ISSN 0915-6364

NATIONAL INSTITUTE FOR FUSION SCIENCE

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(Received - Feb. 13, 1996)

NIFS-DATA-32 Feb. 1996

RESEARCH REPORT
NIFS-DATA Series

NAGOYA, JAPAN

Dielectronic Recombination Rate Coefficients to the Excited States of CII from CIII

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Abstract.

Energy levels, radiative transition probabilities and autoionization rates for CII including $1s^2 2l2l'nl''$ (n=2-6, $l'\leq$(n-1)) states were calculated by using multi-configurational Hartree-Fock (Cowan code) method. Autoionizing levels above three thresholds: $1s^2 2s^2$ (^1S), $1s^2 2s2p(^3P)$, $1s^2 2s2p(^1P)$ were considered. Branching ratios related to the first threshold and the intensity factor were calculated for satellite lines of CII ion.

The dielectronic recombination rate coefficients to the excited states for n=2-6 are calculated with these atomic data. The rate coefficients are fitted to an analytical formula and the fit parameters are given. The values for higher excited states than n=6 are extrapolated and the total dielectronic recombination rate coefficients are derived. The effective recombination rate coefficient for different electron densities are also derived.

Key words;
autoionizing level, dielectronic recombination, carbon ion, excited states, autoionization rate, radiative transition probabilities, satellite spectra.

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1. Introduction

In order to solve the rate equation of the populations of ions, it is necessary to include many number of levels of the highly excited states for the case of dense plasma. The population of the excited states are determined mainly by the excitation from the ground state and the recombination from the ions at low densities. When the electron density increases, the excitation processes from the excited states become important. In the case of a recombining plasma, the recombination to each excited state is necessary to estimate the populations of ions. These data are also necessary to obtain the effective recombination rate coefficients at high electron densities.

Dielectronic recombination (DR) is a process which plays an important role in plasma dynamics, and also is a subject of interest in studies of atomic structure. We used the following notations here: γ and γ' are an autoionization state and excited state of an ion X_Z respectively, $\alpha a=\alpha_c nlLSJ$ is the stationary state of an ion X_{Z+1}. The state γ can be produced by dielectronic capture (if photon γ-γ' is emitted, then the dielectronic recombination takes place) [1] :

$$
\begin{array}{l}
X_{Z+1}(\alpha_0)+e \rightarrow X_Z(\gamma) \rightarrow X_Z(\gamma')+h\nu \\
\qquad\qquad\qquad\quad \downarrow \\
\qquad\qquad\qquad\quad X_{Z+1}(\alpha')+e'
\end{array}
\tag{1}
$$

For example, the transitions $1s2l'nl$ -$1s^2nl$ are satellite lines to the resonance line $1s2p$-$1s^2$, transitions $1s2l'nl$-$1s^22l''$ $1sn'l'nl$-$1s^2nl$ and of Li-like ions are the satellites to the line $1snp$-$1s^2$ of He-like ions. Be-like satellite lines for $1s2p$-$1s^2$ lines of He-like ions are connected with the states $\gamma=1s2l'2l''nl$. An intensity factor Q_d for the transition γ-γ' is defined as follows:

$$
Q_d\left(\gamma,\gamma' \middle| \alpha_0\right)=g_\gamma \frac{A(\gamma,\gamma')}{A_\gamma+\Gamma_\gamma}\Gamma(\gamma,\alpha_0)=g_\gamma A(\gamma,\gamma')K(\gamma,\alpha_0) \tag{2}
$$

$$
K(\gamma,\alpha_0)=\frac{\Gamma(\gamma,\alpha_0)}{\left(A_\gamma+\Gamma_\gamma\right)}, \quad A_\gamma=\sum_{\gamma''}A(\gamma,\gamma''), \quad \Gamma_\gamma=\sum_{\alpha'}\Gamma(\gamma,\alpha') \tag{3}
$$

where $A(\gamma,\gamma')$ is radiative transition probabilities and $\Gamma(\gamma,\alpha)$ is autoionization rate. Dielectronic satellite spectra of H- and He-like resonance lines (1s-np, $1s^2$ - 1snp) have been studied in many papers [2-6].

Recently the dielectronic recombination processes from the ground state of H-like He [7] and He-like C [8] have been studied experimentally. It was measured DR cross section by using a cooled ion beam.

The cross section for DR of C^{4+} ions had been measured in [8] up to the 1s2s ($^{1,3}S$) and 1s2p ($^{1,3}P$) excitation thresholds which gives resolved $1s2s^2\ ^2S$, $1s(2s2p\ ^3P)\ ^2P$, $1s(2s2p\ ^1P)\ ^2P$, $1s2p^2\ ^2D$, $1s2p^2\ ^2S$ levels.

The DR cross section for C^+ ions were studied experimentally [9] and theoretically [10-12]. The studied process was represented as follows [9]:

$$C^+(1s^22s^22p) + e \rightarrow C^{**}(1s^22s2p^2nl') \rightarrow C^*(1s^22s^22pnl) + h\nu, \qquad (4)$$

It was published by Badnell [13] the theoretical calculation of DR total rate coefficients from the ground and metastable levels of C and O ions. The DR rate coefficients to the excited states of CI from CII were calculated recently by Dubau and Kato [14].

Measurements of relative DR cross sections for F-like Xe had been reported by DeWitt [15]. DR onto the ground state of Xe^{45+} is given schematically as

$$A(1s^22s^22p^5) + e \rightarrow A^{**}(1s^22s^22p^43l3l') \rightarrow A^*(1s^22s^22p^53l) + h\nu,$$

$$A(1s^22s^22p^5) + e \rightarrow A^{**}(1s^22s2p^53l3l') \rightarrow A^*(1s^22s^22p^53l) + h\nu \qquad (5)$$

Recombination rates are obtained when the ion recombines with beam electrons in an ion trap [15].

The more complicated system (Ni-like tantalum) had been theoretically studied by Chen [16]. DR rate coefficients from the ground state Ta^{45+} had been calculated for the electron temperatures in the range 0.02<T<10 KeV. This processes can be schematically represented by

$$(\text{Ne core})3s^23p^63d^{10} + e \rightarrow (\text{Ne core})3l^{-1}\,4l'nl'' \rightarrow (\text{Ne core})3s^23p^63d^{10}nl + h\nu \qquad (6)$$

The calculation of atomic characteristics was carried out for the intermediate autoionizing states $3d^{-1}4lnl'$ (n<10), $3p^{-1}4lnl'$ (n<10) and $3s^{-1}4lnl'$ (n<7).

In the present paper we consider more simple system - Be-like Carbon ions. We consider three thresholds ($1s^22s^2$, $1s^22s2p$ ^3P, $1s^22s2p$ ^1P) where the autoionizing states of C^+ ion are situated. This processes can be schematically represented by

$$1s^22s^2 + e \rightarrow 1s^22s2pnl,\ 1s^22p^2nl \rightarrow 1s^22s^2nl,\ 1s^22s2p3l,\ 1s^22s2p^2,\ 1s^22p^3 + h\nu,$$

$$\downarrow$$

$$1s^22l2l' + e \tag{7}$$

For the threshold ($1s^22l2l'$) we consider the $1s^22s2p(^3P)$ and $1s^22s2p(^1P)$ as well as the ground state ($1s^22s^2$). We take into account as well as the $1s^22s^2nl$ excited states the $1s^22s2p3l$. Let us note that $1s^22s2p3l$ states can be autoionized with the intermediate term ^1P ($1s^22s2p[^1P]3l$) and not-autoionized with the intermediate term ^3P ($1s^22s2p[^3P]3l$). This rule works for l=s and l=p . The $1s^22s2p[^3P]3d$ states are in the autoionizing states like the $1s^22s2p[^1P]3d$ ones. It should be noted that the $1s^22p^2nl$ states are autoionized for n≥3 and they are not autoionized for n=2 ($1s^22s2p^2$ and $1s^22p^3$). As a result we found the 77 levels up to n=6 (eq.(7)) as the excited levels and the 717 levels as the autoionizing ones (230 levels are between the $1s^22s^2$ and $1s^22s2p$ ^3P thresholds, 140 levels are $1s^22s2p$ ^3P and $1s^22s2p^1P$ thresholds and 347 levels are above the $1s^22s2p$ ^1P threshold).

2. Energy levels, radiative transition probabilities and autoionization rates

We carried out detailed calculations of radiative transition probabilities and autoionization rates for the intermediate states $1s^22s^2(^1S)nl$, $1s^22s2p(^{1,3}P)nl$ and $1s^22p^2(^3P,^1S,^1D)nl$ (n=2 - 6). The atomic energy levels and bound-state wave functions were obtained by using the atomic structure code of Cowan [17]. It was found (see for example Pindzola et al [18]) that using this code, one could obtain good agreement with experimental energies by scaling the electrostatic Slater parameters using the different factor (0.80 in [18]) to correct for correlation effects.

Table Ia lists non-scaled (a) and scaled (b,c) Hartree-Fock energies together with recommended data (d) by Bashkin & Stoner [19] for B-like ion with $1s^22s^2(^1S)3l$, $1s^22s2p(^{1,3}P)3l$ and $1s^22p^2(^3P,^1S,^1D)3l$ intermediate states. The scaled factor was equal to 0.85. The difference of the energies of $1s^22s^2(^1S)nl$, $1s^22s2p(^{1,3}P)nl$ and

$1s^22p^2(^3P,^1S,^1D)nl$ states (n=2-3) in the case of calculations with including only the n=2-3 states ("b" column in Table Ia) and in the case of including the n=2-6 states ("c" column in Table Ia) can be explained by the correlation effects. We can see from comparison "a" and "b" energies of Table I that the scaling factor changes energies between 1000 - 3000cm^{-1}. The superposition configurations ("b" and "c" energies) is shifted the values with 200 - 1000cm^{-1} only. The difference between these energies ("c") and the recommended energies ("d") are in the range $400<E<7000$ cm^{-1}. The largest difference takes place for the states with equivalent electrons ($1s^22s2p^2$, $1s^22p^3$) and can be explained by the correlation correction. This correction was calculated by perturbation theory (see for example, Ivanova and Safronova [21]) in the frame of two orders by 1/Z- expansion. The second order contribution for the correlation corrections (E_2^{corr}) of C^+ for $1s^22s2p^2$ (^4P, ^2D, ^2S, ^2P) and $1s^22p^3$ (^4S, ^2D, ^2P) states is equal to 7290, -5090, -3200, -11830, 3200, 8620, 10560 cm^{-1} correspondingly. The difference between the recommended data [19] ("d") and non-scaled Hartree-Fock data ("a"- E^{HF}) is equal to 4151, -5037, -5171, -8989, 1163, -7812, -13795 correspondingly. We can see that the largest part of the difference between the recommended data and E^{HF} can be covered by the E_2^{corr} values. We have no data of E_2^{corr} for another states of C^+ ion but we can estimate from this comparison how much we can shift our scaled data calculated in matrixes with superposition of configurations up to n=6 ("c"). We found that the differences between "d" and "c" data for $1s^22s2p^2$ (^4P, ^2D, ^2S, ^2P) and $1s^22p^3$ (^4S, ^2D, ^2P) states are 922, -1647, 646, 441, -80, -5649, -7152 correspondingly. Only for two states $1s^22p^3$ (^2D, ^2P) the scaling and superposition configurations did not solve the problem of the correlation corrections, but the discrepancy was decreased by twice comparing the Hartree-Fock data (column "a" in Table Ia).

Table 1b was prepared almost in the same form as Table 1a but for the $1s^22s^2(^1S)4l$, $1s^22s2p(^{1,3}P)4l$ and $1s^22p^2(^3P,^1S,^1D)4l$ intermediate states. The scaled factor 0.85 was used for computing energies of these sates (see column "a" and "b"). The data given in column "a" were computed using complex states $1s^22s^2(^1S)nl$, $1s^22s2p(^{1,3}P)nl$ and $1s^22p^2(^3P,^1S,^1D)nl$ with n=3.4 and the states with n=3,4,5 and 6 were took into account for data shown in column "b". We can see from this table that these data agree well with recommended data from [19]. The difference in energies given in columns "b" and "c" is 100 - 500cm^{-1}. It is much better than for the energies of $1s^22s^2(^1S)3l$, $1s^22s2p(^{1,3}P)3l$ and $1s^22p^2(^3P,^1S,^1D)3l$ intermediate states (see Table Ia). It should be noted that for the more excited states considered in Table 1b (compared to the states in Table Ia) the contribution of correlation effects can be less important and the scaled factor was enough for the correlation part of energy.

Table Ic lists non-scaled (a) and scaled (b,c) Hartree-Fock transition probabilities sum on all the lower levels multiplied on statistical weight of the upper level (weighted radiative transition probabilities -sum(gAr)) together with recommended data (d) by Wiese et al [20] for the same states as in Table Ia. We can see from Table Ib that disagreement of "a, b, c, d" data is not more than 20% except some levels ($2s^2$ $(^1S)3s$ ^2S , $2s^2(^1S)3p$ ^2P). Superposition configuration (n=3, 4, 5, 6) only slightly changed Sum(gAr). It should be noted that data in [20] were also obtained by HF method but probably with huge number of configuration.

Tables IIa, b, c, and d list energy levels, weighted radiative transition probabilities and autoionization rates for CII. We computed $1s^22s^2nl$, $1s^22s2pnl$ and $1s^22p^2nl$ states with n=2-6 and $l' \leq (n-1)$ but we included in Table II the data up to n=4 and l=s, p, d, f since data file was too large. All data are in the order of increasing the energy levels.. Tables IIa includes levels before the first threshold: $1s^22s^2$ (196660 cm^{-1}). These levels are not autoionizing and we include in this table only radiative transition probabilities. Tables IIb includes levels between the first and the second threshold: $1s^22s2p$ ^3P (248975 cm^{-1}). We included in this table the autoionizing rates also. There is only one decay channel through autoionization for these levels and sum (Aa) is equal to Aa. We can see from Table IIb many zero values for Aa. This means that autoionization rate is very small. We note that all the following levels are included in even ($1s^22s^2ns$, $1s^22s^2nd$, $1s^22s^2ng$, $1s^22p^2ns$, $1s^22p^2nd$, $1s^22p^2ng$, $1s^22s2pnp$, $1s^22s2pnf$, $1s^22s2pnh$) or odd ($1s^22s^2np$, $1s^22s^2nf$, $1s^22s^2nh$, $1s^22p^2np$, $1s^22p^2nf$, $1s^22p^2nh$, $1s^22s2pns$, $1s^22s2pnd$, $1s^22s2png$ and $1s^22p^3$) complexes. For levels of even complex the non-zero data for autoionizing rate take place for ^2S, ^2D and ^2G terms: $1s^22s2pnp$ $^2S \rightarrow 1s^22s^2\varepsilon s$ ^2S, $1s^22s2pnp$ $^2D \rightarrow 1s^22s^2\varepsilon d$ ^2D, $1s^22s2pnf$ ^2G

$\rightarrow 1s^2 2s^2 \varepsilon g\ ^2G$. For levels of odd complex the non-zero data for autoionizing rate take place for ^2P, ^2F and ^2H terms: $1s^2 2s2pns\ ^2P \rightarrow 1s^2 2s^2\ \varepsilon p\ ^2P$, $1s^2 2s2pnd\ ^2F \rightarrow 1s^2 2s^2 \varepsilon f\ ^2F$, $1s^2 2s2png\ ^2H \rightarrow 1s^2 2s^2 \varepsilon h\ ^2H$. We can see from Table IIb that for all above mentioned levels we obtained non-zero data for Γ when the total angular momentum is conserved. The values of Aa (Aa$\equiv\Gamma$) for a such direct decay in LS coupling scheme are equal to 10^{12} - 10^{14} s^{-1} and Aa>>SumAr since $10^9 \leq$SumAr< 10^{11} s^{-1}. As a result the branching ratio $K(\gamma,\alpha_0)$ is equal to 1. The non-zero values of Aa for quartet terms (^4L) takes place by relativistic effects. Aa for the quartet levels is much less than for doublet levels and Aa$\approx$Sum Ar. For these levels ratio $K(\gamma,\alpha_0)$<1.

Tables IIc includes levels between the second $1s^2 2s2p\ ^3P$ (248975 cm^{-1}) and the third threshold: $1s^2 2s2p\ ^1P$ (299011 cm^{-1}). There are 2 decay channels ($1s^2 2s^2$ and $1s^2 2s2p\ ^3P$) for the levels of this interval of energy. As we can see from Table IIc the second channel is more preferable than to the first threshold for the levels in this interval of energy. They are levels of types $1s^2 2s2p(^1P)nl$ and $1s^2 2p^2(^3P)nl$. For decays to the ground state $1s^2 2s^2$ we can use the same rule of the conservation total angular momentum as above but only for $1s^2 2s2p(^1P)nl$ levels. There is no direct decay to the ground state for the autoionizing levels $1s^2 2p^2(^3P)nl$ ($1s^2 2p^2(^3P)nl \rightarrow 1s^2 2s^2 \varepsilon l$). Non-zero value of Aa of these levels one obtained with the superposition of configurations for the target ($1s^2 2s^2\ ^1S + 1s^2 2p^2\ ^1S$). It should be noted that the branching ratios $K(\gamma,\alpha_0)$ can be determined by the ratios of Aa for the first channel ($\alpha_0 = 1s^2 2s^2\ \varepsilon l$) to the sum of Aa since Sum (Ar)<<Sum(Aa).

Tables IId includes levels above the third threshold: $1s^2 2s2p\ ^1P$ (299011 cm^{-1}). There are 3 decay channels: $1s^2 2s^2$, $1s^2 2s2p\ ^3P$ and $1s^2 2s2p\ ^1P$. We can see from this table that there are only few levels with non-zero values to the ground state. It can be explained by absence of direct decay of the level situated in this interval of energy ($1s^2 2p^2(^3P)nl$, $1s^2 2p^2(^1D)nl$, $1s^2 2p^2(^1S)nl$ to the ground state ($1s^2 2s^2$). As we said before the branching ratios $K(\gamma,\alpha_0)$ is really equal to the value of Aa($1s^2 2s^2$)/Sum(Aa) and as a result $K(\gamma,\alpha_0)$<<1 for the levels in this interval of energy.

3. Dielectronic satellite spectra

Autoionizing levels $1s^22s2pnl$, $1s^22p^2nl$ produce satellite lines to the resonance lines from the $1s^22s^22p$ - $1s^22p^22s$ - $1s^22p^3$ transitions in the region of 900 - 2000 Å. Tables III and IV list wavelengths (WL), weighted radiative transition probabilities (gAr), branching ratio (K) and factor of relative intensity (Qd) of dielectronic satellite lines. There are huge number of such lines but we have chosen lines with largest value of gAr for illustration. We discovered that there are only 53 lines with gAr>10^{10} s^{-1}. These lines are given in Table IVa (transitions from even complex to odd one) and Table Va (transitions from odd complex to even one). As we showed in Sect.2 (see Table II) the non-zero values of Aa for levels of odd complex (direct decay from autoionizing levels to $1s^22s^2$) take place for doublet terms with odd L: ^2P, ^2F, ^2H. We can see from Table IVa that only for transitions with ^2F_J , ^2H_J terms for upper level we obtained non-zero values of branching ratios (K) and also Qd. On the contrary Table Va shows that only for transitions with ^2D_J , ^2G_J terms for upper level can give contribution to dielectronic satellite spectra, since only for these terms we obtained non-zero values of branching ratios (K) and also Qd. It should be noted that this conclusion is applicable t for the case of thin plasma where only the lowest level of C^{2+} ($1s^22s^2$) is populated. The values of Aa (and so K and Qd) to other states ($1s^22s2p^{1,3}P$) can be different from zero almost for all transitions given in Tables IVa and Va. Table IVb and Vb were organized in similar to Tables IVa and Va but we choose transitions with gAr>10^{9+} s^{-1}. Also we removed all transitions with zero values of Aa. As a result there are transitions with ^2P, ^2F, ^2H terms of upper states in Table IIIb and transitions with ^2S, ^2D, ^2G terms of upper states in Table IVb.

The satellite spectra shown on Tables IVa,b and Va,b covered the interval of wavelength from 406 Å up to 1230Å. The range of 406 Å up to 950Å consists of the n -2 transitions with n=3 - 6. There are some transitions n=6 - 3 types ($2s^2(^1S)6d$ - $2p^2(^1D)3p$) but their contribution to the satellite spectra is very small (Qd<10^7 s^{-1}). The largest contribution to satellite spectra (≈960 Å) gives transition with $\Delta n=0$ ($2s^2(^1S)nl$ - $2s2p(^1P)nl$ transitions). We have to note that the contribution of the transitions with n≤6 calculated in this section to the total dielectronic satellite lines are only about 1%.

We have to include the contribution from higher levels ($n \leq 500$) in order to obtain the total values. This problem will be considered in the next section.

4. Dielectronic recombination rate coefficients to the excited states

The dielectronic recombination rate coefficients $\alpha_d(\gamma'|\alpha_0)$, to the excited state are obtained by summing up the intensity factor $Q_d(\gamma,\gamma'|\alpha_0)$ (see Eq.(2)) multiplied the exponential factor over the autoionizing levels γ as,

$$\alpha_d\left(\gamma'\middle|\alpha_0\right) = 3.3\times10^{-24}\left(\frac{I_H}{T_e}\right)^{3/2}\sum_{\gamma} e^{-\frac{E_S}{T_e}} Q_d(\gamma,\gamma'|\alpha_0)/g(\alpha_0) \tag{8}$$

where I_H is a hydrogen ionization potential (13.606eV) and E_S is an energy of the autoionizing states counted from the threshold ($1s^22s^2$ in our case) and $g(\alpha_0)$ is the statistical weight of threshold which equal to 1 in our case.

Sum over γ means sum over all autoionization levels. We calculated $Q_d(\gamma,\gamma'|\alpha_0)$ values only up to n=6 by Cowan code and summed all the values up to n=6 to obtain $\alpha_d(\gamma'|2s^2)$. For CII ions, $2s^2nl$, $2p^3$, $2s2p3l$ are under the ionization limit. There are two kind of radiative decay in the dielictronic recombination processes, i) 2p-2s transition such as $2s2pnl$ - $2s^2nl$ and ii) nl -$2l'$ transition such as $2p^2nl$ -$2p^22s$, $2s2pnl$ - $2s^22p$. For the highly excited states $2s^2nl$ (n>6) we consider only the $2s2pnl$ - $2s^2nl$ transition to obtain $\alpha_d(\gamma'|2s^2)$ since only these transitions are dominant for the first case. We used asymptotic formulas for higher level than n=6. We obtain for these transitions from (8)

$$\alpha_d\left(2s^2n\ell\ ^2\ell_J\middle|2s^2\ ^1S_0\right) = 3.3\times10^{-24}\left(\frac{I_H}{T_e}\right)^{3/2}$$
$$\times\sum_{S,L,J'} e^{-\frac{E_S}{T_e}} Q_d(2s2p(^{2S+1}P)n\ell\ ^2L_{J'},2s^2n\ell\ ^2\ell_J|2s^2\ ^1S_0) \tag{9}$$

For 2p - 2s transitions, we can use our calculated data for n=6 to extrapolate the values for n>6:

$$A(2s2p(^{1,3}P)n\ell\ ^2L_{J'} - 2s^2n\ell\ ^2\ell_J) = A(2s2p(^{1,3}P)6\ell\ ^2L_{J'} - 2s^26\ell\ ^2\ell_J) \tag{10}$$

$$\Gamma(2s2p(^{1,3}P)n\ell\ ^2L_{J'},2s^2\ ^1S_0)=\Gamma(2s2p(^{1,3}P)6\ell\ ^2L_{J'},2s^2\ ^1S_0)\left(\frac{6}{n}\right)^3 \quad (11)$$

and the intensity factor Q_d can be equal to (see eq.(2))

$$Q_d(2s2p(^{1,3}P)n\ell\ ^2L_{J'},2s^2n\ell\ ^2\ell_J|2s^2\ ^1S_0)=(2J'+1)\frac{f(n=6)}{1+(n/6)^3 f'(n=6)} \quad (12)$$

where

$$f(n=6)=A(2s2p(^{1,3}P)6\ell\ ^2L_{J'}-2s^2 6\ell\ ^2\ell_J)\frac{\Gamma(2s2p(^{1,3}P)6\ell\ ^2L_{J'}|2s^2\ ^1S_0)}{\Gamma(2s2p(^{1,3}P)6\ell\ ^2L_{J'})}$$

$$f'(n=6)=\frac{A(2s2p(^{1,3}P)6\ell\ ^2L_{J'})}{\Gamma(2s2p(^{1,3}P)6\ell\ ^2L_{J'})} \quad (13)$$

By using these formulas we can calculate Q_d for above mentioned transitions with any n. The values of A and Γ for these transitions with n=6 are given in Table VIII.

