	0.00E+00	0.00E+00	0.00E+00	3.49E-01
F 335-C 333	144.55	5.21E-04	2.72E-02	2.84E-01	3.28E-01
F 333-C 331	147.45	6.43E-04	6.28E-02	6.67E-01	2.50E-01
F 111-C 133	149.31	3.09E-03	3.44E-02	3.80E-01	1.01E-01
F 333-C 333	154.50	4.09E-04	1.46E-02	1.62E-01	2.26E-01
F 331-C 331	164.76	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 335-C 335	167.03	7.33E-04	3.06E-02	3.68E-01	2.42E-01
F 331-C 333	173.61	1.21E-03	1.83E-02	2.28E-01	1.06E-01
F 333-C 335	180.45	4.39E-04	1.28E-02	1.67E-01	1.25E-01
F 331-C 335	207.07	0.00E+00	0.00E+00	0.00E+00	1.81E-02
C 335-E 111	211.61	0.00E+00	0.00E+00	0.00E+00	9.86E-01
F 155-C 133	221.54	4.42E-04	5.41E-02	8.76E-01	3.22E-01
C 333-E 111	263.51	5.22E-06	5.43E-04	3.05E-02	6.07E-01
C 331-E 111	286.89	0.00E+00	0.00E+00	0.00E+00	2.08E-01
F 335-C 133	314.02	3.77E-05	9.29E-03	2.14E-01	2.63E-01
F 333-C 133	365.07	8.02E-07	1.60E-04	4.21E-03	1.49E-01
F 331-C 133	493.41	2.18E-06	2.65E-04	9.84E-03	4.06E-02

Z=27

TRANSITION	WL	A	F	A'	A''
F 111-C 331	86.942	0.00E+00	0.00E+00	0.00E+00	3.00E-03
F 111-C 333	89.695	1.84E-05	7.39E-05	4.52E-04	7.73E-03
F 111-C 335	99.605	0.00E+00	0.00E+00	0.00E+00	3.64E-02
F 155-C 331	108.13	0.00E+00	0.00E+00	0.00E+00	5.62E-02
F 155-C 333	112.43	6.17E-05	1.95E-03	1.68E-02	1.16E-01
C 133-E 111	125.15	2.13E-03	5.00E-02	1.45E+00	3.78E-01
F 155-C 335	128.45	6.05E-04	1.49E-02	1.50E-01	3.89E-01
F 335-C 331	129.22	0.00E+00	0.00E+00	0.00E+00	3.60E-01
F 335-C 333	135.40	5.91E-04	2.71E-02	2.87E-01	3.38E-01
F 333-C 331	137.90	7.25E-04	6.20E-02	6.67E-01	2.50E-01
F 111-C 133	139.88	3.42E-03	3.34E-02	3.75E-01	1.00E-01
F 333-C 333	144.96	4.54E-04	1.43E-02	1.62E-01	2.27E-01
F 331-C 331	156.74	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 335-C 335	159.33	7.41E-04	2.82E-02	3.50E-01	2.36E-01
F 331-C 333	165.92	1.29E-03	1.77E-02	2.30E-01	1.09E-01
F 333-C 335	172.74	4.61E-04	1.24E-02	1.67E-01	1.25E-01
C 335-E 111	196.09	0.00E+00	0.00E+00	0.00E+00	9.82E-01
F 331-C 335	203.34	0.00E+00	0.00E+00	0.00E+00	1.72E-02
F 155-C 133	204.31	5.01E-04	5.22E-02	8.45E-01	3.28E-01
C 333-E 111	250.60	6.84E-06	6.44E-04	3.73E-02	6.05E-01
C 331-E 111	274.92	0.00E+00	0.00E+00	0.00E+00	2.08E-01
F 335-C 133	295.36	4.71E-05	1.03E-02	2.41E-01	2.59E-01
F 333-C 133	345.02	1.07E-06	1.90E-04	5.11E-03	1.48E-01
F 331-C 133	493.34	2.28E-06	2.77E-04	1.11E-02	3.89E-02

TABLE 3. (continued)

Z=28

TRANSITION	WL	A	F	A'	A''
F 111-C 331	81.163	0.00E+00	0.00E+00	0.00E+00	2.41E-03
F 111-C 333	83.882	2.14E-05	7.52E-05	4.63E-04	6.96E-03
F 111-C 335	94.275	0.00E+00	0.00E+00	0.00E+00	3.80E-02
F 155-C 331	100.01	0.00E+00	0.00E+00	0.00E+00	4.63E-02
F 155-C 333	104.17	7.66E-05	2.08E-03	1.79E-02	1.05E-01
C 133-E 111	117.93	2.36E-03	4.91E-02	1.45E+00	3.81E-01
F 155-C 335	120.69	7.51E-04	1.64E-02	1.67E-01	3.94E-01
F 335-C 331	120.77	0.00E+00	0.00E+00	0.00E+00	3.70E-01
F 335-C 333	126.89	6.74E-04	2.71E-02	2.91E-01	3.47E-01
F 333-C 331	129.00	8.20E-04	6.13E-02	6.67E-01	2.50E-01
F 111-C 133	131.05	3.80E-03	3.26E-02	3.69E-01	9.97E-02
F 333-C 333	136.01	5.06E-04	1.40E-02	1.61E-01	2.29E-01
F 331-C 331	149.37	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 335-C 335	152.29	7.48E-04	2.60E-02	3.33E-01	2.31E-01
F 331-C 333	158.85	1.37E-03	1.72E-02	2.31E-01	1.11E-01
F 333-C 335	165.61	4.85E-04	1.19E-02	1.67E-01	1.25E-01
C 335-E 111	181.70	0.00E+00	0.00E+00	0.00E+00	9.78E-01
F 155-C 133	188.36	5.72E-04	5.06E-02	8.15E-01	3.35E-01
F 331-C 335	200.76	0.00E+00	0.00E+00	0.00E+00	1.63E-02
C 333-E 111	238.70	8.84E-06	7.54E-04	4.50E-02	6.04E-01
C 331-E 111	263.86	0.00E+00	0.00E+00	0.00E+00	2.08E-01
F 335-C 133	278.54	5.73E-05	1.11E-02	2.65E-01	2.55E-01
F 333-C 133	326.61	1.39E-06	2.23E-04	6.13E-03	1.46E-01
F 331-C 133	498.88	2.27E-06	2.82E-04	1.23E-02	3.71E-02

Z=29

TRANSITION	WL	A	F	A'	A''
F 111-C 331	75.742	0.00E+00	0.00E+00	0.00E+00	1.91E-03
F 111-C 333	78.405	2.44E-05	7.50E-05	4.61E-04	6.22E-03
F 111-C 335	89.235	0.00E+00	0.00E+00	0.00E+00	3.97E-02
F 155-C 331	92.455	0.00E+00	0.00E+00	0.00E+00	3.79E-02
F 155-C 333	96.453	9.32E-05	2.16E-03	1.86E-02	9.39E-02
C 133-E 111	111.12	2.61E-03	4.84E-02	1.45E+00	3.85E-01
F 335-C 331	112.94	0.00E+00	0.00E+00	0.00E+00	3.79E-01
F 155-C 335	113.38	9.21E-04	1.77E-02	1.83E-01	3.98E-01
F 335-C 333	118.97	7.71E-04	2.73E-02	2.95E-01	3.55E-01
F 333-C 331	120.69	9.30E-04	6.09E-02	6.67E-01	2.50E-01
F 111-C 133	122.75	4.23E-03	3.18E-02	3.64E-01	9.93E-02
F 333-C 333	127.59	5.64E-04	1.38E-02	1.59E-01	2.31E-01
F 331-C 331	142.60	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 335-C 335	145.82	7.53E-04	2.40E-02	3.17E-01	2.27E-01
F 331-C 333	152.34	1.45E-03	1.68E-02	2.33E-01	1.13E-01
F 333-C 335	159.00	5.08E-04	1.15E-02	1.67E-01	1.25E-01
C 335-E 111	168.37	0.00E+00	0.00E+00	0.00E+00	9.74E-01
F 155-C 133	173.62	6.56E-04	4.93E-02	7.88E-01	3.42E-01
F 331-C 335	199.35	0.00E+00	0.00E+00	0.00E+00	1.54E-02
C 333-E 111	227.72	1.12E-05	8.74E-04	5.36E-02	6.02E-01
C 331-E 111	253.61	0.00E+00	0.00E+00	0.00E+00	2.08E-01
F 335-C 133	263.32	6.81E-05	1.18E-02	2.87E-01	2.51E-01
F 333-C 133	309.66	1.79E-06	2.58E-04	7.24E-03	1.44E-01
F 331-C 133	511.21	2.14E-06	2.79E-04	1.35E-02	3.54E-02

Z=30

TRANSITION	WL	A	F	A'	A''
F 111-C 331	70.657	0.00E+00	0.00E+00	0.00E+00	1.48E-03
F 111-C 333	73.241	2.73E-05	7.31E-05	4.48E-04	5.52E-03
F 111-C 335	84.461	0.00E+00	0.00E+00	0.00E+00	4.14E-02
F 155-C 331	85.442	0.00E+00	0.00E+00	0.00E+00	3.11E-02
F 155-C 333	89.251	1.11E-04	2.21E-03	1.89E-02	8.41E-02
C 133-E 111	104.69	2.91E-03	4.77E-02	1.45E+00	3.88E-01
F 335-C 331	105.68	0.00E+00	0.00E+00	0.00E+00	3.86E-01
F 155-C 335	106.49	1.12E-03	1.90E-02	1.97E-01	4.01E-01
F 335-C 333	111.57	8.87E-04	2.76E-02	3.01E-01	3.62E-01
F 333-C 331	112.92	1.06E-03	6.05E-02	6.67E-01	2.50E-01
F 111-C 133	114.97	4.72E-03	3.12E-02	3.58E-01	9.89E-02
F 333-C 333	119.67	6.32E-04	1.36E-02	1.58E-01	2.32E-01
F 331-C 331	136.36	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 335-C 335	139.87	7.58E-04	2.22E-02	3.03E-01	2.24E-01
F 331-C 333	146.33	1.53E-03	1.64E-02	2.35E-01	1.16E-01
F 333-C 335	152.85	5.33E-04	1.12E-02	1.67E-01	1.25E-01
C 335-E 111	156.00	0.00E+00	0.00E+00	0.00E+00	9.70E-01
F 155-C 133	160.02	7.56E-04	4.83E-02	7.64E-01	3.48E-01
F 331-C 335	199.19	0.00E+00	0.00E+00	0.00E+00	1.46E-02
C 333-E 111	217.56	1.41E-05	1.00E-03	6.30E-02	6.00E-01
C 331-E 111	244.08	0.00E+00	0.00E+00	0.00E+00	2.09E-01
F 335-C 133	249.51	7.93E-05	1.23E-02	3.05E-01	2.47E-01
F 333-C 133	294.04	2.28E-06	2.95E-04	8.46E-03	1.43E-01
F 331-C 133	532.28	1.90E-06	2.68E-04	1.45E-02	3.36E-02

Z=31

TRANSITION	WL	A	F	A'	A''
F 111-C 331	65.886	0.00E+00	0.00E+00	0.00E+00	1.14E-03
F 111-C 333	68.375	3.00E-05	7.00E-05	4.25E-04	4.88E-03
F 155-C 331	78.938	0.00E+00	0.00E+00	0.00E+00	2.56E-02
F 111-C 335	79.930	0.00E+00	0.00E+00	0.00E+00	4.30E-02
F 155-C 333	82.538	1.31E-04	2.22E-03	1.88E-02	7.53E-02
C 133-E 111	98.615	3.24E-03	4.72E-02	1.45E+00	3.92E-01
F 335-C 331	98.921	0.00E+00	0.00E+00	0.00E+00	3.91E-01
F 155-C 335	99.986	1.34E-03	2.01E-02	2.10E-01	4.04E-01
F 335-C 333	104.64	1.03E-03	2.80E-02	3.08E-01	3.69E-01
F 333-C 331	105.66	1.20E-03	6.04E-02	6.67E-01	2.50E-01
F 111-C 133	107.65	5.29E-03	3.06E-02	3.53E-01	9.85E-02
F 333-C 333	112.21	7.09E-04	1.34E-02	1.57E-01	2.34E-01
F 331-C 331	130.60	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 335-C 335	134.37	7.64E-04	2.07E-02	2.90E-01	2.21E-01
F 331-C 333	140.75	1.62E-03	1.60E-02	2.36E-01	1.18E-01
C 335-E 111	144.53	0.00E+00	0.00E+00	0.00E+00	9.66E-01
F 333-C 335	147.10	5.57E-04	1.08E-02	1.67E-01	1.25E-01
F 155-C 133	147.50	8.75E-04	4.76E-02	7.42E-01	3.54E-01
F 331-C 335	200.38	0.00E+00	0.00E+00	0.00E+00	1.38E-02
C 333-E 111	208.13	1.75E-05	1.13E-03	7.32E-02	5.99E-01
C 331-E 111	235.18	0.00E+00	0.00E+00	0.00E+00	2.09E-01
F 335-C 133	236.93	9.07E-05	1.27E-02	3.20E-01	2.43E-01
F 333-C 133	279.62	2.85E-06	3.34E-04	9.76E-03	1.41E-01
F 331-C 133	565.33	1.57E-06	2.50E-04	1.54E-02	3.18E-02

Z=32

TRANSITION	WL	A	F	A'	A''
F 111-C 331	61.413	0.00E+00	0.00E+00	0.00E+00	8.56E-04
F 111-C 333	63.792	3.23E-05	6.57E-05	3.93E-04	4.28E-03
F 155-C 331	72.915	0.00E+00	0.00E+00	0.00E+00	2.10E-02
F 111-C 335	75.626	0.00E+00	0.00E+00	0.00E+00	4.46E-02
F 155-C 333	76.294	1.52E-04	2.20E-03	1.84E-02	6.73E-02
F 335-C 331	92.625	0.00E+00	0.00E+00	0.00E+00	3.96E-01
C 133-E 111	92.865	3.62E-03	4.68E-02	1.44E+00	3.96E-01
F 155-C 335	93.857	1.60E-03	2.11E-02	2.22E-01	4.06E-01
F 335-C 333	98.146	1.19E-03	2.86E-02	3.15E-01	3.74E-01
F 333-C 331	98.861	1.37E-03	6.03E-02	6.67E-01	2.50E-01
F 111-C 133	100.78	5.94E-03	3.01E-02	3.47E-01	9.80E-02
F 333-C 333	105.17	7.99E-04	1.32E-02	1.56E-01	2.35E-01
F 331-C 331	125.26	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 335-C 335	129.26	7.70E-04	1.93E-02	2.78E-01	2.19E-01
C 335-E 111	133.90	0.00E+00	0.00E+00	0.00E+00	9.62E-01
F 331-C 333	135.57	1.71E-03	1.57E-02	2.38E-01	1.20E-01
F 155-C 133	135.97	1.02E-03	4.70E-02	7.23E-01	3.60E-01
F 333-C 335	141.74	5.83E-04	1.05E-02	1.67E-01	1.25E-01
C 333-E 111	199.39	2.13E-05	1.27E-03	8.41E-02	5.97E-01
F 331-C 335	203.11	0.00E+00	0.00E+00	0.00E+00	1.30E-02
F 335-C 133	225.43	1.02E-04	1.30E-02	3.32E-01	2.40E-01
C 331-E 111	226.86	0.00E+00	0.00E+00	0.00E+00	2.09E-01
F 333-C 133	266.31	3.52E-06	3.74E-04	1.11E-02	1.40E-01
F 331-C 133	616.08	1.19E-06	2.26E-04	1.62E-02	3.00E-02

=33

TRANSITION	WL	A	F	A'	A''
F 111-C 331	57.223	0.00E+00	0.00E+00	0.00E+00	6.33E-04
F 111-C 333	59.481	3.43E-05	6.06E-05	3.56E-04	3.74E-03
F 155-C 331	67.344	0.00E+00	0.00E+00	0.00E+00	1.74E-02
F 155-C 333	70.493	1.74E-04	2.16E-03	1.78E-02	6.01E-02
F 111-C 335	71.533	0.00E+00	0.00E+00	0.00E+00	4.61E-02
F 335-C 331	86.752	0.00E+00	0.00E+00	0.00E+00	3.99E-01
C 133-E 111	87.420	4.06E-03	4.65E-02	1.44E+00	4.00E-01
F 155-C 335	88.081	1.90E-03	2.21E-02	2.32E-01	4.08E-01
F 335-C 333	92.049	1.38E-03	2.93E-02	3.23E-01	3.79E-01
F 333-C 331	92.499	1.57E-03	6.04E-02	6.67E-01	2.50E-01
F 111-C 133	94.324	6.69E-03	2.97E-02	3.42E-01	9.76E-02
F 333-C 333	98.546	9.01E-04	1.31E-02	1.54E-01	2.36E-01
F 331-C 331	120.31	0.00E+00	0.00E+00	0.00E+00	1.23E-01
C 335-E 111	124.05	0.00E+00	0.00E+00	0.00E+00	9.58E-01
F 335-C 335	124.52	7.77E-04	1.80E-02	2.68E-01	2.17E-01
F 155-C 133	125.39	1.19E-03	4.67E-02	7.06E-01	3.65E-01
F 331-C 333	130.74	1.80E-03	1.54E-02	2.40E-01	1.22E-01
F 333-C 335	136.71	6.09E-04	1.02E-02	1.67E-01	1.25E-01
C 333-E 111	191.26	2.57E-05	1.41E-03	9.56E-02	5.95E-01
F 331-C 335	207.64	0.00E+00	0.00E+00	0.00E+00	1.23E-02
F 335-C 133	214.90	1.14E-04	1.31E-02	3.42E-01	2.37E-01
C 331-E 111	219.05	0.00E+00	0.00E+00	0.00E+00	2.09E-01
F 333-C 133	254.00	4.30E-06	4.15E-04	1.26E-02	1.39E-01
F 331-C 133	695.34	8.05E-07	1.94E-04	1.68E-02	2.83E-02

TABLE 3. (continued)

Z=34

TRANSITION	WL	A	F	A'	A''
F 111-C 331	53.300	0.00E+00	0.00E+00	0.00E+00	4.58E-04
F 111-C 333	55.429	3.58E-05	5.50E-05	3.16E-04	3.25E-03
F 155-C 331	62.195	0.00E+00	0.00E+00	0.00E+00	1.44E-02
F 155-C 333	65.113	1.98E-04	2.09E-03	1.69E-02	5.37E-02
F 111-C 335	67.642	0.00E+00	0.00E+00	0.00E+00	4.76E-02
F 335-C 331	81.266	0.00E+00	0.00E+00	0.00E+00	4.02E-01
C 133-E 111	82.263	4.56E-03	4.62E-02	1.44E+00	4.03E-01
F 155-C 335	82.642	2.25E-03	2.30E-02	2.41E-01	4.09E-01
F 335-C 333	86.321	1.62E-03	3.01E-02	3.31E-01	3.84E-01
F 333-C 331	86.544	1.80E-03	6.07E-02	6.67E-01	2.50E-01
F 111-C 133	88.269	7.55E-03	2.94E-02	3.37E-01	9.71E-02
F 333-C 333	92.299	1.02E-03	1.30E-02	1.53E-01	2.38E-01
C 335-E 111	114.92	0.00E+00	0.00E+00	0.00E+00	9.54E-01
F 155-C 133	115.66	1.39E-03	4.66E-02	6.92E-01	3.70E-01
F 331-C 331	115.70	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 335-C 335	120.09	7.85E-04	1.70E-02	2.59E-01	2.16E-01
F 331-C 333	126.23	1.89E-03	1.51E-02	2.42E-01	1.24E-01
F 333-C 335	131.98	6.35E-04	9.95E-03	1.67E-01	1.25E-01
C 333-E 111	183.69	3.07E-05	1.55E-03	1.08E-01	5.93E-01
F 335-C 133	205.23	1.25E-04	1.32E-02	3.49E-01	2.34E-01
C 331-E 111	211.71	0.00E+00	0.00E+00	0.00E+00	2.10E-01
F 331-C 335	214.37	0.00E+00	0.00E+00	0.00E+00	1.17E-02
F 333-C 133	242.59	5.18E-06	4.57E-04	1.41E-02	1.37E-01
F 331-C 133	826.34	4.63E-07	1.58E-04	1.72E-02	2.67E-02

Z=35

TRANSITION	WL	A	F	A'	A''
F 111-C 331	49.632	0.00E+00	0.00E+00	0.00E+00	3.24E-04
F 111-C 333	51.627	3.69E-05	4.91E-05	2.74E-04	2.81E-03
F 155-C 331	57.443	0.00E+00	0.00E+00	0.00E+00	1.20E-02
F 155-C 333	60.133	2.23E-04	2.01E-03	1.60E-02	4.79E-02
F 111-C 335	63.941	0.00E+00	0.00E+00	0.00E+00	4.91E-02
F 335-C 331	76.140	0.00E+00	0.00E+00	0.00E+00	4.05E-01
C 133-E 111	77.381	5.14E-03	4.61E-02	1.43E+00	4.07E-01
F 155-C 335	77.521	2.65E-03	2.39E-02	2.50E-01	4.11E-01
F 335-C 333	80.937	1.89E-03	3.10E-02	3.40E-01	3.88E-01
F 333-C 331	80.971	2.07E-03	6.10E-02	6.67E-01	2.50E-01
F 111-C 133	82.589	8.55E-03	2.91E-02	3.31E-01	9.67E-02
F 333-C 333	86.419	1.16E-03	1.30E-02	1.51E-01	2.39E-01
C 335-E 111	106.47	0.00E+00	0.00E+00	0.00E+00	9.49E-01
F 155-C 133	106.74	1.64E-03	4.66E-02	6.79E-01	3.75E-01
F 331-C 331	111.41	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 335-C 335	115.94	7.95E-04	1.60E-02	2.50E-01	2.14E-01
F 331-C 333	121.99	1.99E-03	1.48E-02	2.44E-01	1.26E-01
F 333-C 335	127.53	6.63E-04	9.68E-03	1.67E-01	1.25E-01
C 333-E 111	176.62	3.62E-05	1.69E-03	1.20E-01	5.90E-01
F 335-C 133	196.32	1.37E-04	1.32E-02	3.54E-01	2.31E-01
C 331-E 111	204.78	0.00E+00	0.00E+00	0.00E+00	2.10E-01
F 331-C 335	223.86	0.00E+00	0.00E+00	0.00E+00	1.11E-02
F 333-C 133	232.01	6.18E-06	4.98E-04	1.56E-02	1.36E-01
F 331-C 133	1068.5	2.05E-07	1.17E-04	1.76E-02	2.51E-02

Z=36

TRANSITION	WL	A	F	A'	A''
F 111-C 331	46.206	0.00E+00	0.00E+00	0.00E+00	2.23E-04
F 111-C 333	48.066	3.75E-05	4.32E-05	2.33E-04	2.43E-03
F 335-C 331	53.060	0.00E+00	0.00E+00	0.00E+00	1.00E-02
F 335-C 333	55.527	2.50E-04	1.93E-03	1.50E-02	4.27E-02
F 111-C 335	60.424	0.00E+00	0.00E+00	0.00E+00	5.05E-02
F 155-C 331	71.345	0.00E+00	0.00E+00	0.00E+00	4.07E-01
F 335-C 335	72.705	3.12E-03	2.47E-02	2.57E-01	4.12E-01
C 133-E 111	72.759	5.81E-03	4.61E-02	1.43E+00	4.11E-01
F 333-C 331	75.755	2.38E-03	6.15E-02	6.67E-01	2.50E-01
F 155-C 333	75.876	2.22E-03	3.19E-02	3.48E-01	3.91E-01
F 111-C 133	77.265	9.70E-03	2.89E-02	3.27E-01	9.62E-02
F 333-C 333	80.884	1.32E-03	1.29E-02	1.50E-01	2.40E-01
F 335-C 133	98.553	1.93E-03	4.68E-02	6.68E-01	3.79E-01
C 335-E 111	98.652	0.00E+00	0.00E+00	0.00E+00	9.45E-01
F 331-C 331	107.40	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 155-C 335	112.06	8.05E-04	1.51E-02	2.43E-01	2.13E-01
F 331-C 333	118.01	2.09E-03	1.45E-02	2.46E-01	1.28E-01
F 333-C 335	123.33	6.90E-04	9.44E-03	1.67E-01	1.25E-01
C 333-E 111	170.03	4.23E-05	1.83E-03	1.33E-01	5.88E-01
F 155-C 133	188.08	1.48E-04	1.31E-02	3.58E-01	2.29E-01
C 331-E 111	198.24	0.00E+00	0.00E+00	0.00E+00	2.10E-01
F 333-C 133	222.18	7.28E-06	5.39E-04	1.71E-02	1.35E-01
F 331-C 335	237.05	0.00E+00	0.00E+00	0.00E+00	1.05E-02
F 331-C 133	1636.2	5.46E-08	7.30E-05	1.78E-02	2.36E-02

Z=37

TRANSITION	WL	A	F	A'	A''
F 111-C 331	43.009	0.00E+00	0.00E+00	0.00E+00	1.49E-04
F 111-C 333	44.733	3.76E-05	3.76E-05	1.95E-04	2.09E-03
F 335-C 331	49.021	0.00E+00	0.00E+00	0.00E+00	8.44E-03
F 335-C 333	51.274	2.79E-04	1.83E-03	1.39E-02	3.80E-02
F 111-C 335	57.080	0.00E+00	0.00E+00	0.00E+00	5.18E-02
F 155-C 331	66.859	0.00E+00	0.00E+00	0.00E+00	4.08E-01
F 335-C 335	68.178	3.66E-03	2.55E-02	2.64E-01	4.12E-01
C 133-E 111	68.390	6.58E-03	4.61E-02	1.42E+00	4.15E-01
F 333-C 331	70.874	2.75E-03	6.20E-02	6.67E-01	2.50E-01
F 155-C 333	71.120	2.61E-03	3.30E-02	3.57E-01	3.94E-01
F 111-C 133	72.277	1.10E-02	2.88E-02	3.22E-01	9.58E-02
F 333-C 333	75.681	1.50E-03	1.29E-02	1.48E-01	2.41E-01
F 335-C 133	91.042	2.28E-03	4.72E-02	6.58E-01	3.83E-01
C 335-E 111	91.419	0.00E+00	0.00E+00	0.00E+00	9.41E-01
F 331-C 331	103.65	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 155-C 335	108.40	8.17E-04	1.44E-02	2.36E-01	2.13E-01
F 331-C 333	114.26	2.19E-03	1.43E-02	2.48E-01	1.30E-01
F 333-C 335	119.37	7.19E-04	9.21E-03	1.67E-01	1.25E-01
C 333-E 111	163.86	4.89E-05	1.97E-03	1.45E-01	5.86E-01
F 155-C 133	180.45	1.59E-04	1.30E-02	3.60E-01	2.27E-01
C 331-E 111	192.06	0.00E+00	0.00E+00	0.00E+00	2.10E-01
F 333-C 133	213.03	8.51E-06	5.78E-04	1.87E-02	1.34E-01
F 331-C 335	255.35	0.00E+00	0.00E+00	0.00E+00	9.97E-03
F 331-C 133	4295.3	2.87E-09	2.64E-05	1.79E-02	2.22E-02

Z=38

TRANSITION	WL	A	F	A'	A''
F 111-C 331	40.028	0.00E+00	0.00E+00	0.00E+00	9.51E-05
F 111-C 333	41.620	3.72E-05	3.22E-05	1.60E-04	1.79E-03
F 335-C 331	45.301	0.00E+00	0.00E+00	0.00E+00	7.13E-03
F 335-C 333	47.350	3.09E-04	1.73E-03	1.28E-02	3.39E-02
F 111-C 335	53.905	0.00E+00	0.00E+00	0.00E+00	5.31E-02
F 155-C 331	62.661	0.00E+00	0.00E+00	0.00E+00	4.10E-01
F 335-C 335	63.925	4.29E-03	2.63E-02	2.69E-01	4.13E-01
C 133-E 111	64.258	7.47E-03	4.62E-02	1.42E+00	4.18E-01
F 333-C 331	66.309	3.17E-03	6.27E-02	6.67E-01	2.50E-01
F 155-C 333	66.651	3.07E-03	3.41E-02	3.66E-01	3.97E-01
F 111-C 133	67.608	1.26E-02	2.87E-02	3.17E-01	9.53E-02
F 333-C 333	70.794	1.72E-03	1.29E-02	1.46E-01	2.42E-01
F 335-C 133	84.151	2.70E-03	4.77E-02	6.49E-01	3.86E-01
C 335-E 111	84.730	0.00E+00	0.00E+00	0.00E+00	9.37E-01
F 331-C 331	100.13	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 155-C 335	104.96	8.31E-04	1.37E-02	2.31E-01	2.12E-01
F 331-C 333	110.72	2.29E-03	1.40E-02	2.50E-01	1.31E-01
F 333-C 335	115.61	7.48E-04	8.99E-03	1.67E-01	1.25E-01
C 333-E 111	158.07	5.60E-05	2.10E-03	1.58E-01	5.84E-01
F 155-C 133	173.38	1.70E-04	1.28E-02	3.61E-01	2.25E-01
C 331-E 111	186.18	0.00E+00	0.00E+00	0.00E+00	2.10E-01
F 333-C 133	204.51	9.84E-06	6.17E-04	2.02E-02	1.33E-01
F 331-C 335	281.20	0.00E+00	0.00E+00	0.00E+00	9.49E-03
C 133-F 331	4906.5	6.06E-10	2.19E-05	5.36E-02	6.24E-02

Z=39

TRANSITION	WL	A	F	A'	A''
F 111-C 331	37.252	0.00E+00	0.00E+00	0.00E+00	5.75E-05
F 111-C 333	38.716	3.65E-05	2.73E-05	1.29E-04	1.54E-03
F 335-C 331	41.876	0.00E+00	0.00E+00	0.00E+00	6.04E-03
F 335-C 333	43.734	3.42E-04	1.63E-03	1.18E-02	3.02E-02
F 111-C 335	50.891	0.00E+00	0.00E+00	0.00E+00	5.43E-02
F 155-C 331	58.732	0.00E+00	0.00E+00	0.00E+00	4.11E-01
F 335-C 335	59.931	5.03E-03	2.71E-02	2.75E-01	4.14E-01
C 133-E 111	60.357	8.51E-03	4.64E-02	1.41E+00	4.22E-01
F 333-C 331	62.040	3.67E-03	6.35E-02	6.67E-01	2.50E-01
F 155-C 333	62.453	3.62E-03	3.53E-02	3.75E-01	3.99E-01
F 111-C 133	63.240	1.44E-02	2.87E-02	3.13E-01	9.49E-02
F 333-C 333	66.208	1.97E-03	1.29E-02	1.45E-01	2.43E-01
F 335-C 133	77.828	3.19E-03	4.83E-02	6.42E-01	3.89E-01
C 335-E 111	78.548	0.00E+00	0.00E+00	0.00E+00	9.33E-01
F 331-C 331	96.816	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 155-C 335	101.70	8.45E-04	1.31E-02	2.25E-01	2.11E-01
F 331-C 333	107.36	2.40E-03	1.38E-02	2.52E-01	1.33E-01
F 333-C 335	112.05	7.79E-04	8.79E-03	1.67E-01	1.25E-01
C 333-E 111	152.63	6.37E-05	2.22E-03	1.71E-01	5.82E-01
F 155-C 133	166.79	1.81E-04	1.26E-02	3.61E-01	2.23E-01
C 331-E 111	180.60	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	196.56	1.13E-05	6.53E-04	2.17E-02	1.32E-01
F 331-C 335	319.00	0.00E+00	0.00E+00	0.00E+00	9.04E-03
C 133-F 331	1424.2	2.34E-08	7.11E-05	5.34E-02	5.87E-02

TABLE 3.(continued)

Z=40

TRANSITION	WL	A	F	A'	A''
F 111-C 331	34.669	0.00E+00	0.00E+00	0.00E+00	3.22E-05
F 111-C 333	36.009	3.53E-05	2.29E-05	1.01E-04	1.31E-03
F 335-C 331	38.725	0.00E+00	0.00E+00	0.00E+00	5.15E-03
F 335-C 333	40.405	3.77E-04	1.54E-03	1.08E-02	2.69E-02
F 111-C 335	48.032	0.00E+00	0.00E+00	0.00E+00	5.55E-02
F 155-C 331	55.054	0.00E+00	0.00E+00	0.00E+00	4.12E-01
F 335-C 335	56.184	5.89E-03	2.78E-02	2.79E-01	4.14E-01
C 133-E 111	56.677	9.71E-03	4.67E-02	1.41E+00	4.25E-01
F 333-C 331	58.049	4.25E-03	6.44E-02	6.67E-01	2.50E-01
F 155-C 333	58.513	4.27E-03	3.65E-02	3.83E-01	4.01E-01
F 111-C 133	59.154	1.64E-02	2.87E-02	3.09E-01	9.44E-02
F 333-C 333	61.907	2.26E-03	1.30E-02	1.43E-01	2.43E-01
F 335-C 133	72.024	3.78E-03	4.90E-02	6.35E-01	3.92E-01
C 335-E 111	72.835	0.00E+00	0.00E+00	0.00E+00	9.29E-01
F 331-C 331	93.698	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 155-C 335	98.626	8.61E-04	1.25E-02	2.21E-01	2.11E-01
F 331-C 333	104.18	2.51E-03	1.36E-02	2.54E-01	1.34E-01
F 333-C 335	108.67	8.10E-04	8.59E-03	1.67E-01	1.25E-01
C 333-E 111	147.52	7.19E-05	2.34E-03	1.84E-01	5.80E-01
F 155-C 133	160.65	1.92E-04	1.24E-02	3.60E-01	2.22E-01
C 331-E 111	175.29	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	189.12	1.28E-05	6.88E-04	2.32E-02	1.32E-01
F 331-C 335	377.66	0.00E+00	0.00E+00	0.00E+00	8.63E-03
C 133-F 331	789.59	1.29E-07	1.21E-04	5.30E-02	5.51E-02