And we obtained instead of eq. (9) for n>6

$$\alpha_d\left(2s^2n\ell\ ^2\ell_J\middle|\,2s^2\ ^1S_0\right)=3.3\times10^{-24}\left(\frac{I_H}{T_e}\right)^{3/2}\sum_{S,L,J'}e^{-\frac{E_S}{T_e}}(2J'+1)\frac{f(n=6)}{1+\left(\frac{n}{6}\right)^3 f'(n=6)}$$

(14)

It should be noted that we take E_S for the second (2s2p ^3P) and third (2s2p ^1P) thresholds are equal to 6.484eV and 12.685 eV respectively. We can see from Table VIII that the values of E_S are changed from 4.628eV to 4.976eV and from 10.98eV to 11.38ev for $2s2p(^3P)6l$ and $2s2p(^1P)6l$ states for different l. In this case all states with n>6 can be situated in very small interval of energy: 1.856eV - 1.508eV for $2s2p(^3P)nl$ and 1.705eV - 1.305eV for $2s2p(^1P)nl$. We used E_S values at n=6 for n>6.

Results of our calculations of $\alpha_d(\gamma'|\alpha_0)$ for 36 excited levels are shown on Fig.1a,b,c (even complex) and Fig.2a,b,c (odd complex) as a function of T_e. Table VI (even) and Table VII (odd) show the atomic data used for $\alpha_d(\gamma'|2s^2)$ to the excited states.We can see that the form of curves given by Figs.1 and 2 are very different. The values of $\alpha_d(\gamma'|2s^2)$ for γ' related to the even complex ($2s2p^2$, $2s^2ns$, $2s^2nd$, $2s^2ng$, $2s2p(^3P)3p$) are not equal to zero at very low temperature, even T_e equal to 0.1eV, on the contrary the values of $\alpha_d(\gamma'|2s^2)$ for γ' related to the odd complex ($2s^22p$, $2p^3$,

$2s^2np$, $2s^2nf$, $2s2p(^3P)3s$, $2s2p(^3P)3d$) decrease towards the low temperature. There are curves with two maximums (see Fig.1a) and the first maximum is at very small T_e around 0.2eV. This maximum can be explained by contribution from the autoionizing levels $2s2p(^3P)3d\ ^2P_{1/2}$, $^2P_{3/2}$, $^2F_{5/2}$, $^2F_{7/2}$. These terms are situated very near to the threshold $1s^22s^2$ (196659 cm^{-1}) (see Table IIb) and the values of $Q_d(\gamma,\gamma'|2s^2)$ for these levels is around $10^{10}s^{-1}$ (see Table VI). By these data we can obtain the maximum value of $\alpha_d(\gamma'|2s^2)$ around $T_e = E_S$ by these four levels ($2s2p(^3P)3d\ ^2P_{1/2}$, $^2P_{3/2}$, $^2F_{5/2}$, $^2F_{7/2}$).

Let us discuss in more detailed T_e dependence for $\alpha_d(\gamma'|2s^2)$ shown on Fig.1a. Table VI lists some $Q_d(\gamma,\gamma'|2s^2)$ which were used for calculations of $\alpha_d(\gamma'|2s^2)$. We can see from this table that the largest value of $Q_d(\gamma,\gamma'|2s^2)$ for $\gamma'=2p^2(^1D)2s[^2D]$ was obtained by transition from the autoionizing $2s2p(^3P)3d\ [^2F_J]$ levels. The value of E_S for these levels is 0.13eV. And we can see from Fig.1a that the maximum of $\alpha_d(\gamma'|2s^2)$ for $\gamma'=2p^2(^1D)2s[^2D]$ is around T_e=0.13eV. The values of $Q_d(\gamma,\gamma'|2s^2)$ for other γ (see for example $\gamma=2s2p(^1P)3d\ [^2F_J]$) is the same as for $\gamma=2s2p(^3P)3d[^2F_J]$) but the values of E_S for other levels (for example, $E_S(2s2p(^1P)3d[^2F_J])$=6.24eV) are much larger. In the result we the value for the second maximum of $\alpha_d(\gamma'|2s^2)$ is smaller than for the first one.This is exactly what we found for the levels with $\gamma'=2s^23d$, $2s^24s$ and $2s^24d$ (see Table VI and Fig.1a). We can see two maximums for these levels around T_e =0.13eV and T_e =6.24eV. The ratio of values of the first to the second maximums of $\alpha_d(2s^2nl\ |2s^2)$ decreases with increasing of n. We see from Figs.1a and 1c that this ratio is almost equal 1 and 0.1 for $\alpha_d(2s^23d\ |2s^2)$ and $\alpha_d(2s^25d\ |2s^2)$ respectively. This conclusion can be confirmed by data of $Q_d(\gamma,\gamma'|2s^2)$ given in Table VI (see $Q_d(\gamma,\gamma'|2s^2)$ for $\gamma'=2s^2nd$). It should be noted that the first maximum is disappeared for the $\alpha_d(2s^2nl|2s^2)$ with high l (see $\alpha_d(2s^2ng|2s^2)$ given in Fig.1c) because no transitions from $2s2p(^3P)3d[^2F_J]$ levels. We can see from Table VI that there are no direct transitions of these type ($2s^2ng$ - $2s2p(^3P)3d$).

Fig.1b demonstrates $\alpha_d(\gamma'|2s^2)$ for $\gamma'=2s2p(^3P)3p$. These levels are situated very near under the first threshold $2s^2$ and the $2s2p(^3P)3p$-$2s2p(^3P)3d$ transition probabilities can be small since the energy differences are very small. We can see from Table VI that $Q_d(\gamma,\gamma'|2s^2) < 10^9 s^{-1}$ for γ'=2s2p(^{3}P)3p. In this case the value of $\alpha_d(2s2p(^3P)3p|2s^2)$ can be smaller than the value of $\alpha_d(2s2p^2|2s^2)$. Our conclusion agrees with $\alpha_d(\gamma'|2s^2)$ shown by Fig.1b.

We can use asymptotic formula given in paper [22] in order to obtain E_S for 2s2p(^{3}P)nl and 2s2p(^{1}P)nl states as function of nl as follows. We obtain the energy counted from the threshold:

$$E(1s^2 2s2pn\ell) - E(1s^2 2s2p) = -\frac{Z^2}{2n^2} + 2ZE_1(1s, n\ell) + ZE_1(2s, n\ell) + ZE_1(2p, n\ell) \tag{15}$$

where Z is the nuclear charge and $E_1(1s,nl)$, $E_1(2s,nl)$, $E_1(2p,nl)$ are the first order correction which can be represented for the large n in the form:

$$E_1(1s, n\ell) = \frac{1}{n^2} - \frac{a(1s,\ell)}{n^3}, \quad E_1(2s, n\ell) = \frac{1}{n^2} - \frac{a(2s,\ell)}{n^3}, \quad E_1(1s, n\ell) = \frac{1}{n^2} - \frac{a(2p,\ell)}{n^3} \tag{16}$$

where numerical data for a(1s,l), a(2s,l), a(2p,l) are given in [22]. Finally we can rewrite eq.(15) by using method of screening constant:

$$E(1s^2 2s2pn\ell) - E(1s^2 2s2p) = -\frac{1}{2n^2}\left(Z - 4 + \frac{1}{n}b(\ell)\right)^2 \tag{17}$$

where for b(l)=2a(1s,l)+a(2s,l)+a(2p,l). In the case of l=s we obtain from [22] b(s)=2.211. In the result for our ion (Z=6) we can find for s-state:

$$E(1s^2 2s2pns) - E(1s^2 2s2p) = -\frac{1}{2n^2}\left(2 + \frac{2.211}{n}\right)^2 \tag{18}$$

that gives for n=6, -0.07791a.u.=2.120eV. We obtain for E_S =(6.484 -2.120)= 4.364eV and E_S =(12.685 - 2.120)= 10.565eV which agree very well with data given in Table VIII (the four first lines) obtained by Cowan code. Therefore we can use eq.(16) for estimation of E_S as function of n. We simplify eq.(16) for high Z and use only the first term:

$$E_S(2s2p(^3P)n\ell) = 6.484 - \frac{54.42}{n^2}, \quad E_S(2s2p(^1P)n\ell) = 12.685 - \frac{54.42}{n^2} \tag{19}$$

5. Total dielectronic recombination rate coefficients

The total dielectronic recombination rate coefficient is obtained by the sum of all the levels,

$$\alpha_d^t = \sum_{n=2}^{\infty}\alpha_d\left(2s^2 n\ell\ {}^2\ell_J\middle|\ 2s^2\ {}^1S_0\right)+\sum_{LSJ}\Big[\alpha_d\left(2s2p^2(LSJ)\middle|\ 2s^2\ {}^1S_0\right)$$
$$+\alpha_d\left(2p^3(LSJ)\middle|\ 2s^2\ {}^1S_0\right)+\sum_{\ell}\alpha_d\left(2s2p[{}^3P]3\ell(LSJ)\middle|\ 2s^2\ {}^1S_0\right)\Big] \quad (20)$$

The summation in eq.(20) is done up to n = 500 to obtain the total dielectronic recombination rate coefficient. In Fig.3, $\alpha_d(2s^2nl|2s^2)$ is plotted against the principal quantum number n. We can see that the distribution is different for the different l. The contribution of high l is large for smaller n although that is small for larger n.

Fig.3 demonstrates n-dependencies of dielectronic recombination rate coefficient ($\alpha_d(2s^2nl|2s^2)$) calculated by using eqs.(13, 14) for T_e =6eV. It should be noted that we sum on J in (14). We can see from Fig.3 that the values $\alpha_d(2s^2nl|2s^2)$) are almost constant for n=7 - 50. It can be explained that the contribution of the term $f'(n=6)(n^3/6^3)$ is very small in this interval of n; which means Γ is much larger than Ar. For example, the value of f'(n=6) for 6s state with J'=0.5 equal to 0.385×10^{-3} (see the third line in Table VIII: $0.196 \times 10^{+10}/0.509 \times 10^{+13}$). We obtain for this term 3.56 for n=100 and the result $\alpha_d(2s^2100s|2s^2))/\ \alpha_d(2s^26s|2s^2)=0.358$. The 1% contribution is obtained for n=381.

Fig.4 gives the sum of $\alpha_d(2s^2nl|2s^2)$ over n from n=7 to n=N_0 for the same value of T_e as in Fig.3 (T_e =6eV). We can see that $\alpha_d^N(2s^2\ell|2s^2)$

$$\alpha_d^N(2s^2\ell|2s^2)=\sum_{n=7}^{N}\alpha_d(2s^2n\ell|2s^2) \quad (21)$$

reaches constant for n≥300. Sum of $\alpha_d^N(2s^2\ell|2s^2)$ over l=s, p, d. f, g is less stable (see Fig.4) and 1% error as found for N=500 comparing to the total for N=1000. Fig.5 gives these data with N=500 as function of T_e. It should be noted that we have one maximum for $\alpha_d^N(2s^2\ell|2s^2)$ around 10 - 12 eV which is near the threshold 2s2p ^1P.

There is no apparent maximum near the 2s2p(^{3}P) threshold since radiative transition probabilities $A(2s2p(^3P)n\ell - 2s^2n\ell)$ (and Q_d in this case) is much smaller than that with singlet intermediate momentum. The maximum around Te=0.2eV for α_d are mainly due to the contribution of states with 2s2p3d (see Figs.1 and 2). Their contribution to the states with n=2 - 6 is shown in Fig.5 also together with sum over all state. This resulting contribution (solid line on Fig.5) gives total dielectronic recombination rate coefficient for CII ion.

The calculated total dielectronic recombination rate coefficient by Badnell (1988 [23], 1987) [24] and Nussbaumer and Storey (1983) [25], (1984) [26], are shown in Fig. 5 for comparison. The data by Badnell are larger by factor two than ours around Te = 10 eV and smaller more than factor of two at low Te. The difference at high Te (≈10eV) should be explained by different method for calculation the sum over n for α_d (see eq. (9)). In Refs.23, 24 the sum over n was converted to an integral which was evaluated up to n=500 using Simpson's rule. Also it was used in these papers the Coulomb-Bethe approximation for calculations autoionization rates (see eq. (3.3) in [24]) which can caused the difference in calculation Q_d for high n (see eqs.(12), (13)). There are no atomic data in papers [23-26] in order to explain exactly the difference in results except data for total and effective dielectronic recombination rate coefficients. Table IX lists comparison for some transitions. We can see that the difference in results is not more than 15 -30%. This difference can be explained by using different transition energies for calculations of radiative transition probabilities since $Q_d \approx Ar$ when Aa>>Ar. We used data obtained by Cowan code. Small values of transition energy it can make difference in 2-15 -% between Cowan data and more accurate data given in Refs.19, 20 and used in papers [23-26]. For example the wavelength for 2s2s2p[^{3}P]3p(^{2}D)-2s2p[^{3}P]3d(^{2}F) transitions is equal to 8797.3A (see Table IIa in [26]) and 10090.1 ($^2D_{3/2}$-$^2F_{5/2}$), 10092.8 ($^2D_{5/2}$-$^2F_{7/2}$), 10136.9 ($^2D_{5/2}$-$^2F_{5/2}$) by our calculations. In the result we can explain the large disagreement for α_d for this line shown in Table IX. Certainly we can recalculate the value of α_d for this line but there are only a little energy data certainly known by experiment for CII and we decided to use theoretical data for all set of our data. In the result we could not explain the difference in total α_d for low $T_e \approx 0.3$ eV (see Fig.5) since we do not know exactly which set of energy was used in [23-26] for calculations of radiative transition probabilities. Also the values of α_d can be changed very much by the E_s value (see eq.(8)) which is very sensitive for the levels near threshold.

6. The parametrization of the dielectronic recombination rate coefficients

It is convenient to give the rate coefficients in analytical formulae for the use in the various application codes. We have fitted the rate coefficients in the following formula,

$$\alpha_d(\gamma' | \alpha_0) = \sum_i A_i e^{-\frac{E_i}{T_e}} T_e^{-3/2} \qquad \text{in } cm^3 s^{-1} \tag{22}$$

where E_i and T_e are in eV. The four fitting parameters for each excited states are listed in Table X. It should be noted that a little bit different formula with five fitting parameters was used by Nussbaumer and Storey (1983) [25]

7. Effective recombination rate coefficient of Carbon atom

In plasmas, there are three kinds of recombination processes; the radiative, dielectronic and three body recombination. For the recombination of C III to C II, the dielectronic recombination is the most dominant process for Te> 1 eV at low densities. We constructed a collisional radiative model for carbon atom and ions including the levels up to n = 4 and derived the effective emission and ionization rate coefficients for an ionizing plasma. In this paper we have derived the effective recombination rate coefficients using the dielectronic recombination rate coefficients to the excited states obtained in the previous sections. We have calculated the effective recombination by the following formula,

$$\alpha_{eff} = \sum_i [A_{i1} + C_{i1}] n(i) + \alpha_t(1) n_e + \alpha_r(1) + \alpha_d(1) \tag{23}$$

where A_{i1} and C_{i1} are the radiative transition probability and the de-excitation rate coefficients from i to 1 level, n(i) the population density of i level, $\alpha_t(1)$, $\alpha_r(1)$, and

$\alpha_d(1)$ are the three body, radiative and dielectronic recombination to the ground state 1, respectively. The contribution to the states higer than n = 4 is estimated by assuming the threshold by thermal limit.

The effective recombination rate coefficients depend on the electron density very much since the electron is captured to the high n levels through dielectronic recombination. In Fig. 6, the effective recombination rate coefficients including the radiative, three body and dielectronic recombination are plotted as a function of electron temperature for the several electron densities. The decrease of the rate coefficient at medium densities is due to the decrease of the dielectronic recombination and the increase of the rate coefficients at high density of 10^{18} cm^{-3} is due to the three body recombination.

The dielectronic recombination process is also sensitive to the electric field. An electric field increases the rate coefficients due to the Stark mixing at high n levels but on the other hand decreases due to the field ionization. Then we have to take into account this effect as well as the density effect in plasmas. This microfield effect is most dominant around $n_e = 10^8$ cm^{-3} (Reisenfield (1992) [27]) and the collisional effect is more significant than the microfield for $n_e > 10^{10}$ cm^{-3}.

8. Conclusion

Wavelengths, weighted radiative transitions probabilities and branching ratios together with factor intensities were calculated in order to build the dielectronic satellite spectra and to obtain dielectronic rates coefficients into the excited states. From comparison with available theoretical and experimental data we can be sure that accuracy of our data for energies is 0.1 - 1%. This is very important since we should be very accurate for dividing level on non-autoionizing and autoionizing for sum over all state for calculations of dielectronic rate coefficients. The accuracy of data for radiative and non-radiative transition probabilities is much worse than the energy, especially for last one since these data depended on the energy of free electrons.

We have to note that the contribution from the 2s2p3d state gives the first maximum around the first threshold ($2s^2$ ^1S) and 2p-2s transition with n=4-500 creates the second maximum between the second (2s2p ^3P) and third (2s2p ^1P) threshold. In the result the dielrctronic recombination rate coefficient has two maximum in large interval of T_e. By a such behavior the transitions with n≤6 give only 1% to the total dielectronic recombination rate coefficient at T_e=10eV and including the contribution from higher levels (n≤500) provides another 99% that confirm conclusion that it is very important to take into account these transitions.

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Table Ia. Energy (10^3 cm $^{-1}$).of $2l_1 2l_2(L_{12}S_{12})nl$[LSJ] levels
Comparison of different approximation: a-HF (with n=3)
b-scaled HF(with n=3), c-scaled HF(with n=3, 4, 5, 6), d- [19]

$2l_1 2l_2(L_{12}S_{12})nl$ LSJ		a	b	c	d
$2s^2(^1S)2p$	$^2P_{1/2}$	0	0	0	0
$2p^2(^3P)2s$	$^4P_{1/2}$	38.853	41.745	42.082	43.004
$2p^2(^1D)2s$	$^2D_{3/2}$	79.968	76.968	76.578	74.931
$2p^2(^1S)2s$	$^2S_{1/2}$	101.669	95.770	95.848	96.494
$2p^2(^3P)2s$	$^2P_{1/2}$	119.614	110.931	110.184	110.625
$2s^2(^1S)3s$	$^2S_{1/2}$	113.247	114.149	114.254	116.538
$2s^2(^1S)3p$	$^2P_{1/2}$	129.465	130.910	131.169	131.724
$2s^2(^1S)3d$	$^2D_{3/2}$	143.536	144.527	144.792	145.549
$2p^2(^3P)2p$	$^4S_{3/2}$	140.861	141.684	142.114	142.024
$2p^2(^1D)2p$	$^2D_{3/2}$	158.274	157.136	156.111	150.462
$2p^2(^1S)2p$	$^2P_{1/2}$	182.545	178.204	175.902	168.750
$2s2p(^3P)3s$	$^4P_{1/2}$	164.432	164.858	165.100	166.968
$2s2p(^3P)3s$	$^2P_{1/2}$	171.387	169.907	170.370	177.775
$2s2p(^1P)3s$	$^2P_{1/2}$	226.650	218.099	218.177	
$2s2p(^3P)3p$	$^4S_{3/2}$	180.805	181.069	181.224	184.691
$2s2p(^3P)3p$	$^2S_{1/2}$	195.817	193.544	192.672	194.572
$2s2p(^1P)3p$	$^2S_{1/2}$	245.938	236.771	237.909	
$2s2p(^3P)3p$	$^2P_{1/2}$	180.181	180.612	180.591	182.025
$2s2p(^3P)3p$	$^4P_{1/2}$	187.240	186.565	186.823	186.437
$2s2p(^1P)3p$	$^2P_{1/2}$	242.837	234.968	235.534	
$2s2p(^3P)3p$	$^4D_{1/2}$	178.378	179.036	179.131	181.697
$2s2p(^3P)3p$	$^2D_{3/2}$	189.820	188.680	188.700	188.582
$2s2p(^1P)3p$	$^2D_{3/2}$	242.334	233.689	234.760	
$2s2p(^3P)3d$	$^4P_{1/2}$	196.791	196.539	196.918	198.879
$2s2p(^3P)3d$	$^2P_{1/2}$	203.546	201.329	200.947	202.180
$2s2p(^1P)3d$	$^2P_{1/2}$	259.121	249.570	249.557	
$2s2p(^3P)3d$	$^4D_{1/2}$	194.738	194.817	195.128	196.558
$2s2p(^3P)3d$	$^2D_{3/2}$	198.703	197.577	197.733	198.426
$2s2p(^1P)3d$	$^2D_{3/2}$	256.222	247.131	247.510	
$2s2p(^3P)3d$	$^4F_{3/2}$	194.527	194.567	194.838	195.757
$2s2p(^3P)3d$	$^2F_{5/2}$	199.115	198.467	198.611	199.942
$2s2p(^1P)3d$	$^2F_{5/2}$	255.324	246.642	247.015	
$2p^2(^3P)3s$	$^4P_{1/2}$	253.671	252.717	253.109	
$2p^2(^3P)3s$	$^2P_{1/2}$	265.362	261.358	260.059	
$2p^2(^1D)3s$	$^2D_{3/2}$	271.830	269.340	270.519	
$2p^2(^1S)3s$	$^2S_{1/2}$	315.646	304.653	305.323	
$2p^2(^3P)3p$	$^2S_{1/2}$	263.270	262.981	263.102	
$2p^2(^3P)3p$	$^2D_{3/2}$	271.888	270.132	269.762	
$2p^2(^3P)3p$	$^2P_{1/2}$	276.009	273.519	273.856	

Table Ia. (continued)

$2l_1 2l_2(L_{12}S_{12})nl$	LSJ	a	b	c
$2p^2(^3P)3p$	$^4D_{1/2}$	265.933	265.167	265.562
$2p^2(^3P)3p$	$^4P_{1/2}$	267.697	266.636	267.136
$2p^2(^3P)3p$	$^4S_{3/2}$	276.758	274.443	274.165
$2p^2(^1D)3p$	$^2F_{5/2}$	285.661	281.618	282.418
$2p^2(^1D)3p$	$^2D_{3/2}$	291.639	287.039	285.767
$2p^2(^1D)3p$	$^2P_{1/2}$	296.158	290.312	289.000
$2p^2(^1S)3p$	$^2P_{1/2}$	328.265	316.690	316.576
$2p^2(^3P)3d$	$^2P_{1/2}$	281.117	279.941	280.318
$2p^2(^3P)3d$	$^2F_{5/2}$	283.142	281.710	282.180
$2p^2(^3P)3d$	$^2D_{3/2}$	287.297	285.125	285.224
$2p^2(^3P)3d$	$^4F_{3/2}$	279.693	278.777	279.346
$2p^2(^3P)3d$	$^4D_{1/2}$	281.831	280.561	281.178
$2p^2(^3P)3d$	$^4P_{1/2}$	281.279	280.923	281.362
$2p^2(^1D)3d$	$^2F_{5/2}$	297.877	294.246	294.728
$2p^2(^1D)3d$	$^2G_{7/2}$	298.363	294.653	296.234
$2p^2(^1D)3d$	$^2D_{3/2}$	299.421	295.429	295.943
$2p^2(^1D)3d$	$^2S_{1/2}$	301.542	296.252	296.723
$2p^2(^1D)3d$	$^2P_{1/2}$	303.252	298.457	298.558
$2p^2(^1S)3d$	$^2D_{3/2}$	339.526	328.206	329.028