Z=41

TRANSITION	WL	A	F	A'	A''
F 111-C 331	32.267	0.00E+00	0.00E+00	0.00E+00	1.60E-05
F 111-C 333	33.491	3.38E-05	1.89E-05	7.85E-05	1.12E-03
F 335-C 331	35.825	0.00E+00	0.00E+00	0.00E+00	4.40E-03
F 335-C 333	37.340	4.14E-04	1.44E-03	9.83E-03	2.40E-02
F 111-C 335	45.322	0.00E+00	0.00E+00	0.00E+00	5.67E-02
F 155-C 331	51.612	0.00E+00	0.00E+00	0.00E+00	4.12E-01
F 335-C 335	52.670	6.89E-03	2.86E-02	2.83E-01	4.14E-01
C 133-E 111	53.207	1.11E-02	4.71E-02	1.40E+00	4.28E-01
F 333-C 331	54.319	4.93E-03	6.53E-02	6.67E-01	2.50E-01
F 155-C 333	54.816	5.04E-03	3.78E-02	3.91E-01	4.03E-01
F 111-C 133	55.336	1.88E-02	2.88E-02	3.05E-01	9.40E-02
F 333-C 333	57.879	2.60E-03	1.31E-02	1.42E-01	2.44E-01
F 335-C 133	66.696	4.48E-03	4.98E-02	6.29E-01	3.95E-01
C 335-E 111	67.559	0.00E+00	0.00E+00	0.00E+00	9.25E-01
F 331-C 331	90.755	0.00E+00	0.00E+00	0.00E+00	1.23E-01
F 155-C 335	95.709	8.78E-04	1.20E-02	2.17E-01	2.11E-01
F 331-C 333	101.15	2.62E-03	1.34E-02	2.56E-01	1.35E-01
F 333-C 335	105.46	8.41E-04	8.41E-03	1.67E-01	1.25E-01
C 333-E 111	142.71	8.05E-05	2.46E-03	1.96E-01	5.79E-01
F 155-C 133	154.90	2.03E-04	1.22E-02	3.59E-01	2.20E-01
C 331-E 111	170.22	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	182.15	1.45E-05	7.21E-04	2.47E-02	1.31E-01
F 331-C 335	478.12	0.00E+00	0.00E+00	0.00E+00	8.26E-03
C 133-F 331	525.98	4.11E-07	1.70E-04	5.24E-02	5.19E-02

Z=42

TRANSITION	WL	A	F	A'	A''
F 111-C 331	30.035	0.00E+00	0.00E+00	0.00E+00	6.37E-06
F 111-C 333	31.149	3.20E-05	1.55E-05	5.95E-05	9.60E-04
F 335-C 331	33.158	0.00E+00	0.00E+00	0.00E+00	3.78E-03
F 335-C 333	34.521	4.54E-04	1.35E-03	8.95E-03	2.14E-02
F 111-C 335	42.756	0.00E+00	0.00E+00	0.00E+00	5.78E-02
F 155-C 331	48.390	0.00E+00	0.00E+00	0.00E+00	4.13E-01
F 335-C 335	49.376	8.06E-03	2.94E-02	2.87E-01	4.15E-01
C 133-E 111	49.940	1.27E-02	4.75E-02	1.40E+00	4.31E-01
F 333-C 331	50.834	5.72E-03	6.64E-02	6.67E-01	2.50E-01
F 155-C 333	51.349	5.95E-03	3.92E-02	3.99E-01	4.04E-01
F 111-C 133	51.768	2.16E-02	2.89E-02	3.01E-01	9.36E-02
F 333-C 333	54.109	3.00E-03	1.31E-02	1.41E-01	2.45E-01
F 335-C 133	61.801	5.31E-03	5.06E-02	6.24E-01	3.97E-01
C 335-E 111	62.687	0.00E+00	0.00E+00	0.00E+00	9.22E-01
F 331-C 331	87.973	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	92.940	8.96E-04	1.16E-02	2.13E-01	2.10E-01
F 331-C 333	98.267	2.73E-03	1.32E-02	2.57E-01	1.37E-01
F 333-C 335	102.39	8.74E-04	8.24E-03	1.67E-01	1.25E-01
C 333-E 111	138.17	8.96E-05	2.56E-03	2.08E-01	5.77E-01
F 155-C 133	149.52	2.14E-04	1.19E-02	3.57E-01	2.19E-01
C 331-E 111	165.38	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	175.61	1.63E-05	7.52E-04	2.61E-02	1.30E-01
C 133-F 331	383.09	9.97E-07	2.19E-04	5.17E-02	4.88E-02
F 331-C 335	684.25	0.00E+00	0.00E+00	0.00E+00	7.91E-03

Z=43

TRANSITION	WL	A	F	A'	A''
F 111-C 331	27.962	0.00E+00	0.00E+00	0.00E+00	1.54E-06
F 111-C 333	28.974	3.00E-05	1.26E-05	4.40E-05	8.21E-04
F 335-C 331	30.705	0.00E+00	0.00E+00	0.00E+00	3.26E-03
F 335-C 333	31.929	4.97E-04	1.27E-03	8.13E-03	1.91E-02
F 111-C 335	40.327	0.00E+00	0.00E+00	0.00E+00	5.88E-02
F 155-C 331	45.375	0.00E+00	0.00E+00	0.00E+00	4.13E-01
F 335-C 335	46.290	9.42E-03	3.02E-02	2.90E-01	4.15E-01
C 133-E 111	46.866	1.46E-02	4.81E-02	1.39E+00	4.34E-01
F 333-C 331	47.579	6.64E-03	6.75E-02	6.67E-01	2.50E-01
F 155-C 333	48.101	7.02E-03	4.06E-02	4.07E-01	4.06E-01
F 111-C 133	48.437	2.48E-02	2.91E-02	2.97E-01	9.31E-02
F 333-C 333	50.585	3.46E-03	1.33E-02	1.39E-01	2.45E-01
F 335-C 133	57.303	6.30E-03	5.16E-02	6.19E-01	3.99E-01
C 335-E 111	58.188	0.00E+00	0.00E+00	0.00E+00	9.18E-01
F 331-C 331	85.337	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	90.306	9.15E-04	1.12E-02	2.10E-01	2.10E-01
F 331-C 333	95.518	2.85E-03	1.30E-02	2.59E-01	1.38E-01
F 333-C 335	99.475	9.08E-04	8.07E-03	1.67E-01	1.25E-01
C 333-E 111	133.88	9.91E-05	2.66E-03	2.20E-01	5.75E-01
F 155-C 133	144.48	2.24E-04	1.17E-02	3.55E-01	2.18E-01
C 331-E 111	160.75	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	169.46	1.82E-05	7.81E-04	2.75E-02	1.30E-01
C 133-F 331	294.23	2.06E-06	2.68E-04	5.09E-02	4.60E-02
F 331-C 335	1327.7	0.00E+00	0.00E+00	0.00E+00	7.59E-03

Z=44

TRANSITION	WL	A	F	A'	A''
F 111-C 331	26.038	0.00E+00	0.00E+00	0.00E+00	1.71E-08
F 111-C 333	26.956	2.77E-05	1.01E-05	3.16E-05	7.02E-04
F 335-C 331	28.448	0.00E+00	0.00E+00	0.00E+00	2.82E-03
F 335-C 333	29.547	5.43E-04	1.18E-03	7.37E-03	1.71E-02
F 111-C 335	38.030	0.00E+00	0.00E+00	0.00E+00	5.98E-02
F 155-C 331	42.554	0.00E+00	0.00E+00	0.00E+00	4.14E-01
F 335-C 335	43.400	1.10E-02	3.11E-02	2.94E-01	4.15E-01
C 133-E 111	43.976	1.68E-02	4.87E-02	1.39E+00	4.37E-01
F 333-C 331	44.539	7.71E-03	6.88E-02	6.67E-01	2.50E-01
F 155-C 333	45.059	8.29E-03	4.20E-02	4.14E-01	4.07E-01
F 111-C 133	45.327	2.86E-02	2.93E-02	2.94E-01	9.27E-02
F 333-C 333	47.291	4.00E-03	1.34E-02	1.38E-01	2.46E-01
F 335-C 133	53.167	7.46E-03	5.27E-02	6.14E-01	4.01E-01
C 335-E 111	54.034	0.00E+00	0.00E+00	0.00E+00	9.15E-01
F 331-C 331	82.836	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	87.798	9.35E-04	1.08E-02	2.06E-01	2.10E-01
F 331-C 333	92.890	2.97E-03	1.28E-02	2.60E-01	1.39E-01
F 333-C 335	96.689	9.42E-04	7.92E-03	1.67E-01	1.25E-01
C 333-E 111	129.81	1.09E-04	2.75E-03	2.32E-01	5.73E-01
F 155-C 133	139.73	2.35E-04	1.15E-02	3.53E-01	2.17E-01
C 331-E 111	156.32	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	163.68	2.01E-05	8.08E-04	2.88E-02	1.29E-01
C 133-F 331	234.15	3.84E-06	3.15E-04	5.00E-02	4.34E-02
C 335-F 331	6.0264	0.00E+00	0.00E+00	0.00E+00	3.65E-02

Z=45

TRANSITION	WL	A	F	A'	A''
F 111-C 331	24.253	0.00E+00	0.00E+00	0.00E+00	6.89E-07
F 111-C 333	25.083	2.53E-05	7.95E-06	2.20E-05	6.00E-04
F 335-C 331	26.373	0.00E+00	0.00E+00	0.00E+00	2.45E-03
F 335-C 333	27.356	5.92E-04	1.11E-03	6.67E-03	1.53E-02
F 111-C 335	35.859	0.00E+00	0.00E+00	0.00E+00	6.08E-02
F 155-C 331	39.914	0.00E+00	0.00E+00	0.00E+00	4.14E-01
F 335-C 335	40.695	1.29E-02	3.19E-02	2.96E-01	4.15E-01
C 133-E 111	41.261	1.93E-02	4.93E-02	1.38E+00	4.40E-01
F 333-C 331	41.701	8.97E-03	7.01E-02	6.67E-01	2.50E-01
F 155-C 333	42.212	9.79E-03	4.35E-02	4.21E-01	4.08E-01
F 111-C 133	42.424	3.29E-02	2.96E-02	2.91E-01	9.23E-02
F 333-C 333	44.215	4.63E-03	1.35E-02	1.37E-01	2.46E-01
F 335-C 133	49.362	8.85E-03	5.38E-02	6.11E-01	4.03E-01
C 335-E 111	50.199	0.00E+00	0.00E+00	0.00E+00	9.11E-01
F 331-C 331	80.460	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	85.406	9.57E-04	1.05E-02	2.04E-01	2.10E-01
F 331-C 333	90.375	3.10E-03	1.26E-02	2.61E-01	1.40E-01
F 333-C 335	94.026	9.78E-04	7.77E-03	1.67E-01	1.25E-01
C 333-E 111	125.95	1.19E-04	2.84E-03	2.43E-01	5.72E-01
F 155-C 133	135.25	2.46E-04	1.12E-02	3.50E-01	2.16E-01
C 331-E 111	152.07	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	158.22	2.22E-05	8.33E-04	3.00E-02	1.29E-01
C 133-F 331	191.16	6.61E-06	3.62E-04	4.91E-02	4.10E-02
C 335-F 331	1091.3	0.00E+00	0.00E+00	0.00E+00	3.51E-02

TABLE 3. (continued)

Z=46

TRANSITION	WL	A	F	A'	A''
F 111-C 331	22.597	0.00E+00	0.00E+00	0.00E+00	2.74E-06
F 111-C 333	23.347	2.28E-05	6.21E-06	1.47E-05	5.14E-04
F 335-C 331	24.463	0.00E+00	0.00E+00	0.00E+00	2.13E-03
F 335-C 333	25.343	6.45E-04	1.03E-03	6.04E-03	1.36E-02
F 111-C 335	33.809	0.00E+00	0.00E+00	0.00E+00	6.17E-02
F 155-C 331	37.445	0.00E+00	0.00E+00	0.00E+00	4.15E-01
F 335-C 335	38.163	1.50E-02	3.28E-02	2.99E-01	4.16E-01
C 133-E 111	38.713	2.23E-02	5.01E-02	1.38E+00	4.42E-01
F 333-C 331	39.052	1.04E-02	7.15E-02	6.67E-01	2.50E-01
F 155-C 333	39.548	1.15E-02	4.51E-02	4.28E-01	4.09E-01
F 111-C 133	39.715	3.79E-02	2.99E-02	2.88E-01	9.20E-02
F 333-C 333	41.345	5.36E-03	1.37E-02	1.35E-01	2.47E-01
F 335-C 133	45.861	1.05E-02	5.50E-02	6.07E-01	4.04E-01
C 335-E 111	46.658	0.00E+00	0.00E+00	0.00E+00	9.08E-01
F 331-C 331	78.198	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	83.121	9.79E-04	1.01E-02	2.01E-01	2.09E-01
F 331-C 333	87.966	3.22E-03	1.24E-02	2.63E-01	1.40E-01
F 333-C 335	91.479	1.01E-03	7.63E-03	1.67E-01	1.25E-01
C 333-E 111	122.29	1.30E-04	2.92E-03	2.54E-01	5.70E-01
F 155-C 133	131.02	2.56E-04	1.10E-02	3.48E-01	2.15E-01
C 331-E 111	147.99	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	153.06	2.44E-05	8.55E-04	3.13E-02	1.28E-01
C 133-F 331	159.10	1.07E-05	4.07E-04	4.82E-02	3.88E-02
C 335-F 331	529.88	0.00E+00	0.00E+00	0.00E+00	3.38E-02

Z=47

TRANSITION	WL	A	F	A'	A''
F 111-C 331	21.062	0.00E+00	0.00E+00	0.00E+00	5.59E-06
F 111-C 333	21.737	2.03E-05	4.78E-06	9.36E-06	4.41E-04
F 335-C 331	22.705	0.00E+00	0.00E+00	0.00E+00	1.87E-03
F 335-C 333	23.492	7.02E-04	9.67E-04	5.47E-03	1.22E-02
F 111-C 335	31.875	0.00E+00	0.00E+00	0.00E+00	6.25E-02
F 155-C 331	35.135	0.00E+00	0.00E+00	0.00E+00	4.15E-01
F 335-C 335	35.794	1.76E-02	3.37E-02	3.01E-01	4.16E-01
C 133-E 111	36.323	2.57E-02	5.09E-02	1.38E+00	4.45E-01
F 333-C 331	36.579	1.21E-02	7.30E-02	6.67E-01	2.50E-01
F 155-C 333	37.056	1.36E-02	4.67E-02	4.34E-01	4.10E-01
F 111-C 133	37.188	4.37E-02	3.02E-02	2.85E-01	9.16E-02
F 333-C 333	38.667	6.21E-03	1.39E-02	1.34E-01	2.47E-01
F 335-C 133	42.636	1.24E-02	5.63E-02	6.04E-01	4.05E-01
C 335-E 111	43.388	0.00E+00	0.00E+00	0.00E+00	9.05E-01
F 331-C 331	76.042	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	80.936	1.00E-03	9.84E-03	1.99E-01	2.09E-01
F 331-C 333	85.656	3.35E-03	1.23E-02	2.64E-01	1.41E-01
F 333-C 335	89.037	1.05E-03	7.50E-03	1.67E-01	1.25E-01
C 333-E 111	118.80	1.41E-04	2.99E-03	2.64E-01	5.69E-01
F 155-C 133	127.02	2.67E-04	1.08E-02	3.45E-01	2.14E-01
C 133-F 331	134.43	1.67E-05	4.52E-04	4.72E-02	3.67E-02
C 331-E 111	144.07	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	148.18	2.66E-05	8.76E-04	3.24E-02	1.28E-01
C 335-F 331	338.31	0.00E+00	0.00E+00	0.00E+00	3.26E-02

Z=48

TRANSITION	WL	A	F	A'	A''
F 111-C 331	19.638	0.00E+00	0.00E+00	0.00E+00	8.80E-06
F 111-C 333	20.247	1.77E-05	3.62E-06	5.53E-06	3.78E-04
F 335-C 331	21.086	0.00E+00	0.00E+00	0.00E+00	1.64E-03
F 335-C 333	21.790	7.63E-04	9.05E-04	4.95E-03	1.10E-02
F 111-C 335	30.049	0.00E+00	0.00E+00	0.00E+00	6.34E-02
F 155-C 331	32.974	0.00E+00	0.00E+00	0.00E+00	4.15E-01
F 335-C 335	33.579	2.05E-02	3.46E-02	3.03E-01	4.16E-01
C 133-E 111	34.083	2.97E-02	5.17E-02	1.37E+00	4.47E-01
F 333-C 331	34.272	1.41E-02	7.46E-02	6.67E-01	2.50E-01
F 155-C 333	34.727	1.61E-02	4.84E-02	4.40E-01	4.10E-01
F 111-C 133	34.831	5.05E-02	3.06E-02	2.82E-01	9.12E-02
F 333-C 333	36.171	7.20E-03	1.41E-02	1.33E-01	2.47E-01
F 335-C 133	39.664	1.47E-02	5.77E-02	6.01E-01	4.07E-01
C 335-E 111	40.369	0.00E+00	0.00E+00	0.00E+00	9.02E-01
F 331-C 331	73.983	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	78.845	1.03E-03	9.57E-03	1.97E-01	2.09E-01
F 331-C 333	83.435	3.49E-03	1.21E-02	2.65E-01	1.42E-01
F 333-C 335	86.698	1.09E-03	7.37E-03	1.67E-01	1.25E-01
C 133-F 331	115.00	2.50E-05	4.95E-04	4.62E-02	3.49E-02
C 333-E 111	115.48	1.53E-04	3.05E-03	2.74E-01	5.67E-01
F 155-C 133	123.23	2.78E-04	1.05E-02	3.43E-01	2.14E-01
C 331-E 111	140.29	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	143.56	2.90E-05	8.95E-04	3.35E-02	1.28E-01
C 335-F 331	242.30	0.00E+00	0.00E+00	0.00E+00	3.15E-02

Z=49

TRANSITION	WL	A	F	A'	A''
F 111-C 331	18.317	0.00E+00	0.00E+00	0.00E+00	1.21E-05
F 111-C 333	18.865	1.52E-05	2.70E-06	2.92E-06	3.25E-04
F 335-C 331	19.596	0.00E+00	0.00E+00	0.00E+00	1.44E-03
F 335-C 333	20.224	8.29E-04	8.46E-04	4.48E-03	9.83E-03
F 111-C 335	28.329	0.00E+00	0.00E+00	0.00E+00	6.42E-02
F 155-C 331	30.953	0.00E+00	0.00E+00	0.00E+00	4.15E-01
F 335-C 335	31.507	2.39E-02	3.56E-02	3.05E-01	4.16E-01
C 133-E 111	31.984	3.44E-02	5.27E-02	1.37E+00	4.49E-01
F 333-C 331	32.119	1.64E-02	7.63E-02	6.67E-01	2.50E-01
F 155-C 333	32.551	1.89E-02	5.01E-02	4.46E-01	4.11E-01
F 111-C 133	32.632	5.83E-02	3.10E-02	2.79E-01	9.09E-02
F 333-C 333	33.843	8.36E-03	1.43E-02	1.32E-01	2.47E-01
F 335-C 133	36.923	1.74E-02	5.91E-02	5.98E-01	4.08E-01
C 335-E 111	37.579	0.00E+00	0.00E+00	0.00E+00	8.99E-01
F 331-C 331	72.017	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	76.840	1.05E-03	9.32E-03	1.95E-01	2.09E-01
F 331-C 333	81.303	3.62E-03	1.20E-02	2.66E-01	1.43E-01
F 333-C 335	84.452	1.13E-03	7.25E-03	1.67E-01	1.25E-01
C 133-F 331	99.375	3.64E-05	5.38E-04	4.53E-02	3.31E-02
C 333-E 111	112.32	1.65E-04	3.11E-03	2.84E-01	5.66E-01
F 155-C 133	119.64	2.89E-04	1.03E-02	3.40E-01	2.13E-01
C 331-E 111	136.66	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	139.17	3.14E-05	9.12E-04	3.45E-02	1.28E-01
C 335-F 331	184.93	0.00E+00	0.00E+00	0.00E+00	3.05E-02

Z=50

TRANSITION	WL	A	F	A'	A''
F 111-C 331	17.093	0.00E+00	0.00E+00	0.00E+00	1.52E-05
F 111-C 333	17.586	1.27E-05	1.96E-06	1.28E-06	2.80E-04
F 335-C 331	18.222	0.00E+00	0.00E+00	0.00E+00	1.27E-03
F 335-C 333	18.784	9.00E-04	7.92E-04	4.05E-03	8.84E-03
F 111-C 335	26.707	0.00E+00	0.00E+00	0.00E+00	6.49E-02
F 155-C 331	29.063	0.00E+00	0.00E+00	0.00E+00	4.15E-01
F 335-C 335	29.570	2.79E-02	3.66E-02	3.07E-01	4.16E-01
C 133-E 111	30.018	3.98E-02	5.37E-02	1.37E+00	4.51E-01
F 333-C 331	30.110	1.91E-02	7.80E-02	6.67E-01	2.50E-01
F 155-C 333	30.518	2.23E-02	5.19E-02	4.51E-01	4.12E-01
F 111-C 133	30.581	6.73E-02	3.14E-02	2.77E-01	9.06E-02
F 333-C 333	31.674	9.71E-03	1.46E-02	1.31E-01	2.48E-01
F 335-C 133	34.395	2.05E-02	6.06E-02	5.96E-01	4.08E-01
C 335-E 111	35.002	0.00E+00	0.00E+00	0.00E+00	8.96E-01
F 331-C 331	70.133	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	74.916	1.08E-03	9.09E-03	1.93E-01	2.09E-01
F 331-C 333	79.250	3.76E-03	1.18E-02	2.67E-01	1.43E-01
F 333-C 335	82.293	1.17E-03	7.14E-03	1.67E-01	1.25E-01
C 133-F 331	86.616	5.16E-05	5.80E-04	4.43E-02	3.15E-02
C 333-E 111	109.29	1.77E-04	3.17E-03	2.93E-01	5.65E-01
F 155-C 133	116.22	3.00E-04	1.01E-02	3.38E-01	2.13E-01
C 331-E 111	133.16	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	134.99	3.40E-05	9.28E-04	3.55E-02	1.27E-01
C 335-F 331	147.03	0.00E+00	0.00E+00	0.00E+00	2.96E-02

Z=51

TRANSITION	WL	A	F	A'	A''
F 111-C 331	15.958	0.00E+00	0.00E+00	0.00E+00	1.81E-05
F 111-C 333	16.401	1.04E-05	1.39E-06	3.80E-07	2.41E-04
F 335-C 331	16.956	0.00E+00	0.00E+00	0.00E+00	1.12E-03
F 335-C 333	17.458	9.76E-04	7.42E-04	3.67E-03	7.95E-03
F 111-C 335	25.179	0.00E+00	0.00E+00	0.00E+00	6.57E-02
F 155-C 331	27.295	0.00E+00	0.00E+00	0.00E+00	4.16E-01
F 335-C 335	27.759	3.26E-02	3.76E-02	3.08E-01	4.16E-01
C 133-E 111	28.177	4.60E-02	5.48E-02	1.36E+00	4.53E-01
F 333-C 331	28.235	2.23E-02	7.98E-02	6.67E-01	2.50E-01
F 155-C 333	28.618	2.63E-02	5.37E-02	4.57E-01	4.12E-01
F 111-C 133	28.668	7.78E-02	3.19E-02	2.74E-01	9.03E-02
F 333-C 333	29.653	1.13E-02	1.48E-02	1.30E-01	2.48E-01
F 335-C 133	32.061	2.42E-02	6.22E-02	5.93E-01	4.09E-01
C 335-E 111	32.620	0.00E+00	0.00E+00	0.00E+00	8.93E-01
F 331-C 331	68.329	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	73.068	1.11E-03	8.87E-03	1.92E-01	2.09E-01
C 133-F 331	76.048	7.16E-05	6.20E-04	4.34E-02	3.00E-02
F 331-C 333	77.272	3.91E-03	1.17E-02	2.67E-01	1.44E-01
F 333-C 335	80.220	1.21E-03	7.03E-03	1.67E-01	1.25E-01
C 333-E 111	106.39	1.90E-04	3.22E-03	3.02E-01	5.64E-01
F 155-C 133	112.96	3.12E-04	9.93E-03	3.35E-01	2.12E-01
C 335-F 331	120.25	0.00E+00	0.00E+00	0.00E+00	2.87E-02
C 331-E 111	129.78	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	131.02	3.66E-05	9.42E-04	3.65E-02	1.27E-01

TABLE 3. (continued)

Z=52

TRANSITION	WL	A	F	A'	A''
F 111-C 331	14.905	0.00E+00	0.00E+00	0.00E+00	2.07E-05
F 111-C 333	15.303	8.18E-06	9.56E-07	2.42E-08	2.09E-04
F 335-C 331	15.789	0.00E+00	0.00E+00	0.00E+00	9.98E-04
F 335-C 333	16.236	1.06E-03	6.96E-04	3.33E-03	7.17E-03
F 111-C 335	23.741	0.00E+00	0.00E+00	0.00E+00	6.64E-02
F 155-C 331	25.641	0.00E+00	0.00E+00	0.00E+00	4.16E-01
F 335-C 335	26.066	3.79E-02	3.86E-02	3.10E-01	4.16E-01
C 133-E 111	26.455	5.33E-02	5.59E-02	1.36E+00	4.55E-01
F 333-C 331	26.486	2.59E-02	8.18E-02	6.67E-01	2.50E-01
F 155-C 333	26.844	3.09E-02	5.56E-02	4.61E-01	4.13E-01
F 111-C 133	26.884	8.99E-02	3.24E-02	2.72E-01	9.00E-02
F 333-C 333	27.770	1.31E-02	1.51E-02	1.29E-01	2.48E-01
F 335-C 133	29.904	2.86E-02	6.38E-02	5.91E-01	4.10E-01
C 335-E 111	30.417	0.00E+00	0.00E+00	0.00E+00	8.90E-01
F 331-C 331	66.599	0.00E+00	0.00E+00	0.00E+00	1.22E-01
C 133-F 331	67.197	9.76E-05	6.60E-04	4.25E-02	2.87E-02
F 155-C 335	71.292	1.14E-03	8.66E-03	1.90E-01	2.09E-01
F 331-C 333	75.365	4.06E-03	1.15E-02	2.68E-01	1.44E-01
F 333-C 335	78.223	1.26E-03	6.92E-03	1.67E-01	1.25E-01
C 335-F 331	100.43	0.00E+00	0.00E+00	0.00E+00	2.79E-02
C 333-E 111	103.63	2.03E-04	3.26E-03	3.10E-01	5.63E-01
F 155-C 133	109.86	3.23E-04	9.74E-03	3.33E-01	2.12E-01
C 331-E 111	126.52	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	127.24	3.93E-05	9.54E-04	3.74E-02	1.27E-01

Z=53

TRANSITION	WL	A	F	A'	A''
F 111-C 331	13.928	0.00E+00	0.00E+00	0.00E+00	2.29E-05
F 111-C 333	14.286	6.17E-06	6.28E-07	6.49E-08	1.81E-04
F 335-C 331	14.711	0.00E+00	0.00E+00	0.00E+00	8.88E-04
F 335-C 333	15.111	1.15E-03	6.53E-04	3.02E-03	6.46E-03
F 111-C 335	22.387	0.00E+00	0.00E+00	0.00E+00	6.70E-02
F 155-C 331	24.095	0.00E+00	0.00E+00	0.00E+00	4.16E-01
F 335-C 335	24.483	4.42E-02	3.97E-02	3.11E-01	4.16E-01
C 133-E 111	24.843	6.18E-02	5.71E-02	1.36E+00	4.57E-01
F 333-C 331	24.853	3.02E-02	8.38E-02	6.67E-01	2.50E-01
F 155-C 333	25.187	3.63E-02	5.75E-02	4.66E-01	4.13E-01
F 111-C 133	25.219	1.04E-01	3.30E-02	2.70E-01	8.97E-02
F 333-C 333	26.016	1.52E-02	1.54E-02	1.28E-01	2.48E-01
F 335-C 133	27.911	3.37E-02	6.55E-02	5.89E-01	4.11E-01
C 335-E 111	28.380	0.00E+00	0.00E+00	0.00E+00	8.88E-01
C 133-F 331	59.708	1.31E-04	6.99E-04	4.16E-02	2.74E-02
F 331-C 331	64.937	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	69.582	1.17E-03	8.47E-03	1.89E-01	2.09E-01
F 331-C 333	73.526	4.21E-03	1.14E-02	2.69E-01	1.45E-01
F 333-C 335	76.300	1.30E-03	6.82E-03	1.67E-01	1.25E-01
C 335-F 331	85.243	0.00E+00	0.00E+00	0.00E+00	2.71E-02
C 333-E 111	100.97	2.16E-04	3.30E-03	3.18E-01	5.62E-01
F 155-C 133	106.90	3.35E-04	9.56E-03	3.31E-01	2.12E-01
C 331-E 111	123.37	0.00E+00	0.00E+00	0.00E+00	2.11E-01
F 333-C 133	123.62	4.22E-05	9.65E-04	3.82E-02	1.27E-01

Z=54

TRANSITION	WL	A	F	A'	A''
F 111-C 331	13.021	0.00E+00	0.00E+00	0.00E+00	2.48E-05
F 111-C 333	13.343	4.38E-06	3.89E-07	3.82E-07	1.57E-04
F 335-C 331	13.716	0.00E+00	0.00E+00	0.00E+00	7.92E-04
F 335-C 333	14.074	1.24E-03	6.14E-04	2.74E-03	5.84E-03
F 111-C 335	21.113	0.00E+00	0.00E+00	0.00E+00	6.77E-02
F 155-C 331	22.648	0.00E+00	0.00E+00	0.00E+00	4.16E-01
F 335-C 335	23.003	5.15E-02	4.08E-02	3.12E-01	4.16E-01
F 333-C 331	23.329	3.51E-02	8.59E-02	6.67E-01	2.50E-01
C 133-E 111	23.335	7.16E-02	5.84E-02	1.35E+00	4.59E-01
F 155-C 333	23.639	4.26E-02	5.95E-02	4.70E-01	4.13E-01
F 111-C 133	23.666	1.20E-01	3.36E-02	2.68E-01	8.94E-02
F 333-C 333	24.381	1.77E-02	1.57E-02	1.28E-01	2.48E-01
F 335-C 133	26.068	3.97E-02	6.73E-02	5.88E-01	4.11E-01
C 335-E 111	26.494	0.00E+00	0.00E+00	0.00E+00	8.85E-01
C 133-F 331	53.318	1.73E-04	7.37E-04	4.07E-02	2.62E-02
F 331-C 331	63.339	0.00E+00	0.00E+00	0.00E+00	1.22E-01
F 155-C 335	67.934	1.20E-03	8.29E-03	1.88E-01	2.09E-01
F 331-C 333	71.749	4.37E-03	1.12E-02	2.70E-01	1.45E-01
C 335-F 331	73.287	0.00E+00	0.00E+00	0.00E+00	2.63E-02
F 333-C 335	74.447	1.35E-03	6.73E-03	1.67E-01	1.25E-01
C 333-E 111	98.412	2.30E-04	3.34E-03	3.26E-01	5.61E-01
F 155-C 133	104.06	3.47E-04	9.39E-03	3.28E-01	2.11E-01
F 333-C 133	120.17	4.51E-05	9.76E-04	3.90E-02	1.27E-01
C 331-E 111	120.33	0.00E+00	0.00E+00	0.00E+00	2.11E-01

Z=55

TRANSITION	WL	A	F	A'	A''
F 111-C 331	12.180	0.00E+00	0.00E+00	0.00E+00	2.63E-05
F 111-C 333	12.469	2.85E-06	2.21E-07	8.81E-07	1.36E-04
F 335-C 331	12.797	0.00E+00	0.00E+00	0.00E+00	7.08E-04
F 335-C 333	13.117	1.34E-03	5.77E-04	2.49E-03	5.28E-03
F 111-C 335	19.914	0.00E+00	0.00E+00	0.00E+00	6.83E-02
F 155-C 331	21.295	0.00E+00	0.00E+00	0.00E+00	4.16E-01
F 335-C 335	21.619	5.99E-02	4.20E-02	3.14E-01	4.16E-01
F 333-C 331	21.906	4.08E-02	8.80E-02	6.67E-01	2.50E-01
C 133-E 111	21.924	8.29E-02	5.97E-02	1.35E+00	4.60E-01
F 155-C 333	22.194	5.00E-02	6.15E-02	4.74E-01	4.14E-01
F 111-C 133	22.217	1.39E-01	3.42E-02	2.66E-01	8.92E-02
F 333-C 333	22.858	2.05E-02	1.61E-02	1.27E-01	2.49E-01
F 335-C 133	24.361	4.67E-02	6.92E-02	5.86E-01	4.12E-01
C 335-E 111	24.749	0.00E+00	0.00E+00	0.00E+00	8.83E-01
C 133-F 331	47.820	2.26E-04	7.75E-04	3.98E-02	2.51E-02
F 331-C 331	61.802	0.00E+00	0.00E+00	0.00E+00	1.22E-01
C 335-F 331	63.671	0.00E+00	0.00E+00	0.00E+00	2.56E-02
F 155-C 335	66.346	1.23E-03	8.13E-03	1.86E-01	2.09E-01
F 331-C 333	70.034	4.54E-03	1.11E-02	2.70E-01	1.46E-01
F 333-C 335	72.659	1.40E-03	6.64E-03	1.67E-01	1.25E-01
C 333-E 111	95.958	2.44E-04	3.37E-03	3.34E-01	5.60E-01
F 155-C 133	101.35	3.60E-04	9.22E-03	3.26E-01	2.11E-01
F 333-C 133	116.86	4.81E-05	9.85E-04	3.98E-02	1.26E-01
C 331-E 111	117.38	0.00E+00	0.00E+00	0.00E+00	2.11E-01

Table 4a. Cross sections of excitations for SiXI ($2s^2$ -2s2p -$2p^2$)

u	E(ev)	σ(cm²) pres.calc.	σ(cm²) [1]	E(ev)	σ(cm²) pres.calc.	σ(cm²) [1]
	$2s^2\ ^1S_o - 2s2p\ ^3P_o$			$2s^2\ ^1S_o - 2s2p\ ^3P_1$		
6.25-4	22.1	2.96-19	2.76-19	22.4	8.80-19	8.36-19
1.25-3	23.1	2.82-19	2.63-19	23.4	8.39-19	7.98-19
2.50-3	25.2	2.59-19	2.40-19	25.5	7.68-19	7.31-19
5.00-3	29.3	2.21-19	2.04-19	29.6	6.57-19	6.25-19
0.01	37.5	1.71-19	1.56-19	37.8	5.09-19	4.82-19
0.02	54.0	1.17-19	1.04-19	54.3	3.46-19	3.26-19
0.04	86.9	6.87-20	5.98-20	87.2	2.11-19	1.90-19
0.08	153	3.49-20	2.93-20	153	1.08-19	9.57-20
0.16	284	1.47-20	1.20-20	285	4.65-20	4.11-20
0.32	548	4.81-21	4.00-21	549	1.60-20	1.50-20
0.64	1070	1.15-21	1.04-21	1070	4.46-21	4.86-21
1.28	2130	1.92-22	2.12-22	2130	1.19-21	1.64-21
2.56	4230	2.30-23	3.36-23	4230	4.15-22	6.86-22
5.12	8450	4.74-24	5.26-24	8450	2.06-22	3.43-22
10.24	169+2	6.27-25	7.18-25	169+2	1.05-22	1.84-22
	$2s^2\ ^1S_o - 2s2p\ ^3P_2$			$2s^2\ ^1S_o - 2s2p\ ^1P_1$		
6.25-4	23.0	1.45-18	1.31-18	41.9	2.88-17	3.20-17
1.25-3	24.1	1.38-18	1.25-18	42.9	2.87-17	3.14-17
2.50-3	26.1	1.27-18	1.15-18	45.0	2.73-17	3.01-17
5.00-3	30.2	1.08-18	9.86-19	49.1	2.50-17	2.79-17
0.01	38.5	8.40-19	7.85-19	57.3	2.18-17	2.43-17
0.02	54.9	5.72-19	5.07-19	73.8	1.68-17	1.93-17
0.04	87.8	3.37-19	2.93-19	107	1.17-17	1.38-17
0.08	154	1.71-19	1.44-19	173	7.82-18	8.98-18
0.16	285	7.23-20	5.91-20	304	4.92-18	5.59-18
0.32	549	2.36-20	1.96-20	568	3.15-18	3.44-18
0.64	1070	5.62-21	5.06-21	1090	1.99-18	2.08-18
1.28	2130	9.44-22	1.03-21	2150	1.20-18	1.03-18
2.56	4230	1.13-22	1.73-22	4250	6.96-19	7.07-19
5.12	8450	2.33-23	2.54-23	8470	3.92-19	4.00-19
10.24	169+2	3.08-24	3.47-24	169+2	2.14-19	2.22-19

Table 4a (continued)

E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]
	$2s2p\ ^3P_1 - 2p^2\ ^3P_0$			$2s2p\ ^3P_0 - 2p^2\ ^3P_1$			$2s2p\ ^3P_0 - 2p^2\ ^3P_1$	
34.7	5.80-18	6.09-18	35.3	1.68-17	1.79-17	35.0	4.30-18	4.54-18
35.7	5.74-18	5.95-18	36.4	1.67-17	1.74-17	36.0	4.25-18	4.43-18
37.8	5.39-18	5.67-18	38.4	1.57-17	1.67-17	38.1	3.99-18	4.23-18
41.9	4.90-18	5.19-18	42.5	1.42-17	1.53-17	42.2	3.63-18	3.88-18
50.1	4.08-18	4.44-18	50.7	1.19-17	1.31-17	50.4	3.05-18	3.34-18
66.6	3.06-18	3.45-18	67.2	8.90-18	1.02-17	66.9	2.27-18	2.60-18
99.5	2.18-18	2.41-18	100	6.33-18	7.11-18	99.8	1.61-18	1.82-18
165	1.39-18	1.53-18	166	4.02-18	4.54-18	166	1.02-18	1.16-18
297	8.56-19	9.41-19	297	2.49-18	2.79-18	297	6.28-19	7.10-19
561	5.49-19	5.72-19	561	1.60-18	1.70-18	561	3.91-19	4.29-19
1090	3.45-19	3.43-19	1090	1.00-18	1.02-18	1090	2.51-19	2.57-19
2140	1.97-19	2.01-19	2140	5.97-19	5.99-19	2140	1.49-19	1.50-19
4250	1.18-19	1.15-19	4250	3.44-19	3.43-19	4250	8.56-20	8.59-20
8470	6.60-20	6.47-20	8470	1.92-19	1.93-19	8470	4.79-20	4.83-20
169+2	3.59-20	3.59-20	169+2	1.05-19	1.07-19	169+2	2.61-20	2.68-20
	$2s2p\ ^3P_2 - 2p^2\ ^3P_1$			$2s2p\ ^3P_1 - 2p^2\ ^3P_2$			$2s2p\ ^3P_2 - 2p^2\ ^3P_2$	
34.4	4.22-18	4.62-18	35.6	7.06-18	7.42-18	34.9	1.26-17	1.35-17
35.4	4.17-18	4.51-18	36.6	6.98-18	7.24-18	36.0	1.24-17	1.32-17
37.5	3.92-18	4.31-18	38.7	6.55-18	6.92-18	38.0	1.17-17	1.26-17
41.6	3.57-18	3.94-18	42.8	5.97-18	6.35-18	42.1	1.07-17	1.15-17
49.8	2.99-18	3.37-18	51.0	5.00-18	5.45-18	50.4	8.90-18	9.87-18
66.3	2.22-18	2.62-18	67.5	3.37-18	4.62-18	66.8	6.64-18	7.69-18
99.2	1.59-18	1.83-18	100	2.65-18	2.98-18	99.7	4.73-18	5.36-18
165	1.01-18	1.16-18	166	1.69-18	1.90-18	166	3.05-18	3.42-18
297	6.21-19	7.12-19	298	1.04-18	1.17-18	297	1.91-18	2.10-18
560	4.00-19	4.31-19	561	6.65-19	7;09-19	561	1.19-18	1.27-18
1090	2.50-19	2.58-19	1090	2.50-19	2.58-19	1090	7.44-19	7.63-19
2140	1.49-19	1.51-19	2140	2.49-19	2.49-19	2140	4.42-19	4.47-19
4250	8.56-20	8.65-20	4250	1.43-19	1.43-19	4250	2.55-19	2.56-19
8470	4.79-20	4.86-20	8470	8.00-20	8.03-20	8470	1.43-19	1.44-19
169+2	2.61-20	2.69-20	169+2	4.36-20	4.45-20	169+2	7.79-20	7.98-20

Table 4a (continued)

E(ev)	σ(cm^2) pres.calc	[1]	E(ev)	σ(cm^2) pres.calc.	[1]	E(ev)	σ(cm^2) pres.calc.	[1]
2s2p ^3P_o - 2p^2 ^3P_o			2s2p ^3P_o - 2p^2 $^3P_2$			2s2p $^3P_2$ - 2p^2 ^3P_o		
35.0	1.16-19	1.08-19	35.5	1.60-19	1.58-19	34.0	2.47-20	2.40-20
36.0	1.13-19	1.04-19	36.9	1.55-19	1.54-19	35.1	2.42-20	2.39-20
38.1	1.06-19	9.80-20	39.0	1.47-19	1.45-19	37.1	2.29-20	2.18-20
42.2	9.53-20	8.75-20	43.1	1.31-19	1.29-19	41.2	2.05-20	1.94-20
50.4	7.84-20	7.17-20	51.3	1.08-19	1.06-19	49.5	1.72-20	1.59-20
66.9	5.73-20	5.18-20	67.8	7.99-20	7.73-20	65.9	1.24-20	1.14-20
99.8	3.61-20	3.21-20	101	5.06-20	4.79-20	98.8	7.83-21	7.04-20
166	1.92-20	1.66-20	167	2.70-20	2.49-20	165	4.17-21	3.64-21
297	8.36-21	7.63-21	298	1.17-20	1.06-20	296	1.82-21	1.55-21
561	2.76-21	2.36-21	561	3.87-21	3.55-21	560	5.99-22	5.22-22
1090	6.60-22	6.16-22	1090	9.29-22	9.24-22	1090	1.43-22	1.37-22
2140	1.11-22	1.25-22	2140	1.57-22	1.88-22	2140	2.42-23	2.80-23
4250	1.34-23	2.11-23	4250	1.88-23	3.15-23	4250	2.91-24	4.73-24
8470	2.79-24	3.10-24	8470	3.94-24	4.64-24	8470	6.07-25	6.98-25
169+2	3.69-25	4.23-25	169+2	5.21-25	6.33-25	169+2	8.02-26	9.53-26
2s2p $^1P_1$ - 2p^2 ^3P_o			2s2p $^1P_1$ - 2p^2 $^3P_1$			2s2p $^1P_1$ - 2p^2 $^3P_2$		
15.2	1.41-19	1.30-19	15.5	3.53-19	3.45-19	16.1	9.76-19	8.97-19
16.2	1.33-19	1.23-19	16.6	3.30-19	3.23-19	17.1	9.20-19	8.49-19
18.3	1.18-19	1.09-19	18.6	2.93-19	2.86-19	19.2	8.19-19	7.66-19
22.4	9.61-20	9.02-20	22.7	2.39-19	2.32-19	23.3	6.76-19	6.41-19
30.6	6.93-20	6.66-20	31.0	1.73-19	1.68-19	31.5	4.90-19	4.84-19
47.1	4.33-20	4.36-20	47.4	1.10-19	1.06-19	48.0	3.06-19	3.24-19
80.0	2.44-20	2.54-20	80.3	6.13-20	5.80-20	80.9	1.73-19	1.93-19
146	1.26-20	1.33-20	146	3.00-20	2.78-20	147	9.54-20	1.04-19
277	5.89-21	6.32-21	278	1.26-20	1.14-20	278	5.04-20	5.23-20
541	2.50-21	2.81-21	541	4.10-21	3.92-21	542	2.54-20	2.58-20
1070	1.04-21	1.26-21	1070	1.06-21	1.15-21	1070	1.30-20	1.31-20
2120	4.81-22	6.06-22	2120	2.56-22	3.34-22	2120	6.78-21	6.94-21
4230	2.47-22	3.18-22	4230	7.75-23	1.20-22	4230	3.64-21	3.76-21
8440	1.32-22	1.72-22	8440	3.67-23	5.54-23	8440	2.00-21	2.05-21
169+2	7.07-23	9.36-23	169+2	2.26-23	2.90-23	169+2	1.07-21	1.11-21

Table 4a (continued)

E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]
$2s2p\ ^1P_1 - 2p^2\ ^1D_2$			$2s2p\ ^3P_2 - 2p^2\ ^1D_2$			$2s2p\ ^3P_1 - 2p^2\ ^1D_2$		
21.6	5.00-17	5.13-17	40.4	3.15-19	2.85-19	41.1	2.21-19	2.06-19
22.6	4.92-17	4.94-17	41.5	3.07-19	2.79-19	42.1	2.15-19	2.01-19
24.5	4.51-17	4.60-17	43.5	2.91-19	2.68-19	44.2	2.04-19	1.91-19
28.8	3.87-17	4.05-17	47.6	2.66-19	2.49-19	48.3	1.86-19	1.83-19
37.0	3.15-17	3.27-17	55.9	2.25-19	2.17-19	56.5	1.56-19	1.45-19
53.5	2.24-17	2.37-17	72.3	1.70-19	1.70-19	73.0	1.18-19	1.08-19
86.4	1.34-17	1.54-17	105	1.12-19	1.15-19	106	7.65-20	6.87-20
152	8.04-18	9.43-18	171	6.44-20	6.52-20	172	4.18-20	3.66-20
284	5.20-18	5.66-18	303	3.19-20	3.92-20	303	1.37-20	1.60-20
547	3.34-18	3.38-18	566	1.43-20	1.70-20	567	7.36-21	5.61-21
1070	2.04-18	1.99-18	1090	6.47-21	7.16-21	1090	1.89-21	1.63-21
2130	1.19-18	1.14-18	2150	3.22-21	3.63-21	2160	5.40-22	4.50-22
4230	6.73-19	6.45-19	4250	1.74-21	1.93-21	4270	2.05-22	1.53-22
8450	3.71-19	3.58-19	8470	9.70-22	1.05-21	8480	1.05-22	6.98-23
169+2	1.99-19	1.96-19	169+2	5.27-22	5.74-22	169+2	5.55-23	4.03-23
$2s2p\ ^1P_1 - 2p^2\ ^1S_0$			$2s2p\ ^3P_2 - 2p^2\ ^1S_0$			$2s2p\ ^3P_0 - 2p^2\ ^1D_2$		
35.7	1.13-17	1.07-17	54.5	1.23-20	2.28-20	41.4	2.01-19	1.89-19
36.7	1.12-17	1.04-17	55.5	1.21-20	2.23-20	42.4	1.95-19	1.84-19
38.7	1.05-17	9.93-18	57.6	1.15-20	2.14-20	44.4	1.85-19	1.74-19
42.9	9.55-18	9.11-18	61.7	1.07-20	1.97-20	48.6	1.69-19	1.57-19
51.1	8.03-18	7.80-18	69.9	9.29-21	1.70-20	56.8	1.42-19	1.32-19
67.5	6.00-18	6.07-18	86.4	7.28-21	1.31-20	73.2	1.70-19	9.81-20
101	4.30-18	4.23-18	119	4.92-21	8.68-21	106	6.90-20	6.23-20
161	2.75-18	2.71-18	185	2.77-21	4.73-21	172	3.74-20	3.29-20
298	1.71-18	1.67-18	317	1.23-21	2.05-21	304	1.64-20	1.41-20
561	1.10-18	1.02-18	580	4.11-22	6.85-22	567	5.42-21	4.73-21
1090	6.90-19	6.15-19	1090	9.82-23	1.75-22	1090	1.30-21	1.23-21
2140	4.13-19	4.62-19	2160	1.66-23	3.47-23	2150	2.20-22	2.48-22
4250	2.37-19	2.08-19	4270	2.00-24	5.70-24	4250	2.64-23	4.13-23
8460	1.33-19	1.17-19	8480	4.30-25	8.29-25	8470	5.57-24	6.07-24
169+2	7.23-20	6.56-20	169+2	5.71-26	1.12-25	169+2	7.35-25	8.26-25

Table 4b . Excitation rate coefficients (R) for Si XI ($2s^2$ -2s2p -$2p^2$) in units cm^3 s^{-1}.

β	T(ev)	T(10^6)	R	R[1]	R	R[1]
			$2s^2\ ^1S_o$	$-2s2p\ ^3P_o$	$2s^2\ ^1S_o$	$-2s2p\ ^3P_1$
128	12.9	0.149	2.26-11	2.15-11	6.80-11	6.51-11
64	25.7	0.299	3.62-11	3.34-11	1.11-10	1.03-10
32	51.4	0.597	3.75-11	3.37-11	1.16-10	1.06-10
16	103	1.19	3.01-11	2.65-11	9.02-11	8.47-11
8	206	2.39	2.05-11	1.77-11	6.45-11	5.82-11
4	411	4.78	1.21-11	1.04-11	4.13-11	3.57-11
2	823	9.56	6.29-12	5.47-12	2.10-11	1.01-11
1	1650	19.1	2.93-12	2.60-12	1.06-11	1.09-11
0.5	3290	38.2	1.25-12	1.14-12	5.20-12	5.89-12
0.25	6580	76.5	5.01-13	4.65-13	2.68-12	3.39-12

β	R	R[1]	R	R[1]	R	R[1]
	$2s^2\ ^1S_o$	$-2s2p\ ^3P_2$	$2s^2\ ^1S_o$	$-2s2p\ ^1P_1$	$2s2p\ ^3P_o$ -	$2p^2\ ^3P_o$
128	1.04-10	9.88-11	9.22-10	1.07-09	4.68-12	4.87-12
64	1.72-10	1.60-10	3.29-09	3.77-09	1.23-11	1.25-11
32	1.82-10	1.64-10	5.28-09	6.07-09	1.64-11	1.61-11
16	1.48-10	1.30-10	5.83-09	6.68-09	1.50-11	1.44-11
8	1.01-10	8.72-10	5.45-09	6.18-09	1.07-11	1.02-11
4	5.96-11	5.13-11	4.81-09	5.33-09	6.51-12	6.18-12
2	3.11-11	2.69-11	4.15-09	4.47-09	3.43-12	3.28-12
1	1.45-11	1.28-11	3.52-09	3.70-09	1.61-12	1.57-12
0.5	6.19-12	5.58-12	2.92-09	3.02-09	6.87-13	6.86-13
0.25	2.48-12	2.98-12	2.37-09	2.43-09	2.75-13	2.81-13

Table 4b (continued)

β	$2s2p\ ^3P_1 - 2p^2\ ^3P_o$ R	$2s2p\ ^3P_1 - 2p^2\ ^3P_o$ R[1]	$2s2p\ ^3P_o - 2p^2\ ^3P_1$ R	$2s2p\ ^3P_o - 2p^2\ ^3P_1$ R[1]	$2s2p\ ^3P_1 - 2p^2\ ^3P_1$ R	$2s2p\ ^3P_1 - 2p^2\ ^3P_1$ R[1]
128	2.60-10	2.99-10	7.40-10	8.49-10	1.96-10	2.20-10
64	7.00-10	8.01-10	2.05-09	2.33-09	5.36-10	5.98-10
32	9.92-10	1.13-09	2.94-09	3.32-09	7.56-10	8.48-10
16	1.02-09	1.16-09	3.05-09	3.44-09	7.85-10	8.78-10
8	9.29-10	1.04-09	2.78-09	3.10-09	7.11-10	7.89-10
4	8.09-10	8.88-10	2.43-09	2.64-09	6.15-10	6.88-10
2	6.94-10	6.39-10	2.08-09	2.20-09	5.15-10	5.55-10
1	5.84-10	6.08-10	1.75-09	1.81-09	4.40-10	4.55-10
0.5	4.83-10	4.93-10	1.45-09	1.47-09	3.61-10	3.69-10
0.25	3.88-10	3.95-10	1.17-09	1.18-09	2.90-10	2.95-10

β	$2s2p\ ^3P_2 - 2p^2\ ^3P_1$ R	$2s2p\ ^3P_2 - 2p^2\ ^3P_1$ R[1]	$2s2p\ ^3P_1 - 2p^2\ ^3P_2$ R	$2s2p\ ^3P_1 - 2p^2\ ^3P_2$ R[1]	$2s2p\ ^3P_2 - 2p^2\ ^3P_2$ R	$2s2p\ ^3P_2 - 2p^2\ ^3P_2$ R[1]
128	2.02-10	2.31-10	3.07-10	3.48-10	5.71-10	6.54-10
64	5.35-10	6.15-10	8.58-10	9.66-10	1.56-09	1.77-09
32	7.53-10	8.57-10	1.23-09	1.38-09	2.23-09	2.50-09
16	7.77-10	8.82-10	1.29-09	1.44-09	2.30-09	2.59-09
8	7.03-10	7.90-10	1.16-09	1.30-09	2.08-09	2.23-09
4	6.09-10	6.71-10	1.01-09	1.10-09	1.82-09	1.98-09
2	5.21-10	5.57-10	8.66-10	9.17-10	1.56-09	1.64-09
1	4.39-10	4.57-10	7.30-10	7.54-10	1.31-09	1.35-09
0.5	3.60-10	3.71-10	6.01-10	6.12-10	1.08-09	1.10-09
0.25	2.91-10	2.97-10	4.84-10	4.91-10	8.69-10	8.80-10

β	$2s2p\ ^3P_2 - 2p^2\ ^3P_o$ R	$2s2p\ ^3P_2 - 2p^2\ ^3P_o$ R[1]	$2s2p\ ^3P_o - 2p^2\ ^3P_2$ R	$2s2p\ ^3P_o - 2p^2\ ^3P_2$ R[1]	T(ev)
128	1.19-12	1.14-12	6.64-12	6.85-12	12.9
64	3.02-12	2.81-12	1.82-11	1.62-11	25.7
32	3.94-12	3.58-12	2.46-11	2.40-11	51.4
16	3.54-12	3.16-12	2.25-11	2.15-11	103
8	2.54-12	2.24-12	1.63-11	1.54-11	206
4	1.53-12	1.36-12	9.90-12	9.29-12	411
2	8.06-13	7.21-13	5.21-12	4.94-12	823
1	3.76-13	3.45-13	2.43-12	2.36-12	1650
0.5	1.61-13	1.51-13	1.04-12	1.03-12	3290
0.25	6.47-14	6.20-14	4.20-13	4.23-13	6580

Table 4b (continued)

β	$2s2p\ ^1P_1 - 2p^2\ ^3P_0$ R	$2s2p\ ^1P_1 - 2p^2\ ^3P_0$ R[1]	$2s2p\ ^1P_1 - 2p^2\ ^3P_1$ R	$2s2p\ ^1P_1 - 2p^2\ ^3P_1$ R[1]	$2s2p\ ^1P_1 - 2p^2\ ^3P_2$ R	$2s2p\ ^1P_1 - 2p^2\ ^3P_2$ R[1]
128	1.27-11	1.25-11	3.13-11	3.16-11	8.42-11	8.67-11
64	1.57-11	1.54-11	3.89-11	3.83-11	1.07-10	1.12-10
32	1.42-11	1.43-11	3.54-11	3.41-11	1.01-10	1.07-10
16	1.10-11	1.13-11	2.67-11	2.54-11	8.10-11	8.67-11
8	7.69-12	8.08-12	1.76-11	1.66-11	6.09-11	6.48-11
4	5.04-12	5.47-12	1.03-11	9.82-12	4.42-11	4.46-11
2	3.10-12	3.64-12	5.42-12	5.31-12	3.18-11	3.32-11
1	2.05-12	2.40-12	2.66-12	2.71-12	2.32-11	2.41-11
0.5	1.36-12	1.65-12	1.24-12	1.36-12	1.71-11	1.78-11
0.25	9.45-13	1.18-12	5.95-13	7.06-13	1.29-11	1.33-11

β	$2s2p\ ^1P_1 - 2p^2\ ^1D_2$ R	$2s2p\ ^1P_1 - 2p^2\ ^1D_2$ R[1]	$2s2p\ ^3P_2 - 2p^2\ ^1D_2$ R	$2s2p\ ^3P_2 - 2p^2\ ^1D_2$ R[1]	$2s2p\ ^3P_1 - 2p^2\ ^1D_2$ R	$2s2p\ ^3P_1 - 2p^2\ ^1D_2$ R[1]
128	4.14-09	4.44-09	1.07-11	1.04-11	7.07-12	6.83-12
64	6.73-09	7.24-09	3.51-11	3.42-11	2.38-11	2.33-11
32	7.33-09	8.01-09	5.24-11	5.15-11	3.41-11	3.25-11
16	6.65-09	7.37-09	5.20-11	5.15-11	3.44-11	3.09-11
8	5.76-09	6.29-09	4.10-11	4.12-11	2.43-11	2.28-11
4	4.96-09	5.22-09	2.87-11	2.95-11	1.61-11	1.42-11
2	4.22-09	4.28-09	1.91-11	2.01-11	8.95-12	7.81-12
1	3.51-09	3.47-09	1.28-11	1.38-11	4.60-12	3.97-12
0.5	2.85-09	2.79-09	8.97-12	9.76-12	2.33-12	1.95-12
0.25	2.27-09	2.21-09	6.57-12	7.11-12	1.24-12	9.88-13

β	$2s2p\ ^1P_1 - 2p^2\ ^1S_0$ R	$2s2p\ ^1P_1 - 2p^2\ ^1S_0$ R[1]	$2s2p\ ^3P_2 - 2p^2\ ^1S_0$ R	$2s2p\ ^3P_2 - 2p^2\ ^1S_0$ R[1]	$2s2p\ ^3P_0 - 2p^2\ ^1D_2$ R	$2s2p\ ^3P_0 - 2p^2\ ^1D_2$ R[1]
128	4.86-10	4.96-10	1.84-13	3.50-13	6.25-12	6.15-12
64	1.36-09	1.38-09	1.04-12	1.91-12	2.13-11	2.02-11
32	1.97-09	1.97-09	2.00-12	3.60-12	3.19-11	2.95-11
16	2.06-09	2.05-09	2.19-12	3.84-12	3.08-11	2.79-11
8	1.88-09	1.85-09	1.71-12	2.97-12	2.27-11	2.04-11
4	1.64-09	1.58-09	1.07-12	1.86-12	1.40-11	1.25-11
2	1.41-09	1.32-09	5.73-13	9.95-13	7.39-12	6.66-12
1	1.19-09	1.09-09	2.70-13	4.74-13	3.47-12	3.18-12
0.5	9.85-10	8.88-10	1.16-13	2.07-13	1.48-12	1.39-12
0.25	7.93-10	7.14-10	4.68-14	8.41-14	5.96-13	3.58-13

Table 5a. Cross sections of excitations for FeXXIII ($2s^2$-2s2p-$2p^2$)

u	E(ev)	σ(cm²) pres.calc.	σ(cm²) [1]	E(ev)	σ(cm²) pres.calc.	σ(cm²) [1]
		$2s^2\ ^1S_o$ - $2s2p\ ^3P_o$			$2s^2\ ^1S_o$ - $2s2p\ ^3P_1$	
6.25-4	47.7	3.52-20	3.17-20	51.5	2.45-19	2.37-19
1.25-3	52.2	3.21-20	2.89-20	56.0	2.29-19	2.24-19
2.50-3	61.2	2.72-20	2.45-20	65.0	1.99-19	2.02-19
5.00-3	79.2	2.09-20	1.87-20	83.0	1.52-19	1.68-19
0.01	115	1.41-20	1.26-20	119	9.95-20	1.27-19
0.02	187	8.37-21	7.38-21	191	5.83-20	8.45-20
0.04	331	4.39-21	3.81-21	335	3.46-20	5.09-20
0.08	619	2.01-21	1.72-21	623	2.09-20	2.88-20
0.16	1.19+3	7.72-22	6.63-22	1.20+3	1.25-20	1.59-20
0.32	2.35+3	2.19-22	2.07-22	2.35+3	6.82-21	8.82-21
0.64	4.65+3	5.19-23	5.07-23	4.65+3	3.77-21	4.87-21
1.28	9.25+3	8.44-24	9.89-24	9.26+3	2.08-21	2.68-21
2.56	1.85+4	9.88-25	1.61-24	1.85+4	1.14-21	1.47-21
5.12	3.69+4	2.18-25	2.33-25	3.69+4	6.22-22	8.01-22
10.24	7.37+4	2.87-26	3.15-26	7.37+4	3.32-22	4.33-22
		$2s^2\ ^1S_o$ - $2s2p\ ^3P_2$			$2s^2\ ^1S_o$ - $2s2p\ ^1P_1$	
6.25-4	63.1	1.27-19	1.17-19	97.8	3.58-18	3.75-18
1.25-3	67.6	1.18-19	1.09-19	102	3.47-18	3.61-18
2.50-3	76.6	1.04-19	9.57-20	111	3.19-18	3.37-18
5.00-3	94.5	8.33-20	7.65-20	129	2.73-18	2.97-18
0.01	131	5.91-20	5.41-20	165	2.20-18	2.40-18
0.02	202	3.68-20	3.32-20	237	1.60-18	1.74-18
0.04	346	1.99-20	1.77-20	381	9.64-19	1.14-18
0.08	634	9.32-21	8.11-21	669	5.73-19	7.01-19
0.16	1.21+3	3.62-21	3.12-21	1.24+3	3.72-19	4.23-19
0.32	2.36+3	1.09-21	9.67-22	2.40+3	2.40-19	2.53-19
0.64	4.66+3	2.44-22	2.34-22	4.70+3	1.47-19	1.49-19
1.28	9.27+3	3.96-23	4.52-23	9.30+3	8.57-20	8.56-20
2.56	1.85+4	4.68-24	7.29-24	1.85+4	4.83-20	4.82-20
5.12	3.69+4	1.03-24	1.05-24	3.69+4	2.68-20	2.68-20
10.24	7.37+4	1.36-25	1.41-25	7.38+4	1.45-20	1.47-20

Table 5a (continued)

E(ev)	σ(cm^2) pres.calc.	[1]	E(ev)	σ(cm^2) pres.calc.	[1]	E(ev)	σ(cm^2) pres.calc.	[1]
	$2s2p\ ^3P_1 - 2p^2\ ^3P_0$			$2s2p\ ^3P_0 - 2p^2\ ^3P_1$			$2s2p\ ^3P_1 - 2p^2\ ^3P_1$	
75.9	7.67-19	7.75-19	88.5	1.84-18	1.88-18	84.7	4.91-19	4.81-19
80.4	7.45-19	7.40-19	93.0	1.80-18	1.81-18	89.2	4.78-19	4.64-19
89.4	6.67-19	6.79-19	102	1.63-18	1.68-18	98.2	4.45-19	4.30-19
107	5.69-19	5.83-19	120	1.40-18	1.46-18	116	3.81-19	3.71-19
143	4.32-19	4.56-19	156	1.12-18	1.17-18	152	3.00-19	2.98-19
215	2.73-19	3.19-19	228	7.67-19	8.38-19	224	2.00-19	2.19-19
359	1.56-19	2.03-19	372	4.47-19	5.42-19	368	1.15-19	1.37-19
647	9.81-20	1.22-19	660	2.71-19	3.30-19	656	6.98-20	8.31-20
1220	6.49-20	7.28-20	1230	1.77-19	1.98-19	1230	4.51-20	4.95-20
2370	4.13-20	4.32-20	2390	1.14-19	1.18-19	2380	2.84-20	2.93-20
4680	2.48-20	2.52-20	4690	6.92-20	6.94-20	4690	1.72-20	1.71-20
9280	1.43-20	1.44-20	9290	4.03-20	3.98-20	9290	9.92-21	9.78-21
185+2	7.99-21	8.05-21	185+2	2.26-20	2.24-20	185+2	5.55-21	5.49-21
369+2	4.41-21	4.44-21	369+2	1.25-20	1.24-20	369+2	3.08-21	3.04-21
737+2	2.30-21	2.43-21	737+2	6.71-21	6.81-21	737+2	1.65-21	1.66-21
	$2s2p\ ^3P_2 - 2p^2\ ^3P_1$			$2s2p\ ^3P_1 - 2p^2\ ^3P_2$			$2s2p\ ^3P_2 - 2p^2\ ^3P_2$	
73.2	5.97-19	5.87-19	90.2	7.85-19	8.08-19	78.7	1.20-18	1.16-18
77.7	5.75-19	5.59-19	94.7	7.70-19	7.77-19	83.2	1.16-18	1.11-18
86.7	5.15-19	5.12-19	104	6.99-19	7.22-19	92.2	1.04-18	1.02-18
105	4.37-19	4.38-19	122	5.98-19	6.33-19	110	8.93-19	8.85-19
141	3.27-19	3.41-19	169	4.80-19	5.08-19	146	6.88-19	6.99-19
213	2.03-19	2.37-19	230	3.31-19	3.66-19	218	4.42-19	4.92-19
357	1.15-19	1.50-19	374	1.94-19	2.37-19	362	2.53-19	3.14-19
644	7.36-20	9.03-20	661	1.17-19	1.45-19	650	1.57-19	1.89-19
1220	4.86-20	5.38-20	1240	7.60-20	8.64-20	1230	1.04-19	1.12-19
2370	3.08-20	3.18-20	2390	4.83-20	5.14-20	2380	6.60-20	6.66-20
4670	1.85-20	1.85-20	4690	2.94-20	3.01-20	4680	3.99-20	3.90-20
9280	1.07-20	1.05-20	9290	1.71-20	1.73-20	9280	2.31-20	2.23-20
185+2	5.93-21	5.89-21	185+2	9.61-21	9.71-21	185+2	1.29-20	1.25-20
369+2	3.27-21	3.25-21	369+2	5.30-21	5.38-21	369+2	7.10-21	6.93-21
737+2	1,75-21	1.77-21	737+2	2.85-21	2.95-21	737+2	3.81-21	3.79-21