Table Ib. Energy (10^3 cm $^{-1}$) of $2l_1 2l_2(L_{12}S_{12})nl$[LSJ] levels. Comparison of different approximation: a- scaled HF(with n=3,4), b-scaled HF(with n=3, 4, 5, 6), c- [19]

$2l_1 2l_2(L_{12}S_{12})nl$	LSJ	a	b	c
$2s^2(^1S)2p$	$^2P_{1/2}$	0		
$2s^2(^1S)2p$	$^2P_{3/2}$	0.061	0.062	0.064
$2s^2(^1S)4s$	$^2S_{1/2}$	157.249	157.366	157.234
$2s^2(^1S)4p$	$^2P_{1/2}$	162.450	162.560	162.518
$2s^2(^1S)4p$	$^2P_{3/2}$	162.458	162.568	162.525
$2s^2(^1S)4d$	$^2D_{3/2}$	168.066	168.228	168.124
$2s^2(^1S)4d$	$^2D_{5/2}$	168.066	168.228	168.125
$2s^2(^1S)4f$	$^2F_{5/2}$	168.969	169.138	168.979
$2s^2(^1S)4f$	$^2F_{7/2}$	168.969	169.138	168.979
$2s2p(^3P)4s$	$^4P_{1/2}$	208.958	209.086	209.553
$2s2p(^3P)4s$	$^4P_{3/2}$	208.985	209.113	209.577
$2s2p(^3P)4s$	$^4P_{5/2}$	209.030	209.158	209.623
$2s2p(^3P)4s$	$^2P_{1/2}$	211.380	211.473	
$2s2p(^3P)4s$	$^2P_{3/2}$	211.431	211.524	
$2s2p(^1P)4s$	$^2P_{1/2}$	261.127	261.227	
$2s2p(^1P)4s$	$^2P_{3/2}$	261.128	261.228	
$2s2p(^3P)4p$	$^4S_{3/2}$	214.645	214.798	215.765
$2s2p(^3P)4p$	$^2S_{1/2}$	218.813	218.433	
$2s2p(^1P)4p$	$^2S_{1/2}$	267.622	267.622	
$2s2p(^3P)4p$	$^2P_{1/2}$	214.001	214.061	214.408
$2s2p(^3P)4p$	$^2P_{3/2}$	214.029	214.089	214.430
$2s2p(^3P)4p$	$^4P_{1/2}$	216.351	216.411	216.363
$2s2p(^3P)4p$	$^4P_{3/2}$	216.366	216.478	216.380
$2s2p(^3P)4p$	$^4P_{5/2}$	216.383	216.495	216.401
$2s2p(^1P)4p$	$^2P_{1/2}$	269.314	269.346	269.314
$2s2p(^1P)4p$	$^2P_{3/2}$	269.329	269.361	269.329
$2s2p(^3P)4p$	$^4D_{1/2}$	213.942	214.123	214.760
$2s2p(^3P)4p$	$^4D_{3/2}$	214.055	214.236	214.773
$2s2p(^3P)4p$	$^4D_{5/2}$	214.073	214.254	214.795
$2s2p(^3P)4p$	$^4D_{7/2}$	214.106	214.287	214.830
$2s2p(^3P)4p$	$^2D_{3/2}$	216.798	216.844	
$2s2p(^3P)4p$	$^2D_{5/2}$	216.845	216.891	216.928
$2s2p(^1P)4p$	$^2D_{3/2}$	266.232	266.496	
$2s2p(^1P)4p$	$^2D_{5/2}$	266.231	266.495	

Table Ib. (continued)

$2l_1 2l_2(L_{12}S_{12})nl$	LSJ	a	b	c
$2s2p(^3P)4d$	$^4P_{1/2}$	219.958	220.152	220.812
$2s2p(^3P)4d$	$^4P_{3/2}$	219.970	220.164	220.833
$2s2p(^3P)4d$	$^4P_{5/2}$	219.983	220.177	220.845
$2s2p(^3P)4d$	$^2P_{1/2}$	222.199	221.999	222.258
$2s2p(^3P)4d$	$^2P_{3/2}$	222.223	222.023	222.286
$2s2p(^1P)4d$	$^2P_{1/2}$	272.066	272.247	
$2s2p(^1P)4d$	$^2P_{3/2}$	272.070	272.251	
$2s2p(^3P)4d$	$^4D_{1/2}$	219.441	219.602	219.441
$2s2p(^3P)4d$	$^4D_{3/2}$	219.446	219.607	219.446
$2s2p(^3P)4d$	$^4D_{5/2}$	219.454	219.615	219.454
$2s2p(^3P)4d$	$^4D_{7/2}$	219.466	219.623	219.466
$2s2p(^3P)4d$	$^2D_{3/2}$	220.229	220.372	220.229
$2s2p(^3P)4d$	$^2D_{5/2}$	220.244	220.387	220.244
$2s2p(^1P)4d$	$^2D_{3/2}$	272.009	272.161	
$2s2p(^1P)4d$	$^2D_{5/2}$	272.019	272.171	
$2s2p(^3P)4d$	$^4F_{3/2}$	219.141	219.292	219.557
$2s2p(^3P)4d$	$^4F_{5/2}$	219.156	219.307	219.570
$2s2p(^3P)4d$	$^4F_{7/2}$	219.177	219.328	219.591
$2s2p(^3P)4d$	$^4F_{9/2}$	219.206	219.357	219.620
$2s2p(^3P)4d$	$^2F_{5/2}$	221.036	221.103	221.461
$2s2p(^3P)4d$	$^2F_{7/2}$	221.079	221.149	221.504
$2s2p(^1P)4d$	$^2F_{5/2}$	271.181	271.329	
$2s2p(^1P)4d$	$^2F_{7/2}$	271.181	271.329	
$2s2p(^3P)4f$	$^4D_{1/2}$	221.033	221.219	221.743
$2s2p(^3P)4f$	$^4D_{3/2}$	221.023	221.209	221.730
$2s2p(^3P)4f$	$^4D_{5/2}$	221.005	221.191	221.730
$2s2p(^3P)4f$	$^4D_{7/2}$	220.990	221.176	221.699
$2s2p(^3P)4f$	$^2D_{3/2}$	221.050	221.240	221.752
$2s2p(^3P)4f$	$^2D_{5/2}$	221.031	221.221	221.708
$2s2p(^1P)4f$	$^2D_{3/2}$	272.904	273.171	
$2s2p(^1P)4f$	$^2D_{5/2}$	272.904	273.171	
$2s2p(^3P)4f$	$^4F_{3/2}$	220.546	220.716	221.100
$2s2p(^3P)4f$	$^4F_{5/2}$	220.549	220.719	221.106
$2s2p(^3P)4f$	$^4F_{7/2}$	220.549	220.719	221.099
$2s2p(^3P)4f$	$^4F_{9/2}$	220.562	220.732	221.094
$2s2p(^3P)4f$	$^2F_{5/2}$	220.542	220.711	221.089
$2s2p(^3P)4f$	$^2F_{7/2}$	220.558	220.727	221.098
$2s2p(^1P)4f$	$^2F_{5/2}$	272.449	272.599	
$2s2p(^1P)4f$	$^2F_{7/2}$	272.449	272.599	

Table Ib. (continued)

$2l_1 2l_2(L_{12}S_{12})nl$	LSJ	a	b	c
$2s2p(^3P)4f$	$^4G_{5/2}$	220.916	221.086	221.545
$2s2p(^3P)4f$	$^4G_{7/2}$	220.928	221.098	221.554
$2s2p(^3P)4f$	$^4G_{9/2}$	220.950	221.120	221.576
$2s2p(^3P)4f$	$^4G_{11/2}$	220.977	221.147	221.805
$2s2p(^3P)4f$	$^2G_{7/2}$	220.973	221.144	221.588
$2s2p(^3P)4f$	$^2G_{9/2}$	221.012	221.183	221.626
$2s2p(^1P)4f$	$^2G_{7/2}$	272.462	272.620	
$2s2p(^1P)4f$	$^2G_{9/2}$	272.462	272.620	
$2p^2(^3P)4s$	$^4P_{1/2}$	294.374	294.410	
$2p^2(^3P)4s$	$^4P_{3/2}$	294.401	294.437	
$2p^2(^3P)4s$	$^4P_{5/2}$	294.445	294.481	
$2p^2(^3P)4s$	$^2P_{1/2}$	297.172	297.686	
$2p^2(^3P)4s$	$^2P_{3/2}$	297.224	297.738	
$2p^2(^1D)4s$	$^2D_{3/2}$	309.747	309.985	
$2p^2(^1D)4s$	$^2D_{5/2}$	309.748	309.986	
$2p^2(^1S)4s$	$^2S_{1/2}$	342.841	343.225	
$2p^2(^3P)4p$	$^2S_{1/2}$	298.698	298.775	
$2p^2(^3P)4p$	$^2D_{3/2}$	302.450	302.291	
$2p^2(^3P)4p$	$^2D_{5/2}$	302.457	302.338	
$2p^2(^3P)4p$	$^2P_{1/2}$	303.996	303.531	
$2p^2(^3P)4p$	$^2P_{3/2}$	304.012	304.547	
$2p^2(^3P)4p$	$^4D_{1/2}$	299.237	299.398	
$2p^2(^3P)4p$	$^4D_{3/2}$	299.250	299.411	
$2p^2(^3P)4p$	$^4D_{5/2}$	299.273	299.434	
$2p^2(^3P)4p$	$^4D_{7/2}$	299.306	299.467	
$2p^2(^3P)4p$	$^4P_{1/2}$	299.695	299.888	
$2p^2(^3P)4p$	$^4P_{3/2}$	299.709	299.902	
$2p^2(^3P)4p$	$^4P_{5/2}$	299.723	299.916	
$2p^2(^3P)4p$	$^4S_{3/2}$	302.728	302.594	
$2p^2(^1D)4p$	$^2F_{5/2}$	314.177	314.405	
$2p^2(^1D)4p$	$^2F_{7/2}$	314.180	314.408	
$2p^2(^1D)4p$	$^2D_{3/2}$	315.920	316.605	
$2p^2(^1D)4p$	$^2D_{5/2}$	315.915	316.600	
$2p^2(^1D)4p$	$^2P_{1/2}$	318.047	317.807	
$2p^2(^1D)4p$	$^2P_{3/2}$	318.054	318.814	
$2p^2(^1S)4p$	$^2P_{1/2}$	347.971	348.255	
$2p^2(^1S)4p$	$^2P_{3/2}$	347.971	348.255	

Table Ib. (continued)

$2l_12l_2(L_{12}S_{12})nl$	LSJ	a	b
$2p^2(^3P)4d$	$^2P_{1/2}$	304.719	304.876
$2p^2(^3P)4d$	$^2P_{3/2}$	304.687	304.877
$2p^2(^3P)4d$	$^2F_{5/2}$	305.632	305.741
$2p^2(^3P)4d$	$^2F_{7/2}$	305.677	305.786
$2p^2(^3P)4d$	$^2D_{3/2}$	306.883	306.784
$2p^2(^3P)4d$	$^2D_{5/2}$	306.899	306.800
$2p^2(^3P)4d$	$^4F_{3/2}$	303.929	304.089
$2p^2(^3P)4d$	$^4F_{5/2}$	303.944	304.102
$2p^2(^3P)4d$	$^4F_{7/2}$	303.961	304.119
$2p^2(^3P)4d$	$^4F_{9/2}$	303.983	304.141
$2p^2(^3P)4d$	$^4D_{1/2}$	304.511	304.710
$2p^2(^3P)4d$	$^4D_{3/2}$	304.515	304.714
$2p^2(^3P)4d$	$^4D_{5/2}$	304.524	304.723
$2p^2(^3P)4d$	$^4D_{7/2}$	304.536	304.735
$2p^2(^3P)4d$	$^4P_{1/2}$	304.914	305.091
$2p^2(^3P)4d$	$^4P_{3/2}$	304.906	305.085
$2p^2(^3P)4d$	$^4P_{5/2}$	304.885	305.064
$2p^2(^1S)4d$	$^2D_{3/2}$	352.189	352.430
$2p^2(^1S)4d$	$^2D_{5/2}$	352.186	352.427
$2p^2(^1D)4d$	$^2F_{5/2}$	318.832	319.035
$2p^2(^1D)4d$	$^2F_{7/2}$	318.828	319.031
$2p^2(^1D)4d$	$^2G_{7/2}$	318.883	319.098
$2p^2(^1D)4d$	$^2C_{9/2}$	318.883	319.098
$2p^2(^1D)4d$	$^2D_{3/2}$	319.232	319.405
$2p^2(^1D)4d$	$^2D_{5/2}$	319.233	319.406
$2p^2(^1D)4d$	$^2P_{1/2}$	320.572	320.458
$2p^2(^1D)4d$	$^2P_{3/2}$	320.577	320.463
$2p^2(^1D)4d$	$^2S_{1/2}$	320.723	320.814
$2p^2(^3P)4f$	$^2D_{3/2}$	305.723	305.884
$2p^2(^3P)4f$	$^2D_{5/2}$	305.698	305.859
$2p^2(^3P)4f$	$^2G_{7/2}$	305.739	305.944
$2p^2(^3P)4f$	$^2G_{9/2}$	305.780	305.985
$2p^2(^3P)4f$	$^2F_{5/2}$	306.145	306.340
$2p^2(^3P)4f$	$^2F_{7/2}$	306.155	306.350
$2p^2(^3P)4f$	$^4D_{1/2}$	305.712	305.897
$2p^2(^3P)4f$	$^4D_{3/2}$	305.698	305.883
$2p^2(^3P)4f$	$^4D_{5/2}$	305.675	305.860
$2p^2(^3P)4f$	$^4D_{7/2}$	305.665	305.850

Table Ib. (continued)

$2l_1 2l_2(L_{12}S_{12})nl$	LSJ	a	b
$2p^2(^3P)4f$	$^4G_{5/2}$	305.688	305.892
$2p^2(^3P)4f$	$^4G_{7/2}$	305.699	305.903
$2p^2(^3P)4f$	$^4G_{9/2}$	305.719	305.923
$2p^2(^3P)4f$	$^4G_{11/2}$	305.750	305.954
$2p^2(^3P)4f$	$^4F_{3/2}$	306.087	306.284
$2p^2(^3P)4f$	$^4F_{5/2}$	306.091	306.288
$2p^2(^3P)4f$	$^4F_{7/2}$	306.097	306.294
$2p^2(^3P)4f$	$^4F_{9/2}$	306.103	306.300
$2p^2(^1S)4f$	$^2F_{5/2}$	353.421	353.638
$2p^2(^1S)4f$	$^2F_{7/2}$	353.471	353.638
$2p^2(^1D)4f$	$^2G_{7/2}$	319.977	320.184
$2p^2(^1D)4f$	$^2C_{9/2}$	319.977	320.184
$2p^2(^1D)4f$	$^2F_{5/2}$	320.110	320.298
$2p^2(^1D)4f$	$^2F_{7/2}$	320.110	320.298
$2p^2(^1D)4f$	$^2H_{9/2}$	320.361	320.608
$2p^2(^1D)4f$	$^2H_{11/2}$	320.361	320.608
$2p^2(^1D)4f$	$^2D_{3/2}$	320.455	320.627
$2p^2(^1D)4f$	$^2D_{5/2}$	320.456	320.628
$2p^2(^1D)4f$	$^2P_{1/2}$	321.113	321.152
$2p^2(^1D)4f$	$^2P_{3/2}$	321.113	321.152

Table Ic Sum gAr (s^{-1}) of $2l_1 2l_2(L_{12}S_{12})nl$[LSJ] levels. Comparison of different approximation: a-HF (with n=3), b-scaled HF(with n=3), c-scaled HF(with n=3, 4, 5, 6), d- [20]

$2l_1 2l_2(L_{12}S_{12})nl$	LSJ	a	b	c	d
$2p^2(^1D)2s$	$^2D_{3/2}$	1.868+09	1.789+09	1.724+09	2.36+09
$2p^2(^1D)2s$	$^2D_{5/2}$	2.766+09	2.677+09	2.580+09	3.60+09
$2p^2(^1S)2s$	$^2S_{1/2}$	6.424+09	4.634+09	4.582+09	2.20+09
$2p^2(^3P)2s$	$^2P_{1/2}$	1.100+10	9.089+09	9.055+09	8.20+09
$2p^2(^3P)2s$	$^2P_{3/2}$	2.200+10	1.818+10	1.812+10	1.96+10
$2s^2(^1S)3s$	$^2S_{1/2}$	9.331+08	1.866+09	1.936+09	2.40+09
$2s^2(^1S)3p$	$^2P_{1/2}$	3.027+08	2.847+08	2.602+08	0.96+08
$2s^2(^1S)3p$	$^2P_{3/2}$	6.059+08	5.702+08	5.210+08	1.92+08
$2p^2(^3P)2p$	$^4S_{3/2}$	1.713+10	1.627+10	1.602+10	1.28+10
$2s^2(^1S)3d$	$^2D_{3/2}$	1.180+10	1.151+10	1.137+10	9.22+09
$2s^2(^1S)3d$	$^2D_{5/2}$	1.768+10	1.724+10	1.704+10	1.48+10
$2p^2(^1D)2p$	$^2D_{3/2}$	2.857+09	3.657+09	3.358+09	3.88+09
$2p^2(^1D)2p$	$^2D_{5/2}$	4.289+09	5.488+09	5.041+09	5.80+09
$2s2p(^3P)3s$	$^4P_{1/2}$	2.958+08	2.739+08	2.898+08	
$2s2p(^3P)3s$	$^4P_{3/2}$	5.920+09	5.480+09	5.795+09	
$2s2p(^3P)3s$	$^4P_{5/2}$	8.869+09	8.228+09	8.700+09	
$2p^2(^1S)2p$	$^2P_{1/2}$	1.910+09	1.562+09	1.399+09	1.62+09
$2p^2(^1S)2p$	$^2P_{3/2}$	3.799+09	3.100+09	2.772+09	3.16+09
$2s2p(^3P)3s$	$^2P_{1/2}$	4.410+09	5.162+09	4.535+09	
$2s2p(^3P)3s$	$^2P_{3/2}$	8.839+09	1.035+10	9.101+09	
$2s2p(^3P)3p$	$^4D_{1/2}$	6.882+07	7.322+07	6.833+07	7.36+07
$2s2p(^3P)3p$	$^4D_{3/2}$	1.376+08	1.464+08	1.366+08	1.40+08
$2s2p(^3P)3p$	$^4D_{5/2}$	2.067+08	2.195+08	2.048+08	2.32+08
$2s2p(^3P)3p$	$^4D_{7/2}$	2.758+08	2.929+08	2.733+08	2.96+08
$2s2p(^3P)3p$	$^2P_{1/2}$	1.543+09	1.673+09	1.449+09	
$2s2p(^3P)3p$	$^2P_{3/2}$	3.083+09	3.340+09	2.895+09	
$2s2p(^3P)3p$	$^4S_{3/2}$	2.005+08	2.028+08	1.941+08	2.60+08
$2s2p(^3P)3p$	$^4P_{1/2}$	3.378+08	2.890+08	2.760+08	1.73+08
$2s2p(^3P)3p$	$^4P_{3/2}$	6.758+08	5.781+08	5.522+08	3.44+08
$2s2p(^3P)3p$	$^4P_{5/2}$	1.014+09	8.676+08	8.288+08	5.16+08
$2s2p(^3P)3p$	$^2D_{3/2}$	4.379+09	4.240+09	2.889+09	
$2s2p(^3P)3p$	$^2D_{5/2}$	6.569+09	6.360+09	4.335+09	
$2s2p(^3P)3p$	$^2S_{1/2}$	7.763+08	9.352+08	8.721+08	
$2s2p(^3P)3d$	$^4F_{3/2}$	3.899+08	3.304+08	3.090+08	
$2s2p(^3P)3d$	$^4F_{5/2}$	7.283+08	5.925+08	5.504+08	
$2s2p(^3P)3d$	$^4F_{7/2}$	1.030+09	8.259+08	7.647+08	
$2s2p(^3P)3d$	$^4F_{9/2}$	7.658+08	6.836+08	6.438+08	
$2s2p(^3P)3d$	$^4D_{1/2}$	8.573+09	8.272+09	8.601+09	
$2s2p(^3P)3d$	$^4D_{3/2}$	1.706+10	1.648+10	1.715+10	
$2s2p(^3P)3d$	$^4D_{5/2}$	2.544+10	2.462+10	2.563+10	
$2s2p(^3P)3d$	$^4D_{7/2}$	3.386+10	3.279+10	3.414+10	
$2s2p(^3P)3d$	$^4P_{1/2}$	4.803+09	4.633+09	4.836+09	
$2s2p(^3P)3d$	$^4P_{3/2}$	9.600+09	9.272+09	9.665+09	
$2s2p(^3P)3d$	$^4P_{5/2}$	1.438+10	1.389+10	1.448+10	

Table IIa. Energy, radiative widths of CII ion for $1s^22l_12l_2(L_{12}S_{12})nl$ [LSJ] states of *odd complex*

1-$2s^22p$, 2-$2p^3$, 3-$2s^23p$, 4-2s2p3s, 5-2s2p3d, 6-$2p^23p$

7-$2s^24p$, 8-$2s^24f$, 9-2s2p4s, 10-2s2p4d, 11-$2p^24p$, 12-$2p^24f$

13-2s25p, 14-2s25f, 15-2s2p5s, 16-2s2p5d, 17-2s2p5g, 18-2p25p, 19-2p25f,

20-$2s^26p$, 21-$2s^26f$, 22-$2s^26h$, 23-2s2p6s, 24-2s2p6d, 25-2s2p6g,
26- $2p^26p$, 27-$2p^26f$, 28-$2p^26h$

N	$2l_12l_2nl$	$L_{12}S_{12}$	LS	J	(10^3cm^{-1})	Sum(gAr),s^{-1}
1	$2s^22p$	(^1S)	^2P	0.5	.000	0.000+00
1	$2s^22p$	(^1S)	^2P	1.5	.062	0.000+00
3	$2s^23p$	(^1S)	^2P	0.5	131.169	2.479+08
3	$2s^23p$	(^1S)	^2P	1.5	131.179	4.963+08
2	$2p^3$	(^4S)	^4S	1.5	142.114	1.586+10
2	$2p^3$	(^2D)	^2D	1.5	156.111	3.194+09
2	$2p^3$	(^2D)	^2D	2.5	156.113	4.794+09
7	$2s^24p$	(^1S)	^2P	0.5	162.560	7.660+08
7	$2s^24p$	(^1S)	^2P	1.5	162.568	1.525+09
4	2s2p3s	(^3P)	^4P	0.5	165.100	2.978+09
4	2s2p3s	(^3P)	^4P	1.5	165.126	5.959+09
4	2s2p3s	(^3P)	^4P	2.5	165.171	8.948+09
8	$2s^24f$	(^1S)	^2F	2.5	169.138	1.767+09
8	$2s^24f$	(^1S)	^2F	3.5	169.138	2.355+09
4	2s2p3s	(^3P)	^2P	0.5	170.370	4.453+09
4	2s2p3s	(^3P)	^2P	1.5	170.400	8.937+09
2	$2p^3$	(^2P)	^2P	0.5	175.902	8.274+08
2	$2p^3$	(^2P)	^2P	1.5	175.904	1.642+09
13	$2s^25p$	(^1S)	^2P	0.5	178.271	7.070+08
13	$2s^25p$	(^1S)	^2P	1.5	178.285	1.402+09
14	$2s^25f$	(^1S)	^2F	2.5	179.183	8.409+08
14	$2s^25f$	(^1S)	^2F	3.5	179.183	1.121+09
20	$2s^26p$	(^1S)	^2P	0.5	183.354	2.259+08
20	$2s^26p$	(^1S)	^2P	1.5	183.357	4.514+08
21	$2s^26f$	(^1S)	^2F	2.5	184.638	4.857+08
21	$2s^26f$	(^1S)	^2F	3.5	184.638	6.476+08
22	$2s^26h$	(^1S)	^2H	4.5	184.776	2.666+08
22	$2s^26h$	(^1S)	^2H	5.5	184.776	3.200+08
5	2s2p3d	(^3P)	^4F	1.5	194.838	2.987+08
5	2s2p3d	(^3P)	^4F	2.5	194.853	5.239+08
5	2s2p3d	(^3P)	^4F	3.5	194.874	7.244+08
5	2s2p3d	(^3P)	^4F	4.5	194.903	6.336+08
5	2s2p3d	(^3P)	^4D	0.5	195.128	8.727+09
5	2s2p3d	(^3P)	^4D	1.5	195.133	1.741+10
5	2s2p3d	(^3P)	^4D	2.5	195.142	2.603+10
5	2s2p3d	(^3P)	^4D	3.5	195.153	3.467+10
5	2s2p3d	(^3P)	^4P	0.5	196.918	4.894+09
5	2s2p3d	(^3P)	^4P	1.5	196.906	9.782+09
5	2s2p3d	(^3P)	^4P	2.5	196.884	1.465+10

Table IIb. Energy, radiative and non-radiative widths of CII ion for $1s^2 2l_1 2l_2(L_{12}S_{12})nl$ [LSJ] states of *odd complex*

N	$2l_12l_2nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1}	
							$2s^2$ (^1S)	SumAa
5	2s2p3d	(^3P)	^2D	1.5	197.733	9.442+09	0	0
5	2s2p3d	(^3P)	^2D	2.5	197.746	1.417+10	0.0004	0.0004
5	2s2p3d	(^3P)	^2F	2.5	198.611	1.522+10	0.7298	0.7298
5	2s2p3d	(^3P)	^2F	3.5	198.654	2.033+10	0.7364	0.7364
5	2s2p3d	(^3P)	^2P	0.5	200.947	4.610+09	0.0679	0.0679
5	2s2p3d	(^3P)	^2P	1.5	200.923	9.230+09	0.0691	0.0691
9	2s2p4s	(^3P)	^4P	0.5	209.086	1.105+09	0.0003	0.0003
9	2s2p4s	(^3P)	^4P	1.5	209.113	2.051+09	0.0008	0.0008
9	2s2p4s	(^3P)	^4P	2.5	209.158	3.328+09	0	0
9	2s2p4s	(^3P)	^2P	0.5	211.473	1.422+09	10.2973	10.297
9	2s2p4s	(^3P)	^2P	1.5	211.525	2.214+09	10.3023	10.3023
4	2s2p3s	(^1P)	^2P	0.5	218.177	7.082+09	0.4371	0.4371
4	2s2p3s	(^1P)	^2P	1.5	218.179	1.416+10	0.4257	0.4257
10	2s2p4d	(^3P)	^4F	1.5	219.292	2.217+08	0	0
10	2s2p4d	(^3P)	^4F	2.5	219.306	3.625+08	0	0
10	2s2p4d	(^3P)	^4F	3.5	219.328	4.931+08	0.0001	0.0001
10	2s2p4d	(^3P)	^4F	4.5	219.357	5.081+08	0	0
10	2s2p4d	(^3P)	^4D	0.5	219.602	3.924+09	0	0
10	2s2p4d	(^3P)	^4D	1.5	219.607	7.826+09	0	0
10	2s2p4d	(^3P)	^4D	2.5	219.615	1.170+10	0	0
10	2s2p4d	(^3P)	^4D	3.5	219.627	1.561+10	0	0
10	2s2p4d	(^3P)	^4P	0.5	220.152	2.335+09	0	0
10	2s2p4d	(^3P)	^4P	1.5	220.140	4.670+09	0	0
10	2s2p4d	(^3P)	^4P	2.5	220.117	6.999+09	0	0
10	2s2p4d	(^3P)	^2D	1.5	220.372	4.417+09	0	0
10	2s2p4d	(^3P)	^2D	2.5	220.387	6.631+09	0.0003	0.0003
10	2s2p4d	(^3P)	^2F	2.5	221.103	8.386+09	0.3172	0.3172
10	2s2p4d	(^3P)	^2F	3.5	221.146	1.120+10	0.3206	0.3206
10	2s2p4d	(^3P)	^2P	0.5	221.999	2.151+09	0.0043	0.0043
10	2s2p4d	(^3P)	^2P	1.5	221.974	4.301+09	0.0049	0.0049
15	2s2p5s	(^3P)	^4P	0.5	225.447	4.839+08	0.0007	0.0007
15	2s2p5s	(^3P)	^4P	1.5	225.474	9.708+08	0.0018	0.0018
15	2s2p5s	(^3P)	^4P	2.5	225.519	1.463+09	0	0
15	2s2p5s	(^3P)	^2P	0.5	226.525	7.627+08	4.9718	4.9718
15	2s2p5s	(^3P)	^2P	1.5	226.578	1.522+09	4.9735	4.9735
16	2s2p5d	(^3P)	^4F	1.5	230.198	1.518+08	0	0
16	2s2p5d	(^3P)	^4F	2.5	230.212	2.677+08	0	0
16	2s2p5d	(^3P)	^4F	3.5	230.233	3.741+08	0.0001	0.0001
16	2s2p5d	(^3P)	^4F	4.5	230.264	3.183+08	0	0
16	2s2p5d	(^3P)	^4D	0.5	230.390	1.967+09	0	0
16	2s2p5d	(^3P)	^4D	1.5	230.394	3.899+09	0	0
16	2s2p5d	(^3P)	^4D	2.5	230.402	5.789+09	0	0
16	2s2p5d	(^3P)	^4D	3.5	230.417	7.755+09	0	0

Table IIb (continued)

N	$2l_12l_2nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(**gAr**), s^{-1}	**Aa,10^{13} s^{-1}**	
							$2s^2$ (^1S)	SumAa
16	2s2p5d	(^3P)	^4P	0.5	230.650	1.215+09	0	0
16	2s2p5d	(^3P)	^4P	1.5	230.638	2.439+09	0	0
16	2s2p5d	(^3P)	^4P	2.5	230.616	3.669+09	0	0
16	2s2p5d	(^3P)	^2D	1.5	230.713	2.525+09	0	0
16	2s2p5d	(^3P)	^2D	2.5	230.729	3.791+09	0.0003	0.0003
17	2s2p5g	(^3P)	^4G	2.5	231.169	4.577+08	0.0001	0.0001
17	2s2p5g	(^3P)	^4G	3.5	231.163	6.057+08	0	0
17	2s2p5g	(^3P)	^4G	4.5	231.163	7.566+08	0	0
17	2s2p5g	(^3P)	^4G	5.5	231.179	9.105+08	0	0
17	2s2p5g	(^3P)	^2G	3.5	231.169	6.078+08	0	0
17	2s2p5g	(^3P)	^2G	4.5	231.179	7.587+08	0	0
16	2s2p5d	(^3P)	^2F	2.5	231.184	5.567+09	0.1384	0.1384
16	2s2p5d	(^3P)	^2F	3.5	231.226	7.419+09	0.1398	0.1398
17	2s2p5g	(^3P)	^4H	3.5	231.242	6.025+08	0.0003	0.0003
17	2s2p5g	(^3P)	^4H	4.5	231.273	7.392+08	0	0
17	2s2p5g	(^3P)	^4H	5.5	231.273	8.874+08	0	0
17	2s2p5g	(^3P)	^4H	6.5	231.297	1.033+09	0	0
17	2s2p5g	(^3P)	^2H	4.5	231.242	7.375+08	0	0
17	2s2p5g	(^3P)	^2H	5.5	231.298	8.836+08	0	0
17	2s2p5g	(^3P)	^4F	1.5	231.311	2.939+08	0	0
17	2s2p5g	(^3P)	^4F	2.5	231.296	4.427+08	0.0001	0.0001
17	2s2p5g	(^3P)	^4F	3.5	231.296	5.916+08	0.0001	0.0001
17	2s2p5g	(^3P)	^4F	4.5	231.274	7.379+08	0	0
17	2s2p5g	(^3P)	^2F	2.5	231.311	4.422+08	0.0001	0.0001
17	2s2p5g	(^3P)	^2F	3.5	231.274	6.026+08	0.0003	0.0003
16	2s2p5d	(^3P)	^2P	0.5	231.682	1.783+09	0.0185	0.0185
16	2s2p5d	(^3P)	^2P	1.5	231.657	3.574+09	0.0206	0.0206
23	2s2p6s	(^3P)	^4P	0.5	233.412	2.327+08	0.0016	0.0016
23	2s2p6s	(^3P)	^4P	1.5	233.439	4.684+08	0.0037	0.0037
23	2s2p6s	(^3P)	^4P	2.5	233.485	7.074+08	0	0
23	2s2p6s	(^3P)	^2P	0.5	234.003	6.498+08	3.3163	3.3163
23	2s2p6s	(^3P)	^2P	1.5	234.057	1.288+09	3.3124	3.3124
24	2s2p6d	(^3P)	^4F	1.5	236.013	5.506+07	0	0
24	2s2p6d	(^3P)	^4F	2.5	236.026	1.360+08	0	0
24	2s2p6d	(^3P)	^4F	3.5	236.047	2.097+08	0.0001	0.0001
24	2s2p6d	(^3P)	^4F	4.5	236.080	5.187+07	0	0
24	2s2p6d	(^3P)	^4D	0.5	236.135	1.025+09	0.0001	0.0001
24	2s2p6d	(^3P)	^4D	1.5	236.138	2.005+09	0	0
24	2s2p6d	(^3P)	^4D	2.5	236.145	2.916+09	0	0
24	2s2p6d	(^3P)	^4D	3.5	236.163	3.946+09	0	0
24	2s2p6d	(^3P)	^4P	0.5	236.295	6.486+08	0	0
24	2s2p6d	(^3P)	^4P	1.5	236.282	1.524+09	0	0
24	2s2p6d	(^3P)	^4P	2.5	236.261	2.112+09	0	0

Table IIb (continued)

N	$2l_12l_2nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(gAr), s^{-1}	**Aa,10^{13} s^{-1}**	
							$2s^2$ (^1S)	SumAa
24	2s2p6d	(^3P)	^2D	1.5	236.293	2.006+09	0.0002	0.0002
24	2s2p6d	(^3P)	^2D	2.5	236.309	3.225+09	0.0003	0.0003
25	2s2p6g	(^3P)	^4G	2.5	236.565	2.565+08	0	0
25	2s2p6g	(^3P)	^4G	3.5	236.552	3.413+08	0	0
25	2s2p6g	(^3P)	^4G	4.5	236.552	4.270+08	0	0
25	2s2p6g	(^3P)	^4G	5.5	236.572	5.130+08	0	0
25	2s2p6g	(^3P)	^2G	3.5	236.565	3.421+08	0	0
25	2s2p6g	(^3P)	^2G	4.5	236.572	4.273+08	0	0
25	2s2p6g	(^3P)	^4H	3.5	236.605	3.404+08	0	0
25	2s2p6g	(^3P)	^4H	4.5	236.640	4.257+08	0	0
25	2s2p6g	(^3P)	^4H	5.5	236.640	5.111+08	0	0
25	2s2p6g	(^3P)	^4H	6.5	236.660	5.961+08	0	0
25	2s2p6g	(^3P)	^2H	4.5	236.605	4.251+08	0	0
25	2s2p6g	(^3P)	^2H	5.5	236.660	5.095+08	0	0
24	2s2p6d	(^3P)	^2F	2.5	236.631	6.550+09	0.0060	0.0060
24	2s2p6d	(^3P)	^2F	3.5	236.673	8.805+09	0.0613	0.0613
25	2s2p6g	(^3P)	^4F	1.5	236.665	1.700+08	0	0
25	2s2p6g	(^3P)	^4F	2.5	236.654	2.805+08	0.0002	0.0002
25	2s2p6g	(^3P)	^4F	3.5	236.654	3.591+08	0.0001	0.0001
25	2s2p6g	(^3P)	^4F	4.5	236.638	4.261+08	0	0
25	2s2p6g	(^3P)	^2F	2.5	236.666	2.783+08	0.0002	0.0002
25	2s2p6g	(^3P)	^2F	3.5	236.638	3.460+08	0	0
24	2s2p6d	(^3P)	^2P	0.5	237.060	3.284+09	0.1043	0.1043
24	2s2p6d	(^3P)	^2P	1.5	237.034	6.570+09	0.1063	0.1063
5	2s2p3d	(^1P)	^2F	2.5	247.015	2.269+10	29.2504	29.2504
5	2s2p3d	(^1P)	^2F	3.5	247.014	3.022+10	29.2476	29.2476
5	2s2p3d	(^1P)	^2D	1.5	247.510	2.392+10	0	0
5	2s2p3d	(^1P)	^2D	2.5	247.512	3.585+10	0	0

Table IIc. Energy, radiative and non-radiative widths of CII ion for $1s^2 2l_1 2l_2 (L_{12}S_{12}) nl$ [LSJ] states of *odd complex*

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	$E(10^3 cm^{-1})$	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1} 2s^2 (^{1}S)	SumAa
5	2s2p3d	(^{1}P)	^{2}P	0.5	249.598	9.199+09	3.5714	3.6964
5	2s2p3d	(^{1}P)	^{2}P	1.5	249.599	1.839+10	3.5711	3.6953
9	2s2p4s	(^{1}P)	^{2}P	0.5	261.227	5.077+09	0.9092	2.0799
9	2s2p4s	(^{1}P)	^{2}P	1.5	261.228	1.015+10	0.9029	2.0798
6	2p^{2}3p	(^{3}P)	^{2}S	0.5	263.102	5.618+09	0	0.0002
6	2p^{2}3p	(^{3}P)	^{4}D	0.5	265.562	3.533+09	0	0.0109
6	2p^{2}3p	(^{3}P)	^{4}D	1.5	265.576	7.068+09	0	0.0109
6	2p^{2}3p	(^{3}P)	^{4}D	2.5	265.600	1.061+10	0	0.0109
6	2p^{2}3p	(^{3}P)	^{4}D	3.5	265.635	1.415+10	0	0.0107
6	2p^{2}3p	(^{3}P)	^{4}P	0.5	267.136	3.719+09	0	1.6963
6	2p^{2}3p	(^{3}P)	^{4}P	1.5	267.150	7.440+09	0	1.6964
6	2p^{2}3p	(^{3}P)	^{4}P	2.5	267.174	1.116+10	0	1.8966
6	2p^{2}3p	(^{3}P)	^{2}D	1.5	269.762	1.224+10	0	3.7421
6	2p^{2}3p	(^{3}P)	^{2}D	2.5	269.803	1.850+10	0	3.6221
10	2s2p4d	(^{1}P)	^{2}F	2.5	271.329	1.513+10	12.8645	13.6565
10	2s2p4d	(^{1}P)	^{2}F	3.5	271.329	2.015+10	12.8626	13.6510
10	2s2p4d	(^{1}P)	^{2}D	1.5	272.161	9.947+09	0.0004	13.3031
10	2s2p4d	(^{1}P)	^{2}D	2.5	272.171	1.478+10	0.0001	13.4131
10	2s2p4d	(^{1}P)	^{2}P	0.5	272.187	7.082+09	2.8713	3.2781
10	2s2p4d	(^{1}P)	^{2}P	1.5	272.191	1.417+10	2.8726	6.2408
6	2p23p	(^{3}P)	^{2}P	0.5	273.856	3.663+09	0.0123	13.9731
6	2p^{2}3p	(^{3}P)	^{2}P	1.5	273.857	7.319+09	0.0114	13.9698
6	2p^{2}3p	(^{3}P)	^{4}S	1.5	274.165	6.953+09	0	0.0001
15	2s2p5s	(^{1}P)	^{2}P	0.5	277.411	4.285+09	0.6774	0.7814
15	2s2p5s	(^{1}P)	^{2}P	1.5	277.412	8.567+09	0.6752	0.7779
6	2p^{2}3p	(^{1}D)	^{2}F	2.5	281.418	9.275+09	0.6576	2.6230
6	2p^{2}3p	(^{1}D)	^{2}F	3.5	281.421	1.239+10	0.6667	2.6187
16	2s2p5d	(^{1}P)	^{2}D	1.5	282.440	1.113+10	03	.8817
16	2s2p5d	(^{1}P)	^{2}D	2.5	282.441	1.669+10	0	3.8856
16	2s2p5d	(^{1}P)	^{2}P	0.5	282.823	5.787+09	1.5157	1.5195
16	2s2p5d	(^{1}P)	^{2}P	1.5	282.823	1.157+10	1.5161	1.5199
17	2s2p5g	(^{1}P)	^{2}G	3.5	283.117	1.516+10	0	0
17	2s2p5g	(^{1}P)	^{2}G	4.5	283.117	1.794+10	0	0
17	2s2p5g	(^{1}P)	^{2}H	4.5	283.171	1.791+10	0.0969	0.0969
17	2s2p5g	(^{1}P)	^{2}H	5.5	283.171	2.151+10	0.0969	0.0969
16	2s2p5d	(^{1}P)	^{2}F	2.5	283.189	6.280+09	7.7590	14.0563
16	2s2p5d	(^{1}P)	^{2}F	3.5	283.191	8.421+09	7.6721	13.9090
17	2s2p5g	(^{1}P)	^{2}F	2.5	283.217	1.135+10	0.4001	0.7452
17	2s2p5g	(^{1}P)	^{2}F	3.5	283.218	1.506+10	0.4733	0.8804
23	2s2p6s	(^{1}P)	^{2}P	0.5	285.229	3.915+09	0.3073	0.5090
23	2s2p6s	(^{1}P)	^{2}P	1.5	285.231	7.830+09	0.3071	0.5060

Table IIc (continued)

N	$2l_12l_2nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(**gAr**), s^{-1}	**Aa,10^{13} s^{-1}**	
							$2s^2$ (^1S)	SumAa
6	$2p^23p$	(^1D)	^2D	1.5	285.767	3.405+09	0.0001	2.1182
6	$2p^23p$	(^1D)	^2D	2.5	285.762	5.104+09	0	4.1209
24	2s2p6d	(^1P)	^2P	0.5	288.131	4.636+09	0.4120	2.4879
24	2s2p6d	(^1P)	^2P	1.5	288.136	9.384+09	0.4237	2.4514
24	2s2p6d	(^1P)	^2D	1.5	288.140	1.054+10	0.0035	1.6140
24	2s2p6d	(^1P)	^2D	2.5	288.140	1.563+10	0.1644	1.7529
24	2s2p6d	(^1P)	^2F	2.5	288.140	1.049+10	4.6681	5.6415
24	2s2p6d	(^1P)	^2F	3.5	288.140	1.373+10	4.8302	5.7773
25	2s2p6g	(^1P)	^2G	3.5	288.519	1.503+10	0	0
25	2s2p6g	(^1P)	^2G	4.5	288.519	1.880+10	0	0
25	2s2p6g	(^1P)	^2H	4.5	288.545	1.672+10	0.1031	0.1032
25	2s2p6g	(^1P)	^2H	5.5	288.545	2.006+10	0.1031	0.1031
25	2s2p6g	(^1P)	^2F	2.5	288.577	1.223+10	0.0002	0.0002
25	2s2p6g	(^1P)	^2F	3.5	288.577	1.631+10	0.0002	0.0002
6	$2p^23p$	(^1D)	^2P	0.5	289.000	3.644+09	0.9043	7.1540
6	$2p^23p$	(^1D)	^2P	1.5	289.016	7.186+09	0.8865	7.2407
11	$2p^24p$	(^3P)	^2S	0.5	298.775	4.697+09	0	0.0010
11	$2p^24p$	(^3P)	^4D	0.5	299.398	3.414+09	0	0.1622
11	$2p^24p$	(^3P)	^4D	1.5	299.411	6.831+09	0	0.1634
11	$2p^24p$	(^3P)	^4D	2.5	299.434	1.025+10	0	0.1638
11	$2p^24p$	(^3P)	^4D	3.5	299.468	1.367+10	0	0.1615

Table IId. Energy, radiative and non-radiative widths of CII ion for $1s^2 2l_1 2l_2(L_{12}S_{12})nl$ [LSJ] states of *odd complex*

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	E($10^3 cm^{-1}$)	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1}	
							$2s^2$ (^1S)	SumAa
11	$2p^2 4p$	(^3P)	^4P	0.5	299.891	3.668+09	0	1.4995
11	$2p^2 4p$	(^3P)	^4P	1.5	299.905	7.336+09	0	1.4987
11	$2p^2 4p$	(^3P)	^4P	2.5	299.929	1.101+10	0	1.4983
11	$2p^2 4p$	(^3P)	^2D	1.5	302.291	6.897+09	0	5.6490
11	$2p^2 4p$	(^3P)	^2D	2.5	302.338	1.036+10	0	5.6433
11	$2p^2 4p$	(^3P)	^4S	1.5	302.594	6.226+09	0	0.0017
11	$2p^2 4p$	(^3P)	^2P	0.5	303.531	3.517+09	0.0198	18.0949
11	$2p^2 4p$	(^3P)	^2P	1.5	303.549	7.037+09	0.0203	18.0582
12	$2p^2 4f$	(^3P)	^4D	0.5	305.897	3.675+09	0	0.0002
12	$2p^2 4f$	(^3P)	^4D	1.5	305.882	7.344+09	0	0.0142
12	$2p^2 4f$	(^3P)	^4D	2.5	305.882	1.101+10	0	0.0251
12	$2p^2 4f$	(^3P)	^4D	3.5	305.850	1.468+10	0	0.0114
12	$2p^2 4f$	(^3P)	^2D	1.5	305.906	7.345+09	0	0.0271
12	$2p^2 4f$	(^3P)	^2D	2.5	305.859	1.101+10	0	0.0329
12	$2p^2 4f$	(^3P)	^4G	2.5	305.892	1.045+10	0	2.6865
12	$2p^2 4f$	(^3P)	^4G	3.5	305.903	1.390+10	0	2.7061
12	$2p^2 4f$	(^3P)	^4G	4.5	305.924	1.739+10	0	2.7029
12	$2p^2 4f$	(^3P)	^4G	5.5	305.954	2.091+10	0	2.6986
12	$2p^2 4f$	(^3P)	^2G	3.5	305.944	1.369+10	0	2.7935
12	$2p^2 4f$	(^3P)	^2G	4.5	305.985	1.711+10	0	2.8013
12	$2p^2 4f$	(^3P)	^4F	1.5	306.284	6.992+09	0	1.9029
12	$2p^2 4f$	(^3P)	^4F	2.5	306.288	1.049+10	0	1.9043
12	$2p^2 4f$	(^3P)	^4F	3.5	306.294	1.398+10	0	1.9066
12	$2p^2 4f$	(^3P)	^4F	4.5	306.300	1.748+10	0	1.9146
12	$2p^2 4f$	(^3P)	^2F	2.5	306.340	1.024+10	0.0004	2.0091
12	$2p^2 4f$	(^3P)	^2F	3.5	306.350	1.365+10	0.0004	2.0175
18	$2p^2 5p$	(^3P)	^2S	0.5	312.682	4.447+09	0	0.0044
18	$2p^2 5p$	(^3P)	^4D	0.5	312.899	3.196+09	0	0.1854
18	$2p^2 5p$	(^3P)	^4D	1.5	312.912	6.395+09	0	0.1888
18	$2p^2 5p$	(^3P)	^4D	2.5	312.934	9.599+09	0	0.1904
18	$2p^2 5p$	(^3P)	^4D	3.5	312.969	1.280+10	0	0.1825
18	$2p^2 5p$	(^3P)	^4P	0.5	313.118	3.445+09	0	0.9946
18	$2p^2 5p$	(^3P)	^4P	1.5	313.130	6.860+09	0	0.9705
18	$2p^2 5p$	(^3P)	^4P	2.5	313.152	1.024+10	0	0.9350
18	$2p^2 5p$	(^3P)	^2D	1.5	313.151	6.155+09	0	0.3618
18	$2p^2 5p$	(^3P)	^2D	2.5	313.186	9.248+09	0	0.3790
18	$2p^2 5p$	(^3P)	^2P	0.5	313.430	3.853+09	0.0026	1.9958
18	$2p^2 5p$	(^3P)	^2P	1.5	313.448	7.699+09	0.0026	1.9624
18	$2p^2 5p$	(^3P)	^4S	1.5	314.523	5.922+09	0	0.0005
11	$2p^2 4p$	(^1D)	^2F	2.5	314.405	3.035+09	0.2426	1.8395
11	$2p^2 4p$	(^1D)	^2F	3.5	314.408	4.049+09	0.2425	1.8388