Table 5a (continued)

E(ev)	$\sigma(cm^2)$ pres.calc.	[1]	E(ev)	$\sigma(cm^2)$ pres.calc.	[1]	E(ev)	$\sigma(cm^2)$ pres.calc.	[1]
	$2s2p\ ^3P_o - 2p^2\ ^3P_o$			$2s2p\ ^3P_o - 2p^2\ ^3P_2$			$2s2p\ ^3P_2 - 2p^2\ ^3P_o$	
79.7	1.25-20	1.34-20	94.0	3.06-20	3.05-20	64.4	2.32-21	1.85-21
84.2	1.18-20	1.26-20	98.6	2.90-20	2.91-20	68.9	2.17-21	1.72-21
93.2	1.06-20	1.13-20	108	2.65-20	2.65-20	77.8	1.91-21	1.51-21
111	8.82-21	9.40-21	126	2.26-20	2.24-20	95.8	1.51-21	1.22-21
147	6.52-21	6.93-21	162	1.72-20	1.70-20	132	1.10-21	8.64-22
219	4.22-21	4.43-21	234	1.14-20	1.12-20	204	6.84-22	5.53-22
363	2.36-21	2.43-21	377	6.52-21	6.29-21	348	3.70-22	2.87-22
651	1.12-21	1.14-21	665	3.16-21	2.99-21	635	1.73-22	1.34-22
1230	4.41-22	4.34-22	1240	1.24-21	1.17-21	1210	6.67-23	5.25-23
2380	1.34-22	1.38-22	2390	3.80-22	3.65-22	2360	2.01-23	1.67-23
4680	3.01-23	3.35-23	4690	8.56-23	8.86-23	4660	4.50-24	4.16-24
9280	4.91-24	6.45-24	9300	1.40-23	1.71-23	9270	7.30-25	8.21-25
185+2	5.75-25	1.04-24	185+2	1.65-24	2.75-24	185+2	8.56-26	1.35-25
369+2	1.28-25	1.50-25	369+2	3.66-25	3.95-25	369+2	1.90-26	1.96-26
737+5	1.68-26	2.02-26	738+2	4.83-26	5.32-26	737+2	2.50-27	2.66-27
	$2s2p\ ^1P_1 - 2p^2\ ^3P_o$			$2s2p\ ^1P_1 - 2p^2\ ^3P_1$			$2s2p\ ^1P_1 - 2p^2\ ^3P_2$	
30.3	8.27-20	1.05-19	39.1	5.92-20	5.06-20	44.6	1.32-18	1.36-18
34.8	7.28-20	9.41-20	43.6	5.37-20	4.67-20	49.1	1.24-18	1.26-18
43.8	5.06-20	7.86-20	52.6	4.29-20	4.06-20	58.1	1.03-18	1.10-18
61.7	3.37-20	5.94-20	70.6	2.92-20	3.25-20	76.1	7.24-19	8.82-19
97.7	2.24-20	4.02-20	107	1.93-20	2.35-20	112	4.48-19	6.32-19
170	1.55-20	2.47-20	179	1.16-20	1.52-20	184	2.70-19	4.07-19
314	1.07-20	1.42-20	322	6.89-21	8.94-21	328	1.81-19	2.45-19
601	7.01-21	8.06-21	610	3.96-21	4.88-21	616	1.23-19	1.44-19
1180	4.31-21	4.61-21	1190	2.16-21	2.58-21	1190	8.01-20	8.45-20
2330	2.52-21	2.65-21	2340	1.14-21	1.38-21	2340	4.86-20	4.92-20
4630	1.43-21	1.50-21	4640	6.01-22	7.29-22	4640	2.84-20	2.81-20
9240	7.94-22	8.38-22	9240	3.23-22	3.93-22	9250	1.60-20	1.58-20
184+2	4.34-22	4.60-22	184+2	1.75-22	2.13-22	184+2	8.80-21	8.70-21
369+2	2.34-22	2.49-22	369+2	9.47-23	1.15-22	369+2	4.79-21	4.75-21
737+2	1.24-22	1.34-22	737+2	5.04-23	6.18-23	737+2	2.55-21	2.57-21

Table 5a (continued)

E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]
$2s2p\ ^1P_1 - 2p^2\ ^1D_2$			$2s2p\ ^3P_2 - 2p^2\ ^1D_2$			$2s2p\ ^3P_1 - 2p^2\ ^1D_2$		
61.1	3.91-18	3.68-18	95.2	3.67-19	3.75-19	107	5.34-20	3.33-20
65.6	3.71-18	3.48-18	99.7	3.61-19	3.62-19	111	4.27-20	3.23-20
74.6	3.32-18	3.13-18	109	3.30-19	3.38-19	120	3.97-20	3.05-20
92.6	2.68-18	2.62-18	127	2.82-19	2.98-19	138	3.43-20	2.74-20
129	1.83-18	1.98-18	163	2.28-19	2.42-19	174	2.78-20	2.29-20
201	1.06-18	1.34-18	235	1.62-19	1.76-19	246	2.03-20	1.72-20
344	6.34-19	8.33-19	379	9.58-20	1.15-19	390	1.26-20	1.16-20
632	4.25-19	4.97-19	666	5.65-20	6.99-20	678	7.14-21	7.11-21
1210	2.81-19	2.96-19	1240	3.60-20	4.13-20	1250	4.32-21	4.10-21
2360	1.76-19	1.75-19	2390	2.27-20	2.44-20	2400	2.52-21	2.33-21
4660	1.05-19	1.01-19	4770	1.38-20	1.42-20	4710	1.55-21	1.33-21
9270	5.97-20	5.72-20	9300	8.00-21	8.15-21	9310	9.07-22	7.62-22
185+2	3.32-20	3.19-20	185+2	4.51-21	4.59-21	185+2	5.13-22	4.30-22
369+2	1.82-20	1.75-20	369+2	2.49-21	2.54-21	369+2	2.85-22	2.40-22
737+2	9.73-21	9.53-21	738+2	1.34-21	1.40-21	738+2	1.54-22	1.50-22
$2s2p\ ^1P_1 - 2p^2\ ^1S_o$			$2s2p\ ^3P_2 - 2p^2\ ^1S_o$			$2s2p\ ^3P_o - 2p^2\ ^1D_2$		
88.2	1.11-18	1.04-18	122	2.39-21	3.48-21	111	5.02-21	4.51-21
92.7	1.08-18	9.94-19	127	2.30-21	3.35-21	115	4.81-21	4.32-21
102	9.78-19	9.22-19	136	2.14-21	3.11-21	124	4.45-21	3.98-21
120	8.38-19	8.05-19	154	1.86-21	2.71-21	142	3.94-21	3.43-21
156	6.69-19	6.43-19	190	1.48-21	2.14-21	178	3.02-21	2.67-21
228	4.56-19	4.60-19	262	1.03-21	1.47-21	250	2.06-21	1.81-21
371	2.65-19	2.97-19	406	6.11-22	8.58-22	394	1.20-21	1.04-21
659	1.60-19	1.81-19	693	3.02-22	4.17-22	682	5.93-22	5.03-22
1240	1.06-19	1.09-19	1270	1.20-22	1.64-22	1260	2.36-22	1.99-22
2390	6.77-20	6.50-20	2420	3.66-23	5.08-23	2410	7.20-23	6.20-23
4690	4.11-20	3.82-20	4720	8.22-24	1.21-23	4710	1.63-23	1.50-23
9290	2.39-20	2.20-20	9330	1.34-24	2.30-24	9320	2.66-24	2.88-24
185+2	1.34-20	1.24-20	185+2	1.58-25	3.68-25	185+2	3.12-25	4.63-25
369+2	7.42-21	6.86-21	370+2	3.58-26	5.25-26	369+2	7.03-26	6.65-26
738+2	4.02-21	3.76-21	739+2	4.72-27	7.04-27	738+2	9.24-27	8.94-27

Table 5b. Excitation rate coefficients (R) for FeXXIII ($2s^2-2s2p-2p^2$) in units cm^3s^{-1}

β	T(ev)	T(10^6K)	R	R[1]	R	R[1]
			$2s^2\ ^1S_o-2s2p\ ^3P_o$		$2s^2\ ^1S_o-2s2p\ ^3P_1$	
128	56.2	0.653	6.51-12	6.06-12	4.56-11	5.47-11
64	112	1.31	6.72-12	6.08-12	4.89-11	6.24-11
32	225	2.61	5.50-12	4.90-12	4.31-11	5.77-11
16	450	5.22	3.88-12	3.42-12	3.53-11	4.81-11
8	899	10.4	2.43-12	2.14-12	2.84-11	3.81-11
4	1800	20.9	1.36-12	1.20-12	2.24-11	2.97-11
2	3600	41.8	6.83-13	6.12-13	1.76-11	2.30-11
1	7190	83.6	3.09-13	2.84-13	1.37-11	1.78-11
0.5	144+2	167	1.30-13	1.22-13	1.06-11	1.38-11
0.25	288+2	334	5.16-14	4.94-14	8.20-11	1.06-11

β	R	R[1]	R	R[1]	R	R[1]
	$2s^2\ ^1S_o-2s2p\ ^3P_2$		$2s^2\ ^1S_o-2s2p\ ^1P_1$		$2s2p\ ^3P_o-2p^2\ ^3P_o$	
128	2.36-11	2.25-11	5.86-10	6.62-10	2.17-12	2.42-12
64	2.79-11	2.59-11	9.89-10	1.10-09	2.98-12	3.20-12
32	2.49-11	2.22-11	1.08-09	1.23-09	2.82-12	2.98-12
16	1.79-11	1.60-11	9.91-10	1.14-09	2.13-12	2.23-12
8	1.14-11	1.01-11	8.63-10	9.80-10	1.38-12	1.44-12
4	6.41-12	5.72-12	7.42-10	8.15-10	7.85-12	8.17-12
2	3.22-12	2.91-12	6.32-10	6.69-10	3.97-12	4.17-12
1	1.46-12	1.35-12	5.28-10	5.43-10	1.80-13	1.93-13
0.5	6.15-12	5.77-12	4.29-10	4.36-10	7.59-14	8.28-14
0.25	2.44-12	2.33-12	3.42-10	3.45-10	3.01-14	3.34-14

Table 5b (continued)

β	$2s2p\ ^3P_1 - 2p^2\ ^3P_o$ R	R[1]	$2s2p\ ^3P_o - 2p^2\ ^3P_1$ R	R[1]	$2s2p\ ^3P_1 - 2p^2\ ^3P_1$ R	R[1]
128	1.46-10	1.59-10	3.37-10	3.56-10	8.89-11	9.43-11
64	1.97-10	2.21-10	5.04-10	5.51-10	1.31-10	1.42-10
32	1.93-10	2.26-10	5.26-10	5.94-10	1.35-10	1.51-10
16	1.70-10	2.01-10	4.79-10	5.41-10	1.20-10	1.36-10
8	1.58-10	1.69-10	4.08-10	4.60-10	1.02-10	1.15-10
4	1.28-10	1.39-10	3.51-10	3.81-10	8.76-11	9.48-11
2	1.07-10	1.13-10	2.97-10	3.12-10	7.40-11	7.72-11
1	8.87-11	9.15-11	2.48-10	2.53-10	6.09-11	6.24-11
0.5	7.20-11	7.30-11	2.01-10	2.03-10	4.95-11	4.98-11
0.25	5.70-11	5.76-11	1.61-10	1.60-10	3.92-11	3.94-11

β	$2s2p\ ^3P_2 - 2p^2\ ^3P_1$ R	R[1]	$2s2p\ ^3P_1 - 2p^2\ ^3P_2$ R	R[1]	$2s2p\ ^3P_2 - 2p^2\ ^3P_2$ R	R[1]
128	1.14-10	1.22-10	1.38-10	1.51-10	2.25-10	2.35-10
64	1.51-10	1.66-10	2.16-10	2.38-10	3.12-10	3.35-10
32	1.45-10	1.68-10	2.27-10	2.59-10	3.12-10	3.48-10
16	1.29-10	1.49-10	2.04-10	2.36-10	2.73-10	3.10-10
8	1.09-10	1.25-10	1.75-10	2.01-10	2.36-10	2.61-10
4	9.40-11	1.02-10	1.50-10	1.66-10	2.03-10	2.15-10
2	7.97-11	8.34-11	1.27-10	1.36-10	1.72-10	1.75-10
1	6.57-11	6.72-11	1.05-10	1.10-10	1.42-10	1.42-10
0.5	5.32-11	5.35-11	8.53-11	8.79-11	1.15-10	1.13-10
0.25	4.20-11	4.22-11	6.77-11	6.95-11	9.12-11	8.96-11

β	$2s2p\ ^3P_2 - 2p^2\ ^3P_o$ R	R[1]	$2s2p\ ^3P_o - 2p^2\ ^3P_2$ R	R[1]	T(ev)
128	4.31-13	3.54-13	4.88-12	5.03-12	56.2
64	5.15-13	4.13-13	7.60-12	7.62-12	112
32	4.54-13	3.59-13	7.65-12	7.52-12	225
16	2.91-13	2.61-13	5.99-12	5.80-12	450
8	2.11-13	1.67-13	3.93-12	3.79-12	899
4	1.19-13	9.52-14	2.25-12	2.17-12	1800
2	5.96-14	4.89-14	1.14-12	1.11-12	3600
1	2.70-14	2.29-14	5.20-13	5.15-13	7190
0.5	1.14-14	9.87-15	2.18-13	2.21-13	144+2
0.25	4.50-15	4.01-15	8.66-14	8.90-14	288+2

Table 5b (continued)

β	$2s2p\ ^1P_1-2p^2\ ^3P_0$ R	$2s2p\ ^1P_1-2p^2\ ^3P_0$ R[1]	$2s2p\ ^1P_1-2p^2\ ^3P_1$ R	$2s2p\ ^1P_1-2p^2\ ^3P_1$ R[1]	$2s2p\ ^1P_1-2p^2\ ^3P_2$ R	$2s2p\ ^1P_1-2p^2\ ^3P_2$ R[1]
128	1.25-11	2.08-11	1.01-11	1.12-11	2.32-10	2.96-10
64	1.24-11	1.97-11	9.80-12	1.16-11	2.36-10	3.15-10
32	1.16-11	1.67-11	8.31-12	1.02-11	2.15-10	2.84-10
16	1.05-11	1.35-11	6.63-12	8.18-12	1.93-10	2.38-10
8	9.08-12	1.08-11	5.13-12	6.28-12	1.70-10	1.95-10
4	7.71-12	8.61-12	3.89-12	4.74-12	1.46-10	1.58-10
2	6.32-12	6.85-12	2.94-12	3.56-12	1.23-10	1.27-10
1	5.06-12	5.41-12	2.21-12	2.68-12	1.00-10	1.01-10
0.5	3.98-12	4.24-12	1.66-12	2.03-12	7.98-11	7.98-11
0.25	3.08-12	3.28-12	1.27-12	1.55-12	6.25-12	6.22-12

β	$2s2p\ ^1P_1-2p^2\ ^1D_2$ R	$2s2p\ ^1P_1-2p^2\ ^1D_2$ R[1]	$2s2p\ ^3P_2-2p^2\ ^1D_2$ R	$2s2p\ ^3P_2-2p^2\ ^1D_2$ R[1]	$2s2p\ ^3P_1-2p^2\ ^1D_2$ R	$2s2p\ ^3P_1-2p^2\ ^1D_2$ R[1]
128	7.53-10	8.00-10	6.23-11	6.79-11	6.69-12	5.58-12
64	8.73-10	9.81-10	1.02-10	1.12-10	1.21-11	1.03-11
32	7.46-10	9.16-10	1.10-10	1.24-10	1.38-11	1.21-11
16	7.09-10	8.20-10	9.86-11	1.14-10	1.25-11	1.14-11
8	6.17-10	6.83-10	8.45-11	9.67-11	1.04-11	9.63-12
4	5.33-10	5.80-10	7.16-11	7.95-11	8.63-12	7.80-12
2	4.51-10	4.54-10	6.02-11	6.48-11	7.06-12	6.22-12
1	3.71-10	3.65-10	4.97-11	5.21-11	5.77-12	4.96-12
0.5	2.99-10	2.90-10	4.02-11	4.16-11	4.64-12	3.93-12
0.25	2.35-10	2.28-10	3.19-11	3.29-11	3.67-12	3.10-12

β	$2s2p\ ^1P_1-2p^2\ ^1S_0$ R	$2s2p\ ^1P_1-2p^2\ ^1S_0$ R[1]	$2s2p\ ^3P_2-2p^2\ ^1S_0$ R	$2s2p\ ^3P_2-2p^2\ ^1S_0$ R[1]	$2s2p\ ^3P_0-2p^2\ ^1D_2$ R	$2s2p\ ^3P_0-2p^2\ ^1D_2$ R[1]
128	2.00-10	1.96-10	2.99-13	4.51-13	7.02-13	6.53-13
64	2.71-10	3.03-10	5.98-13	8.75-13	1.27-12	1.14-12
32	3.18-10	3.26-10	6.81-13	9.76-13	1.37-12	1.21-12
16	2.84-10	2.97-10	4.35-13	7.98-13	1.11-12	9.66-13
8	2.45-10	2.52-10	3.82-13	5.34-13	7.40-13	6.42-13
4	2.11-10	2.09-10	2.20-13	3.09-13	4.27-13	3.70-13
2	1.83-10	1.72-10	1.12-13	1.58-13	2.17-13	1.90-13
1	1.49-10	1.39-10	5.09-14	7.31-14	9.89-14	8.82-14
0.5	1.21-10	1.12-10	2.14-14	3.12-14	4.17-14	3.78-14
0.25	9.60-11	8.86-11	8.50-15	1.26-14	1.65-14	1.52-14

Table 6a. Cross sections of excitations for MoXXX1X ($2s^2$-2s2p-$2p^2$)

u	E(ev)	σ(cm^2) pres.calc.	[1]	E(ev)	σ(cm^2) pres.calc.	[1]
	$2s^2\ ^1S_0$ - 2s2p $^3P_0$			$2s^2\ ^1S_0$ - 2s2p $^3P_1$		
6.25-4	87.9	7.02-21	6.45-21	103	1.80-19	2.24-19
1.25-3	101	6.10-21	5.61-21	116	1.65-19	2.05-19
2.50-3	127	4.83-21	4.43-21	141	1.22-19	1.74-19
5.00-3	178	3.39-21	3.11-21	193	8.27-20	1.34-19
0.01	282	2.10-21	1.92-21	297	5.19-20	9.32-20
0.02	489	1.16-21	1.06-21	503	3.40-20	5.85-20
0.04	902	5.75-22	5.22-22	917	2.36-20	3.46-20
0.08	1.73+3	2.53-22	2.29-22	1.74+3	1.59-20	2.01-20
0.16	3.38+3	9.31-23	8.62-23	3.40+3	1.01-20	1.17-20
0.32	6.69+3	2.72-23	2.65-23	6.71+3	5.92-21	6.75-21
0.64	1.33+4	5.95-24	6.40-24	1.33+4	3.41-21	3.81-21
1.28	2.66+4	9.55-25	1.23-24	2.66+4	1.91-21	2.12-21
2.56	5.30+4	1.11-25	1.99-25	5.30+4	1.04-21	1.17-21
5.12	1.06+5	2.50-26	2.87-26	1.06+5	5.65-22	6.33-22
10.24	2.12+5	3.30-27	3.87-27	2.12+5	3.00-22	3.41-22
	$2s^2\ ^1S_0$ - 2s2p $^3P_2$			$2s^2\ ^1S_0$ - 2s2p $^1P_1$		
6.25-4	211	1.28-20	1.21-20	261	4.74-19	4.79-19
1.25-3	224	1.20-20	1.14-20	274	4.65-19	4.61-19
2.50-3	249	1.07-20	1.01-20	300	4.22-19	4.28-19
5.00-3	301	8.71-21	8.27-21	352	3.60-19	3.74-19
0.01	405	6.40-21	6.00-21	455	2.90-19	3.00-19
0.02	611	4.06-21	3.77-21	662	2.01-19	2.15-19
0.04	1.03+3	2.21-21	2.04-21	1.08+3	1.18-19	1.40-19
0.08	1.85+3	1.03-21	9.41-22	1.90+3	7.11-20	8.55-20
0.16	3.51+3	3.92-22	3.60-22	3.56+3	4.64-20	5.14-20
0.32	6.92+3	1.16-22	1.10-22	6.87+3	2.99-20	3.07-20
0.64	1.34+4	2.56-23	2.63-23	1.35+4	1.82-20	1.81-20
1.28	2.67+4	4.13-24	4.99-24	2.67+4	1.06-20	1.04-20
2.56	5.32+4	4.86-25	7.98-25	5.32+4	5.94-21	5.83-21
5.12	1.06+5	1.10-25	1.14-25	1.06+5	3.29-21	3.24-21
10.24	2.12+5	1.45-26	1.53-26	2.12+5	1.78-21	1.77-21

Table 6a (continued)

E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]
$2s2p\ ^3P_1 - 2p^2\ ^3P_0$			$2s2p\ ^3P_0 - 2p^2\ ^3P_1$			$2s2p\ ^3P_1 - 2p^2\ ^3P_1$		
139	1.70-19	1.83-19	254	2.29-19	2.32-19	242	5.49-20	5.23-20
152	1.61-19	1.71-19	270	2.25-19	2.23-19	255	5.34-20	5.02-20
178	1.38-19	1.51-19	298	2.04-19	2.07-19	281	4.80-20	4.64-20
230	1.02-19	1.22-19	347	1.74-19	1.81-19	332	4.10-20	4.04-20
333	6.38-20	8.83-20	451	1.39-19	1.44-19	436	3.23-20	3.22-20
540	3.72-20	5.75-20	658	9.56-20	1.04-19	642	2.14-20	2.29-20
954	2.43-20	3.47-20	1070	5.59-20	6.70-20	1056	1.23-20	1.48-20
1780	1.57-20	2.04-20	1900	3.37-20	4.09-20	1880	7.50-21	8.95-21
3440	1.02-20	1.20-20	3550	2.21-20	2.46-20	3540	4.88-21	5.32-21
6750	6.73-21	7.05-21	6860	1.42-20	1.47-20	6850	3.10-21	3.15-21
13400	3.96-21	4.06-21	13500	8.65-21	8.63-21	13500	1.87-21	1.84-21
26600	2.24-21	2.28-21	26700	5.02-21	4.95-21	26700	1.08-21	1.05-21
53000	1.24-21	1.26-21	53200	2.81-21	2.79-21	53200	6.06-22	5.90-22
106+2	6.73-22	6.91-22	106+2	1.56-21	1.55-21	106+2	3.34-22	3.26-22
212+2	3.59-22	3.75-22	212+2	8.42-22	8.48-22	212+2	1.80-22	1.79-22
$2s2p\ ^3P_2 - 2p^2\ ^3P_1$			$2s2p\ ^3P_1 - 2p^2\ ^3P_2$			$2s2p\ ^3P_2 - 2p^2\ ^3P_2$		
134	1.15-19	1.21-19	254	1.41-19	1.45-19	146	1.34-19	1.38-19
147	1.08-19	1.12-19	267	1.38-19	1.40-19	159	1.26-19	1.29-19
173	9.16-20	9.86-20	293	1.25-19	1.29-19	185	1.10-19	1.15-19
224	6.63-20	7.94-20	345	1.06-19	1.13-19	237	8.32-20	9.36-20
328	4.11-20	5.74-20	448	8.49-20	9.05-20	340	5.27-20	6.87-20
535	2.43-20	3.73-20	655	5.80-20	6.48-20	547	3.06-20	4.53-20
948	1.61-20	2.26-20	1070	3.37-20	4.19-20	961	1.94-20	2.76-20
1780	1.10-20	1.33-20	1900	2.04-20	2.55-20	1790	1.32-20	1.63-20
3430	7.17-21	7.87-21	3550	1.32-20	1.53-20	3440	8.71-21	9.65-21
6740	4.41-21	4.60-21	6860	8.47-21	9.10-21	6750	5.35-21	5.65-21
13400	2.59-21	2.64-21	13500	5.14-21	5.33-21	13400	3.15-21	3.25-21
26600	1.46-21	1.48-21	26700	3.00-21	3.06-21	26600	1.79-21	1.83-21
53100	8.06-22	8.19-22	53200	1.67-21	1.72-21	53100	9.89-22	1.01-21
106+2	4.99-22	4.47-22	106+2	9.27-22	9.53-22	106+2	5.38-22	5.54-22
212+2	2.34-22	2.42-22	212+2	5.00-22	5.22-22	212+2	2.87-22	3.01-22

Table 6a (continued)

E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]
$2s2p\ ^3P_o - 2p^2\ ^3P_o$			$2s2p\ ^3P_o - 2p^2\ ^3P_2$			$2s2p\ ^3P_2 - 2p^2\ ^3P_o$		
154	2.31-21	2.58-21	269	4.53-21	4.27-21	31.0	7.86-22	8.42-22
167	2.12-21	2.37-21	282	4.31-21	4.07-21	44.0	5.54-22	5.29-22
193	1.83-21	2.04-21	308	3.92-21	3.72-21	69.8	3.47-22	3.02-22
244	1.42-21	1.53-21	360	3.32-21	3.16-21	122	1.97-22	1.61-22
348	9.80-22	1.09-21	463	2.52-21	2.41-21	225	1.04-22	8.19-23
555	5.89-22	6.53-22	670	1.67-21	1.66-21	432	5.16-23	4.00-23
961	3.09-22	3.40-22	1080	9.38-22	9.08-22	846	2.42-23	1.85-23
1800	1.41-22	1.53-22	1910	4.47-22	4.34-22	1670	1.02-23	7.84-24
3450	5.29-23	5.79-23	3570	1.73-22	1.71-22	3330	3.69-24	2.91-24
8780	1.56-23	1.76-23	6880	5.14-23	5.33-23	6640	1.06-24	8.93-25
134+2	3.44-24	4.21-24	135+2	1.14-23	1.30-23	133+2	2.29-25	2.17-25
266+2	5.55-25	8.01-25	267+2	1.84-24	2.50-24	265+2	3.63-26	4.20-26
531+2	6.45-26	1.28-25	532+2	2.17-25	4.03-25	530+2	4.16-27	6.83-27
106+3	1.46-26	1.84-26	106+3	4.96-26	5.79-25	106+3	9.54-28	9.86-28
212+3	1.92-27	2.47-27	212+3	6.53-27	7.80-27	212+3	1.26-28	1.33-28
$2s2p\ ^1P_1 - 2p^2\ ^3P_o$			$2s2p\ ^1P_1 - 2p^2\ ^3P_1$			$2s2p\ ^1P_1 - 2p^2\ ^3P_2$		
-45.3	1.49-20	1.12-20	83.5	2.77-20	3.63-20	95.8	3.17-19	3.67-19
-58.2	1.45-20	3.39-20	96.4	2.50-20	3.25-20	109	2.86-19	3.33-19
-84.1	1.10-20	2.52-20	122	1.68-20	2.70-20	135	2.03-19	2.81-19
-136	8.98-21	1.68-20	174	1.14-20	2.03-20	186	1.35-19	2.15-19
-239	6.72-21	1.02-20	277	7.59-21	1.36-20	290	8.69-20	1.47-19
-446	4.75-21	5.79-21	484	5.20-21	8.34-21	497	5.94-20	9.11-20
-860	3.12-21	3.24-21	898	3.54-21	4.81-21	910	4.23-20	5.35-20
-1690	2.00-21	1.86-2	1730	2.26-21	2.73-21	1730	2.26-20	2.73-20
-3340	1.15-21	1.08-21	3380	1.39-21	1.56-21	3390	1.82-20	1.83-20
-6650	6.65-22	6.24-22	6690	8.06-22	8.93-22	6700	1.10-20	1.06-20
-133+2	3.71-22	3.51-22	133+2	4.55-22	5.03-22	133+2	6.33-21	6.05-21
-265+2	2.00-22	1.94-22	266+2	2.53-22	2.79-22	266+2	3.54-21	3.37-21
-530+2	1.10-22	1.05-22	530+2	1.38-22	1.53-22	530+2	1.94-21	1.85-21
-106+3	5.87-23	5.65-23	106+3	7.42-23	8.28-23	106+3	1.05-21	1.01-21
-212+2	3.10-23	3.02-23	212+3	3.94-23	4.45-23	212+3	5.57-22	5.43-22

Table 6a (continued)

E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]	E(ev)	σ(cm²) pres.calc.	[1]
$2s2p\ ^1P_1 - 2p^2\ ^1D_2$			$2s2p\ ^3P_2 - 2p^2\ ^1D_2$			$2s2p\ ^3P_1 - 2p^2\ ^1D_2$		
214	2.71-19	2.67-19	264	1.00-19	9.87-20	372	2.56-21	1.69-21
226	2.62-19	2.54-19	277	9.83-20	9.50-20	385	2.50-21	1.65-21
252	2.34-19	2.33-19	303	8.94-20	8.84-20	411	2.37-21	1.56-21
304	1.97-19	2.00-19	354	7.62-20	7.76-20	462	2.08-21	1.62-21
407	1.49-19	1.54-19	458	6.24-20	6.24-20	566	1.69-21	1.20-21
614	9.13-20	1.08-19	665	4.26-20	4.51-20	773	1.26-21	9.14-22
1030	5.30-20	6.86-20	1080	2.50-20	2.93-20	1190	8.53-22	6.26-22
1860	3.36-20	4.13-20	1910	1.50-20	1.79-20	2010	5.07-22	3.93-22
3510	2.23-20	2.46-20	3560	9.69-21	1.09-20	3670	3.21-22	2.38-22
6820	1.41-20	1.46-20	6870	6.18-21	6.35-21	6980	2.08-22	1.43-22
134+2	8.51-21	8.52-21	135+2	3.76-21	3.72-21	136+2	1.29-22	8.45-23
267+2	4.90-21	4.86-21	267+2	2.19-21	2.14-21	268+2	7.67-23	4.92-23
532+2	2.73-21	2.72-21	532+2	1.23-21	1.20-21	533+2	4.35-23	2.80-23
106+3	1.50-21	1.50-21	106+3	6.79-22	6.67-22	106+3	2.42-23	1.57-23
212+3	8.18-22	8.20-22	212+3	3.66-22	3.66-22	212+3	1.31-23	1.01-23
$2s2p\ ^1P_1 - 2p^2\ ^1S_0$			$2s2p\ ^3P_2 - 2p^2\ ^1S_0$			$2s2p\ ^3P_0 - 2p^2\ ^1D_2$		
252	1.07-19	1.04-19	303	5.65-22	6.61-22	387	2.90-23	2.51-23
265	1.05-19	9.95-20	316	5.41-22	6.32-22	400	2.78-23	2.42-23
291	9.49-20	9.22-20	342	4.97-22	5.79-22	426	2.56-23	2.26-23
343	8.09-20	8.04-20	393	4.26-22	4.97-26	477	2.20-23	1.99-23
446	6.47-20	6.41-20	497	3.30-22	3.83-22	581	1.70-23	1.59-23
653	4.40-20	4.58-20	704	2.22-22	2.56-22	788	1.15-23	1.11-23
1070	2.55-20	2.96-20	1120	1.28-22	1.46-22	1200	6.67-24	6.61-24
1890	1.55-20	1.80-20	1940	6.13-23	6.95-23	2030	3.22-24	3.25-24
3550	1.02-20	1.08-20	3600	2,37-23	2.70-23	3680	1.26-24	1.29-24
6860	6.52-21	6.48-21	6910	7.12-24	8.26-24	6990	3.78-25	4.01-25
135+2	3.98-21	3.81-21	135+2	1.58-24	1.96-24	136+2	8.44-26	9.62-26
267+2	2.31-21	2.19-21	268+2	2.57-25	3.70-25	269+2	1.37-26	1 83-26
532+2	1.30-21	1.23-21	532+2	3.01-26	5.89-26	533+2	1.61-27	2.92-27
106+3	7.17-22	6.83-22	106+3	6.92-27	8.40-27	106+3	3.69-28	4.18-28
212+3	3.87-22	3.75-22	212+3	9.12-28	1.12-27	212+3	4.85-29	5.60-29

Table 6b. Excitation rate coefficients (R) for MoXXXIX
($2s^2$ - 2s2p - $2p^2$) in units $cm^3 s^{-1}$

$\bar{\beta}$	T(ev)	T(10^6K)	R	R[1]	R	R[1]
			$2s^2\ ^1S_o$-2s2p ^3P_o		$2s^2\ ^1S_o$-2s2p $^3P_1$	
128	162	1.88	1.91-12	1.81-12	4.89-11	7.92-11
64	323	3.75	1.68-12	1.56-12	4.83-11	7.83-11
32	646	7.51	1.26-12	1.16-12	4.46-11	6.83-11
16	1290	15.0	8.49-13	7.82-12	4.04-11	5.64-11
8	2590	30.0	5.15-13	4.77-12	3.56-11	4.58-11
4	5170	60.1	2.82-13	2.65-12	2.97-11	3.68-11
2	103+2	120	1.39-13	1.34-12	2.52-11	2.94-11
1	207+2	240	6.27-14	6.17-12	2.03-11	2.33-11
0.5	414+2	481	2.61-14	2.64-12	1.61-11	1.82-11
0.25	827+2	961	1.03-14	1.06-14	1.25-11	1.41-11

β	R	R[1]	R	R[1]	R	R[1]
	$2s^2\ ^1S_o$-2s2p $^3P_2$		$2s^2\ ^1S_o$-2s2p $^1P_1$		2s2p ^3P_o-$2p^2\ ^3P_o$	
128	3.89-12	3.81-12	1.42-10	1.51-10	7.29-13	8.51-13
64	5.02-12	4.78-12	2.20-10	2.38-10	7.96-13	8.97-13
32	4.57-12	4.29-12	2.33-10	2.59-10	6.58-13	7.37-13
16	3.38-12	3.15-12	2.11-10	2.37-10	4.66-13	5.18-13
8	2.16-12	2.01-12	1.80-10	2.02-10	2.90-13	3.22-13
4	1.20-12	1.13-12	1.56-10	1.68-10	1.61-13	1.80-13
2	6.01-13	5.72-13	1.33-10	1.38-10	8.01-14	9.05-14
1	2.72-13	2.64-13	1.11-10	1.12-10	3.61-14	4.16-14
0.5	1.14-13	1.13-13	9.01-11	8.94-11	1.51-14	1.77-14
0.25	4.49-14	4.52-14	7.17-11	7.08-11	5.94-15	7.12-15

Table 6b. (continued)

β	$2s2p\ ^3P_1-2p^2\ ^3P_0$ R	$2s2p\ ^3P_1-2p^2\ ^3P_0$ R[1]	$2s2p\ ^3P_0-2p^2\ ^3P_1$ R	$2s2p\ ^3P_0-2p^2\ ^3P_1$ R[1]	$2s2p\ ^3P_1-2p^2\ ^3P_1$ R	$2s2p\ ^3P_1-2p^2\ ^3P_1$ R[1]
128	5.27-11	6.80-11	6.85-11	7.39-11	1.68-11	1.73-11
64	5.51-11	7.46-11	1.06-10	1.15-10	2.47-11	2.59-11
32	5.03-11	6.81-11	1.11-10	1.24-10	2.52-11	2.75-11
16	4.49-11	5.74-11	9.94-11	1.14-10	2.22-11	2.49-11
8	4.15-11	4.71-11	8.04-11	9.67-11	1.91-11	2.10-11
4	3.43-11	3.84-11	7.42-11	8.02-11	1.63-11	1.73-11
2	2.89-11	3.10-11	6.32-11	6.58-11	1.38-11	1.41-11
1	2.37-11	2.48-11	5.26-11	5.33-11	1.14-11	1.14-11
0.5	1.89-11	1.96-11	4.27-11	4.27-11	9.13-12	9.07-12
0.25	1.48-11	1.53-11	3.42-11	3.38-11	7.28-12	7.16-12

β	$2s2p\ ^3P_2-2p^2\ ^3P_1$ R	$2s2p\ ^3P_2-2p^2\ ^3P_1$ R[1]	$2s2p\ ^3P_1-2p^2\ ^3P_2$ R	$2s2p\ ^3P_1-2p^2\ ^3P_2$ R[1]	$2s2p\ ^3P_2-2p^2\ ^3P_2$ R	$2s2p\ ^3P_2-2p^2\ ^3P_2$ R[1]
128	3.49-11	4.48-11	4.22-11	4.66-11	4.20-11	5.17-11
64	3.61-11	4.86-11	6.45-11	7.22-11	4.50-11	5.81-11
32	3.29-11	4.42-11	6.77-11	7.79-11	4.08-11	5.38-11
16	2.95-11	3.73-11	6.04-11	7.09-11	3.59-11	4.58-11
8	2.60-11	3.07-11	5.70-11	6.02-11	3.16-11	3.72-11
4	2.25-11	2.50-11	4.45-11	4.98-11	2.73-11	3.07-11
2	1.89-11	2.02-11	3.78-11	4.07-11	2.31-11	2.48-11
1	1.55-11	1.61-11	3.14-11	3.30-11	1.83-11	1.98-11
0.5	1.24-11	1.27-11	2.54-11	2.64-11	1.51-11	1.57-11
0.25	9.69-12	9.92-12	2.02-11	2.03-11	1.19-11	1.23-11

β	$2s2p\ ^3P_2-2p^2\ ^3P_0$ R	$2s2p\ ^3P_2-2p^2\ ^3P_0$ R[1]	$2s2p\ ^3P_0-2p^2\ ^3P_2$ R	$2s2p\ ^3P_0-2p^2\ ^3P_2$ R[1]	T(ev)
128	1.06-13	8.58-14	1.22-12	1.25-12	162
64	7.86-14	6.30-14	1.89-12	1.89-12	323
32	5.39-14	4.43-14	1.89-12	1.85-12	646
16	3.47-14	2.99-14	1.46-12	1.42-12	1290
8	2.06-14	1.91-14	9.48-13	9.23-13	2590
4	1.11-14	1.14-14	5.36-13	5.26-13	5170
2	5.44-15	6.27-15	2.69-13	2.67-13	103+2
1	2.43-15	3.15-15	1.22-13	1.23-13	207+2
0.5	1.01-15	1.46-15	5.10-14	5.26-14	414+2
0.25	3.99-16	6.24-16	2.02-14	2.11-14	827+2

Table 6b (continued)

β	$2s2p\ ^1P_1 - 2p^2\ ^3P_0$ R	$2s2p\ ^1P_1 - 2p^2\ ^3P_0$ R[1]	$2s2p\ ^1P_1 - 2p^2\ ^3P_1$ R	$2s2p\ ^1P_1 - 2p^2\ ^3P_1$ R[1]	$2s2p\ ^1P_1 - 2p^2\ ^3P_2$ R	$2s2p\ ^1P_1 - 2p^2\ ^3P_2$ R[1]
128	7.89-12	9.78-12	6.91-12	1.21-11	8.25-11	1.27-10
64	6.47-12	8.17-12	6.83-12	1.13-11	8.39-11	1.23-10
32	5.40-12	6.56-12	6.94-12	9.55-12	7.84-11	1.06-10
16	4.86-12	5.24-12	5.70-12	7.73-12	7.19-11	8.76-11
8	4.18-12	4.20-12	4.95-12	6.17-12	6.45-11	7.12-11
4	3.45-12	3.38-12	4.16-12	4.92-12	5.63-11	5.76-11
2	2.80-12	2.69-12	3.41-12	3.90-12	4.65-11	4.63-11
1	2.22-12	2.21-12	2.72-12	3.07-12	3.76-11	3.68-11
0.5	1.72-12	1.65-12	2.14-12	2.39-12	3.00-11	2.89-11
0.25	1.33-12	1.27-12	1.65-12	1.85-12	2.32-11	2.24-11

β	$2s2p\ ^1P_1 - 2p^2\ ^1D_2$ R	$2s2p\ ^1P_1 - 2p^2\ ^1D_2$ [R]	$2s2p\ ^3P_2 - 2p^2\ ^1D_2$ R	$2s2p\ ^3P_2 - 2p^2\ ^1D_2$ [R]	$2s2p\ ^3P_1 - 2p^2\ ^1D_2$ R	$2s2p\ ^3P_1 - 2p^2\ ^1D_2$ [R]
128	8.70-11	9.33-11	3.29-11	3.10-11	5.62-13	3.79-13
64	1.15-10	1.28-10	4.92-11	4.04-11	1.25-12	8.39-13
32	1.13-10	1.30-10	5.10-11	5.41-11	1.58-12	1.08-12
16	9.83-11	1.15-10	4.50-11	4.96-11	1.57-12	1.07-12
8	8.65-11	9.68-11	3.84-11	4.21-11	1.26-12	9.36-13
4	7.31-11	7.97-11	3.18-11	3.48-11	1.18-12	7.86-13
2	6.21-11	6.50-11	2.77-11	2.85-11	1.00-12	6.48-13
1	5.12-11	5.24-11	2.30-11	2.30-11	8.30-13	5.29-13
0.5	4.15-11	4.18-11	1.85-11	1.85-11	6.88-13	4.27-13
0.25	3.29-11	3.30-11	1.48-11	1.46-11	5.48-13	3.41-13

β	$2s2p\ ^1P_1 - 2p^2\ ^1S_0$ R	$2s2p\ ^1P_1 - 2p^2\ ^1S_0$ R[1]	$2s2p\ ^3P_2 - 2p^2\ ^1S_0$ R	$2s2p\ ^3P_2 - 2p^2\ ^1S_0$ R[1]	$2s2p\ ^3P_0 - 2p^2\ ^1D_2$ R	$2s2p\ ^3P_0 - 2p^2\ ^1D_2$ R[1]
128	3.24-11	3.33-11	1.56-13	1.69-13	4.38-15	4.58-15
64	4.93-11	5.12-11	2.52-13	2.82-13	9.72-15	1.06-14
32	5.12-11	5.51-11	2.58-13	2.91-13	1.14-14	1.24-14
16	4.59-11	5.01-11	2.02-13	2.29-13	9.86-15	1.04-14
8	3.97-11	4.26-11	1.32-13	1.50-13	6.67-15	7.09-15
4	3.27-11	3.54-11	7.47-14	8.58-14	3.86-15	4.13-15
2	2.83-11	2.90-11	3.75-14	4.36-14	1.96-15	2.12-15
1	2.39-11	2.35-11	1.70-14	2.01-14	8.88-16	9.82-16
0.5	1.90-11	1.89-11	7.05-15	8.58-15	3.77-16	4.20-16
0.25	1.56-11	1.50-11	2.24-15	3.44-15	1.49-16	1.69-16

Table 7. Energy transitions of Be-like Ions (E/Z^2, Ry).
a - data from Ref.1, b - present calculations, $P - Q = P \times 10^{-Q}$

Transitions		Z=14	Z=26	Z=42	Z=54
$2s^2\ ^1S_0 - 2s2p\ ^3P_0$	a	9.293-3	4.996-3	3.106-3	2.470-3
	b	7.903-3	4.699-3	3.124-3	2.423-3
$2s^2\ ^1S_0 - 2s2p\ ^3P_1$	a	9.468-3	5.505-3	3.779-3	3.090-3
	b	8.013-3	5.116-3	3.739-3	2.963-3
$2s^2\ ^1S_0 - 2s2p\ ^3P_2$	a	9.843-3	7.005-3	8.669-3	1.178-2
	b	8.258-3	6.370-3	8.241-3	1.101-2
$2s^2\ ^1S_0 - 2s2p\ ^1P_1$	a	1.804-2	1.105-2	1.079-2	1.333-2
	b	1.533-2	1.008-2	1.0344-2	1.250-2
$2s2p\ ^1P_1 - 2p^2\ ^1S_0$	a	1.582-2	1.003-2	1.051-2	1.324-2
	b	1.2985-2	9.099-3	9.979-3	1.232-2
$2s2p\ ^1P_1 - 2p^2\ ^1D_2$	a	9.661-3	6.893-3	8.885-3	1.208-2
	b	7.707-3	6.893-3	8.885-3	1.208-2
$2s2p\ ^3P_0 - 2p^2\ ^3P_0$	a	1.498-2	8.815-3	5.940-3	4.790-3
	b	1.273-2	8.815-3	5.940-3	4.790-3
$2s2p\ ^3P_0 - 2p^2\ ^3P_1$	a	1.519-2	1.003-2	1.062-2	1.335-2
	b	1.286-2	9.142-3	1.016-2	1.250-2
$2s2p\ ^3P_0 - 2p^2\ ^3P_2$	a	1.553-2	1.079-2	1.125-2	1.386-2
	b	1.307-2	9.742-3	1.068-2	1.288-2
$2s2p\ ^3P_1 - 2p^2\ ^3P_0$	a	1.480-2	8.304-3	5.266-3	4.170-3
	b	1.262-2	7.765-3	5.257-3	4.064-3
$2s2p\ ^3P_1 - 2p^2\ ^3P_1$	a	1.501-2	9.579-3	9.950-3	1.273-2
	b	1.275-2	8.725-3	9.547-3	1.196-2
$2s2p\ ^3P_1 - 2p^2\ ^3P_2$	a	1.535-2	1.028-2	1.058-2	1.324-2
	b	1.296-2	9.325-3	1.0060-2	1.234-2

Table 7 (continued).

Transitions		Z=14	Z=26	Z=42	Z=54
$2s2p\,^3P_1-2p^2\,^1S_0$	a	2.438-2	1.557-2	1.752-2	2.348-2
	b	2.030-2	1.406-2	1.658-2	2.185-2
$2s2p\,^3P_2-2p^2\,^1S_0$	a	2.401-2	1.402-2	1.263-2	1.479-2
	b	2.006-2	1.281-2	1.208-2	1.381-2
$2s2p\,^3P_0-2p^2\,^1D_2$	a	1.841-2	1.295-2	1.656-2	2.293-2
	b	1.513-2	1.153-2	1.558-2	2.126-2
$2s2p\,^3P_1-2p^2\,^1D_2$	a	1.823-2	1.244-2	1.589-2	2.232-2
	b	1.502-2	1.112-2	1.496-2	2.072-2
$2s2p\,^3P_2-2p^2\,^3P_0$	a	1.443-2	6.755-3	3.767-4	-4.519-3
	b	1.2375-2	6.510-3	7.550-4	-3.979-3
$2s2p\,^3P_2-2p^2\,^3P_1$	a	1.464-2	7.971-3	5.061-3	4.040-3
	b	1.251-2	7.471-3	5.045-3	3.913-3
$2s2p\,^3P_2-2p^2\,^3P_2$	a	1.498-2	8.734-3	5.688-3	4.546-3
	b	1.272-2	8.071-3	5.558-3	4.292-3
$2s2p\,^3P_0-2p^2\,^1S_0$	a	2.456-2	1.608-2	1.819-2	2.410-2
	b	2.041-2	1.448-2	1.720-2	2.239-2
$2s2p\,^3P_2-2p^2\,^1D_2$	a	1.786-2	1.089-2	1.100-2	1.365-2
	b	1.478-2	9.863-3	1.046-2	1.268-2
$2s2p\,^1P_1-2p^2\,^3P_0$	a	6.231-3	2.759-3	-3.805-3	-6.069-3
	b	5.304-3	2.802-3	-1.348-3	-5.469-3
$2s2p\,^1P_1-2p^2\,^3P_1$	a	6.441-3	3.975-3	2.944-3	2.490-3
	b	5.437-3	3.763-3	2.942-3	2.427-3
$2s2p\,^1P_1\ 2p^2\,^3P_2$	a	6.784-3	4.738-3	3.572-3	2.996-3
	b	5.647-3	4.363-3	3.455-3	2.802-3

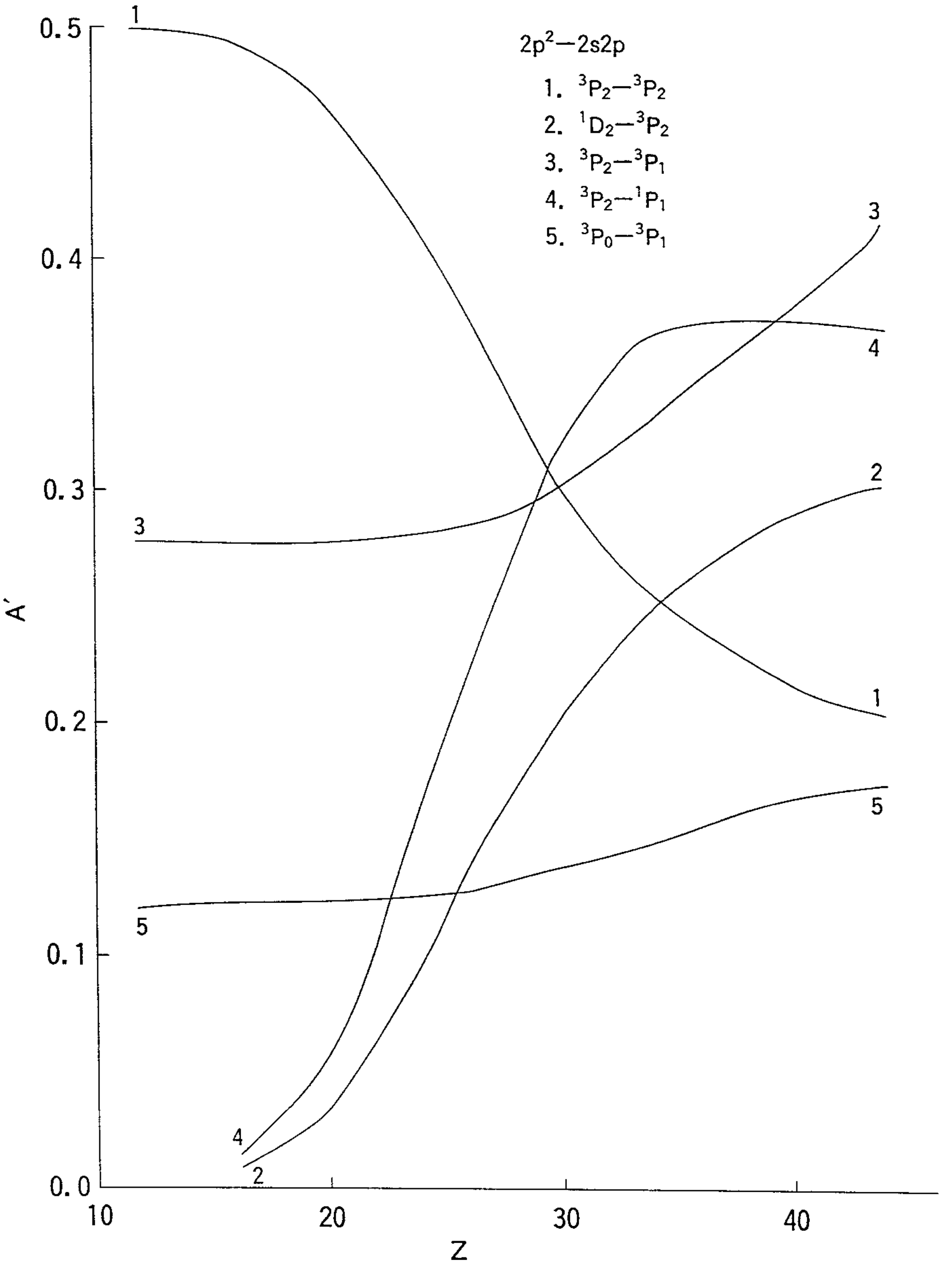
Figure Captions

Fig.1. (a) The coefficients A' in Eq.(1) as a function of Z.
(b) The coefficients A" in Eq.(1) as a function of Z.

Fig.2. Comparison of the collision strengths for OV ions.

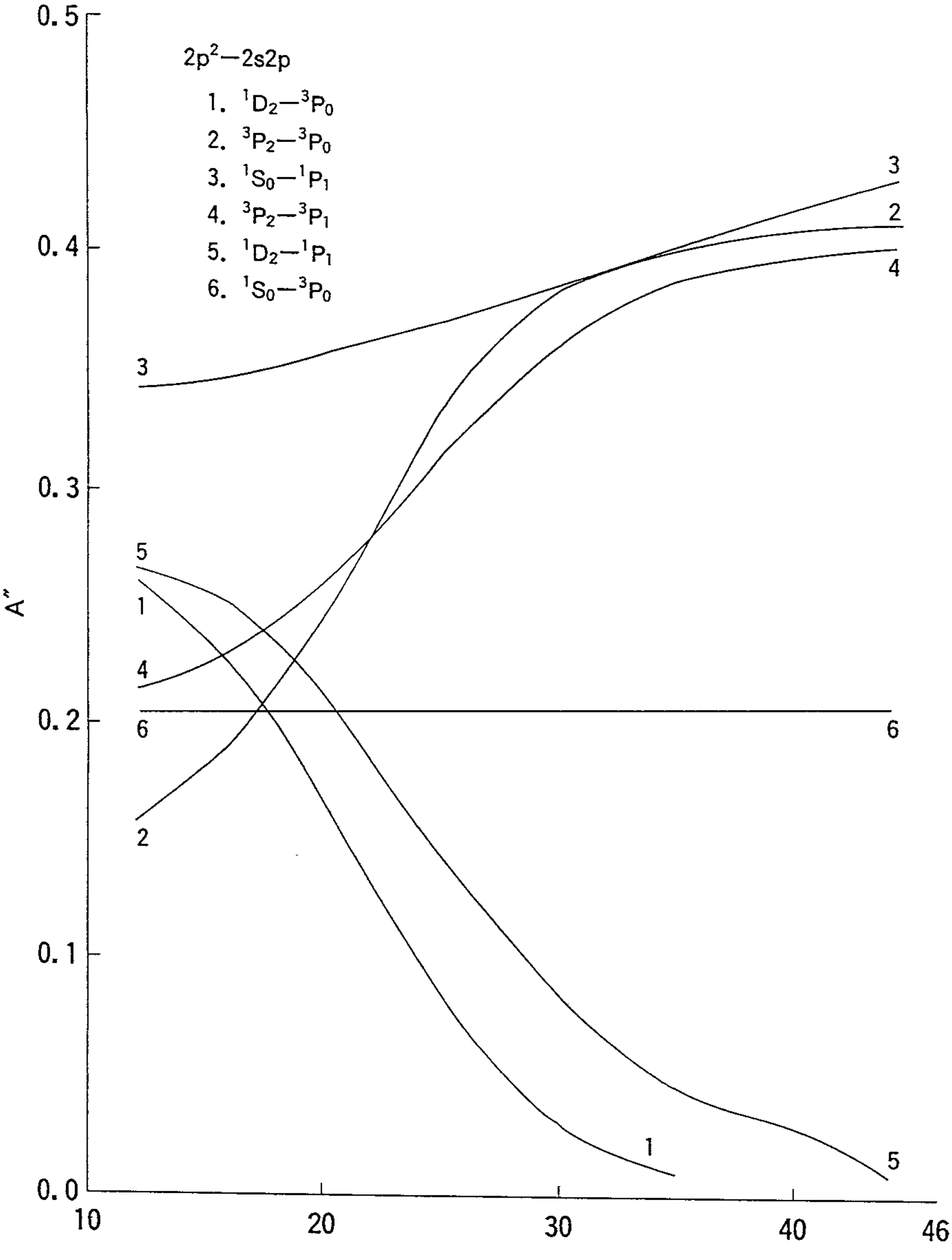
Fig.3. Comparison of the cross sections for OV ions.

Fig.4. Comparison of the cross sections with our results (solid lines) and Goett et al (1980) (dashed lines) for the $2s^2\ {}^1S_0$ - $2s2p\ {}^3P_1$ transition.



2p²—2s2p
1. ³P₂—³P₂
2. ¹D₂—³P₂
3. ³P₂—³P₁
4. ³P₂—¹P₁
5. ³P₀—³P₁
0.5
0.4
0.3
0.2
0.1
0.0
A′
10
20
30
40
Z
1
2
3
4
5

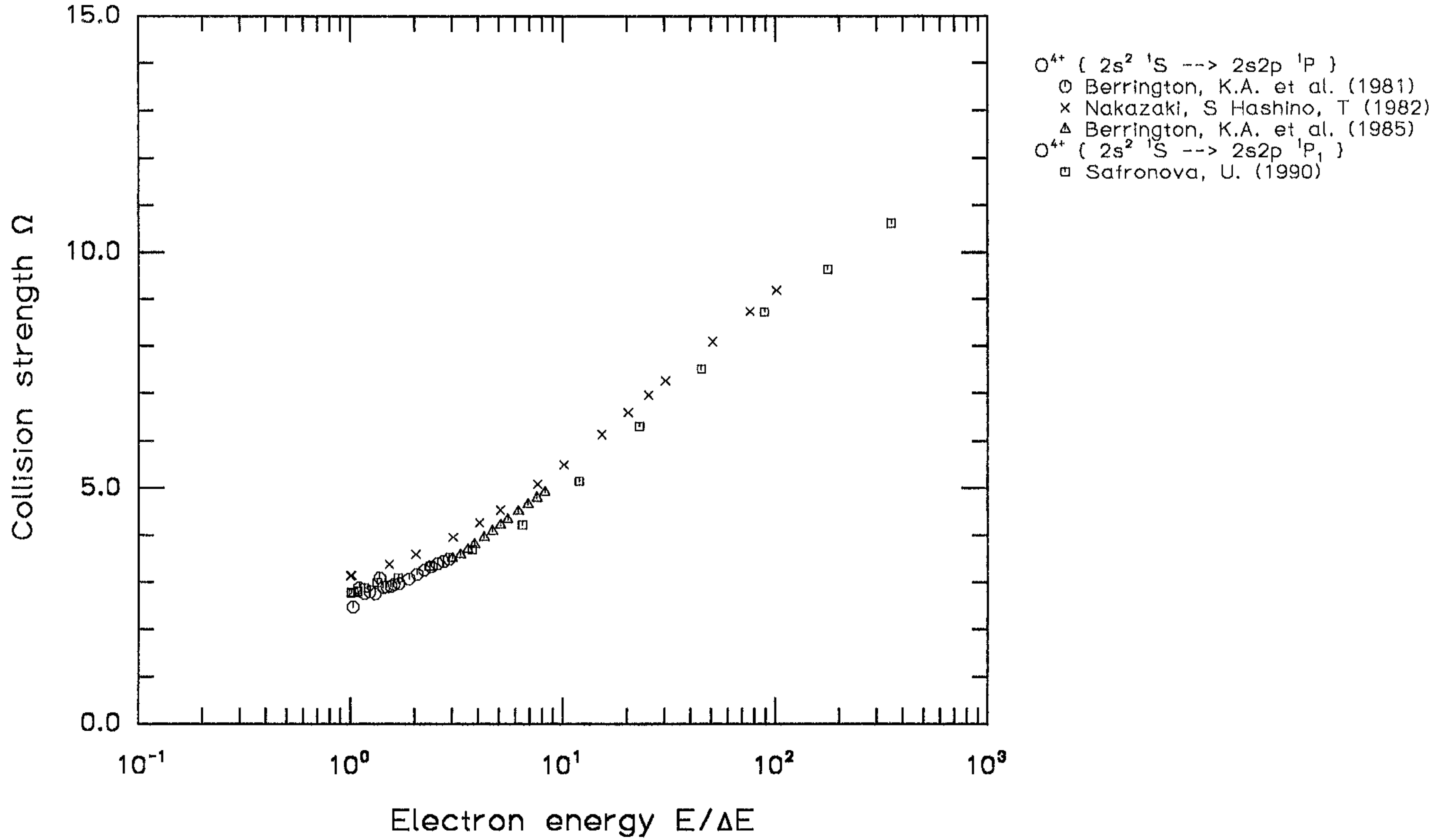
Fig.1. (a)



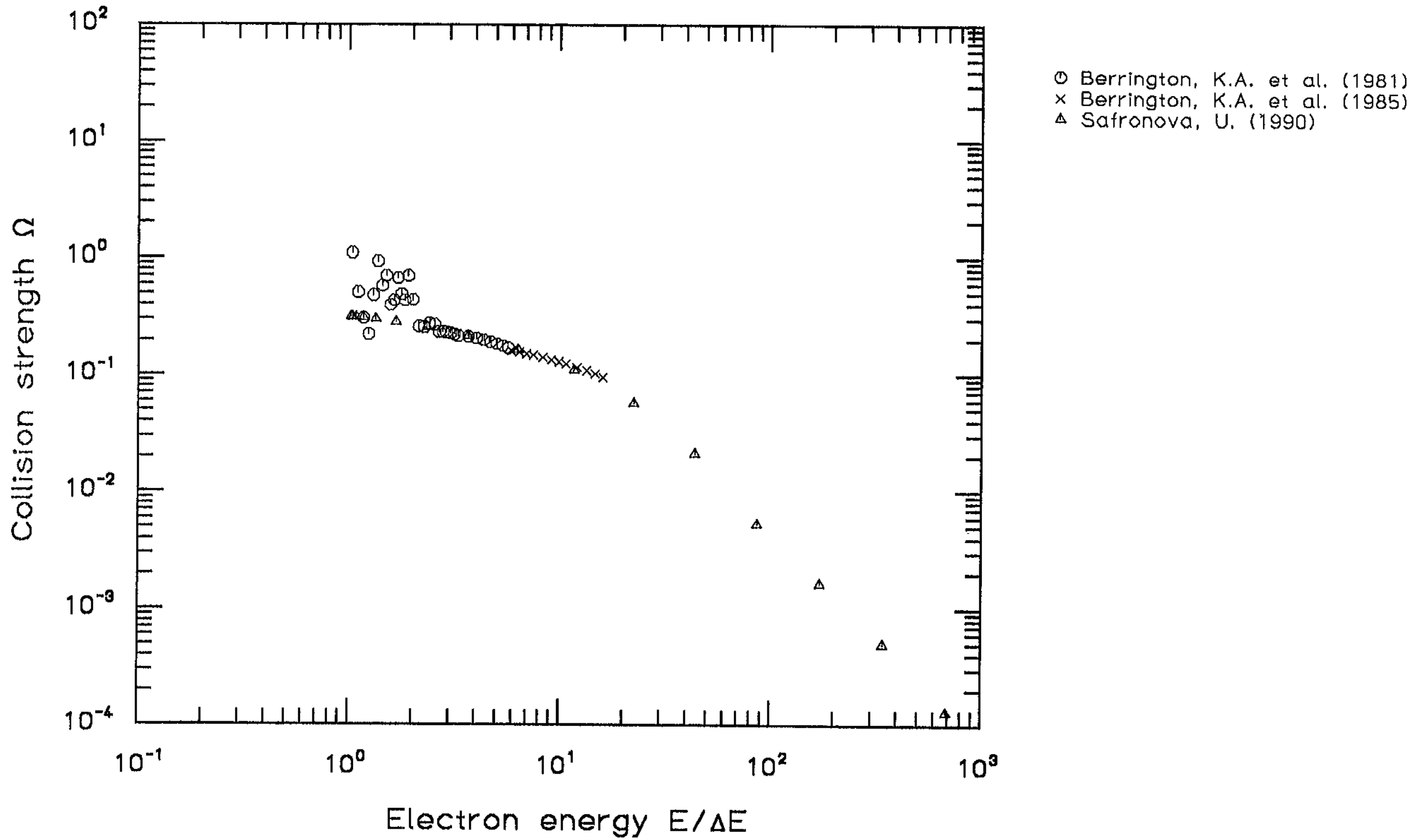
2p²—2s2p
1. ¹D₂—³P₀
2. ³P₂—³P₀
3. ¹S₀—¹P₁
4. ³P₂—³P₁
5. ¹D₂—¹P₁
6. ¹S₀—³P₀
A″
Z
0.5
0.4
0.3
0.2
0.1
0.0
10
20
30
40
46

Fig.1. (b)

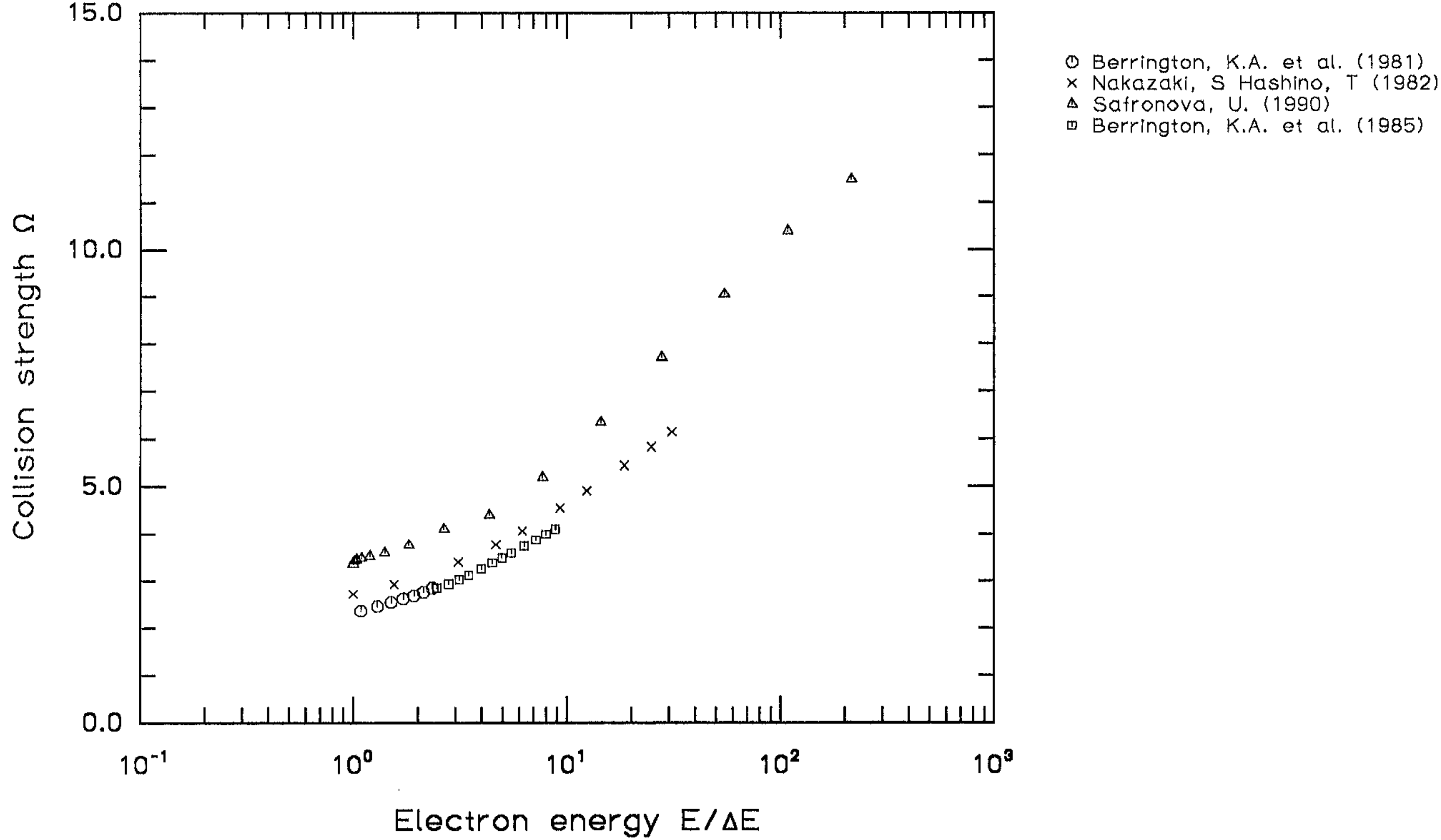
Fig.2.