Table IId (continued)

N	$2l_12l_2nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1} 2s^2 (^{1}S)	SumAa
19	2p^{2}5f	(^{3}P)	^{2}D	1.5	315.984	6.753+09	0	0.1256
19	2p^{2}5f	(^{3}P)	^{2}D	2.5	315.954	9.816+09	0	0.8689
19	2p^{2}5f	(^{3}P)	^{4}D	0.5	316.007	3.405+09	0	0.0001
19	2p^{2}5f	(^{3}P)	^{4}D	1.5	316.005	6.771+09	0	0.0774
19	2p^{2}5f	(^{3}P)	^{4}D	2.5	315.985	1.018+10	0	0.0572
19	2p^{2}5f	(^{3}P)	^{4}D	3.5	315.957	1.350+10	0	0.1904
19	2p^{2}5f	(^{3}P)	^{4}G	2.5	315.960	9.628+09	0	1.3187
19	2p^{2}5f	(^{3}P)	^{4}G	3.5	315.968	1.252+10	0	1.8860
19	2p^{2}5f	(^{3}P)	^{4}G	4.5	315.988	1.555+10	0	2.0397
19	2p^{2}5f	(^{3}P)	^{4}G	5.5	316.021	1.868+10	0	2.0379
19	2p^{2}5f	(^{3}P)	^{2}G	3.5	316.002	1.233+10	0	2.1145
19	2p^{2}5f	(^{3}P)	^{2}G	4.5	316.043	1.540+10	0	2.1281
19	2p^{2}5f	(^{3}P)	^{4}F	1.5	316.176	6.479+09	0	1.5097
19	2p^{2}5f	(^{3}P)	^{4}F	2.5	316.181	9.719+09	0	1.5112
19	2p^{2}5f	(^{3}P)	^{4}F	3.5	316.188	1.296+10	0	1.5189
19	2p^{2}5f	(^{3}P)	^{4}F	4.5	316.192	1.618+10	0	1.5435
19	2p^{2}5f	(^{3}P)	^{2}F	2.5	316.223	9.620+09	0.0002	1.6266
19	2p^{2}5f	(^{3}P)	^{2}F	3.5	316.232	1.282+10	0.0002	1.6450
6	2p^{2}3p	(^{1}S)	^{2}P	0.5	316.576	3.926+09	0.1351	10.5175
6	2p^{2}3p	(^{1}S)	^{2}P	1.5	316.582	7.878+09	0.1349	10.5118
11	2p^{2}4p	(^{1}D)	^{2}D	1.5	316.605	3.577+09	0	2.3261
11	2p^{2}4p	(^{1}D)	^{2}D	2.5	316.620	5.377+09	0	2.3552
11	2p^{2}4p	(^{1}D)	^{2}P	0.5	317.807	3.097+09	0.0330	7.0217
11	2p^{2}4p	(^{1}D)	^{2}P	1.5	317.824	6.166+09	0.0328	7.0987
26	2p^{2}6p	(^{3}P)	^{2}S	0.5	319.665	5.120+09	0	0.0091
26	2p^{2}6p	(^{3}P)	^{4}D	0.5	319.742	3.057+09	0	0.1372
26	2p^{2}6p	(^{3}P)	^{4}D	1.5	319.754	6.121+09	0	10.144
26	2p^{2}6p	(^{3}P)	^{4}D	2.5	319.776	9.192+09	0	0.1478
26	2p^{2}6p	(^{3}P)	^{4}D	3.5	319.811	1.223+10	0	0.1329
26	2p^{2}6p	(^{3}P)	^{4}P	0.5	319.860	3.341+09	0	0.6160
26	2p^{2}6p	(^{3}P)	^{4}P	1.5	319.873	6.642+09	0	0.6134
26	2p^{2}6p	(^{3}P)	^{4}P	2.5	319.897	9.964+09	0	0.6103
12	2p^{2}4f	(^{1}D)	^{2}G	3.5	320.184	4.638+09	0	1.6709
12	2p^{2}4f	(^{1}D)	^{2}G	4.5	320.184	5.798+09	0	1.6708
12	2p^{2}4f	(^{1}D)	^{2}F	2.5	320.298	3.551+09	0.0242	0.4159
12	2p^{2}4f	(^{1}D)	^{2}F	3.5	320.298	4.735+09	0.0242	0.4158
12	2p^{2}4f	(^{1}D)	^{2}H	4.5	320.608	5.155+09	0	4.2396
12	2p^{2}4f	(^{1}D)	^{2}H	5.5	320.608	6.155+09	0.0003	4.2396
12	2p^{2}4f	(^{1}D)	^{2}D	1.5	320.626	2.389+09	0	0.2726
12	2p^{2}4f	(^{1}D)	^{2}D	2.5	320.628	3.533+09	0	0.2394
26	2p^{2}6p	(^{3}P)	^{4}S	1.5	320.778	6.162+09	0	0.0020
12	2p^{2}4f	(^{1}D)	^{2}P	0.5	321.152	1.367+09	0.0143	1.5260
12	2p^{2}4f	(^{1}D)	^{2}P	1.5	321.154	2.730+09	0.0146	1.4882

Table IId (continued)

N	$2l_12l_2nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1}	
							$2s^2$ (^{1}S)	SumAa
26	$2p^26p$	(^{3}P)	^{2}D	1.5	320.908	7.629+09	0	1.9260
26	$2p^26p$	(^{3}P)	^{2}D	2.5	320.948	1.148+10	0	1.9444
12	$2p^24f$	(^{1}D)	^{2}P	0.5	321.152	1.367+09	0.0143	1.5260
12	$2p^24f$	(^{1}D)	^{2}P	1.5	321.154	2.730+09	0.0146	1.4882
27	$2p^26f$	(^{3}P)	^{4}D	0.5	321.487	3.420+09	0	0.0001
27	$2p^26f$	(^{3}P)	^{4}D	1.5	321.468	6.885+09	0	0.0639
27	$2p^26f$	(^{3}P)	^{4}D	2.5	321.447	1.038+10	0	0.1120
27	$2p^26f$	(^{3}P)	^{4}D	3.5	321.431	1.261+10	0	0.7783
27	$2p^26f$	(^{3}P)	^{4}D	3.5	321.440	1.277+10	0	0.6370
27	$2p^26f$	(^{3}P)	^{4}G	2.5	321.427	8.888+09	0	1.2882
27	$2p^26f$	(^{3}P)	^{4}G	4.5	321.456	1.470+10	0	1.3529
27	$2p^26f$	(^{3}P)	^{4}G	5.5	321.492	1.758+10	0	1.3513
27	$2p^26f$	(^{3}P)	^{2}G	3.5	321.464	1.179+10	0	1.4090
27	$2p^26f$	(^{3}P)	^{2}G	4.5	321.506	1.468+10	0	1.4269
27	$2p^26f$	(^{3}P)	^{2}D	1.5	321.497	7.088+09	0	0.0100
27	$2p^26f$	(^{3}P)	^{2}D	2.5	321.470	1.054+10	0	0.0521
27	$2p^26f$	(^{3}P)	^{4}F	1.5	321.573	6.426+09	0	1.0273
27	$2p^26f$	(^{3}P)	^{4}F	2.5	321.577	9.625+09	0	1.0510
27	$2p^26f$	(^{3}P)	^{4}F	3.5	321.583	1.278+10	0	1.0697
27	$2p^26f$	(^{3}P)	^{4}F	4.5	321.587	6.799+09	0	1.1105
27	$2p^26f$	(^{3}P)	^{4}F	2.5	321.607	1.026+10	0.0002	1.1639
27	$2p^26f$	(^{3}P)	^{4}F	3.5	321.616	1.365+10	0.0002	1.2118
28	$2p^26h$	(^{3}P)	^{4}I	4.5	321.568	1.490+10	0	0.0001
28	$2p^26h$	(^{3}P)	^{4}I	4.5	321.587	1.181+10	0	0.0024
28	$2p^26h$	(^{3}P)	^{4}I	5.5	321.597	1.719+10	0	0
28	$2p^26h$	(^{3}P)	^{4}I	6.5	321.597	2.006+10	0	0.0302
28	$2p^26h$	(^{3}P)	^{4}I	7.5	321.642	2.261+10	0	0
28	$2p^26h$	(^{3}P)	^{4}G	2.5	321.639	9.559+09	0	0.0002
28	$2p^26h$	(^{3}P)	^{4}G	3.5	321.599	1.251+10	0	0.0002
28	$2p^26h$	(^{3}P)	^{4}G	4.5	321.599	2.796+10	0	0.0002
28	$2p^26h$	(^{3}P)	^{4}G	5.5	321.568	1.789+10	0	0.0001
28	$2p^26h$	(^{3}P)	^{4}G	5.5	321.587	1.810+10	0	0.0001
28	$2p^26h$	(^{3}P)	^{2}G	3.5	321.639	1.275+10	0	0.0002
28	$2p^26h$	(^{3}P)	^{2}I	6.5	321.642	1.979+10	0	00
28	$2p^26h$	(^{3}P)	^{2}H	4.5	321.655	1.534+10	0	0.0001
28	$2p^26h$	(^{3}P)	^{2}H	5.5	321.661	1.785+10	0	0.0001
28	$2p^26h$	(^{3}P)	^{4}H	3.5	321.655	1.238+10	0	0.0001
28	$2p^26h$	(^{3}P)	^{4}H	4.5	321.661	1.512+10	0	0.0001
28	$2p^26h$	(^{3}P)	^{4}H	5.5	321.661	1.821+10	0	0.0001
28	$2p^26h$	(^{3}P)	^{4}H	6.5	321.661	2.082+10	0	0.1087
26	$2p^26p$	(^{3}P)	^{2}P	0.5	322.473	4.598+09	0.1068	20.4329
26	$2p^26p$	(^{3}P)	^{2}P	1.5	322.484	9.206+09	0.1065	20.3399

Table IId (continued)

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	$E(10^3 cm^{-1})$	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1}	
							$2s^2$ (^1S)	SumAa
18	$2p^2 5p$	(^1D)	^2F	2.5	327.560	2.578+09	0.0534	0.5997
18	$2p^2 5p$	(^1D)	^2F	3.5	327.561	3.439+09	0.0533	0.5996
18	$2p^2 5p$	(^1D)	^2D	1.5	328.441	1.510+09	0	1.1063
18	$2p^2 5p$	(^1D)	^2D	2.5	328.439	2.265+09	0	1.1051
18	$2p^2 5p$	(^1D)	^2P	0.5	329.225	1.159+09	0.0013	15.6593
18	$2p^2 5p$	(^1D)	^2P	1.5	329.233	2.320+09	0.0014	15.7088
19	$2p^2 5f$	(^1D)	^2G	3.5	330.323	3.225+09	0	1.2375
19	$2p^2 5f$	(^1D)	^2G	4.5	330.323	4.031+09	0	1.2373
19	$2p^2 5f$	(^1D)	^2F	2.5	330.390	2.579+09	0.0172	0.3063
19	$2p^2 5f$	(^1D)	^2F	3.5	330.390	3.438+09	0.0172	0.3062
19	$2p^2 5f$	(^1D)	^2H	4.5	330.518	3.539+09	0	3.3399
19	$2p^2 5f$	(^1D)	^2H	5.5	330.518	4.246+09	0	3.3399
19	$2p^2 5f$	(^1D)	^2D	1.5	330.568	1.816+09	0	0.0482
19	$2p^2 5f$	(^1D)	^2D	2.5	330.568	2.725+09	0	0.0484
19	$2p^2 5f$	(^1D)	^2P	0.5	330.789	9.087+08	0.0124	0.0496
19	$2p^2 5f$	(^1D)	^2P	1.5	330.789	1.819+09	0.0124	0.0497
26	$2p^2 6p$	(^1D)	^2F	2.5	334.285	2.519+09	0.0177	0.2878
26	$2p^2 6p$	(^1D)	^2F	3.5	334.285	3.359+09	0.0177	0.2878
26	$2p^2 6p$	(^1D)	^2D	1.5	334.719	1.658+09	0	0.4852
26	$2p^2 6p$	(^1D)	^2D	2.5	334.717	2.498+09	0	0.4830
26	$2p^2 6p$	(^1D)	^2P	0.5	335.185	1.709+09	0	10.7149
26	$2p^2 6p$	(^1D)	^2P	1.5	335.190	3.415+09	0	10.7940
27	$2p^2 6f$	(^1D)	^2G	3.5	335.825	2.630+09	0	0.8008
27	$2p^2 6f$	(^1D)	^2G	4.5	335.825	3.288+09	0	0.8007
27	$2p^2 6f$	(^1D)	^2H	4.5	335.933	2.784+09	0	2.3259
27	$2p^2 6f$	(^1D)	^2H	5.5	335.933	3.340+09	0	2.3259
27	$2p^2 6f$	(^1D)	^2F	2.5	335.864	2.253+09	0.0114	0.2010
27	$2p^2 6f$	(^1D)	^2F	3.5	335.864	3.005+09	0.0113	0.2009
27	$2p^2 6f$	(^1D)	^2D	1.5	335.970	2.175+09	0	0.0327
27	$2p^2 6f$	(^1D)	^2D	2.5	335.970	3.266+09	0	0.0329
28	$2p^2 6h$	(^1D)	^2H	4.5	336.006	2.974+09	0	0.0003
28	$2p^2 6h$	(^1D)	^2H	5.5	336.006	3.568+09	0	0.0003
28	$2p^2 6h$	(^1D)	^2I	5.5	336.005	3.201+09	0	0
28	$2p^2 6h$	(^1D)	^2K	6.5	336.034	3.200+09	0	0
28	$2p^2 6h$	(^1D)	^2K	7.5	336.034	3.657+09	0	0
28	$2p^2 6h$	(^1D)	^2G	3.5	336.025	2.571+09	0	0.0002
28	$2p^2 6h$	(^1D)	^2G	4.5	336.025	3.214+09	0	0.0002
28	$2p^2 6h$	(^1D)	^2F	2.5	336.052	2.038+09	0	0.0001
28	$2p^2 6h$	(^1D)	^2F	3.5	336.052	2.718+09	0	0.0001
27	$2p^2 6f$	(^1D)	^2P	0.5	336.097	1.171+09	0.0077	0.0918
27	$2p^2 6f$	(^1D)	^2P	1.5	336.097	2.343+09	0.0077	0.0924

Table IId (continued)

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	$E(10^3 cm^{-1})$	Sum(**gAr**), s^{-1}	**Aa,10^{13} s^{-1}** 2s^2 (^{1}S)	SumAa
11	2p^{2}4p	(^{1}S)	^{2}P	0.5	348.255	5.712+09	0.0496	2.3824
11	2p^{2}4p	(^{1}S)	^{2}P	1.5	348.255	1.142+10	0.0495	2.3770
12	2p^{2}4f	(^{1}S)	^{2}F	2.5	353.638	1.647+10	0.0174	3.8088
12	2p^{2}4f	(^{1}S)	^{2}F	3.5	353.638	2.196+10	0.0174	3.8087
18	2p^{2}5p	(^{1}S)	^{2}P	0.5	361.002	5.781+09	0.0161	1.2330
18	2p^{2}5p	(^{1}S)	^{2}P	1.5	361.003	1.156+10	0.0160	1.2319
19	2p^{2}5f	(^{1}S)	^{2}F	2.5	363.616	1.554+10	0.0126	2.9305
19	2p^{2}5f	(^{1}S)	^{2}F	3.5	363.616	2.071+10	0.0126	2.9304
26	2p^{2}6p	(^{1}S)	^{2}P	0.5	367.580	5.718+09	0.0070	0.7791
26	2p^{2}6p	(^{1}S)	^{2}P	1.5	367.580	1.144+10	0.0070	0.7786
27	2p^{2}6f	(^{1}S)	^{2}F	2.5	369.049	1.537+10	0.0086	2.0106
27	2p^{2}6f	(^{1}S)	^{2}F	3.5	369.049	2.049+10	0.0085	2.0105
28	2p^{2}6h	(^{1}S)	^{2}H	4.5	369.159	2.474+10	0	0.0002
28	2p^{2}6h	(^{1}S)	^{2}H	5.5	369.159	2.969+10	0	0.0002

Table IIIa. Energy, radiative widths of CII ion for $1s^2 2l_1 2l_2 (L_{12}S_{12}) nl$ [LSJ] states of *even complex*

1-2s2p^2, 2-2s^{2}3s, 3-2s^{2}3d, 4-2s2p3p, 5-2p^{2}3s, 6-2p^{2}3d

7-2s^{2}4s, 8-2s^{2}4d, 9-2s2p4p, 10-2s2p4f, 11-2p^{2}4s, 12-2p^{2}4d

13-2s^{2}5s, 14-2s^{2}5d, 15-2s^{2}5g, 16-2s2p5p, 17-2s2p5f, 18-2p^{2}5s, 19-2p^{2}5d, 20-2p^{2}5g

21-2s^{2}6s, 22-2s^{2}6d, 23-2s^{2}6g, 24-2s2p6p, 25-2s2p6f, 26-2s2p6f,

27-2p^{2}6s, 28-2p^{2}6d, 29-2p^{2}6g

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(gAr), s^{-1}
1	2s2p^2	(^{3}P)	^{4}P	0.5	42.082	0.000+00
1	2s2p^2	(^{3}P)	^{4}P	1.5	42.103	0.000+00
1	2s2p^2	(^{3}P)	^{4}P	2.5	42.138	0.000+00
1	2s2p^2	(^{1}D)	^{2}D	1.5	76.578	1.678+09
1	2s2p^2	(^{1}D)	^{2}D	2.5	76.578	2.511+09
1	2s2p^2	(^{1}S)	^{2}S	0.5	95.848	4.535+09
1	2s2p^2	(^{3}P)	^{2}P	0.5	110.184	9.017+09
1	2s2p^2	(^{3}P)	^{2}P	1.5	110.225	1.804+10
2	2s^{2}3s	(^{1}S)	^{2}S	0.5	114.254	1.978+09
3	2s^{2}3d	(^{1}S)	^{2}D	1.5	144.792	1.134+10
3	2s^{2}3d	(^{1}S)	^{2}D	2.5	144.792	1.699+10
7	2s^{2}4s	(^{1}S)	^{2}S	0.5	157.366	1.317+09
8	2s^{2}4d	(^{1}S)	^{2}D	1.5	168.228	5.177+09
8	2s^{2}4d	(^{1}S)	^{2}D	2.5	168.228	8.646+09
13	2s^{2}5s	(^{1}S)	^{2}S	0.5	173.630	6.339+08
14	2s^{2}5d	(^{1}S)	^{2}D	1.5	178.729	3.108+09
14	2s^{2}5d	(^{1}S)	^{2}D	2.5	178.729	4.998+09
4	2s2p3p	(^{3}P)	^{4}D	0.5	179.131	6.648+07
4	2s2p3p	(^{3}P)	^{4}D	1.5	179.147	1.329+08
4	2s2p3p	(^{3}P)	^{4}D	2.5	179.172	1.992+08
4	2s2p3p	(^{3}P)	^{4}D	3.5	179.207	2.659+08
15	2s^{2}5g	(^{1}S)	^{2}G	4.5	179.379	7.409+08
15	2s^{2}5g	(^{1}S)	^{2}G	3.5	179.379	5.928+08
4	2s2p3p	(^{3}P)	^{2}P	0.5	180.591	1.379+09
4	2s2p3p	(^{3}P)	^{2}P	1.5	180.613	2.755+09
4	2s2p3p	(^{3}P)	^{4}S	1.5	181.356	1.923+08
21	2s^{2}6s	(^{1}S)	^{2}S	0.5	181.568	3.199+08
22	2s^{2}6d	(^{1}S)	^{2}D	1.5	184.346	2.273+09
22	2s^{2}6d	(^{1}S)	^{2}D	2.5	184.347	3.401+09
23	2s^{2}6g	(^{1}S)	^{2}G	3.5	184.753	3.393+08
23	2s^{2}6g	(^{1}S)	^{2}G	4.5	184.753	4.241+08
4	2s2p3p	(^{3}P)	^{4}P	0.5	186.823	2.736+08
4	2s2p3p	(^{3}P)	^{4}P	1.5	186.838	5.476+08
4	2s2p3p	(^{3}P)	^{4}P	2.5	186.863	8.215+08
4	2s2p3p	(^{3}P)	^{2}D	1.5	188.700	1.875+09
4	2s2p3p	(^{3}P)	^{2}D	2.5	188.746	2.823+09
4	2s2p3p	(^{3}P)	^{2}S	0.5	192.532	1.037+09

Table IIIb. Energy, radiative and non-radiative widths of CII ion for $1s^2 2l_1 2l_2 (L_{12}S_{12}) nl$ [LSJ] states of *even complex*

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1} $2s^2$ (^1S)	SumAa
9	2s2p4p	(^{3}P)	^{2}P	0.5	214.064	1.232+09	0	0
9	2s2p4p	(^{3}P)	^{2}P	1.5	214.092	2.489+09	0.0001	0.0001
9	2s2p4p	(^{3}P)	^{4}D	0.5	214.133	2.106+08	0.0001	0.0001
9	2s2p4p	(^{3}P)	^{4}D	1.5	214.146	3.940+08	0.0001	0.0001
9	2s2p4p	(^{3}P)	^{4}D	2.5	214.167	4.406+08	0.0001	0.0001
9	2s2p4p	(^{3}P)	^{4}D	3.5	214.200	5.877+08	0	0
9	2s2p4p	(^{3}P)	^{4}S	1.5	214.798	3.032+08	0	0
9	2s2p4p	(^{3}P)	^{4}P	0.5	216.478	9.996+07	0.0001	0.0001
9	2s2p4p	(^{3}P)	^{4}P	1.5	216.493	2.004+08	0.0003	0.0003
9	2s2p4p	(^{3}P)	^{4}P	2.5	216.516	3.027+08	0.0016	0.0016
9	2s2p4p	(^{3}P)	^{2}D	1.5	216.844	2.338+09	1.7708	1.7708
9	2s2p4p	(^{3}P)	^{2}D	2.5	216.891	3.507+09	1.7716	1.7716
9	2s2p4p	(^{3}P)	^{2}S	0.5	218.433	8.416+08	0.9059	0.9059
10	2s2p4f	(^{3}P)	^{2}F	2.5	220.711	1.845+09	0	0
10	2s2p4f	(^{3}P)	^{2}F	3.5	220.719	2.448+09	0	0
10	2s2p4f	(^{3}P)	^{4}F	1.5	220.716	1.217+09	0	0
10	2s2p4f	(^{3}P)	^{4}F	2.5	220.719	1.828+09	0	0
10	2s2p4f	(^{3}P)	^{4}F	3.5	220.728	2.449+09	0	0
10	2s2p4f	(^{3}P)	^{4}F	4.5	220.731	3.044+09	0	0
10	2s2p4f	(^{3}P)	^{4}G	2.5	221.088	1.849+09	0	0
10	2s2p4f	(^{3}P)	^{4}G	3.5	221.100	2.435+09	0.0002	0.0002
10	2s2p4f	(^{3}P)	^{4}G	4.5	221.121	3.062+09	0	0
10	2s2p4f	(^{3}P)	^{4}G	5.5	221.148	3.699+09	0	0
10	2s2p4f	(^{3}P)	^{2}G	3.5	221.144	2.208+09	0.0014	0.0014
10	2s2p4f	(^{3}P)	^{2}G	4.5	221.183	2.741+09	0.0016	0.0016
10	2s2p4f	(^{3}P)	^{4}D	0.5	221.219	5.806+08	0	0
10	2s2p4f	(^{3}P)	^{4}D	1.5	221.208	1.156+09	0.0016	0.0016
10	2s2p4f	(^{3}P)	^{4}D	2.5	221.189	1.717+09	0.0054	0.0054
10	2s2p4f	(^{3}P)	^{4}D	3.5	221.175	2.323+09	0	0
10	2s2p4f	(^{3}P)	^{2}D	1.5	221.240	1.101+09	0.0198	0.0198
10	2s2p4f	(^{3}P)	^{2}D	2.5	221.215	1.670+09	0.0156	0.0156
16	2s2p5p	(^{3}P)	^{2}P	0.5	227.678	1.024+09	0	0
16	2s2p5p	(^{3}P)	^{2}P	1.5	227.705	2.055+09	0	0
16	2s2p5p	(^{3}P)	^{4}D	0.5	227.825	9.533+07	0	0
16	2s2p5p	(^{3}P)	^{4}D	1.5	227.838	1.830+08	0	0
16	2s2p5p	(^{3}P)	^{4}D	2.5	227.860	2.590+08	0	0
16	2s2p5p	(^{3}P)	^{4}D	3.5	227.894	3.437+08	0	0
16	2s2p5p	(^{3}P)	^{4}S	1.5	228.121	2.051+08	0	0
16	2s2p5p	(^{3}P)	^{2}D	1.5	228.613	2.760+09	0.0404	0.0404
16	2s2p5p	(^{3}P)	^{2}D	2.5	228.655	4.151+09	0.0385	0.0385
16	2s2p5p	(^{3}P)	^{4}P	0.5	228.874	5.794+07	0.0001	0.0001