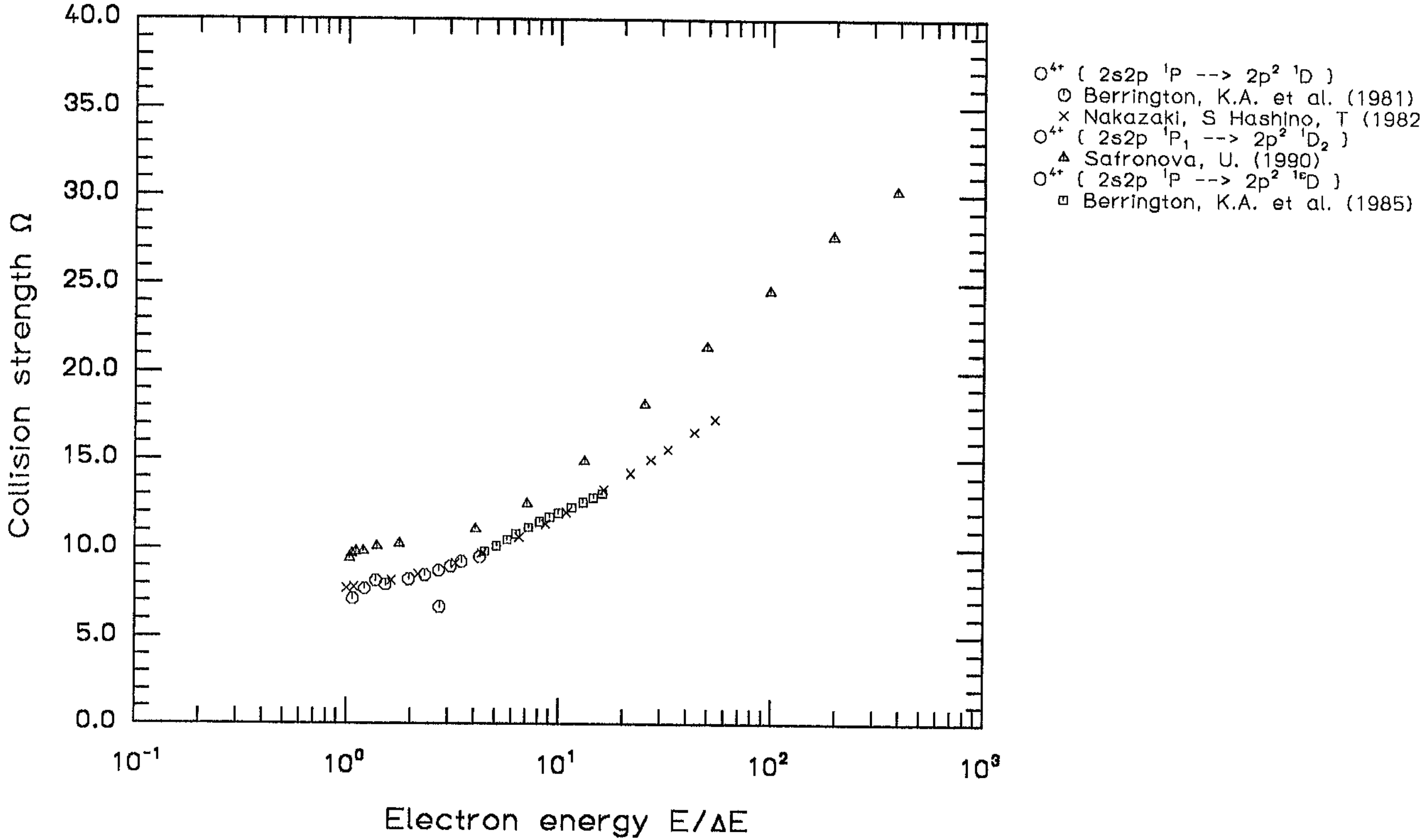

Collision strength Ω
15.0
10.0
5.0
0.0
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
Electron energy E/ΔE
O^{4+} ($2s^2$ ^1S --> $2s2p$ ^1P)
Berrington, K.A. et al. (1981)
Nakazaki, S Hashino, T (1982)
Berrington, K.A. et al. (1985)
O^{4+} ($2s^2$ ^1S --> $2s2p$ $^1P_1$)
Safronova, U. (1990)

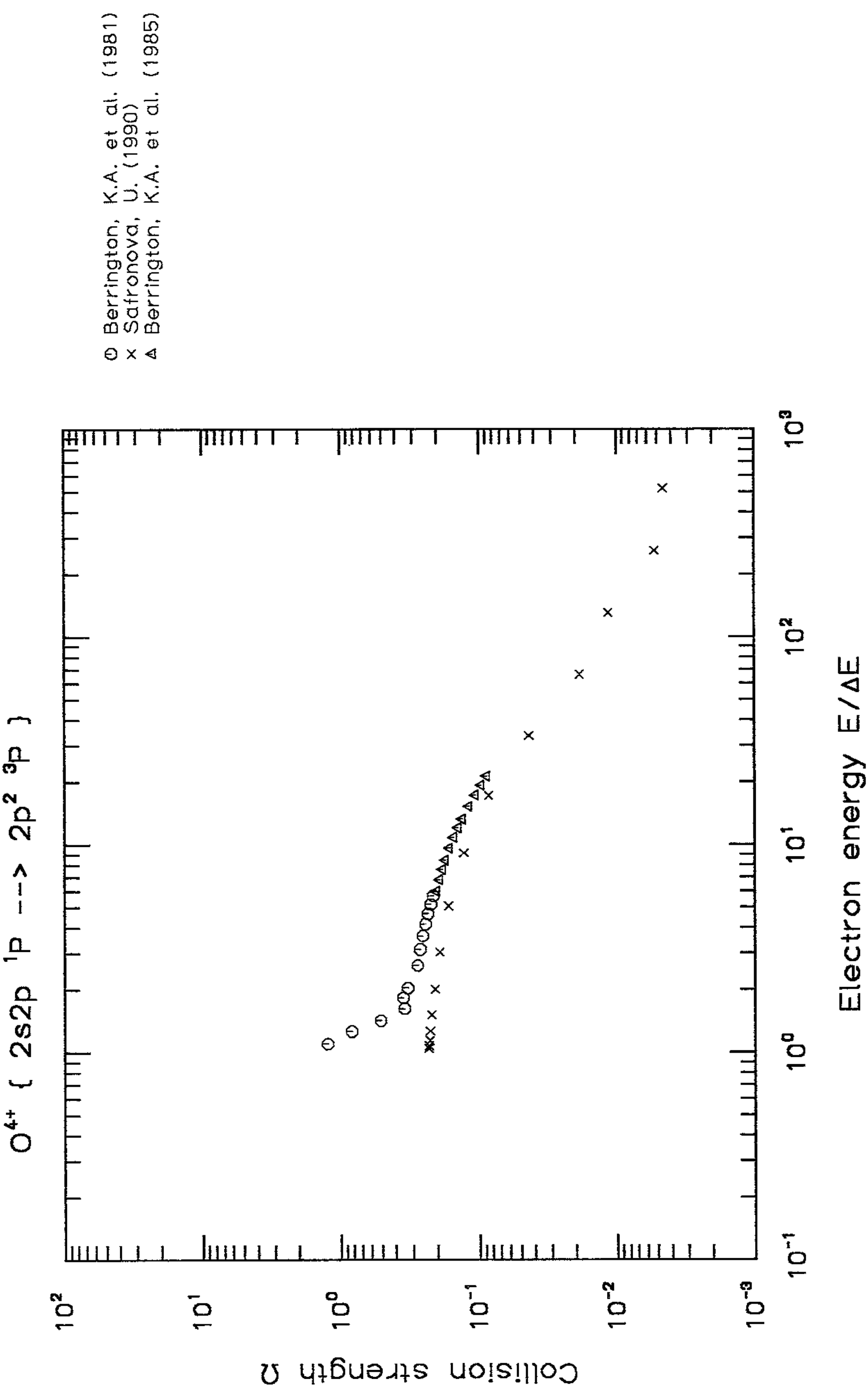
O^{4+} { $2s^2$ ^1S --> 2s2p ^3P }



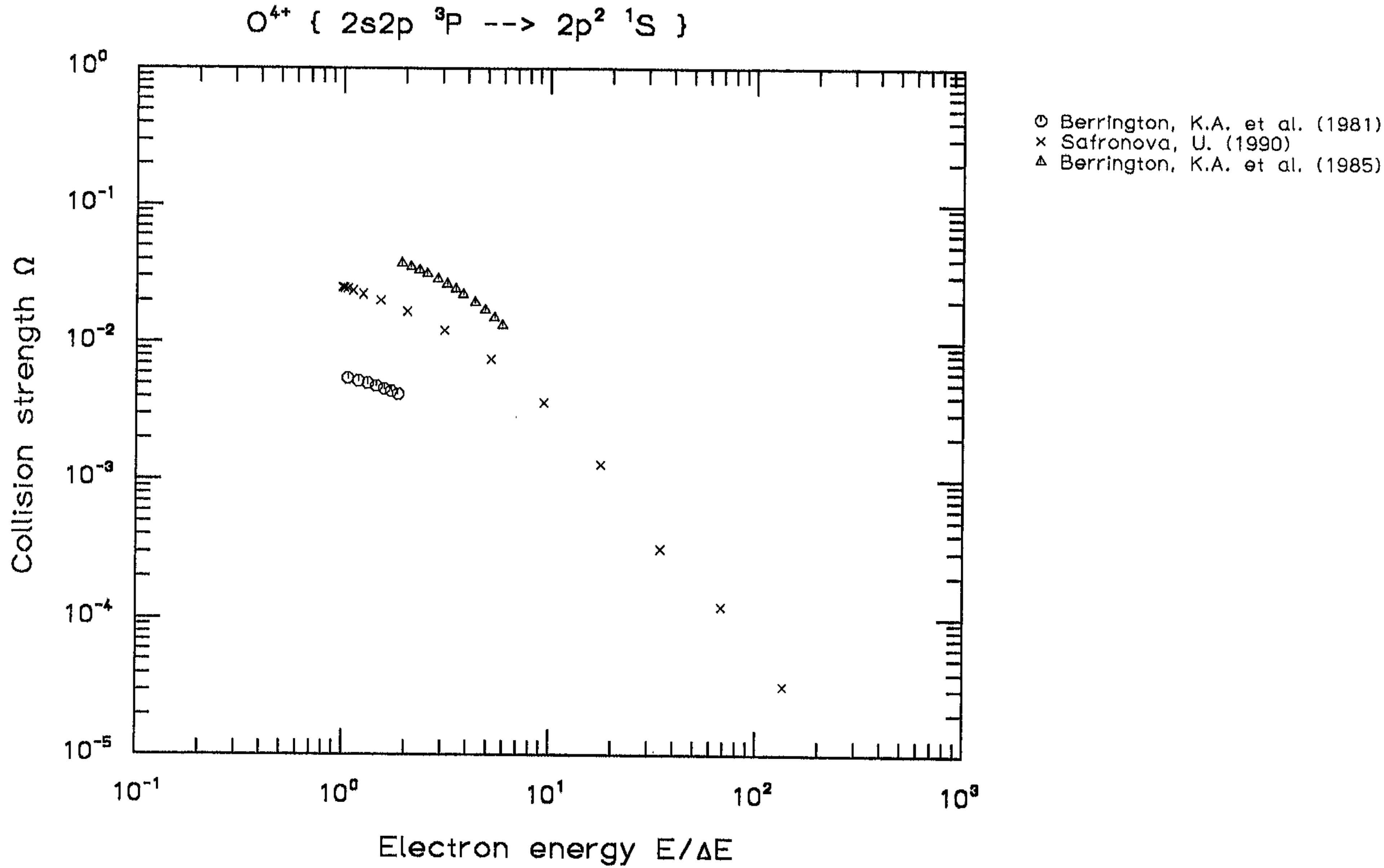
O^{4+} { 2s2p ^1P --> $2p^2$ ^1S }

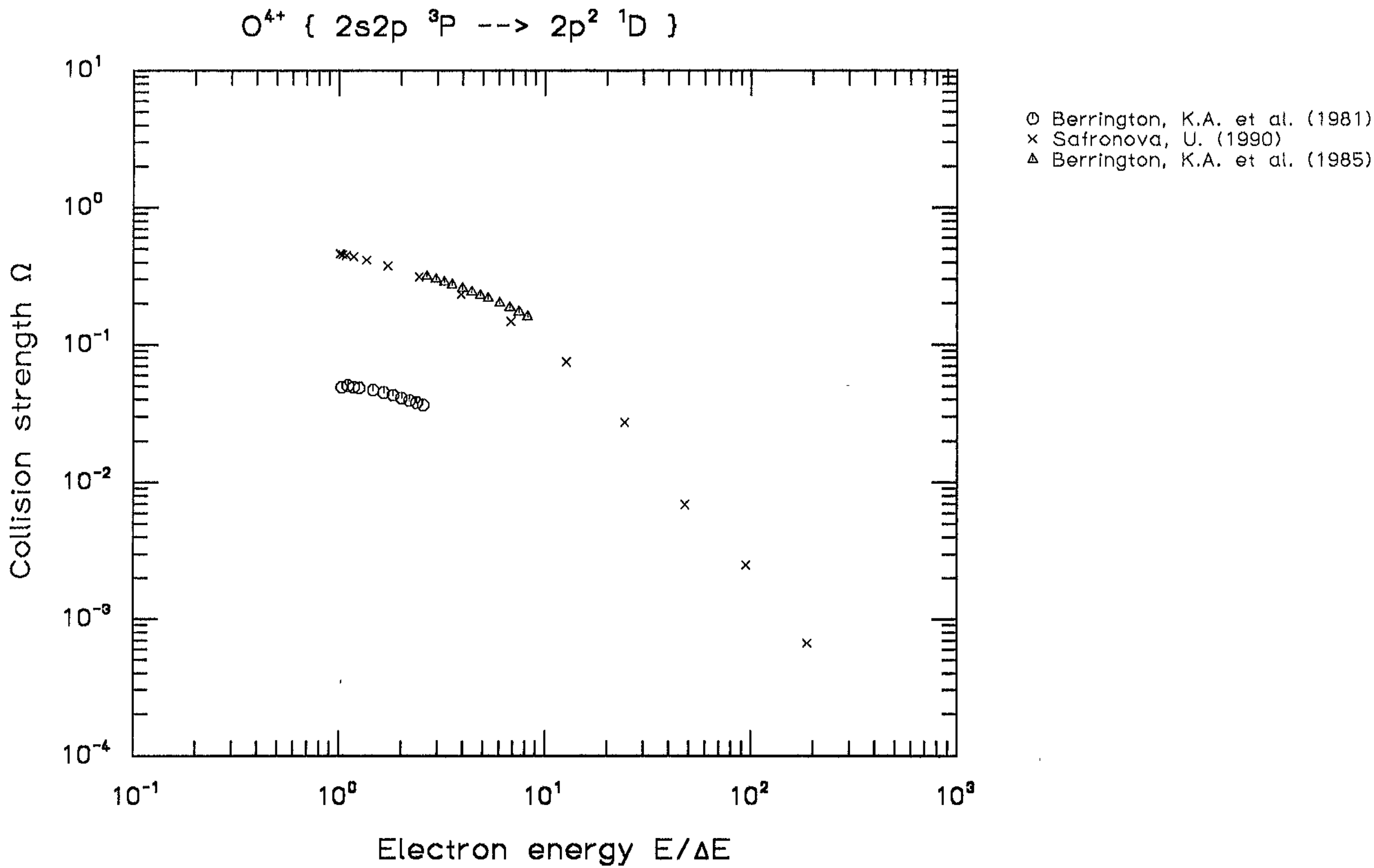


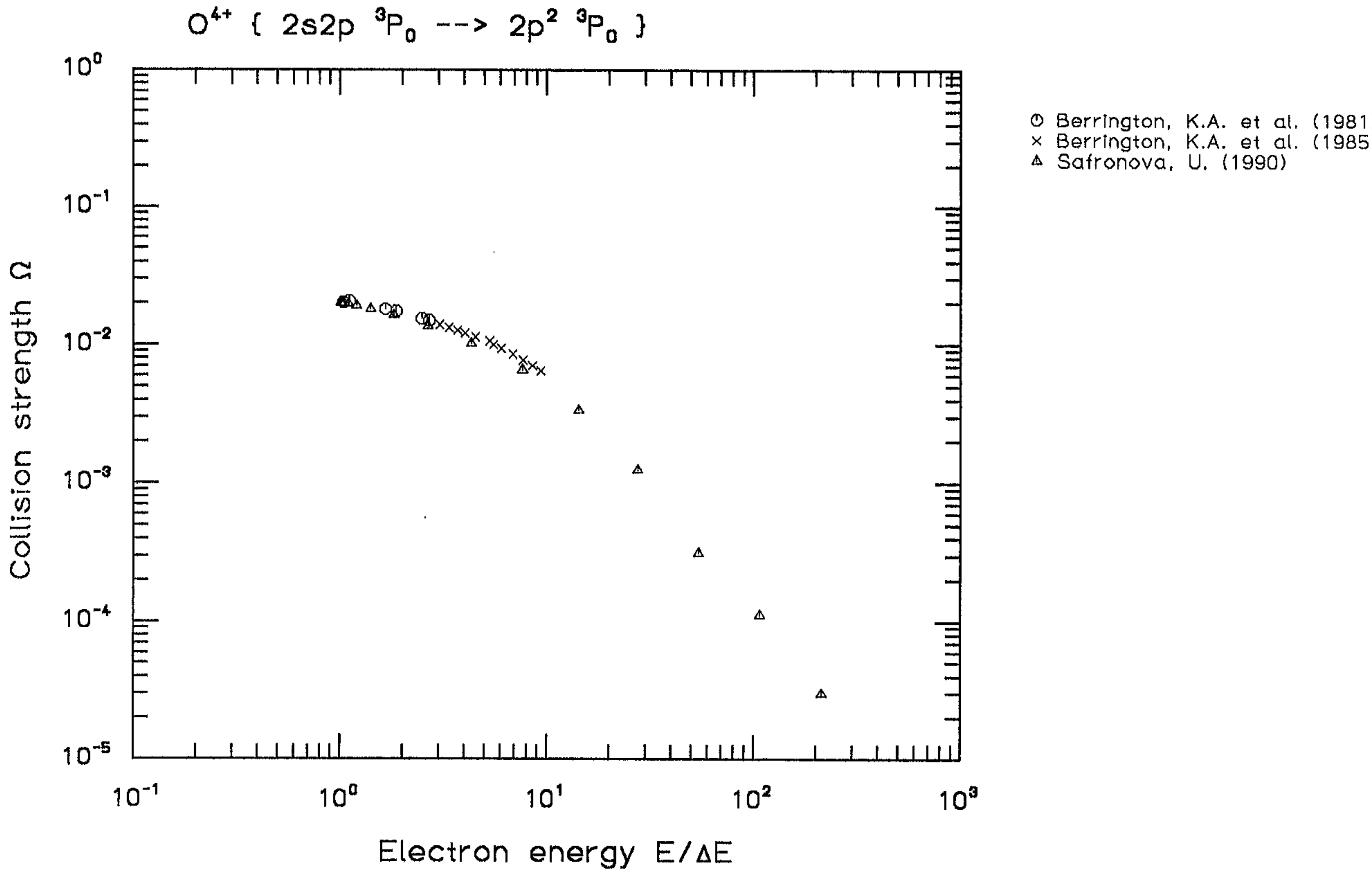

40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Collision strength Ω
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
Electron energy E/ΔE
O^{4+} (2s2p ^1P --> $2p^2$ ^1D)
Berrington, K.A. et al. (1981)
Nakazaki, S Hashino, T (1982)
O^{4+} (2s2p $^1P_1$ --> $2p^2$ $^1D_2$)
Safronova, U. (1990)
O^{4+} (2s2p ^1P --> $2p^2$ $^{1\epsilon}D$)
Berrington, K.A. et al. (1985)



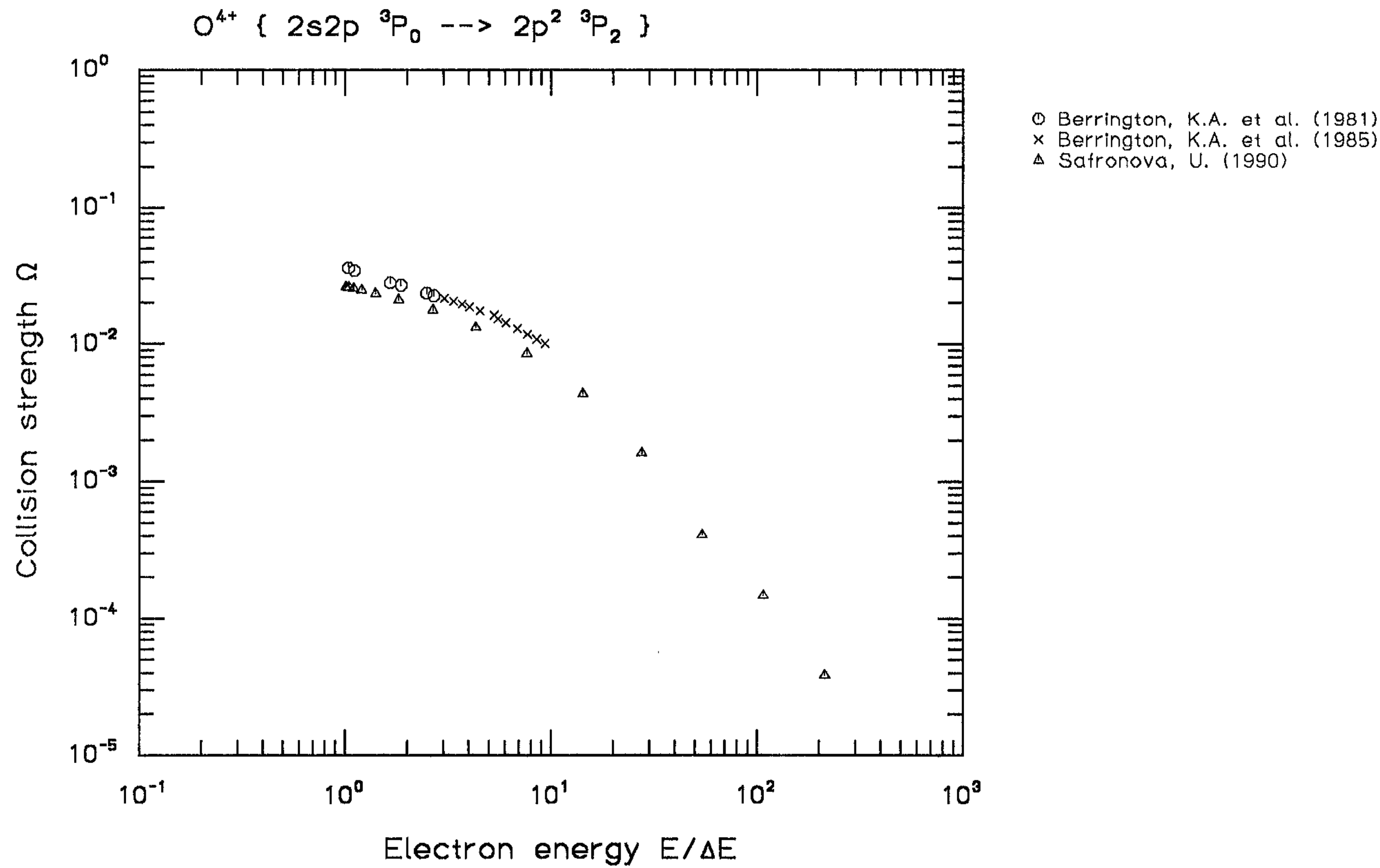
O^{4+} { 2s2p ^1P --> $2p^2$ ^3P }
Collision strength Ω
Electron energy E/ΔE
10^{-1} 10^{0} 10^{1} 10^{2} 10^{3}
10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1} 10^{2}
Berrington, K.A. et al. (1981)
Safronova, U. (1990)
Berrington, K.A. et al. (1985)


O^{4+} { 2s2p ^3P --> $2p^2$ ^1S }
Collision strength Ω
Electron energy E/ΔE
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-1}
10^0
10^1
10^2
10^3
Berrington, K.A. et al. (1981)
Safronova, U. (1990)
Berrington, K.A. et al. (1985)

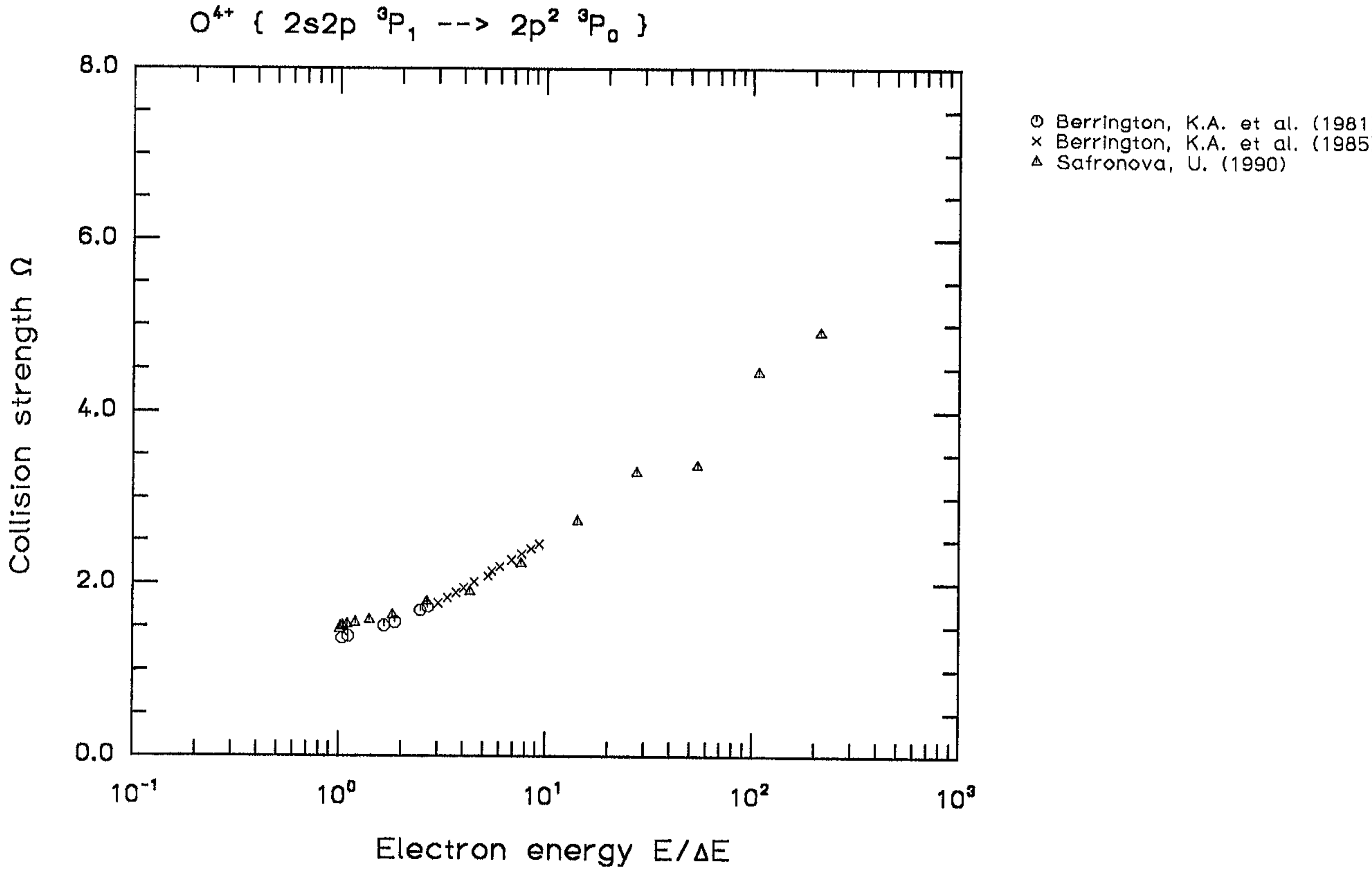

O^{4+} { 2s2p ^3P --> $2p^2$ ^1D }
Collision strength Ω
Electron energy E/ΔE
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
Berrington, K.A. et al. (1981)
Safronova, U. (1990)
Berrington, K.A. et al. (1985)

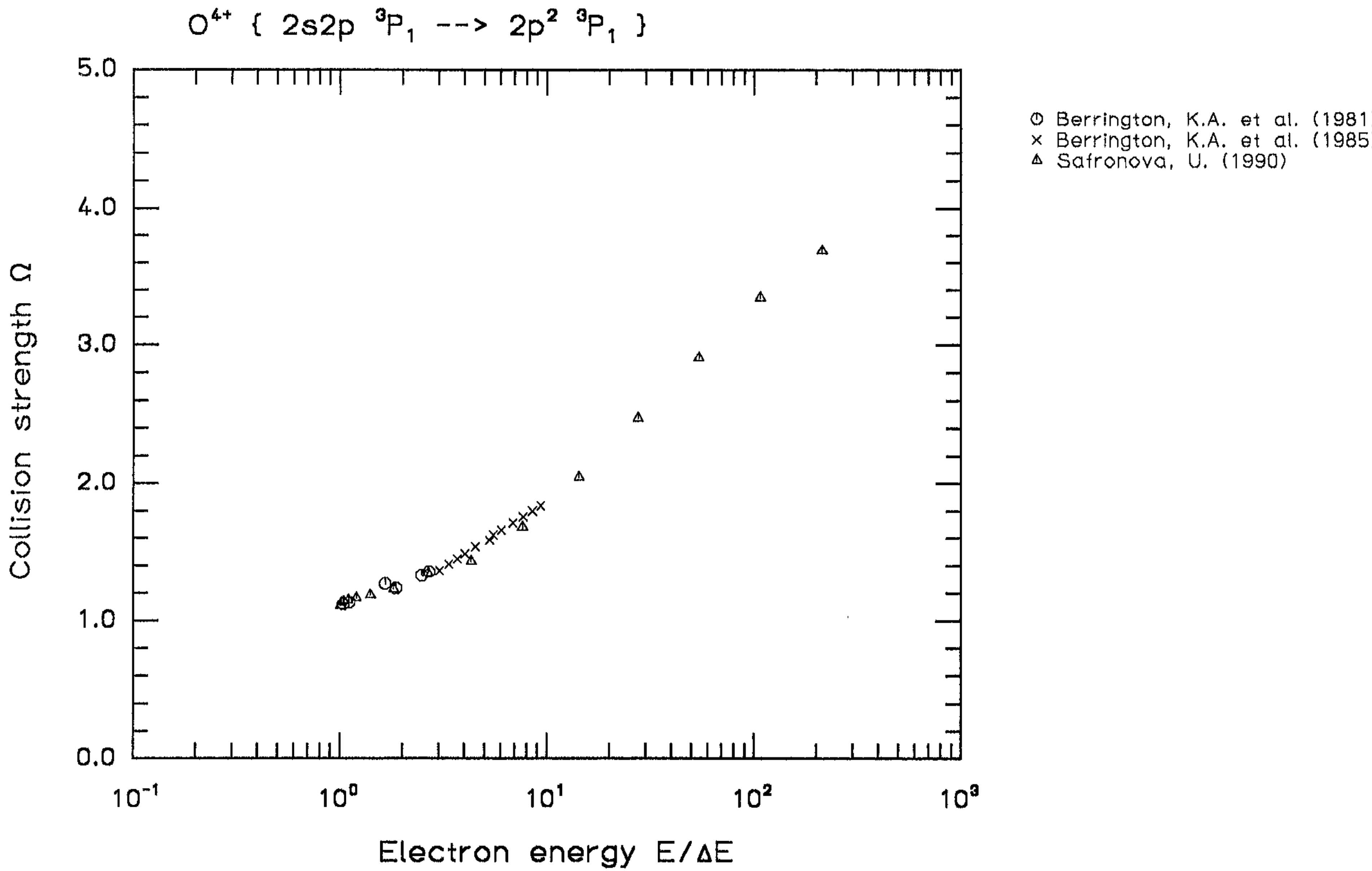


O^{4+} { 2s2p $^3P_0$ --> $2p^2$ $^3P_0$ }
Collision strength Ω
Electron energy E/ΔE
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-1
10^0
10^1
10^2
10^3
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)

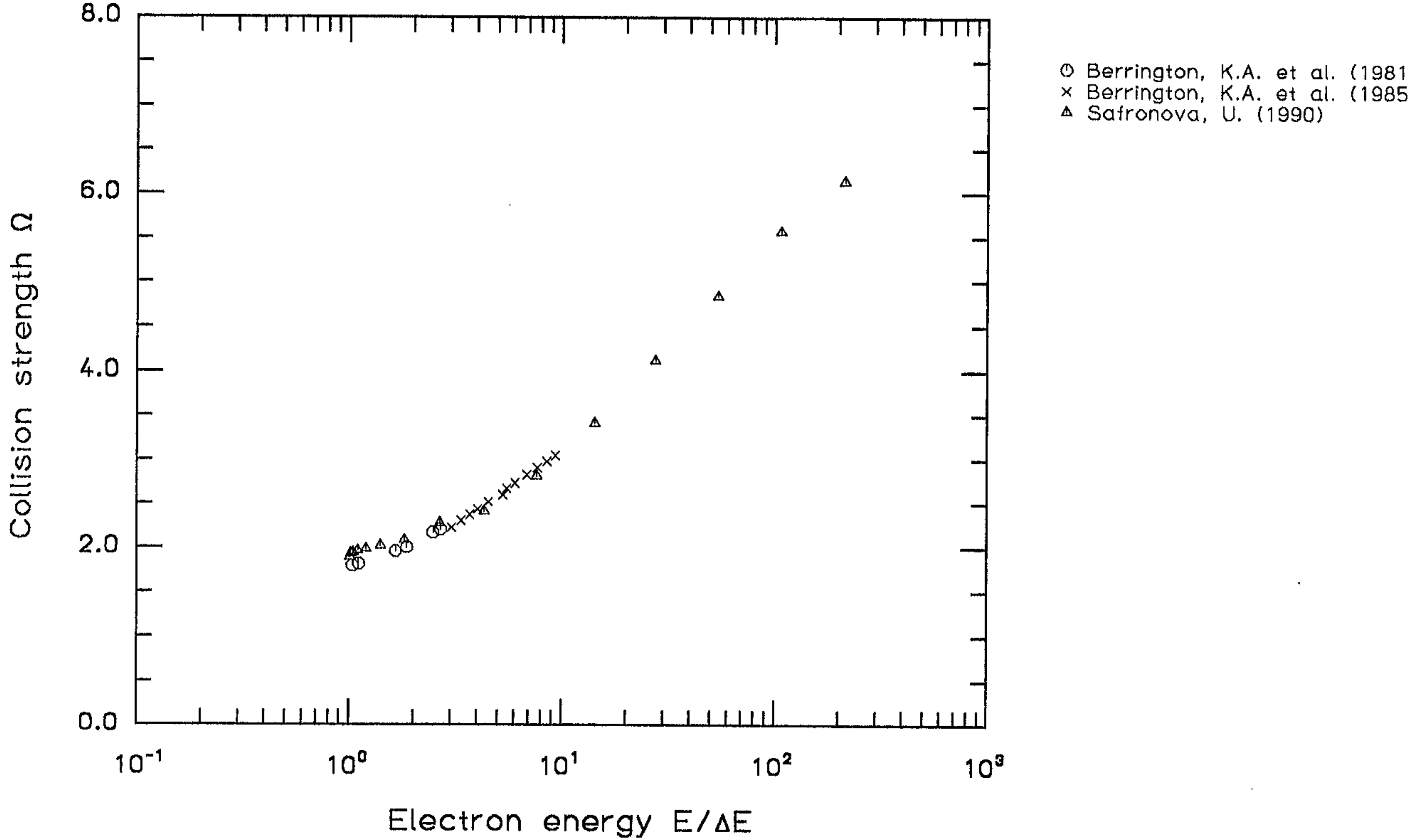


O4+ { 2s2p 3P0 --> 2p2 3P2 }
Collision strength Ω
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-1
10^0
10^1
10^2
10^3
Electron energy E/ΔE
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)


O^{4+} { 2s2p $^3P_1$ --> $2p^2$ $^3P_0$ }
Collision strength Ω
8.0
6.0
4.0
2.0
0.0
10^{-1}
10^0
10^1
10^2
10^3
Electron energy E/ΔE
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)


O4+ { 2s2p 3P1 --> 2p2 3P1 }
Collision strength Ω
Electron energy E/ΔE
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)
5.0
4.0
3.0
2.0
1.0
0.0
10-1
100
101
102
103

O^{4+} { 2s2p $^3P_2$ --> $2p^2$ $^3P_1$ }



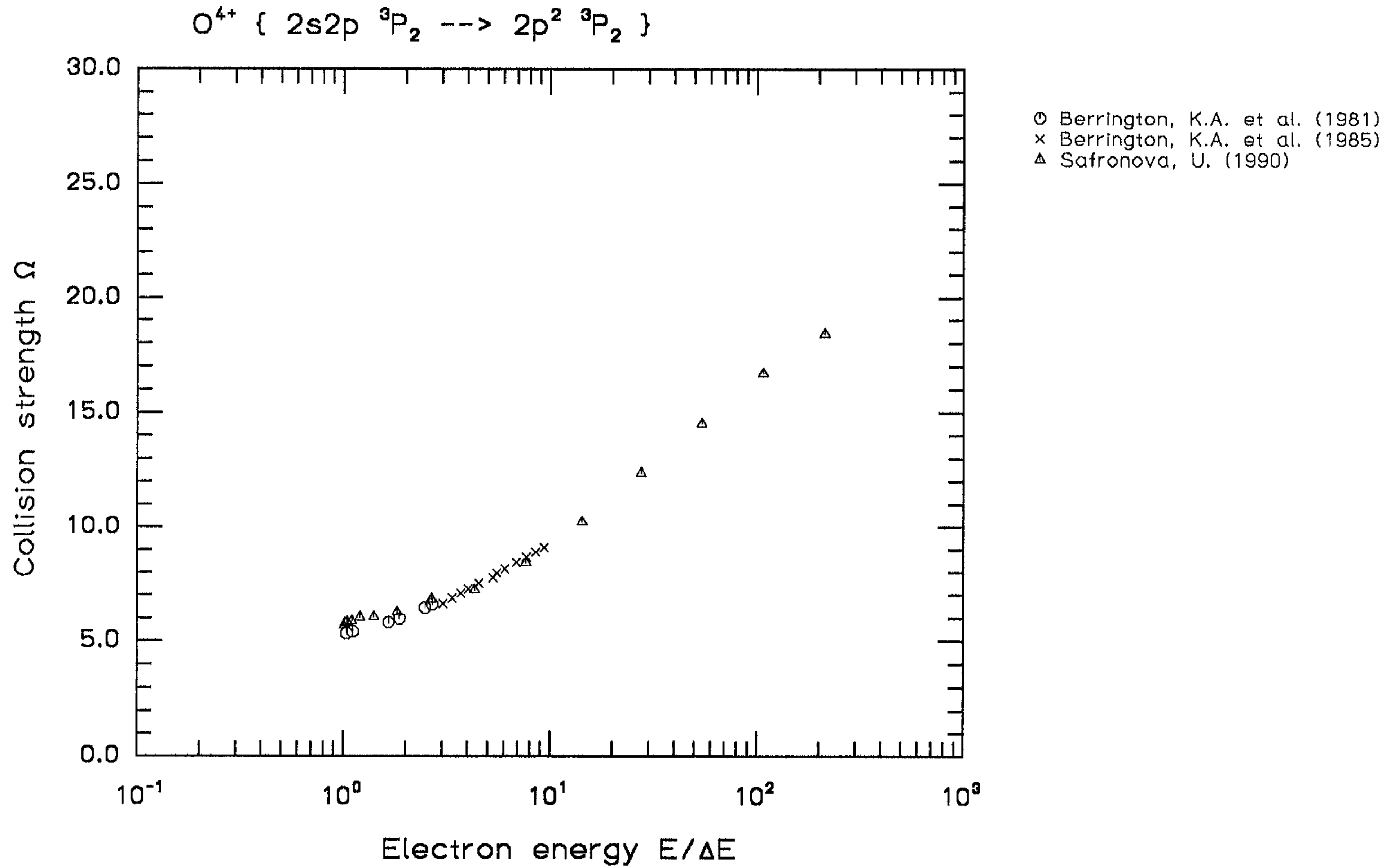
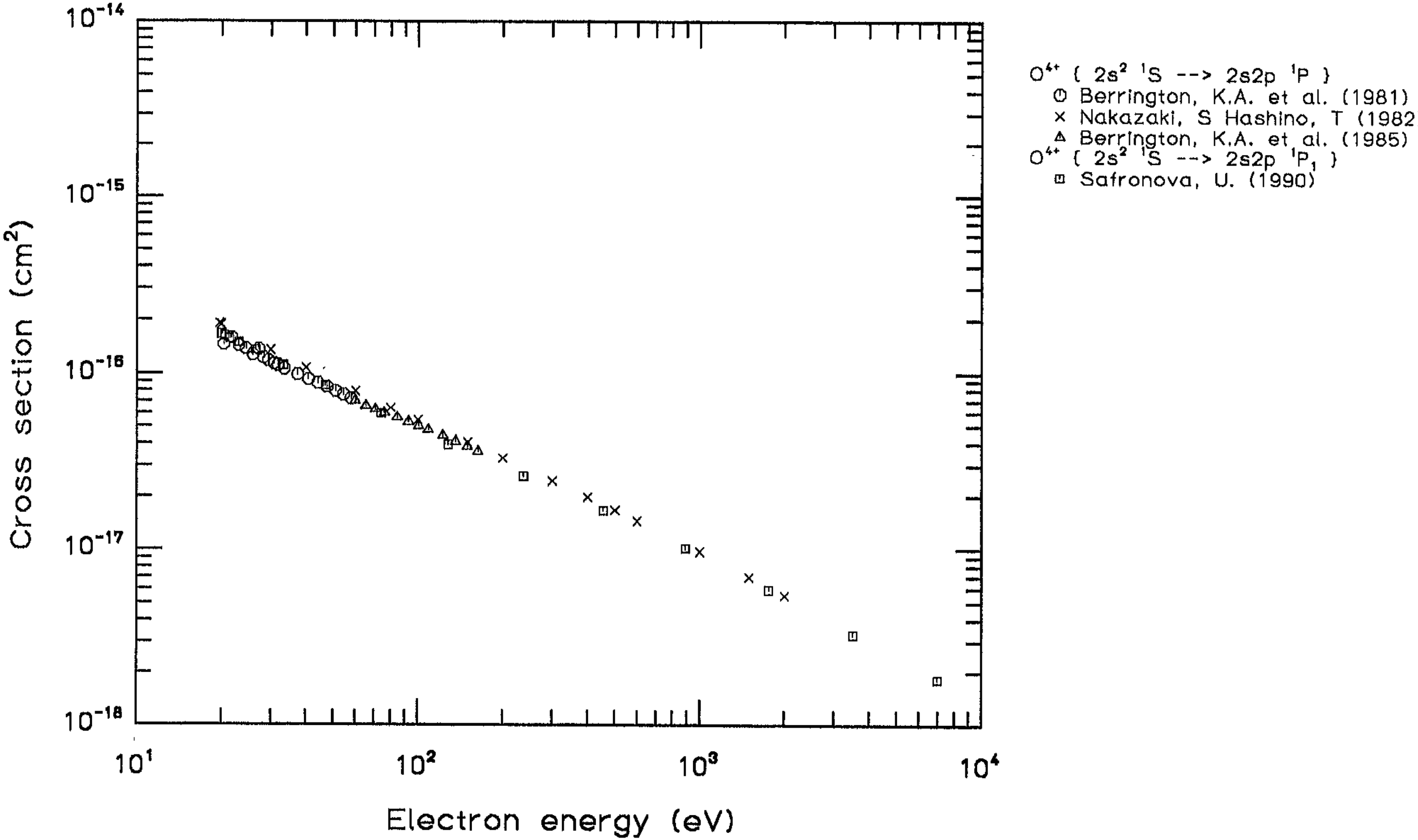
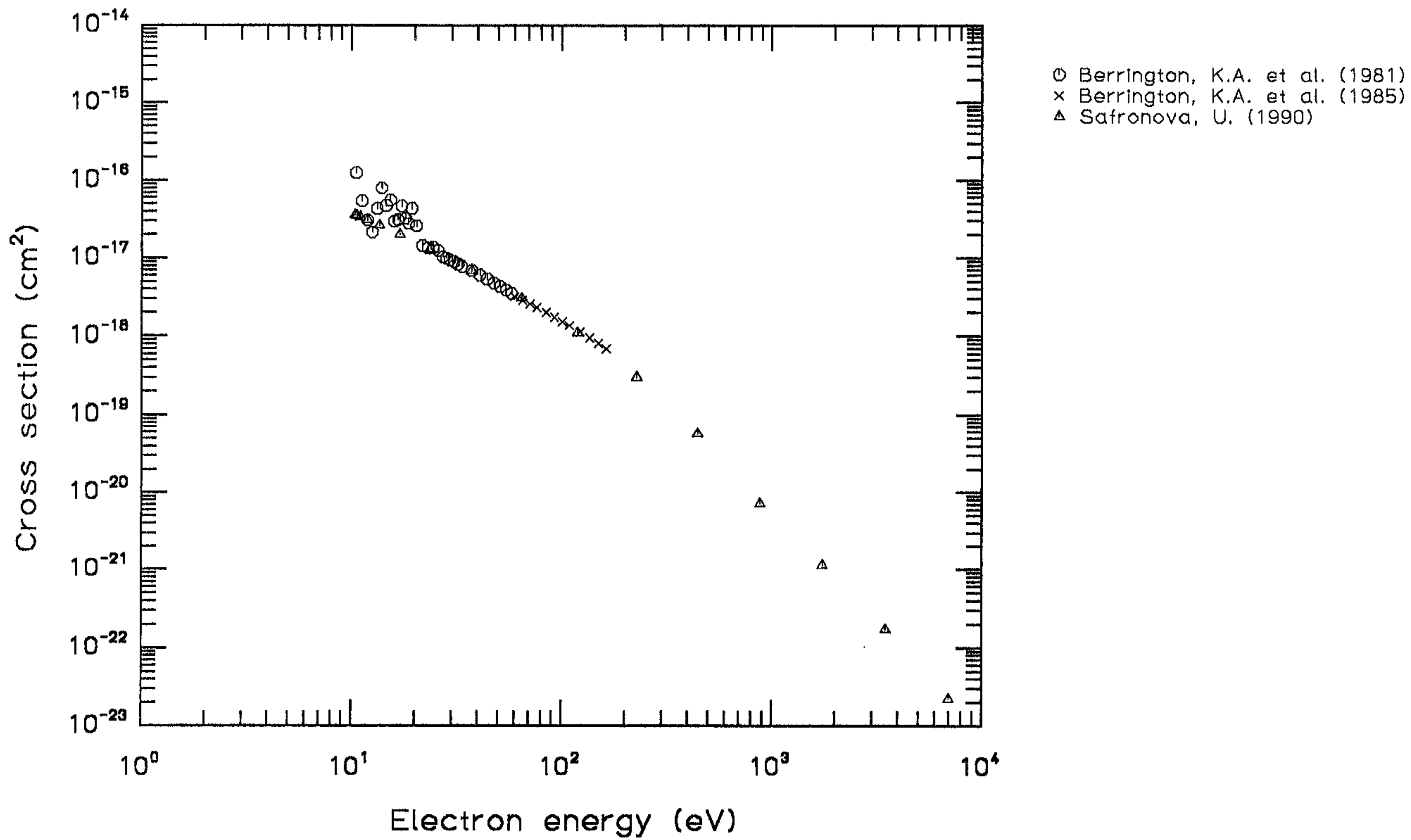

O4+ { 2s2p 3P2 --> 2p2 3P2 }
Collision strength Ω
Electron energy E/ΔE
30.0
25.0
20.0
15.0
10.0
5.0
0.0
10-1
100
101
102
103
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)

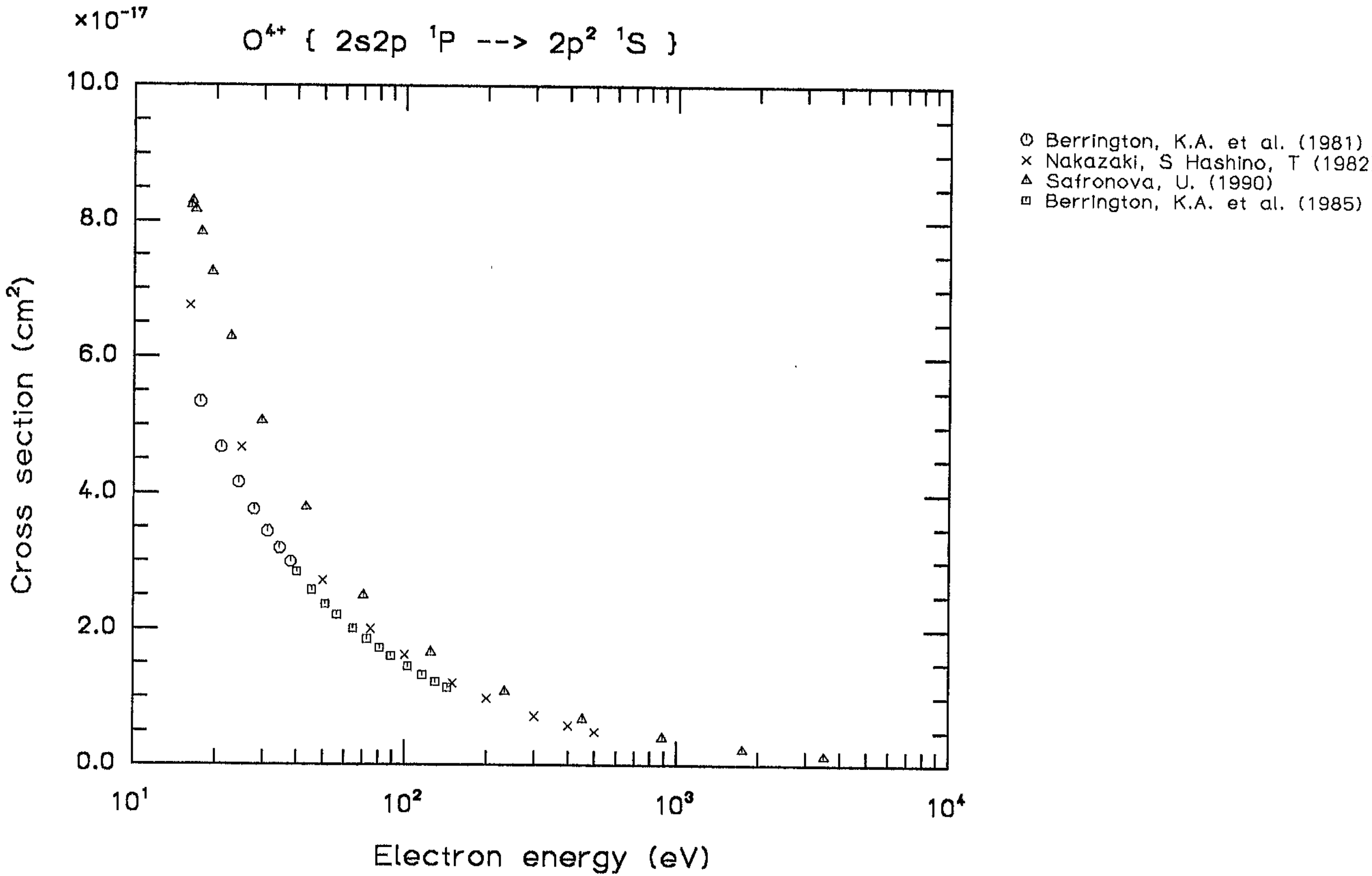
Fig.3.

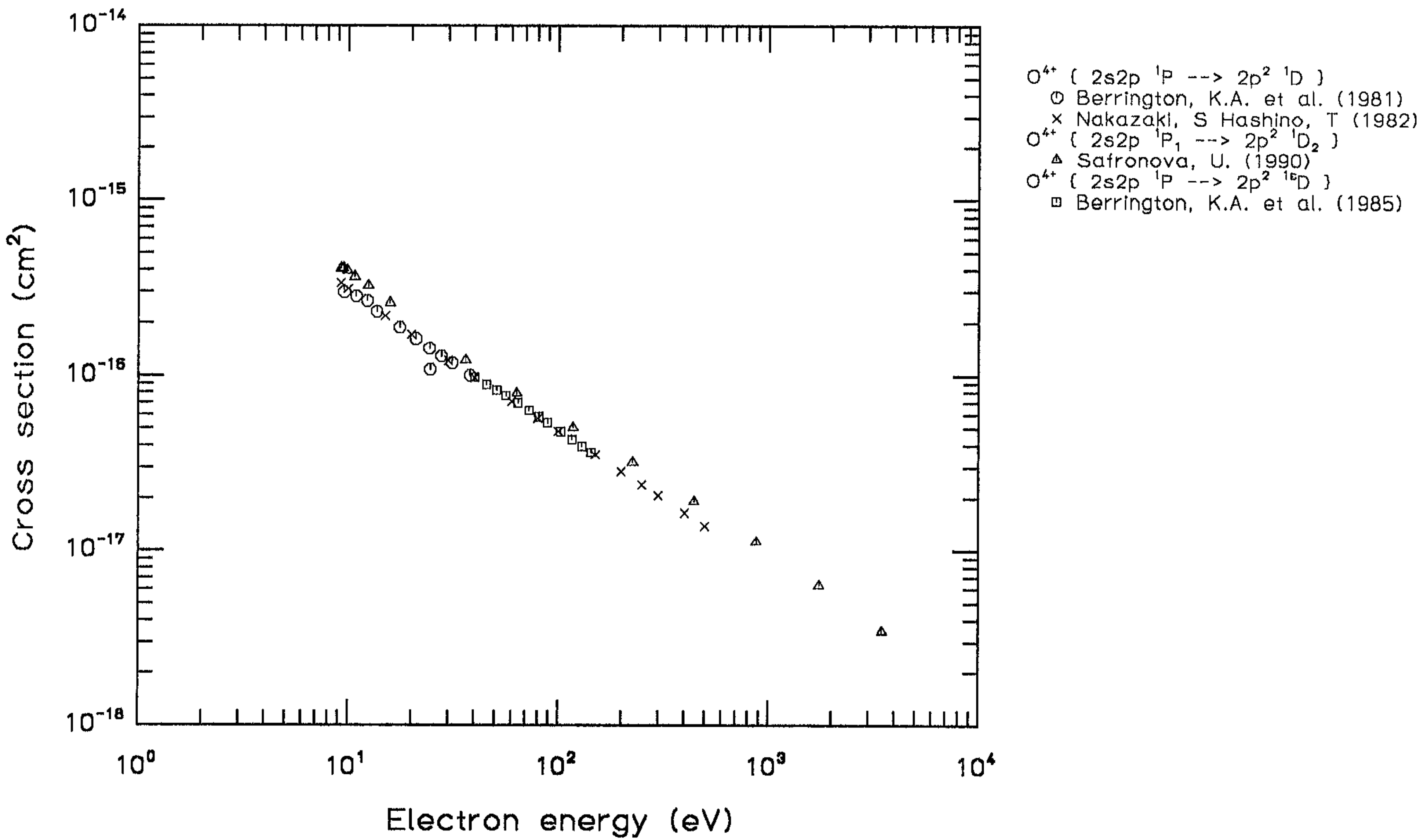


Cross section (cm²)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10¹
10²
10³
10⁴
Electron energy (eV)
O⁴⁺ { 2s² ¹S --> 2s2p ¹P }
Berrington, K.A. et al. (1981)
Nakazaki, S Hashino, T (1982)
Berrington, K.A. et al. (1985)
O⁴⁺ { 2s² ¹S --> 2s2p ¹P₁ }
Safronova, U. (1990)

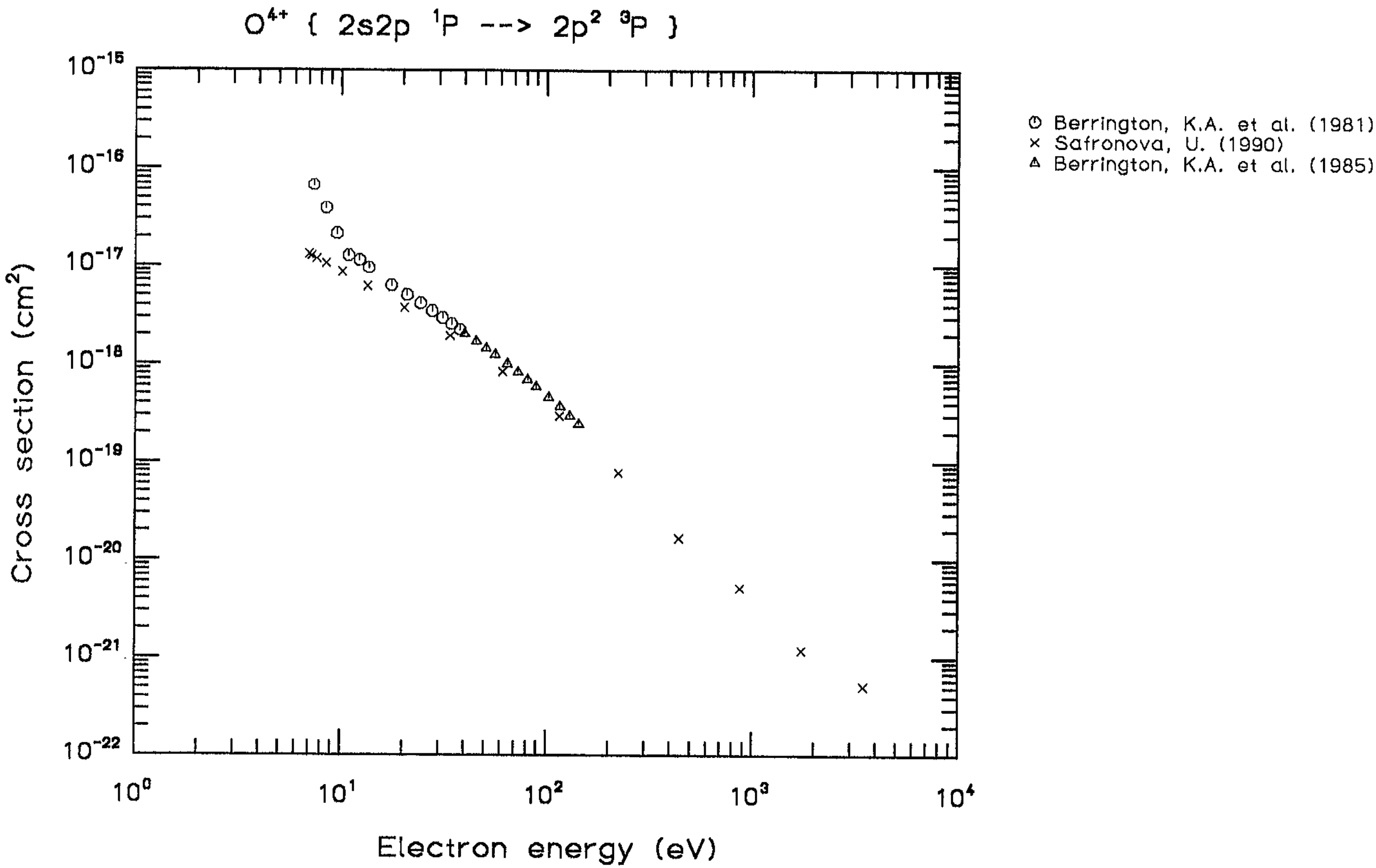
O^{4+} { $2s^2\ ^1S$ --> $2s2p\ ^3P$ }



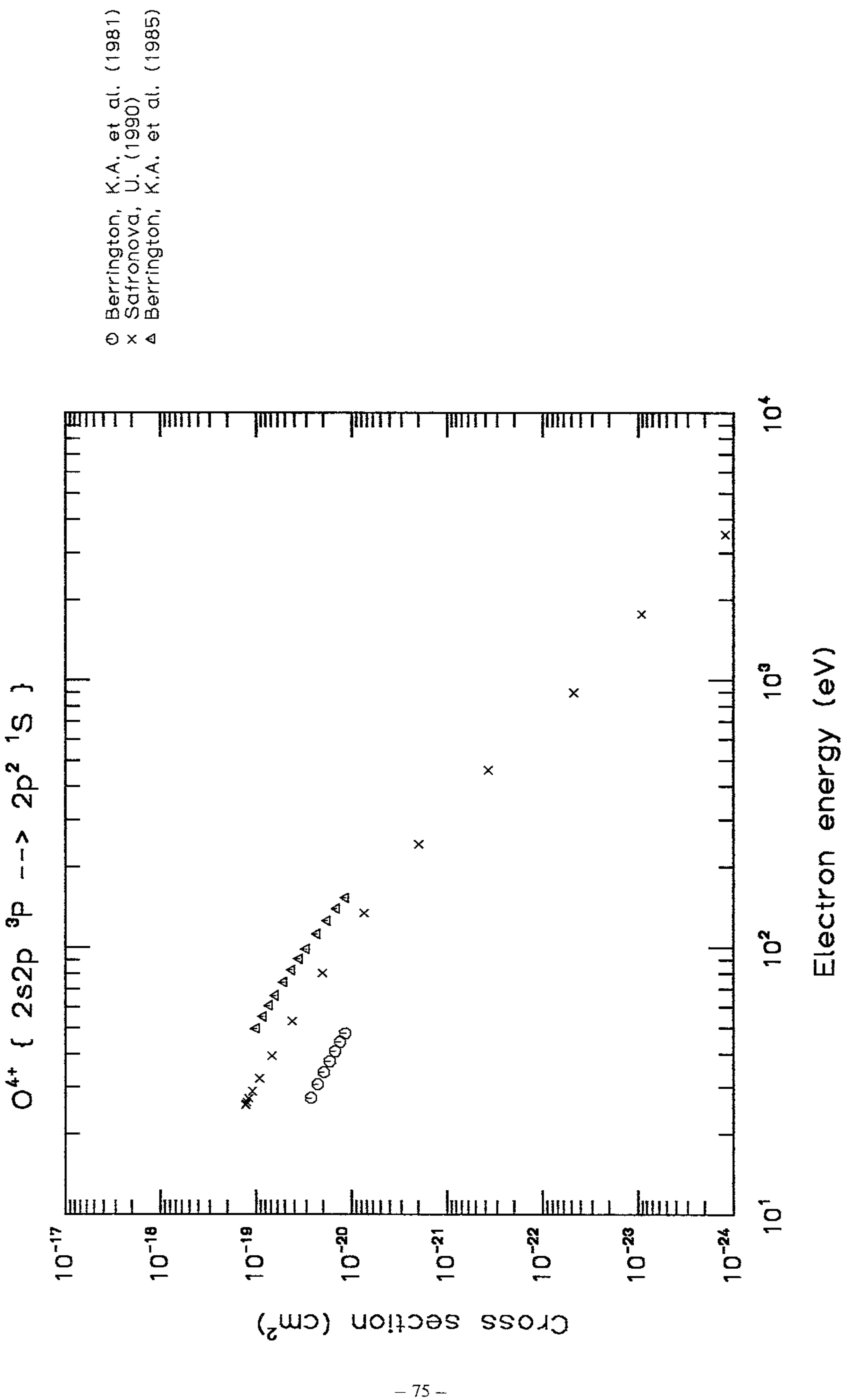

O^{4+} { 2s2p ^1P --> $2p^2$ ^1S }
×10⁻¹⁷
Cross section (cm^2)
Electron energy (eV)
10.0
8.0
6.0
4.0
2.0
0.0
10^1
10^2
10^3
10^4
Berrington, K.A. et al. (1981)
Nakazaki, S Hashino, T (1982)
Safronova, U. (1990)
Berrington, K.A. et al. (1985)