Table IIIb.(continued)

N	$2l_1 2l_2 nl$ $L_{12}S_{12}$	LS	J	E($10^3 cm^{-1}$)	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1} 2s^2 (^{1}S)	SumAa
16	2s2p5p (^{3}P)	^{4}P	1.5	228.890	1.144+08	0	0
16	2s2p5p (^{3}P)	^{4}P	2.5	228.917	1.771+08	0	0
16	2s2p5p (^{3}P)	^{2}S	0.5	229.360	1.169+09	0.0106	0.0106
17	2s2p5f (^{3}P)	^{2}F	2.5	230.891	8.289+08	0.0004	0.0004
17	2s2p5f (^{3}P)	^{2}F	3.5	230.906	1.117+09	0	0
17	2s2p5f (^{3}P)	^{4}F	1.5	230.894	5.671+08	0.0002	0.0002
17	2s2p5f (^{3}P)	^{4}F	2.5	230.896	8.508+08	0.0003	0.0003
17	2s2p5f (^{3}P)	^{4}F	3.5	230.895	1.123+09	0	0
17	2s2p5f (^{3}P)	^{4}F	4.5	230.909	1.421+09	0	0
17	2s2p5f (^{3}P)	^{4}G	2.5	231.081	9.225+08	0.0002	0.0002
17	2s2p5f (^{3}P)	^{4}G	3.5	231.091	1.204+09	0.0002	0.0002
17	2s2p5f (^{3}P)	^{4}G	4.5	231.113	1.524+09	0	0
17	2s2p5f (^{3}P)	^{4}G	5.5	231.140	1.849+09	0	0
17	2s2p5f (^{3}P)	^{4}D	0.5	231.164	2.896+08	0	0
17	2s2p5f (^{3}P)	^{4}D	1.5	231.154	5.755+08	0.0064	0.0064
17	2s2p5f (^{3}P)	^{4}D	2.5	231.134	8.511+08	0.0213	0.0213
17	2s2p5f (^{3}P)	^{4}D	3.5	231.123	1.158+09	0	0
17	2s2p5f (^{3}P)	^{2}G	3.5	231.129	1.096+09	0.0010	0.0010
17	2s2p5f (^{3}P)	^{2}G	4.5	231.166	1.351+09	0.0012	0.0012
17	2s2p5f (^{3}P)	^{2}D	1.5	231.177	5.544+08	0.0454	0.0454
17	2s2p5f (^{3}P)	^{2}D	2.5	231.156	8.442+08	0.0294	0.0294
4	2s2p3p (^{1}P)	^{2}D	1.5	233.764	5.166+09	3.6795	3.6795
4	2s2p3p (^{1}P)	^{2}D	2.5	233.787	7.773+09	3.7530	3.7530
24	2s2p6p (^{3}P)	^{2}P	0.5	234.434	1.622+09	0.0071	0.0071
24	2s2p6p (^{3}P)	^{2}P	1.5	234.459	3.269+09	0.0026	0.0026
24	2s2p6p (^{3}P)	^{2}S	0.5	234.665	2.170+09	0.9839	0.9839
24	2s2p6p (^{3}P)	^{4}D	0.5	234.725	4.152+07	0.0001	0.0001
24	2s2p6p (^{3}P)	^{4}D	1.5	234.738	7.971+07	0.0011	0.0011
24	2s2p6p (^{3}P)	^{4}D	2.5	234.760	1.139+08	0.0017	0.0017
24	2s2p6p (^{3}P)	^{4}D	3.5	234.793	1.501+08	0	0
24	2s2p6p (^{3}P)	^{4}S	1.5	234.885	1.295+08	0	0
24	2s2p6p (^{3}P)	^{4}P	0.5	235.293	5.213+07	0.0010	0.0010
24	2s2p6p (^{3}P)	^{4}P	1.5	235.309	1.037+08	0.0001	0.0001
24	2s2p6p (^{3}P)	^{4}P	2.5	235.331	1.506+08	0.0006	0.0006
4	2s2p3p (^{1}P)	^{2}P	0.5	235.534	4.538+09	0.0003	0.0003
4	2s2p3p (^{1}P)	^{2}P	1.5	235.547	9.045+09	0.0008	0.0008
25	2s2p6f (^{3}P)	^{2}F	2.5	236.404	4.493+08	0.0520	0.0520
25	2s2p6f (^{3}P)	^{2}F	3.5	236.421	5.785+08	0	0
25	2s2p6f (^{3}P)	^{4}F	1.5	236.408	2.974+08	0.0199	0.0199
25	2s2p6f (^{3}P)	^{4}F	2.5	236.408	4.407+08	0.0013	0.0013
25	2s2p6f (^{3}P)	^{4}F	3.5	236.407	5.897+08	0	0
25	2s2p6f (^{3}P)	^{4}F	4.5	236.423	7.364+08	0	0

Table IIIb.(continued)

N	$2l_12l_2nl$ $L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1} 2s^2 (^{1}S)	SumAa
25	2s2p6f (^{3}P)	^{4}G	2.5	236.506	6.623+08	0.5848	0.5848
25	2s2p6f (^{3}P)	^{4}G	2.5	236.519	6.826+08	0.6675	0.6675
25	2s2p6f (^{3}P)	^{4}G	3.5	236.519	6.646+08	0.0002	0.0002
25	2s2p6f (^{3}P)	^{4}G	4.5	236.544	8.142+08	0.0001	0.0001
25	2s2p6f (^{3}P)	^{4}G	5.5	236.567	9.740+08	0	0
25	2s2p6f (^{3}P)	^{2}D	1.5	236.527	6.978+08	1.7768	1.7768
25	2s2p6f (^{3}P)	^{4}D	0.5	236.578	1.694+08	0	0
25	2s2p6f (^{3}P)	^{4}D	1.5	236.572	3.485+08	0.0487	0.0487
25	2s2p6f (^{3}P)	^{4}D	2.5	236.561	5.254+08	0.0640	0.0640
25	2s2p6f (^{3}P)	^{4}D	3.5	236.541	6.694+08	0	0
25	2s2p6f (^{3}P)	^{2}G	3.5	236.551	6.906+08	0.0006	0.0006
25	2s2p6f (^{3}P)	^{2}G	4.5	236.581	8.806+08	0.0008	0.0008
26	2s2p6h (^{3}P)	^{4}H	3.5	236.596	2.146+08	0	0
26	2s2p6h (^{3}P)	^{4}H	4.5	236.576	2.676+08	0	0
26	2s2p6h (^{3}P)	^{4}H	5.5	236.576	3.210+08	0	0
26	2s2p6h (^{3}P)	^{4}H	6.5	236.600	3.753+08	0	0
26	2s2p6h (^{3}P)	^{2}H	4.5	236.596	2.683+08	0	0
26	2s2p6h (^{3}P)	^{2}H	5.5	236.600	3.217+08	0	0
26	2s2p6h (^{3}P)	^{4}I	4.5	236.615	2.660+08	0	0
26	2s2p6h (^{3}P)	^{4}I	5.5	236.663	3.207+08	0	0
26	2s2p6h (^{3}P)	^{4}I	6.5	236.663	3.741+08	0	0
26	2s2p6h (^{3}P)	^{4}I	7.5	236.675	4.260+08	0	0
26	2s2p6h (^{3}P)	^{2}G	3.5	236.679	2.126+08	0	0
26	2s2p6h (^{3}P)	^{2}G	4.5	236.661	2.674+08	0	0
26	2s2p6h (^{3}P)	^{4}G	2.5	236.679	1.595+08	0	0
26	2s2p6h (^{3}P)	^{4}G	3.5	236.670	2.131+08	0	0
26	2s2p6h (^{3}P)	^{4}G	4.5	236.670	2.663+08	0	0
26	2s2p6h (^{3}P)	^{4}G	5.5	236.615	3.194+08	0	0
26	2s2p6h (^{3}P)	^{4}G	5.5	236.661	3.208+08	0	0
26	2s2p6h (^{3}P)	^{2}I	6.5	236.675	3.728+08	0	0
24	2s2p6p (^{3}P)	^{2}D	1.5	236.808	2.573+09	5.9398	5.9398
24	2s2p6p (^{3}P)	^{2}D	2.5	236.825	3.992+09	6.3411	6.3411
4	2s2p3p (^{1}P)	^{2}S	0.5	240.616	2.614+09	12.346	12.346

Table IIIc. Energy, radiative and non-radiative widths of CII ion for $1s^2 2l_1 2l_2 (L_{12}S_{12}) nl$ [LSJ] states of *even complex*

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	E($10^3 cm^{-1}$)	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1}	
							$2s^2$ (^1S)	SumAa
5	$2p^23s$	(^3P)	^4P	0.5	253.109	4.053+09	0	5.8493
5	$2p^23s$	(^3P)	^4P	1.5	253.135	8.112+09	0	5.8503
5	$2p^23s$	(^3P)	^4P	2.5	253.179	1.218+10	0	5.8516
5	$2p^23s$	(^3P)	^2P	0.5	260.059	5.715+09	0	40.7613
5	$2p^23s$	(^3P)	^2P	1.5	260.096	1.143+10	0	40.3632
9	2s2p4p	(^1P)	^2D	1.5	266.496	7.528+09	1.8768	26.9276
9	2s2p4p	(^1P)	^2D	2.5	266.496	1.130+10	1.8674	26.9158
9	2s2p4p	(^1P)	^2S	0.5	267.927	5.339+09	6.5577	36.2787
9	2s2p4p	(^1P)	^2P	0.5	269.346	4.143+09	0	32.8848
9	2s2p4p	(^1P)	^2P	1.5	269.360	8.292+09	0.0001	32.9938
5	$2p^23s$	(^1D)	^2D	1.5	270.519	6.562+09	0.1187	32.7533
5	$2p^23s$	(^1D)	^2D	2.5	270.521	9.854+09	0.1187	32.7498
10	2s2p4f	(^1P)	^2F	2.5	272.599	1.299+10	0	0.0066
10	2s2p4f	(^1P)	^2F	3.5	272.599	1.732+10	0	0.0063
10	2s2p4f	(^1P)	^2G	3.5	272.629	1.543+10	1.9514	2.1678
10	2s2p4f	(^1P)	^2G	4.5	272.629	1.929+10	1.9514	1.9909
10	2s2p4f	(^1P)	^2D	1.5	273.044	8.518+09	0.0001	0.0931
10	2s2p4f	(^1P)	^2D	2.5	273.044	1.278+10	0.0001	0.0933
6	$2p^23d$	(^3P)	^4F	1.5	279.346	6.238+09	0	27.2983
6	$2p^23d$	(^3P)	^4F	2.5	279.361	9.359+09	0	27.2981
6	$2p^23d$	(^3P)	^4F	3.5	279.382	1.248+10	0	27.1217
6	$2p^23d$	(^3P)	^4F	4.5	279.409	1.561+10	0	27.2992
16	2s2p5p	(^1P)	^2D	1.5	280.145	7.625+09	0.6638	2.6216
16	2s2p5p	(^1P)	^2D	2.5	280.145	1.144+10	0.6625	2.5996
6	$2p^23d$	(^3P)	^2P	0.5	280.318	6.139+09	0.0002	3.6870
6	$2p^23d$	(^3P)	^2P	1.5	280.286	1.232+10	0.0001	3.5145
16	2s2p5p	(^1P)	^2S	0.5	280.501	5.376+09	3.6561	17.0156
16	2s2p5p	(^1P)	^2P	0.5	280.673	3.980+09	0.0001	4.7319
16	2s2p5p	(^1P)	^2P	1.5	280.675	7.911+09	0	4.9282
6	$2p^23d$	(^3P)	^4D	0.5	281.178	3.257+09	0	19.5756
6	$2p^23d$	(^3P)	^4D	1.5	281.181	6.754+09	0	19.3360
6	$2p^23d$	(^3P)	^4D	2.5	281.186	1.055+10	0	19.0576
6	$2p^23d$	(^3P)	^4D	3.5	281.202	1.285+10	0	19.6806
6	$2p^23d$	(^3P)	^4P	0.5	281.362	1.186+10	0	2.2304
6	$2p^23d$	(^3P)	^4P	1.5	281.352	2.347+10	0	2.4759
6	$2p^23d$	(^3P)	^4P	2.5	281.332	3.475+10	0	2.7604
6	$2p^23d$	(^3P)	^2F	2.5	282.180	1.802+10	0	32.0608
6	$2p^23d$	(^3P)	^2F	3.5	282.227	2.393+10	0.0001	31.7476
17	2s2p5f	(^1P)	^2G	3.5	282.663	1.374+10	1.4039	1.5502
17	2s2p5f	(^1P)	^2G	4.5	282.663	1.718+10	1.4041	1.4567
17	2s2p5f	(^1P)	^2F	2.5	282.812	1.326+10	0	1.4929

Table IIIc.(continued)

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1}	
							$2s^2$ (^{1}S)	SumAa
17	2s2p5f	(^{1}P)	^{2}F	3.5	282.815	1.784+10	0.0001	1.3133
17	2s2p5f	(^{1}P)	^{2}D	1.5	283.029	8.259+09	0	0.0207
17	2s2p5f	(^{1}P)	^{2}D	2.5	283.029	1.239+10	0	0.0220
6	$2p^2$23d	(^{3}P)	^{2}D	1.5	285.224	1.479+10	0.0983	22.1780
6	$2p^2$23d	(^{3}P)	^{2}D	2.5	285.239	2.219+10	0.0980	22.1713
24	2s2p6p	(^{1}P)	^{2}D	1.5	286.848	7.311+09	0.2560	1.8703
24	2s2p6p	(^{1}P)	^{2}D	2.5	286.848	1.197+10	0.2549	1.8722
24	2s2p6p	(^{1}P)	^{2}P	0.5	287.013	4.035+09	0.0039	1.8223
24	2s2p6p	(^{1}P)	^{2}P	1.5	287.015	8.060+09	0	1.6575
24	2s2p6p	(^{1}P)	^{2}S	0.5	287.027	5.877+09	2.1977	9.5926
25	2s2p6f	(^{1}P)	^{2}G	3.5	288.144	1.320+10	0.7258	2.6743
25	2s2p6f	(^{1}P)	^{2}G	4.5	288.144	1.650+10	0.7258	0.7820
25	2s2p6f	(^{1}P)	^{2}F	2.5	288.273	1.145+10	0	0.0515
25	2s2p6f	(^{1}P)	^{2}F	3.5	288.272	1.526+10	0	0.0511
25	2s2p6f	(^{1}P)	^{2}D	1.5	288.456	8.749+09	0.0004	0.0047
25	2s2p6f	(^{1}P)	^{2}D	2.5	288.456	1.313+10	0.0004	0.0049
26	2s2p6h	(^{1}P)	^{2}H	4.5	288.561	1.856+10	0	0
26	2s2p6h	(^{1}P)	^{2}H	5.5	288.561	2.228+10	0	0.0002
26	2s2p6h	(^{1}P)	^{2}I	5.5	288.581	1.987+10	0	0
26	2s2p6h	(^{1}P)	^{2}I	6.5	288.581	2.318+10	0	0
26	2s2p6h	(^{1}P)	^{2}G	3.5	288.592	1.610+10	0	0.0001
26	2s2p6h	(^{1}P)	^{2}G	4.5	288.592	2.013+10	0	0.0001
6	$2p^2$3d	(^{1}D)	^{2}F	2.5	294.728	2.755+10	0	0.5489
6	$2p^2$3d	(^{1}D)	^{2}F	3.5	294.723	2.336+10	0	0.5422
11	$2p^2$4s	(^{3}P)	^{4}P	0.5	294.910	3.587+09	0	0.2413
11	$2p^2$4s	(^{3}P)	^{4}P	1.5	294.937	7.179+09	0	0.2432
11	$2p^2$4s	(^{3}P)	^{4}P	2.5	294.981	1.078+10	0	0.2417
6	$2p^2$3d	(^{1}D)	^{2}D	1.5	295.943	1.501+10	0.0639	0.1482
6	$2p^2$3d	(^{1}D)	^{2}D	2.5	295.945	2.203+10	0.0642	0.1430
6	$2p^2$3d	(^{1}D)	^{2}G	3.5	296.234	4.585+09	0.3409	1.1339
6	$2p^2$3d	(^{1}D)	^{2}G	4.5	296.235	5.730+09	0.3458	1.1260
6	$2p^2$3d	(^{1}D)	^{2}S	0.5	296.723	7.879+09	0.0648	14.0676
11	$2p^2$4s	(^{3}P)	^{2}P	0.5	297.686	5.146+09	0	48.6168
11	$2p^2$4s	(^{3}P)	^{2}P	1.5	297.738	1.032+10	0	48.5514
6	$2p^2$3d	(^{1}D)	^{2}P	0.5	298.558	4.246+09	0	0.0145
6	$2p^2$3d	(^{1}D)	^{2}P	1.5	298.566	8.476+09	0	0.0207

Table IIId. Energy, radiative and non-radiative widths of CII ion for $1s^2 2l_1 2l_2 (L_{12}S_{12}) nl$ [LSJ] states of *even complex*

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	$E(10^3 cm^{-1})$	Sum(gAr), s^{-1}	$Aa, 10^{13} s^{-1}$	
							$2s^2$ (^1S)	SumAa
12	$2p^2 4d$	(^3P)	^4F	1.5	304.089	5.902+09	0	10.8142
12	$2p^2 4d$	(^3P)	^4F	2.5	304.104	8.856+09	0	10.8138
12	$2p^2 4d$	(^3P)	^4F	3.5	304.125	1.181+10	0	10.8138
12	$2p^2 4d$	(^3P)	^4F	4.5	304.152	1.477+10	0	10.8150
12	$2p^2 4d$	(^3P)	^4D	0.5	304.680	3.230+09	0	9.2928
12	$2p^2 4d$	(^3P)	^4D	1.5	304.684	6.481+09	0	9.2840
12	$2p^2 4d$	(^3P)	^4D	2.5	304.693	9.675+09	0	9.3748
12	$2p^2 4d$	(^3P)	^4D	3.5	304.706	1.279+10	0	9.4307
12	$2p^2 4d$	(^3P)	^2P	0.5	304.876	5.097+09	0	1.2678
12	$2p^2 4d$	(^3P)	^2P	1.5	304.843	1.019+10	0	1.2634
12	$2p^2 4d$	(^3P)	^4P	0.5	305.091	7.443+09	0.0001	1.2901
12	$2p^2 4d$	(^3P)	^4P	1.5	305.080	1.486+10	0	1.3079
12	$2p^2 4d$	(^3P)	^4P	2.5	305.058	2.224+10	0	1.3289
5	$2p^2 3s$	(^1S)	^2S	0.5	305.323	4.151+09	0.5520	25.2366
12	$2p^2 4d$	(^3P)	^2F	2.5	305.741	1.867+10	0	19.2710
12	$2p^2 4d$	(^3P)	^2F	3.5	305.785	2.492+10	0	19.2714
12	$2p^2 4d$	(^3P)	^2D	1.5	306.784	1.137+10	0.0819	14.0029
12	$2p^2 4d$	(^3P)	^2D	2.5	306.799	1.798+10	0.0817	14.0247
11	$2p^2 4s$	(^1D)	^2D	1.5	309.984	3.461+09	0.0001	15.5036
11	$2p^2 4s$	(^1D)	^2D	2.5	309.985	5.186+09	0.0001	15.4945
18	$2p^2 5s$	(^3P)	^4P	0.5	310.775	3.247+09	0	0.0087
18	$2p^2 5s$	(^3P)	^4P	1.5	310.801	6.500+09	0	0.0158
18	$2p^2 5s$	(^3P)	^4P	2.5	310.846	9.761+09	0	0.0040
18	$2p^2 5s$	(^3P)	^2P	0.5	311.885	4.351+09	0	18.7903
18	$2p^2 5s$	(^3P)	^2P	1.5	311.939	8.705+09	0	38.7701
19	$2p^2 5d$	(^3P)	^2P	0.5	315.410	3.762+09	0	1.9912
19	$2p^2 5d$	(^3P)	^2P	1.5	315.359	7.711+09	0	1.5640
19	$2p^2 5d$	(^3P)	^4F	1.5	315.100	5.815+09	0	4.7735
19	$2p^2 5d$	(^3P)	^4F	2.5	315.113	8.729+09	0	4.7752
19	$2p^2 5d$	(^3P)	^4F	3.5	315.134	1.164+10	0	4.7759
19	$2p^2 5d$	(^3P)	^4F	4.5	315.163	1.454+10	0	4.7734
19	$2p^2 5d$	(^3P)	^4D	0.5	315.368	3.490+09	0	3.3540
19	$2p^2 5d$	(^3P)	^4D	1.5	315.393	6.824+09	0	3.7674
19	$2p^2 5d$	(^3P)	^4D	2.5	315.393	9.748+09	0	4.6615
19	$2p^2 5d$	(^3P)	^4D	3.5	315.407	1.284+10	0	4.7317
19	$2p^2 5d$	(^3P)	^4P	0.5	315.637	5.616+09	0	0.7817
19	$2p^2 5d$	(^3P)	^4P	1.5	315.626	1.119+10	0	0.8099
19	$2p^2 5d$	(^3P)	^4P	2.5	315.605	1.673+10	0	0.8404
19	$2p^2 5d$	(^3P)	^2F	2.5	315.740	1.113+10	0	9.0860
19	$2p^2 5d$	(^3P)	^2F	3.5	315.782	1.481+10	0	9.0728

Table IIId.(continued)

N	$2l_12l_2nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1}	
							$2s^2$ (^1S)	SumAa
20	$2p^25g$	(^3P)	^4F	1.5	316.221	6.355+09	0	0.0010
20	$2p^25g$	(^3P)	^4F	2.5	316.193	9.507+09	0	0.0140
20	$2p^25g$	(^3P)	^4F	3.5	316.193	1.268+10	0	0.0135
20	$2p^25g$	(^3P)	^4F	4.5	316.163	1.560+10	0	0.0781
20	$2p^25g$	(^3P)	^2F	2.5	316.221	9.532+09	0	0.0023
20	$2p^25g$	(^3P)	^2F	3.5	316.163	1.248+10	0	0.0810
20	$2p^25g$	(^3P)	^4H	3.5	316.175	1.227+10	0	0.1493
20	$2p^25g$	(^3P)	^4H	4.5	316.196	1.510+10	0	0.2186
20	$2p^25g$	(^3P)	^4H	5.5	316.196	1.812+10	0	0.2184
20	$2p^25g$	(^3P)	^4H	6.5	316.235	2.113+10	0	0
20	$2p^25g$	(^3P)	^2G	3.5	316.296	1.235+10	0	0.1639
20	$2p^25g$	(^3P)	^2G	4.5	316.308	1.534+10	0	0.1789
20	$2p^25g$	(^3P)	^4G	2.5	316.296	9.264+09	0	0.1631
20	$2p^25g$	(^3P)	^4G	3.5	316.305	1.234+10	0	0.1691
20	$2p^25g$	(^3P)	^4G	4.5	316.305	1.542+10	0	0.1688
20	$2p^25g$	(^3P)	^4G	5.5	316.307	1.847+10	0	0.1779
20	$2p^25g$	(^3P)	^2H	4.5	316.175	1.533+10	0	0.1510
20	$2p^25g$	(^3P)	^2H	5.5	316.235	1.811+10	0	0.2216
19	$2p^25d$	(^3P)	^2D	1.5	316.566	9.661+09	0.0586	8.9005
19	$2p^25d$	(^3P)	^2D	2.5	316.581	1.450+10	0.0586	8.9034
27	$2p^26s$	(^3P)	^4P	0.5	318.567	3.086+09	0	0.0171
27	$2p^26s$	(^3P)	^4P	1.5	318.593	6.179+09	0	0.0324
27	$2p^26s$	(^3P)	^4P	2.5	318.638	9.279+09	0	0.0044
12	$2p^24d$	(^1D)	^2F	2.5	319.035	1.020+09	0	7.1455
12	$2p^24d$	(^1D)	^2F	3.5	319.037	1.368+10	0	7.2169
12	$2p^24d$	(^1D)	^2G	3.5	319.098	2.401+09	0.0018	20.6808
12	$2p^24d$	(^1D)	^2G	4.5	319.098	2.975+09	0.0018	20.7021
27	$2p^26s$	(^3P)	^2P	0.5	319.160	4.281+09	0	26.9429
27	$2p^26s$	(^3P)	^2P	1.5	319.213	8.576+09	0	26.9142
12	$2p^24d$	(^1D)	^2D	1.5	319.405	8.156+09	0.0058	1.4936
12	$2p^24d$	(^1D)	^2D	2.5	319.407	1.223+10	0.0059	1.4939
12	$2p^24d$	(^1D)	^2P	0.5	320.458	2.571+09	0	1.7685
12	$2p^24d$	(^1D)	^2P	1.5	320.455	5.140+09	0	1.7779
12	$2p^24d$	(^1D)	^2S	0.5	320.814	2.867+09	0.1129	5.8249
28	$2p^26d$	(^3P)	^4F	1.5	320.955	5.753+09	0	2.3407
28	$2p^26d$	(^3P)	^4F	2.5	320.968	8.652+09	0	2.3459
28	$2p^26d$	(^3P)	^4F	3.5	320.989	1.155+10	0	2.3484
28	$2p^26d$	(^3P)	^4F	4.5	321.019	1.436+10	0	2.3373
28	$2p^26d$	(^3P)	^4D	0.5	321.107	3.446+09	0	2.5798
28	$2p^26d$	(^3P)	^4D	1.5	321.111	6.938+09	0	2.5460
28	$2p^26d$	(^3P)	^4D	2.5	321.118	1.049+10	0	2.5067
28	$2p^26d$	(^3P)	^4D	3.5	321.134	1.369+10	0	2.5921

Table IIId.(continued)

N	$2l_12l_2nl$	$L_{12}S_{12}$	LS	J	E(10^3cm^{-1})	Sum(**gAr**), s^{-1}	**Aa,10^{13} s^{-1}** 2s^2 (^{1}S)	SumAa
28	2p^{2}6d	(^{3}P)	^{4}P	0.5	321.287	5.245+09	0	0.5241
28	2p^{2}6d	(^{3}P)	^{4}P	1.5	321.276	1.043+10	0	0.5588
28	2p^{2}6d	(^{3}P)	^{4}P	2.5	321.256	1.553+10	0	0.5995
28	2p^{2}6d	(^{3}P)	^{2}P	0.5	321.451	5.152+09	0	0.7824
28	2p^{2}6d	(^{3}P)	^{2}P	1.5	321.428	1.029+10	0.0001	0.8095
29	2p^{2}6g	(^{3}P)	^{2}F	2.5	321.605	9.902+09	0	0.2339
29	2p^{2}6g	(^{3}P)	^{4}H	3.5	321.540	1.206+10	0	0.1421
29	2p^{2}6g	(3P)	^{4}H	3.5	321.555	1.225+10	0	0.1022
29	2p^{2}6g	(^{3}P)	^{4}H	4.5	321.570	1.440+10	0	0.2247
29	2p^{2}6g	(^{3}P)	^{4}H	5.5	321.570	1.728+10	0	0.2243
29	2p^{2}6g	(^{3}P)	^{4}H	6.5	321.611	2.002+10	0	0.2209
29	2p^{2}6g	(^{3}P)	^{4}F	1.5	321.605	6.457+09	0	0.0011
29	2p^{2}6g	(^{3}P)	^{4}F	2.5	321.583	1.256+10	0	0.0411
29	2p^{2}6g	(^{3}P)	^{4}F	3.5	321.583	1.279+10	0	0.0344
29	2p^{2}6g	(^{3}P)	^{4}F	4.5	321.540	1.508+10	0	0.1412
29	2p^{2}6g	(^{3}P)	^{4}F	4.5	321.555	1.530+10	0	0.1039
29	2p^{2}6g	(^{3}P)	^{2}H	5.5	321.612	1.715+10	0	0.2295
28	2p^{2}6d	(^{3}P)	^{2}F	2.5	321.620	1.761+10	0.0002	9.4815
28	2p^{2}6d	(^{3}P)	^{2}F	3.5	321.661	2.365+10	0	9.6440
29	2p^{2}6g	(^{3}P)	^{2}G	3.5	321.642	1.236+10	0	0.1673
29	2p^{2}6g	(^{3}P)	^{2}G	4.5	321.652	1.518+10	0	0.1952
29	2p^{2}6g	(^{3}P)	^{4}G	2.5	321.661	9.280+09	0	0.1780
29	2p^{2}6g	(^{3}P)	^{4}G	3.5	321.650	1.232+10	0	0.2280
29	2p^{2}6g	(^{3}P)	^{4}G	4.5	321.650	1.531+10	0	0.1752
29	2p^{2}6g	(^{3}P)	^{4}G	5.5	321.651	1.821+10	0	0.1938
28	2p^{2}6d	(^{3}P)	^{2}D	1.5	321.948	1.252+10	0.0635	8.4704
28	2p^{2}6d	(^{3}P)	^{2}D	2.5	321.964	1.880+10	0.0634	8.4957
18	2p^{2}5s	(^{1}D)	^{2}D	1.5	325.427	2.682+09	0.0010	7.8945
18	2p^{2}5s	(^{1}D)	^{2}D	2.5	325.427	4.020+09	0.0010	7.8909
6	2p^{2}3d	(^{1}S)	^{2}D	1.5	329.025	2.146+10	0.0001	34.3726
6	2p^{2}3d	(^{1}S)	^{2}D	2.5	329.025	2.727+10	0.0001	34.4753
19	2p^{2}5d	(^{1}D)	^{2}F	2.5	329.807	7.197+09	0	4.2290
19	2p^{2}5d	(^{1}D)	^{2}F	3.5	329.805	9.534+09	0	4.2508
19	2p^{2}5d	(^{1}D)	^{2}D	1.5	330.180	5.249+09	0.0018	12.8541
19	2p^{2}5d	(^{1}D)	^{2}D	2.5	330.179	7.836+09	0.0018	12.7742
19	2p^{2}5d	(^{1}D)	^{2}G	3.5	329.786	2.150+09	0	9.8583
19	2p^{2}5d	(^{1}D)	^{2}G	4.5	329.787	2.641+09	0	9.8907
20	2p^{2}5g	(^{1}D)	^{2}G	3.5	330.586	2.729+09	0.0003	0.0408
20	2p^{2}5g	(^{1}D)	^{2}G	4.5	330.586	3.411+09	0	0.0408
20	2p^{2}5g	(^{1}D)	^{2}F	2.5	330.654	2.075+09	0	0.0029
20	2p^{2}5g	(^{1}D)	^{2}F	3.5	330.654	2.767+09	0	0.0029

Table IIId.(continued)

N	$2l_1 2l_2 nl$	$L_{12}S_{12}$	LS	J	E($10^3 cm^{-1}$)	Sum(gAr), s^{-1}	Aa,10^{13} s^{-1}	
							$2s^2$ (^1S)	SumAa
20	$2p^2 5g$	(^1D)	^2H	4.5	330.575	3.280+09	0	0.1485
20	$2p^2 5g$	(^1D)	^2H	5.5	330.575	3.936+09	0	0.1485
19	$2p^2 5d$	(^1D)	^2S	0.5	330.592	2.305+09	0.0322	3.2481
19	$2p^2 5d$	(^1D)	^2P	0.5	330.645	2.647+09	0	1.8567
19	$2p^2 5d$	(^1D)	^2P	1.5	330.648	5.297+09	0	1.8547
20	$2p^2 5g$	(^1D)	^2I	5.5	330.674	3.651+09	0	0.3637
20	$2p^2 5g$	(^1D)	^2I	6.5	330.674	4.258+09	0	0.2288
20	$2p^2 5g$	(^1D)	^2D	1.5	330.792	2.015+09	0.0001	2.4144
20	$2p^2 5g$	(^1D)	^2D	2.5	330.792	3.014+09	0.0001	2.3987
27	$2p^2 6s$	(^1D)	^2D	1.5	333.153	1.658+09	0.0006	5.0337
27	$2p^2 6s$	(^1D)	^2D	2.5	333.153	2.486+09	0	5.0339
28	$2p^2 6d$	(^1D)	^2G	3.5	335.520	2.022+09	0	5.2015
28	$2p^2 6d$	(^1D)	^2G	4.5	335.520	2.299+09	0	5.3179
28	$2p^2 6d$	(^1D)	^2F	2.5	335.525	5.340+09	0	2.1520
28	$2p^2 6d$	(^1D)	^2F	3.5	335.524	6.913+09	0	2.2607
28	$2p^2 6d$	(^1D)	^2D	1.5	335.663	4.337+09	0.0005	1.7916
28	$2p^2 6d$	(^1D)	^2D	2.5	335.664	6.508+09	0.0005	1.7871
29	$2p^2 6g$	(^1D)	^2I	5.5	336.019	2.908+09	0	0.3869
29	$2p^2 6g$	(^1D)	^2I	6.5	336.019	3.392+09	0	0.3637
29	$2p^2 6g$	(^1D)	^2H	4.5	335.964	2.856+09	0	0.1517
29	$2p^2 6g$	(^1D)	^2H	5.5	335.964	3.427+09	0	0.1517
29	$2p^2 6g$	(^1D)	^2G	3.5	335.972	2.550+09	0.0003	0.0418
29	$2p^2 6g$	(^1D)	^2G	4.5	335.972	3.186+09	0.0003	0.0418
28	$2p^2 6d$	(^1D)	^2S	0.5	335.981	3.088+09	0.0131	2.1766
29	$2p^2 6g$	(^1D)	^2F	2.5	336.013	2.065+09	0	0.0032
29	$2p^2 6g$	(^1D)	^2F	3.5	336.013	2.754+09	0.0003	0.0032
28	$2p^2 6d$	(^1D)	^2P	0.5	336.062	3.405+09	0	1.6084
28	$2p^2 6d$	(^1D)	^2P	1.5	336.064	6.827+09	0	1.6095
29	$2p^2 6g$	(^1D)	^2D	1.5	336.073	1.481+09	0	0.1516
29	$2p^2 6g$	(^1D)	^2D	2.5	336.073	2.222+09	0	0.1513
11	$2p^2 4s$	(^1S)	^2S	0.5	343.225	6.058+09	0.0378	19.9575
12	$2p^2 4d$	(^1S)	^2D	1.5	352.430	1.391+10	0.0002	25.0537
12	$2p^2 4d$	(^1S)	^2D	2.5	352.429	2.085+10	0.0002	23.0442
18	$2p^2 5s$	(^1S)	^2S	0.5	358.565	6.449+09	0.0054	10.2535
19	$2p^2 5d$	(^1S)	^2D	1.5	363.016	1.220+10	0.0005	11.5946
19	$2p^2 5d$	(^1S)	^2D	2.5	363.016	1.829+10	0.0005	11.5870
20	$2p^2 5g$	(^1S)	^2G	3.5	363.776	2.016+10	0.0002	0.3022
20	$2p^2 5g$	(^1S)	^2G	4.5	363.776	2.519+10	0.0002	0.3022
27	$2p^2 6s$	(^1S)	^2S	0.5	366.233	6.550+09	0.0013	5.9944
28	$2p^2 6d$	(^1S)	^2D	1.5	368.706	1.211+10	0.0004	6.6160
28	$2p^2 6d$	(^1S)	^2D	2.5	368.705	1.815+10	0.0004	6.6096
29	$2p^2 6g$	(^1S)	^2G	3.5	369.138	1.992+10	0.0002	0.3172
29	$2p^2 6g$	(^1S)	^2G	4.5	369.138	2.547+10	0.0002	0.3172

Table IVa. *Wavelengths (WL), radiative transition probabilities (gAr), branching ratios (K) and factor intensities (Qd) for dielctronic satellite lines CII*

Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
$2p^2\,(^3P)2s[^4P_{5/2}]$	$2s2p(^3P)4d[^4D_{7/2}]$	563.4	1.490+10	0	0
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	586.7	1.456+10	1	1.456+10
$2p^2\,(^1D)2s[^2D_{3/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	586.7	1.022+10	1	1.022+10
$2p^2\,(^3P)2s[^4P_{5/2}]$	$2s2p(^3P)3d[^4P_{5/2}]$	646.2	1.031+10	0	0
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)4d[^2F_{7/2}]$	691.7	1.066+10	0.942	1.004+10
$2p^2\,(^3P)2s[^2P_{1/2}]$	$2s2p(^1P)3d[^2D_{3/2}]$	728.1	1.258+10	0	0
$2p^2\,(^3P)2s[^2P_{3/2}]$	$2s2p(^1P)3d[^2D_{5/2}]$	728.4	2.264+10	0	0
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{7/2}]$	819.1	2.009+10	1	2.009+10
$2p^2\,(^1D)2s[^2D_{3/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	819.4	1.388+10	1	1.388+10
$2s^2\,(^1S)5g[^2G_{7/2}]$	$2s2p(^1P)5g[^2F_{5/2}]$	963.0	1.060+10	0.536	5.682+09
$2s^2\,(^1S)5g[^2G_{9/2}]$	$2s2p(^1P)5g[^2F_{7/2}]$	963.0	1.361+10	0.538	7.322+09
$2s^2\,(^1S)6g[^2G_{9/2}]$	$2s2p(^1P)6g[^2F_{7/2}]$	963.1	1.541+10	0.101	1.556+09
$2s^2\,(^1S)6g[^2G_{7/2}]$	$2s2p(^1P)6g[^2F_{5/2}]$	963.1	1.189+10	0.141	1.676+09
$2s^2\,(^1S)6d[^2D_{5/2}]$	$2s2p(^1P)6d[^2F_{7/2}]$	963.4	1.202+10	0.836	1.005+10
$2s^2\,(^1S)5g[^2G_{7/2}]$	$2s2p(^1P)5g[^2H_{9/2}]$	963.4	1.672+10	0.978	1.635+10
$2s^2\,(^1S)6g[^2G_{7/2}]$	$2s2p(^1P)6g[^2H_{9/2}]$	963.4	1.593+10	0.999	1.591+10
$2s^2\,(^1S)5g[^2G_{9/2}]$	$2s2p(^1P)5g[^2H_{11/2}]$	963.4	2.052+10	0.978	2.007+10
$2s^2\,(^1S)6g[^2G_{9/2}]$	$2s2p(^1P)6g[^2H_{11/2}]$	963.4	1.955+10	0.999	1.953+10
$2s^2\,(^1S)6g[^2G_{9/2}]$	$2s2p(^1P)6g[^2G_{9/2}]$	963.7	1.796+10	0	0
$2s^2\,(^1S)6g[^2G_{7/2}]$	$2s2p(^1P)6g[^2G_{7/2}]$	963.7	1.428+10	0	0
$2s^2\,(^1S)5g[^2G_{7/2}]$	$2s2p(^1P5g[^2G_{7/2}]$	963.9	1.414+10	0	0
$2s^2\,(^1S)5g[^2G_{9/2}]$	$2s2p(^1P)5g[^2G_{9/2}]$	963.9	1.778+10	0	0
$2s^2\,(^1S)5d[^2D_{5/2}]$	$2s2p(^1P)5d[^2D_{5/2}]$	964.2	1.029+10	0	0
$2s^2\,(^1S)4d[^2D_{5/2}]$	$2s2p(^1P)4d[^2F_{7/2}]$	969.9	1.309+10	0.942	1.233+10
$2s^2\,(^1S)3d[^2D_{5/2}]$	$2s2p(^1P)3d[^2D_{5/2}]$	973.5	1.014+10	0	0
$2s^2\,(^1S)3d[^2D_{3/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	978.2	1.030+10	1	1.030+10
$2s^2\,(^1S)3d[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	978.2	1.471+10	1	1.471+10

Table IVb. *Wavelengths (WL), radiative transition probabilities (gAr), branching ratios (K) and factor intensities (Qd) for dielctronic satellite lines CII*

Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2p^2(^1D)4p[^2F_{7/2}]$	420.4	1.102+09	0.132	1.455+08
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2p^2(^3P)5p[^2P_{3/2}]$	422.1	1.108+09	0.00132	1.463+06
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2p^2(^3P)6p[^2P_{3/2}]$	406.6	1.570+09	0.00524	8.227+06
$2p^2\,(^3P)2s[^2P_{3/2}]$	$2p^2(^1D)6p[^2P_{3/2}]$	444.5	1.016+09	0	0
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2p^2(^1D)3p[^2F_{7/2}]$	488.1	3.125+09	0.251	7.844+08
$2p^2\,(^1D)2s[^2D_{3/2}]$	$2p^2(^1D)3p[^2F_{5/2}]$	488.1	2.191+09	0.251	5.499+08
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2s2p(^1P)4d[^2F_{7/2}]$	513.4	6.089+09	0.942	5.736+09
$2p^2\,(^1D)2s[^2D_{3/2}]$	$2s2p(^1P)4d[^2F_{5/2}]$	513.4	4.281+09	0.942	4.033+09
$2p^2\,(^3P)2s[^2P_{3/2}]$	$2s2p(^1P)5d[^2P_{3/2}]$	579.3	1.526+09	0.997	1.521+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^1P)4d[^2P_{3/2}]$	567.0	1.146+09	0.480	5.501+08
$2p^2\,(^3P)2s[^2P_{1/2}]$	$2s2p(^1P)4d[^2P_{1/2}]$	617.2	1.621+09	0.476	7.716+08
$2p^2\,(^3P)2s[^2P_{3/2}]$	$2s2p(^1P)4d[^2P_{3/2}]$	617.4	4.038+09	0.480	1.938+09
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)6d[^2F_{7/2}]$	624.6	7.940+09	1.0	7.940+09
$2p^2\,(^1D)2s[^2D_{3/2}]$	$2s2p(^3P)6d[^2F_{5/2}]$	624.7	5.373+09	0.902	4.846+09
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)5d[^2F_{7/2}]$	646.6	6.896+09	1.0	6.896+09
$2p^2\,(^1D)2s[^2D_{3/2}]$	$2s2p(^3P)5d[^2F_{5/2}]$	646.8	4.729+09	1.0	4.729+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	650.4	1.325+09	1.0	1.325+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	650.4	2.627+09	1.0	2.627+09
$2p^2\,(^1D)2s[^2D_{3/2}]$	$2s2p(^3P)4d[^2F_{5/2}]$	691.9	7.347+09	1.0	7.347+09
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2s2p(^1P)3s[^2P_{3/2}]$	706.2	2.327+09	1.0	2.327+09
$2p^2\,(^1D)2s[^2D_{3/2}]$	$2s2p(^1P)3s[^2P_{1/2}]$	706.2	1.299+09	1.0	1.299+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)6d[^2P_{1/2}]$	708.1	2.094+09	1.0	2.094+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)6d[^2P_{3/2}]$	708.2	4.198+09	1.0	4.198+09
$2p^2\,(^3P)2s[^2P_{1/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	717.2	2.457+09	1.0	2.457+09
$2p^2\,(^3P)2s[^2P_{1/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	717.2	1.231+09	1.0	1.231+09
$2p^2\,(^3P)2s[^2P_{3/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	717.4	1.230+09	1.0	1.230+09
$2p^2\,(^3P)2s[^2P_{3/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	717.4	6.153+09	1.0	6.153+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)5d[^2P_{3/2}]$	736.3	2.494+09	1.0	2.494+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)5d[^2P_{1/2}]$	736.1	1.241+09	1.0	1.241+09
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)4s[^2P_{3/2}]$	741.0	1.112+09	1.0	1.112+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)4d[^2P_{3/2}]$	792.8	3.017+09	1.0	3.017+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)4d[^2P_{1/2}]$	792.7	1.506+09	1.0	1.506+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^1P)3s[^2P_{3/2}]$	817.4	1.554+09	1.0	1.554+09
$2p^2\,(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{7/2}]$	819.4	1.160+09	1.0	1.160+09
$2p^2\,(^3P)2s[^2P_{1/2}]$	$2s2p(^1P)3s[^2P_{1/2}]$	925.9	1.275+09	1.0	1.275+09
$2p^2\,(^3P)2s[^2P_{3/2}]$	$2s2p(^3P)3s[^2P_{3/2}]$	926.3	3.166+09	1.0	3.166+09
$2s^2\,(^1S)4d[^2D_{5/2}]$	$2p^2(^3P)3p[^2P_{3/2}]$	946.7	1.270+09	0.00624	7.925+06
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	951.4	3.177+09	1.0	3.177+09
$2p^2\,(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	951.7	6.380+09	0.989	6.310+09
$2s^2\,(^1S)3d[^2D_{3/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	954.1	3.898+09	1.0	3.898+09
$2s^2\,(^1S)6d[^2D_{3/2}]$	$2p^2(^1D)3p[^2P_{1/2}]$	955:5	1.342+09	0.00164	2.201+06

Table IVb.*(continued)*

Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
$2s^2(^1S)6d[^2D_{5/2}]$	$2p^2(^1D)3p[^2P_{3/2}]$	955.3	2.345+09	0.00159	3.729+06
$2s^2(^1S)3d[^2D_{5/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	954.1	7.016+09	1.0	7.016+09
$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^1P)5d[^2F_{7/2}]$	957.2	6.324+09	0.552	3.491+09
$2s^2(^1S)5d[^2D_{3/2}]$	$2s2p(^1P)5d[^2F_{5/2}]$	957.3	4.480+09	0.552	2.473+09
$2s^2(^1S)5d[^2D_{3/2}]$	$2s2p(^1P)5d[^2P_{1/2}]$	960.6	3.998+09	0.997	3.986+09
$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^1P)5d[^2P_{3/2}]$	960.6	7.196+09	0.997	7.174+09
$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^1P)4d[^2P_{3/2}]$	961.8	6.025+09	0.480	2.892+09
$2s^2(^1S)4d[^2D_{3/2}]$	$2s2p(^1P)4d[^2P_{1/2}]$	961.9	3.317+09	0.476	1.579+08
$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^1P)3s[^2P_{1/2}]$	962.2	3.064+09	1.0	3.064+09
$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^1P)3s[^2P_{3/2}]$	962.2	6.134+09	1.0	6.134+09
$2s^2(^1S)4s[^2S_{1/2}]$	$2s2p(^1P)4s[^2P_{1/2}]$	962.8	3.618+09	0.465	1.682+09
$2s^2(^1S)4s[^2S_{1/2}]$	$2s2p(^1P)4s[^2P_{3/2}]$	962.8	7.236+09	0.462	3.343+09
$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^1P)6d[^2P_{3/2}]$	963.4	5.578+09	0.173	9.650+08
$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^1P)6d[^2F_{7/2}]$	963.4	1.857+09	0.827	1.536+09
$2s^2(^1S)6d[^2D_{3/2}]$	$2s2p(^1P)6d[^2F_{5/2}]$	963.4	7.235+09	0.827	5.983+09
$2s^2(^1S)5s[^2S_{1/2}]$	$2s2p(^1P)5s[^2P_{1/2}]$	963.5	3.582+09	0.867	3.106+09
$2s^2(^1S)5s[^2S_{1/2}]$	$2s2p(^1P)5s[^2P_{3/2}]$	963.5	7.164+09	0.868	6.219+09
$2s^2(^1S)6d[^2D_{3/2}]$	$2s2p(^1P)6d[^2P_{1/2}]$	963.5	2.880+09	0.166	4.781+08
$2s^2(^1S)6s[^2S_{1/2}]$	$2s2p(^1P)6s[^2P_{1/2}]$	964.6	3.380+09	0.604	2.041+09
$2s^2(^1S)6s[^2S_{1/2}]$	$2s2p(^1P)6s[^2P_{3/2}]$	964.6	6.764+09	0.607	4.106+09
$2s^2(^1S)4d[^2D_{3/2}]$	$2s2p(^1P)4d[^2F_{5/2}]$	969.9	9.146+09	0.942	8.616+09
$2s^2(^1S)5d[^2D_{5/2}]$	$2p^2(^1D)3p[^2F_{7/2}]$	973.7	6.412+09	0.255	1.635+09
$2s^2(^1S)5d[^2D_{3/2}]$	$2p^2(^1D)3p[^2F_{5/2}]$	973.8	4.465+09	0.251	1.121+09
$2p^2(^3P)2s[^2P_{3/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	1102.5	2.099+09	1.0	2.099+09
$2s2p(^3P)3p[^2D_{5/2}]$	$2p^2(^3P)3p[^2P_{3/2}]$	1174.9	1.781+09	0.00624	1.111+07
$2s2p(^3P)3p[^2S_{1/2}]$	$2p^2(^3P)3p[^2P_{3/2}]$	1229.6	1.200+09	0.00643	7.716+06