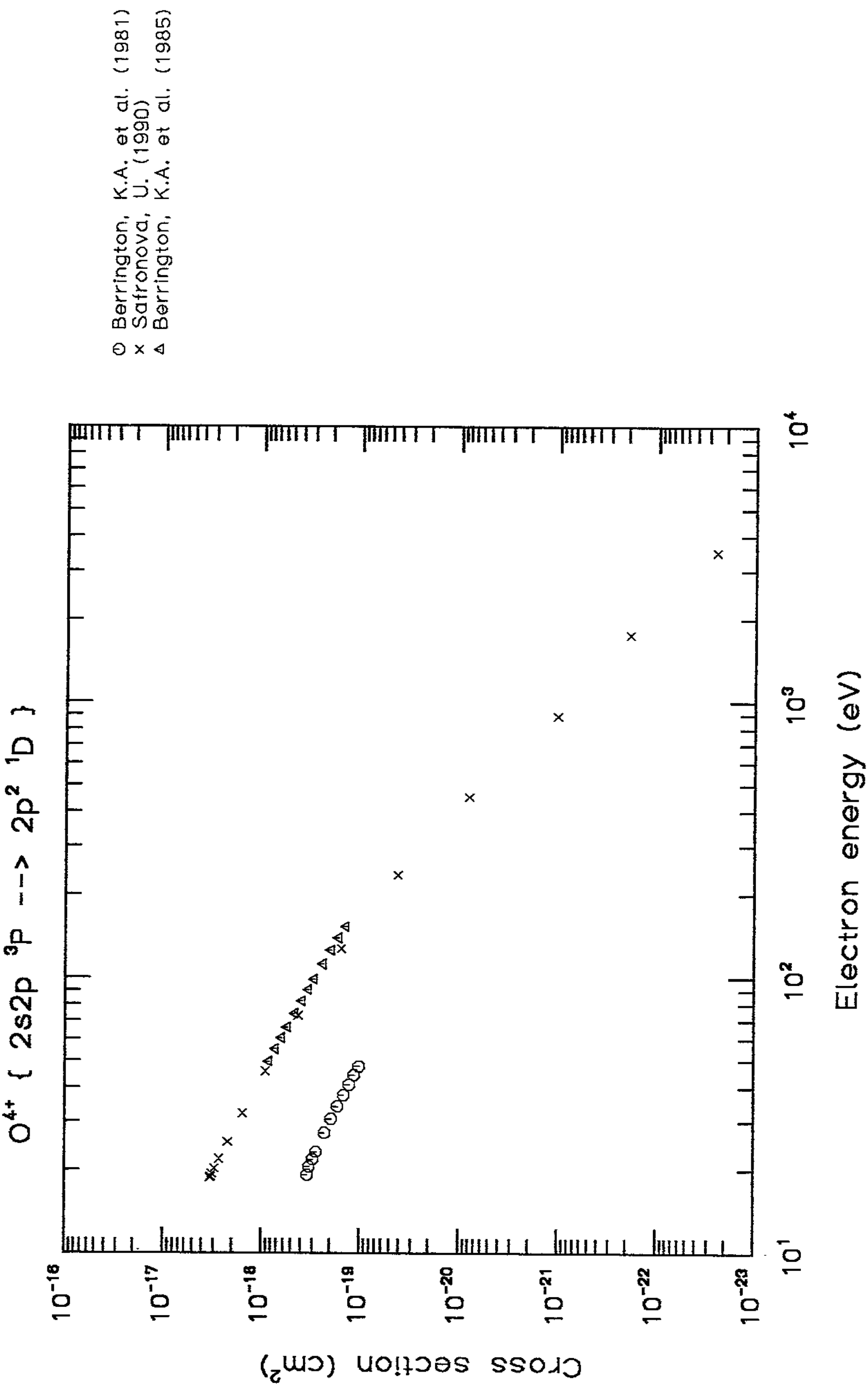
10^-14
10^-15
10^-16
10^-17
10^-18
Cross section (cm^2)
10^0
10^1
10^2
10^3
10^4
Electron energy (eV)
O^4+ { 2s2p ^1P --> 2p^2 ^1D }
Berrington, K.A. et al. (1981)
Nakazaki, S Hashino, T (1982)
O^4+ { 2s2p ^1P_1 --> 2p^2 ^1D_2 }
Safronova, U. (1990)
O^4+ { 2s2p ^1P --> 2p^2 ^1eD }
Berrington, K.A. et al. (1985)



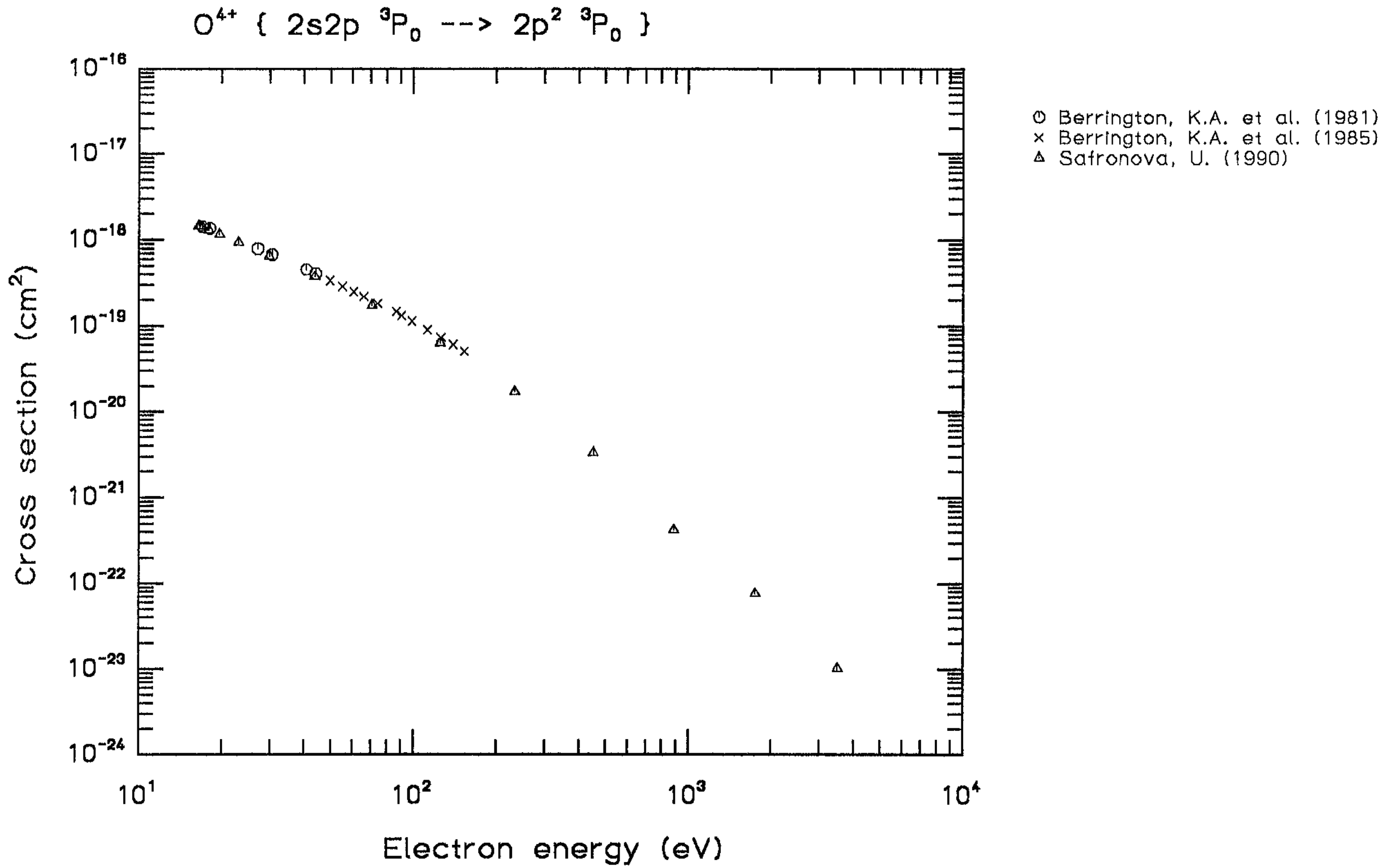
O4+ { 2s2p 1P --> 2p2 3P }
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
10-20
10-21
10-22
100
101
102
103
104
Electron energy (eV)
Berrington, K.A. et al. (1981)
Safronova, U. (1990)
Berrington, K.A. et al. (1985)

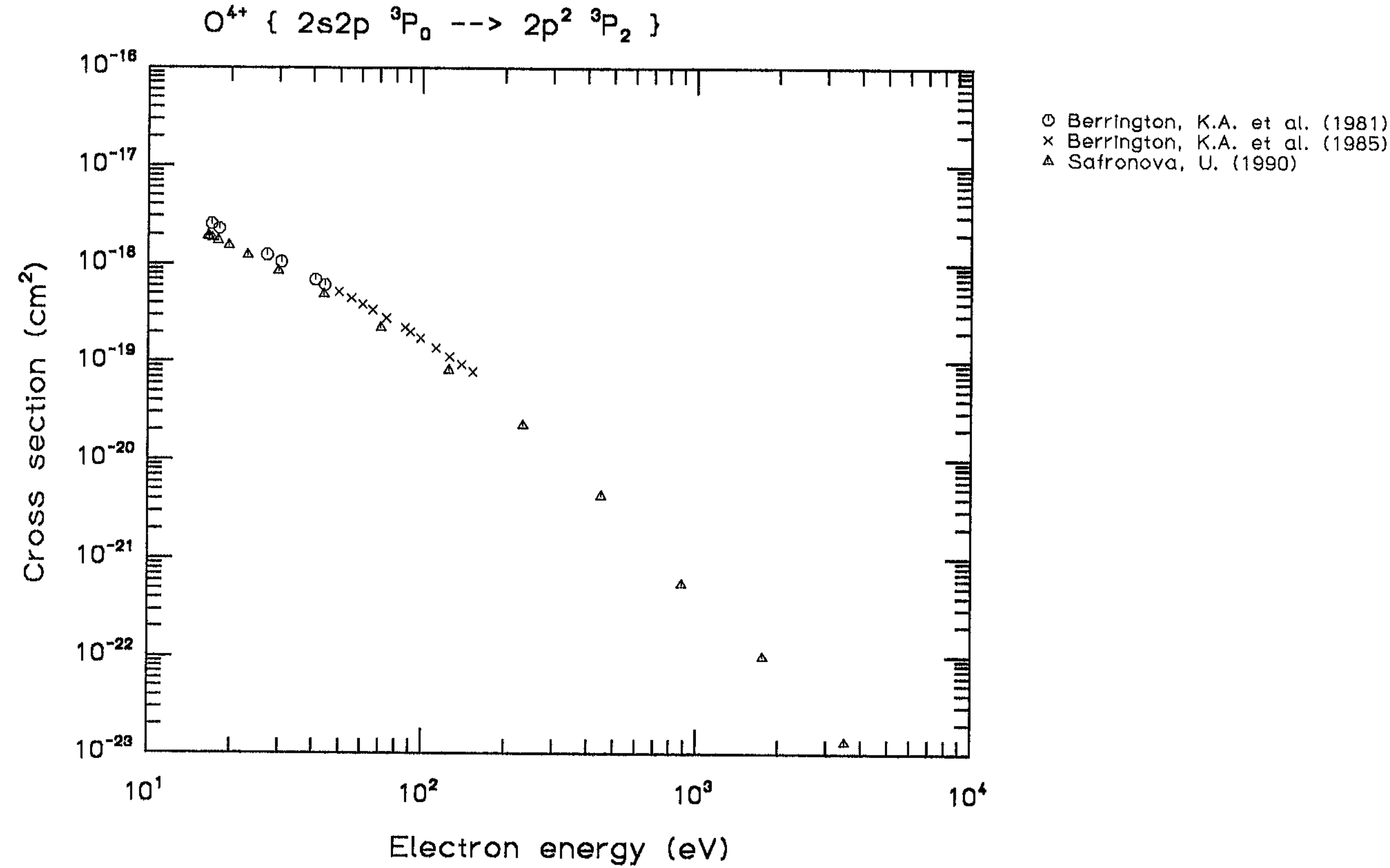


O^{4+} { 2s2p ^3P --> $2p^2$ ^1S }
Cross section (cm^2)
Electron energy (eV)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^{-22}
10^{-23}
10^{-24}
10^1
10^2
10^3
10^4
○ Berrington, K.A. et al. (1981)
× Safronova, U. (1990)
△ Berrington, K.A. et al. (1985)

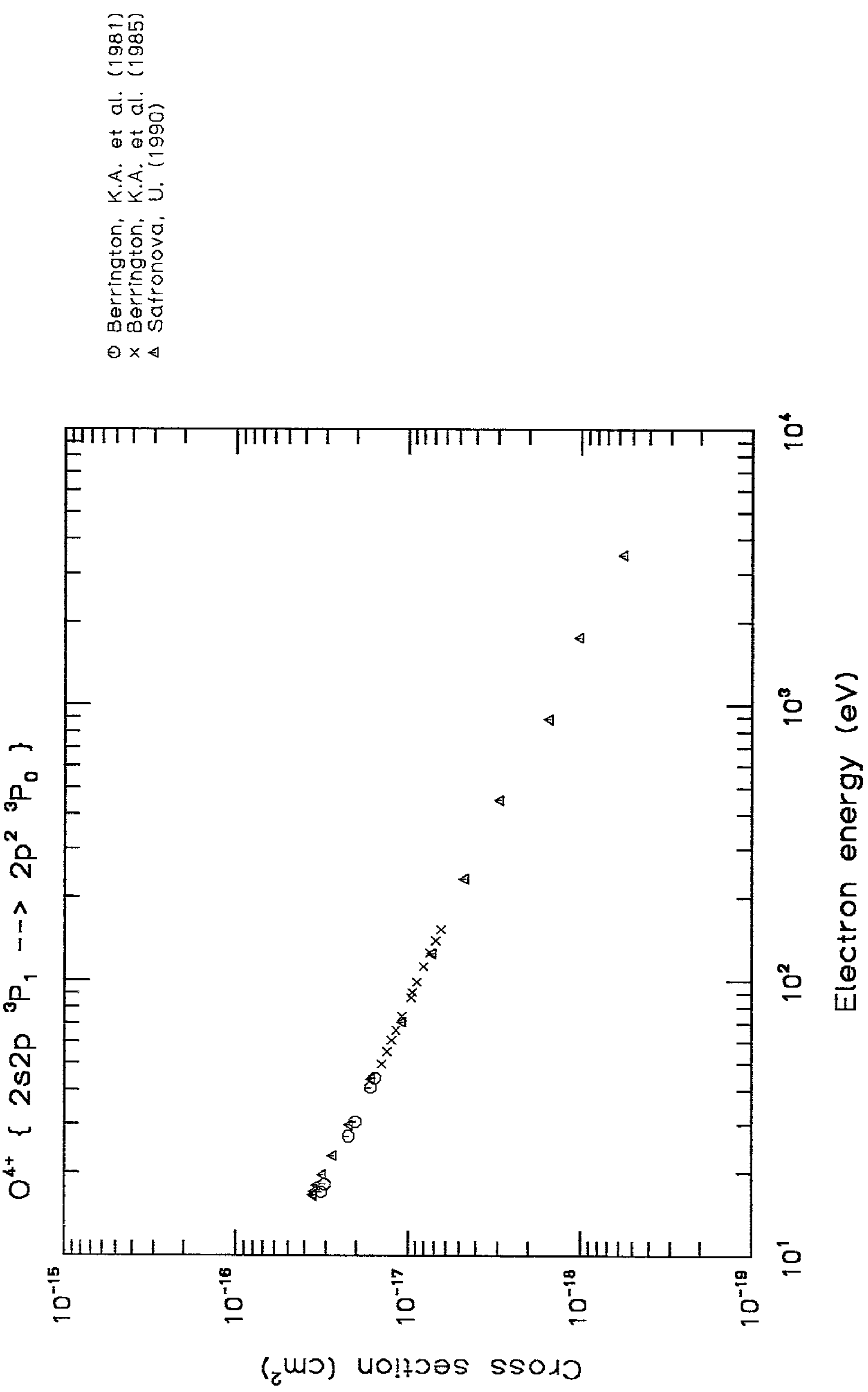


O4+ { 2s2p 3P --> 2p2 1D }
Berrington, K.A. et al. (1981)
Safronova, U. (1990)
Berrington, K.A. et al. (1985)
Cross section (cm2)
Electron energy (eV)
10-16
10-17
10-18
10-19
10-20
10-21
10-22
10-23
101
102
103
104

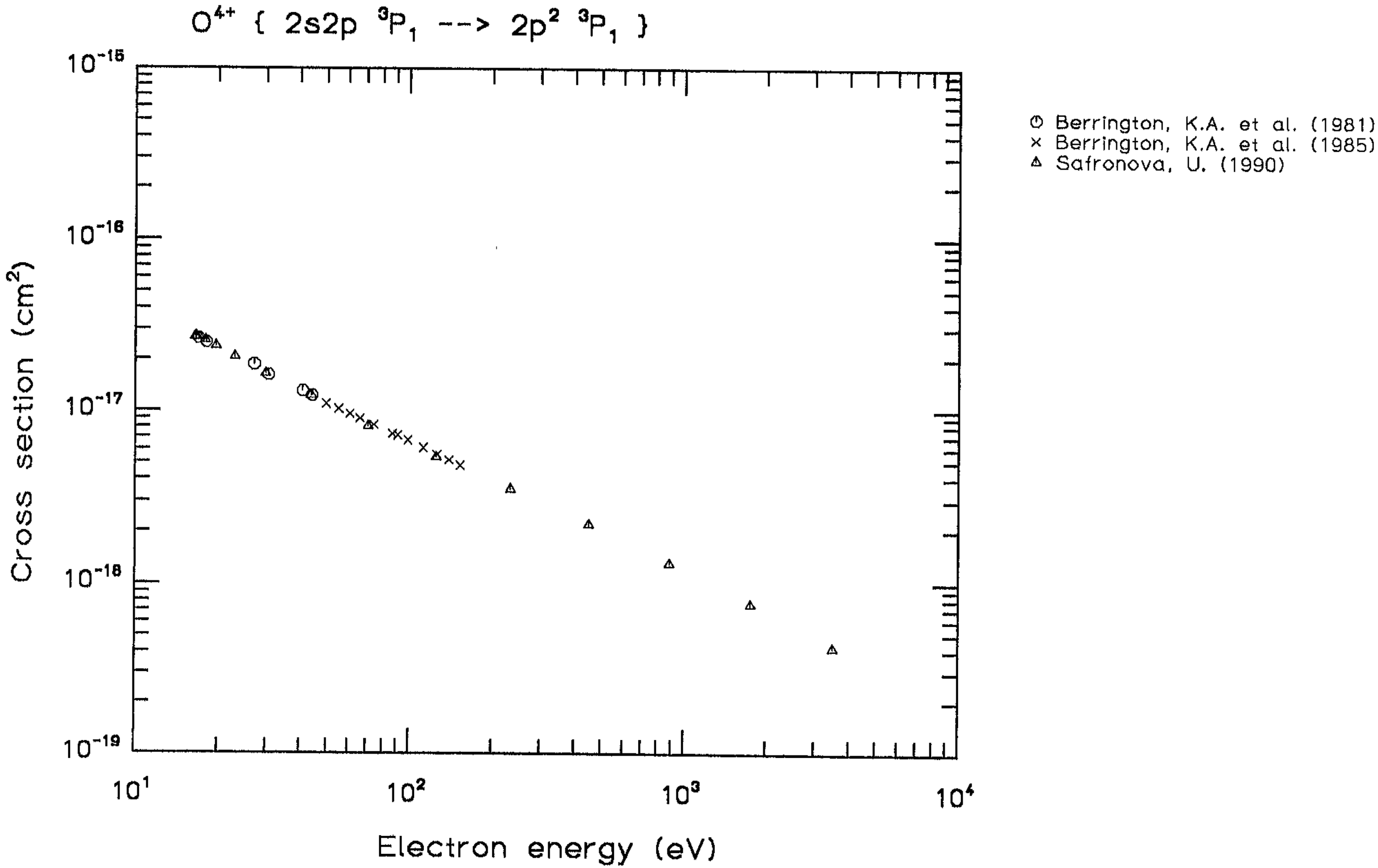

O4+ { 2s2p 3P0 --> 2p2 3P0 }
Cross section (cm2)
Electron energy (eV)
10-16
10-17
10-18
10-19
10-20
10-21
10-22
10-23
10-24
101
102
103
104
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)



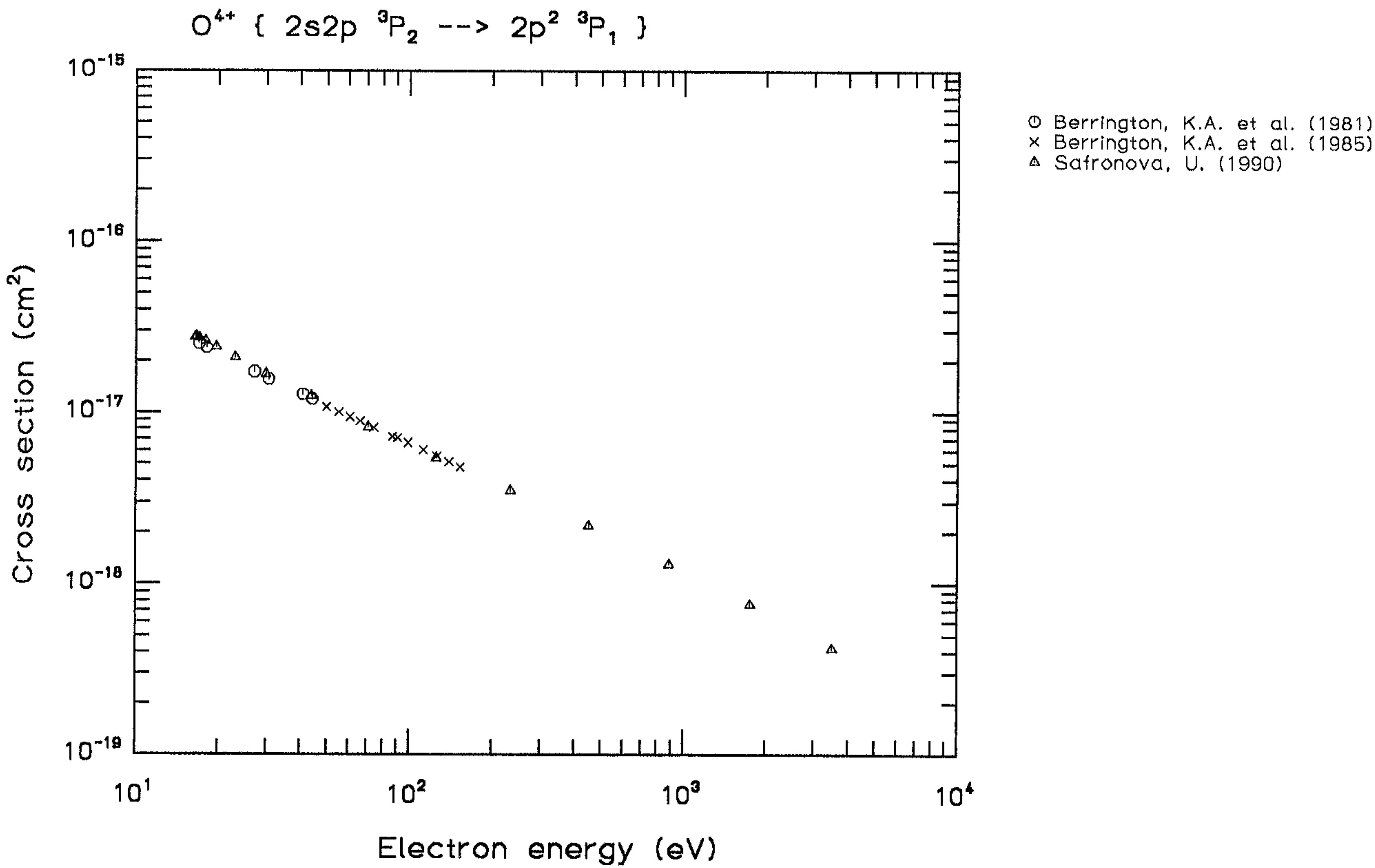
O^{4+} { 2s2p $^3P_0$ --> $2p^2$ $^3P_2$ }
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^{-22}
10^{-23}
10^1
10^2
10^3
10^4
Electron energy (eV)
Berrington, K.A. et al. (1981)
× Berrington, K.A. et al. (1985)
Safronova, U. (1990)



O4+ { 2s2p 3P1 --> 2p2 3P0 }
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
101
102
103
104
Electron energy (eV)



O^{4+} { 2s2p $^3P_1$ --> $2p^2$ $^3P_1$ }
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
Electron energy (eV)
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)


O4+ { 2s2p 3P2 --> 2p2 3P1 }
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
101
102
103
104
Electron energy (eV)
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)

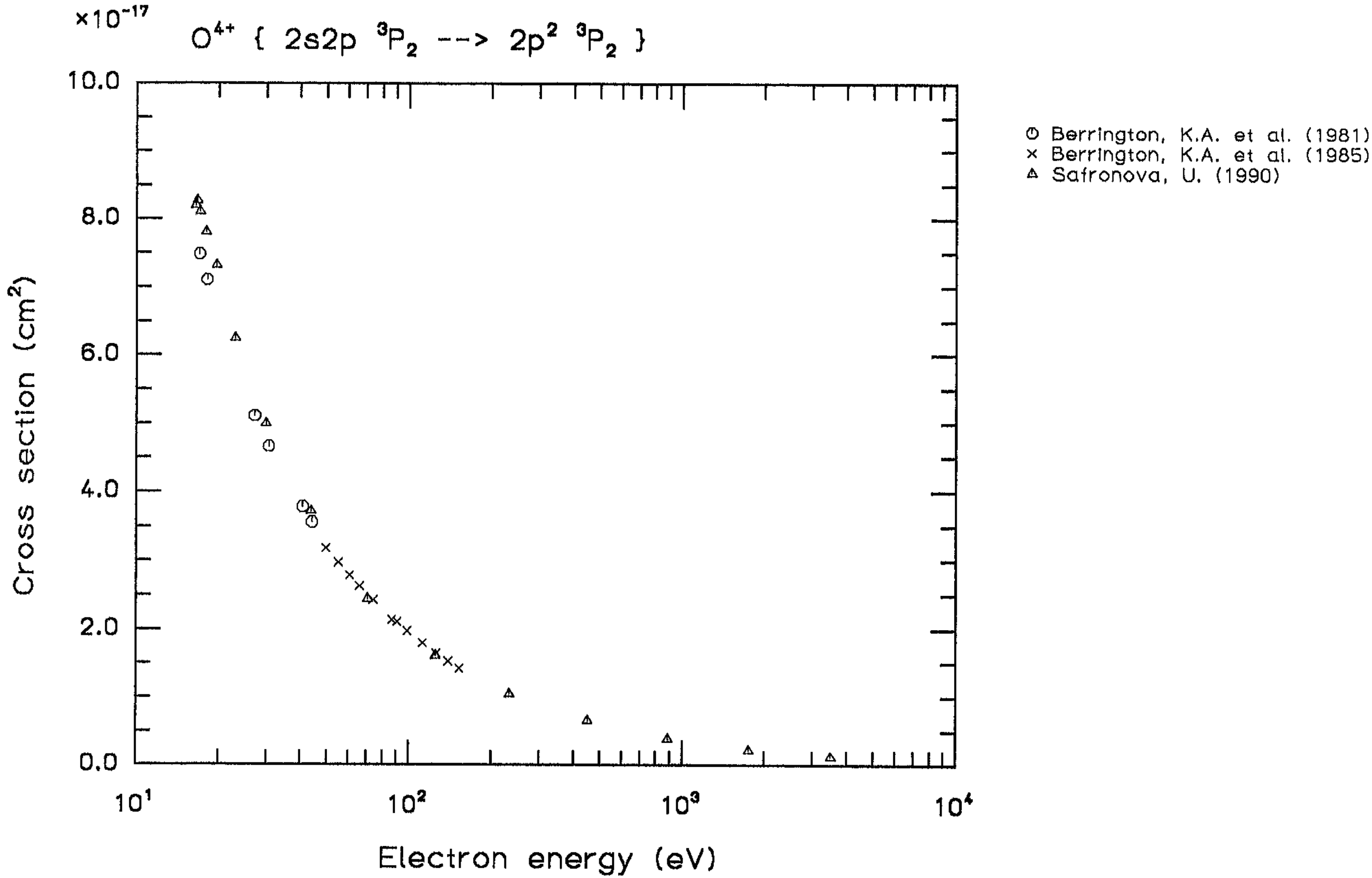
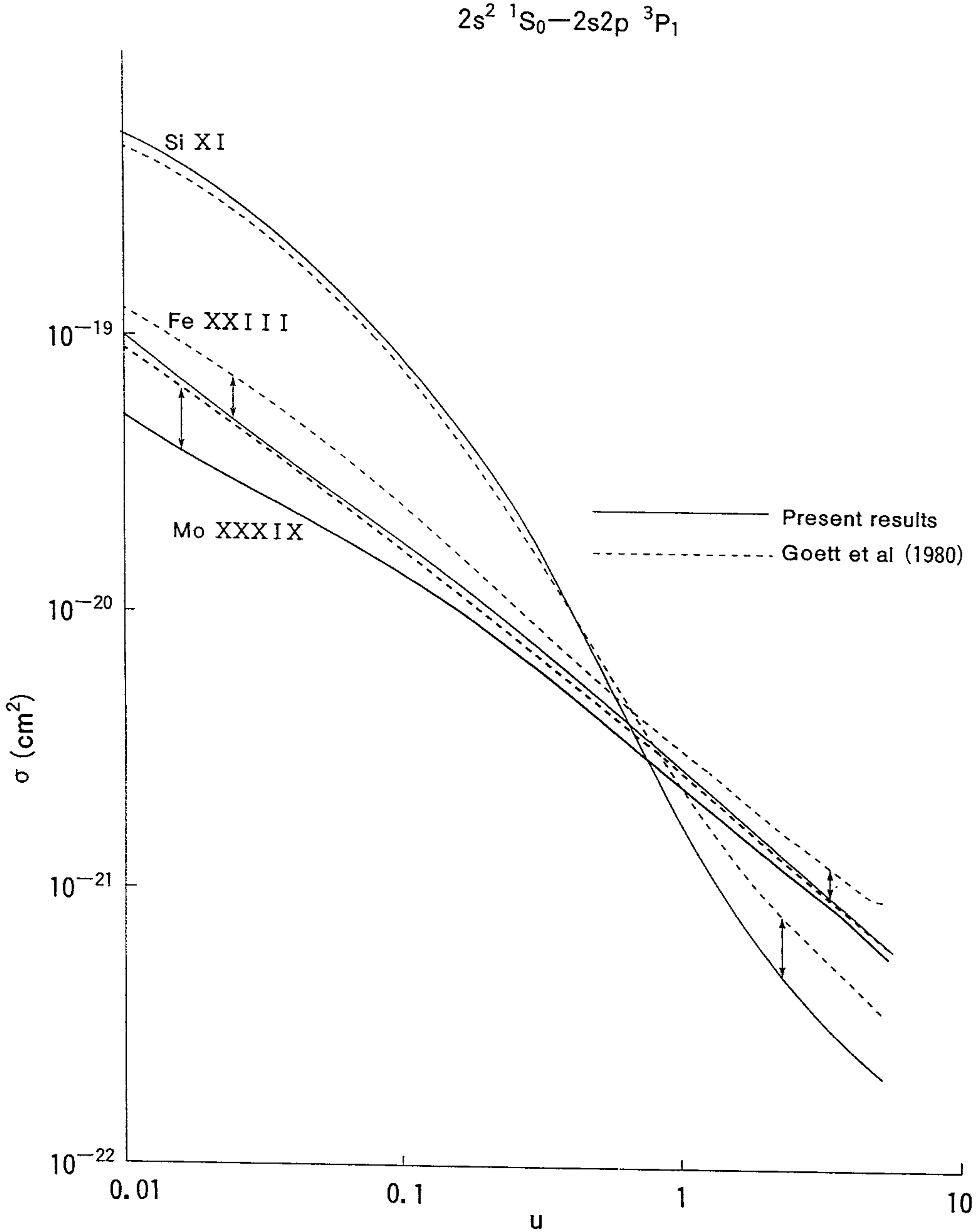

×10⁻¹⁷
O4+ { 2s2p 3P2 --> 2p2 3P2 }
10.0
8.0
6.0
4.0
2.0
0.0
Cross section (cm2)
10^1
10^2
10^3
10^4
Electron energy (eV)
Berrington, K.A. et al. (1981)
Berrington, K.A. et al. (1985)
Safronova, U. (1990)

Fig.4.



$2s^2\ ^1S_0 - 2s2p\ ^3P_1$
Si XI
Fe XXIII
Mo XXXIX
Present results
Goett et al (1980)
10^{-19}
10^{-20}
10^{-21}
10^{-22}
σ (cm²)
0.01
0.1
1
10
u

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