Table Va. *Wavelengths (WL), radiative transition probabilities (gAr), branching ratios (K) and factor intensities (Qd) for dielctronic satellite lines CII*

Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)6d[^2F_{7/2}]$	604.0	1.180+10	0	0
$2p^2(^3P)2p[^4S_{3/2}]$	$2p^2(^3P)4d[^4P_{5/2}]$	613.7	1.196+10	0	0
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)4d[^2F_{7/2}]$	668.1	1.171+10	0	0
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^1D)3d[^2D_{5/2}]$	715.1	1.322+10	0.605	8.016+09
$2p^2(^3P)2p[^4S_{3/2}]$	$2p^2(^3P)3d[^4P_{3/2}]$	718.1	1.659+10	0	0
$2p^2(^3P)2p[^4S_{3/2}]$	$2p^2(^3P)3d[^4P_{5/2}]$	718.2	2.445+10	0	0
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^1D)3d[^2F_{7/2}]$	721.4	1.809+10	0	0
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)3d[^2F_{5/2}]$	721.4	1.265+10	0	0
$2s^2(^1S)4f[^2F_{7/2}]$	$2s2p(^1P)4f[^2D_{5/2}]$	962.4	1.053+10	0.0012	1.218+07
$2s^2(^1S)5f[^2F_{7/2}]$	$2s2p(^1P)5f[^2D_{5/2}]$	962.9	1.091+10	0.0045	4.910+07
$2s^2(^1S)6h[^2H_{11/2}]$	$2s2p(^1P)6h[^2G_{9/2}]$	963.2	1.950+10	0	0
$2s^2(^1S)6h[^2H_{9/2}]$	$2s2p(^1P)6h[^2G_{7/2}]$	963.2	1.589+10	0	0
$2s^2(^1S)6f[^2F_{7/2}]$	$2s2p(^1P)6f[^2D_{5/2}]$	963.2	1.123+10	0.0645	7.243+08
$2s^2(^1S)6h[^2H_{9/2}]$	$2s2p(^1P)6h[^2I_{13/2}]$	963.3	1.925+10	0	0
$2s^2(^1S)6h[^2H_{9/2}]$	$2s2p(^1P)6h[^2I_{13/2}]$	963.3	1.925+10	0	0
$2s^2(^1S)6h[^2H_{11/2}]$	$2s2p(^1P)6h[^2H_{11/2}]$	963.5	2.162+10	0	0
$2s^2(^1S)6h[^2H_{9/2}]$	$2s2p(^1P)6h[^2H_{9/2}]$	963.5	1.796+10	0	0
$2s^2(^1S)5f[^2F_{7/2}]$	$2s2p(^1P)5f[^2F_{7/2}]$	964.9	1.304+10	0	0
$2s^2(^1S)6f[^2F_{7/2}]$	$2s2p(^1P)6f[^2F_{7/2}]$	964.9	1.398+10	0	0
$2s^2(^1S)6f[^2F_{5/2}]$	$2s2p(^1P)6f[^2F_{5/2}]$	964.9	1.036+10	0	0
$2s^2(^1S)6f[^2F_{5/2}]$	$2s2p(^1P)6f[^2G_{7/2}]$	966.1	1.222+10	0	0
$2s^2(^1S)6f[^2F_{7/2}]$	$2s2p(^1P)6f[^2G_{9/2}]$	966.1	1.585+10	0.928	1.471+10
$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^1P)6p[^2D_{5/2}]$	966.2	1.023+10	0.136	1.392+09
$2s^2(^1S)4f[^2F_{5/2}]$	$2s2p(^1P)4f[^2G_{7/2}]$	966.2	1.247+10	0.898	1.120+10
$2s^2(^1S)4f[^2F_{7/2}]$	$2s2p(^1P)4f[^2G_{9/2}]$	966.2	1.618+10	0.980	1.586+10
$2s^2(^1S)5f[^2F_{5/2}]$	$2s2p(^1P)5f[^2G_{7/2}]$	966.3	1.222+10	0.906	1.107+10
$2s^2(^1S)5f[^2F_{7/2}]$	$2s2p(^1P)5f[^2G_{9/2}]$	966.3	1.592+10	0.964	1.535+10
$2s^2(^1S)4f[^2F_{5/2}]$	$2s2p(^1P)4f[^2F_{5/2}]$	966.5	1.052+10	0	0
$2s^2(^1S)4f[^2F_{7/2}]$	$2s2p(^1P)4f[^2F_{7/2}]$	966.5	1.419+10	0	0

Table Vb. *Wavelengths (WL), radiative transition probabilities (gAr), branching ratios (K) and factor intensities (Qd) for dielctronic satellite lines CII*

Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)6p[^2D_{5/2}]$	422.3	1.266+09	1.0	1.266+09
$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^1P)3p[^2D_{5/2}]$	427.8	1.136+09	1.0	1.136+09
$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)5p[^2D_{5/2}]$	437.4	2.170+09	1.0	2.170+09
$2s^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)5p[^2D_{3/2}]$	437.4	1.183+09	1.0	1.183+09
$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)5p[^2D_{5/2}]$	437.4	2.170+09	1.0	2.170+09
$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	461.1	2.566+09	1.0	2.566+09
$2s^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	461.1	1.416+09	1.0	1.416+09
$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^1D)4d[^2D_{5/2}]$	549.3	1.783+09	3.1-5	5.527+04
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^1D)6d[^2D_{5/2}]$	556.9	2.096+09	2.80-4	5.869+05
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)6d[^2D_{3/2}]$	556.9	1.356+09	2.79-4	3.783+05
$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^1S)4d[^2D_{5/2}]$	566.4	1.617+09	3.1-5	5.013+04
$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^1S)4d[^2D_{5/2}]$	574.2	1.344+09	3.1-5	4.166+04
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^1D)5d[^2D_{5/2}]$	574.4	2.942+09	1.47-5	4.325+04
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)5d[^2D_{3/2}]$	574.4	1.894+09	1.40-4	2.652+05
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)6d[^2D_{5/2}]$	602.9	1.561+09	0.00746	1.165+07
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)4d[^2D_{3/2}]$	612.3	3.862+09	0.0179	6.913+07
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^1D)4d[^2D_{5/2}]$	612.3	5.944+09	0.0184	1.094+08
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)5d[^2D_{5/2}]$	623.1	1.718+09	0.00658	1.130+07
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^3P)5d[^2D_{3/2}]$	623.2	1.068+09	0.00658	7.027+06
$2s2p(^3P)3s[^2P_{1/2}]$	$2p^2(^1S)3d[^2D_{3/2}]$	630.2	2.275+09	0.0129	2.936+07
$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^1S)3d[^2D_{5/2}]$	630.4	4.120+09	1.01-5	4.161+04
$2p^2(^1S)2p[^2P_{1/2}]$	$2p^2(^1S)3d[^2D_{3/2}]$	653.0	2.549+09	8.1-6	2.065+04
$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^1S)3d[^2D_{5/2}]$	653.0	4.558+09	1.01-5	4.604+04
$2s^2(^1S)5p[^2P_{1/2}]$	$2p^2(^1S)3d[^2D_{3/2}]$	663.3	1.937+09	8.1-6	1.569+04
$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^1S)3d[^2D_{5/2}]$	663.3	3.469+09	1.01-5	3.504+04
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)4d[^2D_{5/2}]$	663.6	1.959+09	0.998	1.955+09
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^3P)4d[^2D_{3/2}]$	663.6	1.214+09	0.998	1.212+09
$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^3P)6d[^2D_{5/2}]$	684.6	1.890+09	0.00746	1.410+07
$2p^2(^3P)2p[^2P_{1/2}]$	$2p^2(^3P)6d[^2D_{3/2}]$	684.7	1.014+09	0.00750	7.605+06
$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^1D)4d[^2D_{5/2}]$	696.8	1.021+09	0.00184	1.779+06
$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^3P)6d[^2D_{5/2}]$	695.9	1.860+09	0.00746	1.388+07
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)3d[^2D_{3/2}]$	715.1	8.539+09	0.605	5.166+08
$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^3P)4d[^2D_{5/2}]$	763.9	1.446+09	0.998	1.443+09
$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^3P)4d[^2D_{5/2}]$	733.1	1.331+09	0.998	1.328+09
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)3d[^2D_{5/2}]$	774.4	3.301+09	0.00517	1.707+07
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^3P)3d[^2D_{3/2}]$	774.5	2.082+09	0.00520	1.083+07
$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^3P)4d[^2D_{5/2}]$	778.1	1.173+09	0.998	1.171+09
$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^1D)3d[^2D_{5/2}]$	796.5	1.548+09	0.647	1.002+09
$2p^2(^1S)2p[^2P_{3/2}]$	$2p^2(^1P)3d[^2S_{1/2}]$	827.6	1.333+09	0.0027	3.595+06
$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^1D)3d[^2D_{5/2}]$	833.0	1.683+09	0.647	1.089+09
$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^1D)3d[^2S_{1/2}]$	844.3	1.102+09	0.0027	2.975+06

Table Vb. *(continued)*

Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^1D)3d[^2D_{5/2}]$	849.9	1.782+09	0.647	1.152+09
$2s2p(^3P)3s[^2P_{1/2}]$	$2p^2(^3P)3d[^2D_{3/2}]$	870.6	1.058+09	0.00520	5.502+06
$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^3P)3d[^2D_{5/2}]$	870.7	1.919+09	0.00517	9.921+06
$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)3s[^2D_{5/2}]$	874.0	3.968+09	0.0946	3.754+08
$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)3s[^2D_{3/2}]$	874.0	2.553+09	0.00946	2.415+07
$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^1P)3p[^2S_{1/2}]$	913.7	1.194+09	1.0	1.194+09
$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^3P)3d[^2D_{5/2}]$	914.6	2.065+09	0.00517	1.068+07
$2p^2(^3P)2p[^2P_{1/2}]$	$2p^2(^3P)3d[^2D_{3/2}]$	914.7	1.152+09	0.00520	5.990+06
$2s^2(^1S)4p[^2P_{3/2}]$	$2p^2(^1D)3s[^2D_{5/2}]$	926.3	1.437+09	0.00946	1.359+07
$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^3P)3d[^2D_{5/2}]$	934.9	1.250+09	.00517	6.463+06
$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^3P)6p[^2D_{5/2}]$	946.5	1.963+09	1.0	1.963+09
$2s^2(^1S)3p[^2P_{1/2}]$	$2s2p(^1P)6p[^2D_{3/2}]$	946.6	1.034+09	0.137	1.417+08
$2s^2(^1S)4p[^2P_{1/2}]$	$2s2p(^1P)4p[^2S_{1/2}]$	949.0	1.101+09	0.195	2.147+08
$2s^2(^1S)4p[^2P_{3/2}]$	$2s2p(^1P)4p[^2S_{1/2}]$	949.1	2.193+09	0.195	4.276+08
$2p^2(^1S)2p[^2P_{3/2}]$	$2s2p(^1P)5p[^2S_{1/2}]$	956.0	1.233+09	0.215	2.651+08
$2p^2(^1S)2p[^2P_{1/2}]$	$2s2p(^1P)5p[^2D_{3/2}]$	959.3	3.129+09	0.253	7.916+08
$2p^2(^1D)2p[^2D_{3/2}]$	$2s2p(^1P)5p[^2D_{5/2}]$	959.3	5.696+09	0.255	1.452+09
$2s^2(^1S)4p[^2P_{1/2}]$	$2s2p(^1P)4p[^2D_{3/2}]$	962.1	4.484+09	0.0609	2.781+08
$2s^2(^1S)4p^2[P_{3/2}]$	$2s2p(^1P)4p[^2D_{5/2}]$	962.2	8.064+09	0.0609	4.911+08
$2s^2(^1S)4f[^2F_{5/2}]$	$2s2p(^1P)4f[^2D_{3/2}]$	962.4	7.372+09	0	0
$2s^2(^1S)5f[^2F_{5/2}]$	$2s2p(^1P)5f[^2D_{3/2}]$	962.9	7.638+09	0.0483	3.689+08
$2s^2(^1S)6f[^2F_{5/2}]$	$2s2p(^1P)6f[^2D_{3/2}]$	963.2	7.859+09	0.0714	5.611+08
$2s^2(^1S)6p[^2P_{1/2}]$	$2s2p(^1P)6p[^2S_{1/2}]$	964.5	1.296+09	0.229	2.968+08
$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^1P)6p[^2S_{1/2}]$	964.5	3.065+09	0.229	7.019+08
$2s^2(^1S)6p[^2P_{1/2}]$	$2s2p(^1P)6p[^2D_{3/2}]$	966.2	5.691+09	0.137	7.780+08
$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^1P)6p[^2D_{3/2}]$	966.2	1.134+09	0.137	1.554+08
$2s^2(^1S)3p[^2P_{1/2}]$	$2s2p(^1P)3p[^2D_{3/2}]$	974.7	3.285+09	1.0	3.285+09
$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^1P)3p[^2D_{5/2}]$	974.5	5.893+09	1.0	1.297+09
$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^1P)5p[^2S_{1/2}]$	978.3	1.200+09	0.215	2.580+08
$2s^2(^1S)5p[^2P_{1/2}]$	$2s2p(^1P)5p[^2D_{3/2}]$	981.6	2.451+09	0.253	6.201+08
$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^1P)5p[^2D_{5/2}]$	981.7	4.367+09	0.255	1.114+09
$2s2p(^3P)3s[^2P_{3/2}]$	$2s2p(^1P)4p[^2D_{5/2}]$	1040.6	1.397+09	0.0609	8.508+07
$2s^2(^1S)3s[^2P_{3/2}]$	$2s2p(^1P)5p[^2D_{5/2}]$	1025.8	1.297+09	1.0	1.297+09

Table VI. *Wavelengths (WL), radiative transition probabilities (gAr), branching ratios (K) and factor intensities (Qd) for dielctronic satellite lines CII*

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
3	$2p^2(^1D)2s[^2D_{3/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	819.4	1.388+10	1.0	1.388+10
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	819.4	1.160+09	1.0	1.160+09
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{7/2}]$	819.1	2.009+10	1.0	2.009+10
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2s2p(^1P)3s[^2P_{3/2}]$	706.2	2.327+09	1.0	2.327+09
3	$2p^2(^1D)2s[^2D_{3/2}]$	$2s2p(^1P)3s[^2P_{1/2}]$	706.2	1.299+09	1.0	1.299+09
3	$2p^2(^1D)2s[^2D_{3/2}]$	$2s2p(^3P)4d[^2F_{5/2}]$	691.9	7.347+09	1.0	7.347+09
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)4d[^2F_{7/2}]$	691.7	1.066+10	0.942	1.004+10
3	$2p^2(^1D)2s[^2D_{3/2}]$	$2s2p(^3P)5d[^2F_{5/2}]$	646.8	4.729+09	1.0	4.729+09
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)5d[^2F_{7/2}]$	646.6	6.896+09	1.0	6.896+09
3	$2p^2(^1D)2s[^2D_{3/2}]$	$2s2p(^3P)6d[^2F_{5/2}]$	624.7	5.373+09	0.902	4.846+09
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2s2p(^3P)6d[^2F_{7/2}]$	624.6	7.940+09	1.0	7.940+09
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	586.7	1.456+10	1.0	1.456+10
3	$2p^2(^1D)2s[^2D_{3/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	586.7	1.022+10	1.0	1.022+10
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2s2p(^1P)4d[^2F_{7/2}]$	513.4	6.089+09	0.942	5.736+09
3	$2p^2(^1D)2s[^2D_{3/2}]$	$2s2p(^1P)4d[^2F_{5/2}]$	513.4	4.281+09	0.942	4.033+09
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2p^2(^1D)3p[^2F_{7/2}]$	488.1	3.125+09	0.251	7.844+08
3	$2p^2(^1D)2s[^2D_{3/2}]$	$2p^2(^1D)3p[^2F_{5/2}]$	488.1	2.191+09	0.251	5.499+08
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2p^2(^3P)5p[^2P_{3/2}]$	422.1	1.108+09	0.00132	1.463+06
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2p^2(^1D)4p[^2F_{7/2}]$	420.4	1.102+09	0.132	1.455+08
3	$2p^2(^1D)2s[^2D_{5/2}]$	$2p^2(^3P)6p[^2P_{3/2}]$	406.6	1.570+09	0.00524	8.227+06
4	$2p^2(^3P)2s[^2P_{3/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	1102.5	2.099+09	1.0	2.099+09
4	$2p^2(^3P)2s[^2P_{3/2}]$	$2s2p(^3P)3s[^2P_{3/2}]$	926.3	3.166+09	1.0	3.166+09
4	$2p^2(^3P)2s[^2P_{1/2}]$	$2s2p(^1P)3s[^2P_{1/2}]$	925.9	1.275+09	1.0	1.275+09
4	$2p^2(^3P)2s[^2P_{3/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	717.4	1.230+09	1.0	1.230+09
4	$2p^2(^3P)2s[^2P_{3/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	717.4	6.153+09	1.0	6.153+09
4	$2p^2(^3P)2s[^2P_{1/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	717.2	1.231+09	1.0	1.231+09
4	$2p^2(^3P)2s[^2P_{1/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	717.2	2.457+09	1.0	2.457+09
4	$2p^2(^3P)2s[^2P_{3/2}]$	$2s2p(^1P)4d[^2P_{3/2}]$	617.4	4.038+09	0.480	1.938+09
4	$2p^2(^3P)2s[^2P_{1/2}]$	$2s2p(^1P)4d[^2P_{1/2}]$	617.2	1.621+09	0.476	7.716+08
4	$2p^2(^3P)2s[^2P_{3/2}]$	$2s2p(^1P)5d[^2P_{3/2}]$	579.3	1.526+09	0.997	1.521+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	951.7	6.380+09	1.0	6.380+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	951.4	3.177+09	1.0	3.177+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^1P)3s[^2P_{3/2}]$	817.4	1.554+09	1.0	1.554+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)4d[^2P_{3/2}]$	792.8	3.017+09	1.0	3.017+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)4d[^2P_{1/2}]$	792.7	1.506+09	1.0	1.506+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)5d[^2P_{3/2}]$	736.3	2.494+09	1.0	2.494+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)5d[^2P_{1/2}]$	736.1	1.241+09	1.0	1.241+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)6d[^2P_{3/2}]$	708.2	4.198+09	1.0	4.198+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^3P)6d[^2P_{1/2}]$	708.1	2.094+09	1.0	2.094+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	650.4	1.325+09	1.0	1.325+09

Table VI (continued)

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	650.4	2.627+09	1.0	2.627+09
5	$2p^2(^1S)2s[^2S_{1/2}]$	$2s2p(^1P)4d[^2P_{3/2}]$	567.0	1.146+09	0.480	5.501+08
6	$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	1153.8	1.341+08	1.0	1.341+08
6	$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^1P)3s[^2P_{1/2}]$	962.2	3.064+09	1.0	3.064+09
6	$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^1P)3s[^2P_{3/2}]$	962.2	6.134+09	1.0	6.134+09
6	$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^3P)4d[^2P_{3/2}]$	928.3	4.361+08	1.0	4.361+08
6	$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^3P)4d[^2P_{1/2}]$	928.1	2.164+08	1.0	2.164+08
6	$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^3P)5d[^2P_{3/2}]$	851.7	1.436+08	1.0	1.436+08
6	$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^3P)6d[^2P_{3/2}]$	814.4	3.252+08	1.0	3.252+08
6	$2s^2(^1S)3s[^2S_{1/2}]$	$2s2p(^3P)6d[^2P_{1/2}]$	814.2	1.636+08	1.0	1.636+08
8	$2s^2(^1S)3d[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{7/2}]$	1856.6	5.776+07	1.0	5.776+07
8	$2s^2(^1S)3d[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	1858.0	2.975+06	1.0	2.975+06
8	$2s^2(^1S)3d[^2D_{3/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	1858.0	3.993+07	1.0	3.993+07
8	$2s^2(^1S)3d[^2D_{3/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	978.2	1.030+10	1.0	1.030+10
8	$2s^2(^1S)3d[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	978.2	1.471+10	1.0	1.471+10
8	$2s^2(^1S)3d[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	978.2	7.336+08	1.0	7.336+08
8	$2s^2(^1S)3d[^2D_{3/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	954.1	3.898+09	1.0	3.898+09
8	$2s^2(^1S)3d[^2D_{5/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	954.1	7.016+09	1.0	7.016+09
12	$2s^2(^1S)4s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	2295.8	7.122+06	1.0	7.122+06
12	$2s^2(^1S)4s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	2294.5	3.568+06	1.0	3.568+06
12	$2s^2(^1S)4s[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	1084.2	1.703+06	0.966	1.645+06
12	$2s^2(^1S)4s[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1084.2	3.422+06	0.966	3.306+06
12	$2s^2(^1S)4s[^2S_{1/2}]$	$2s2p(^1P)4s[^2P_{1/2}]$	962.8	3.618+09	0.465	1.682+09
12	$2s^2(^1S)4s[^2S_{1/2}]$	$2s2p(^1P)4s[^2P_{3/2}]$	962.8	7.236+09	0.462	3.343+09
14	$2s^2(^1S)4d[^2D_{3/2}]$	$2s2p(^3P)3d[^2D_{5/2}]$	3387.8	1.560+05	0.219	3.416+04
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^3P)3d[^2D_{5/2}]$	3387.8	1.370+06	0.219	3.000+05
14	$2s^2(^1S)4d[^2D_{3/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	3291.2	9.097+06	1.0	9.097+06
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	3291.3	7.005+05	1.0	7.005+05
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{7/2}]$	3286.6	1.306+07	1.0	1.306+07
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	3058.6	4.103+05	1.0	4.103+05
14	$2s^2(^1S)4d[^2D_{3/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	3056.3	2.251+05	1.0	2.251+05
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	1269.2	8.319+06	1.0	8.319+06
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1269.2	4.197+05	1.0	4.197+05
14	$2s^2(^1S)4d[^2D_{3/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1269.2	5.833+06	1.0	5.833+06
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1228.9	1.663+05	1.0	1.663+05
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^1P)4d[^2F_{7/2}]$	969.9	1.309+10	0.942	1.233+10
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2p^2(^3P)3p[^2P_{3/2}]$	946.7	1.270+09	0.00624	7.925+06
14	$2s^2(^1S)4d[^2D_{5/2}]$	$2s2p(^1P)4d[^2P_{3/2}]$	961.8	6.025+09	0.480	2.892+09
14	$2s^2(^1S)4d[^2D_{3/2}]$	$2s2p(^1P)4d[^2P_{1/2}]$	961.9	3.317+09	0.476	1.579+08
14	$2s^2(^1S)4d[^2D_{3/2}]$	$2s2p(^1P)4d[^2F_{5/2}]$	969.9	9.146+09	0.942	8.616+09

Table VI (continued)

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
19	$2s2p(^3P)3p[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	11917.9	3.314+07	1.0	3.314+07
19	$2s2p(^3P)3p[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	11884.2	1.676+07	1.0	1.676+07
19	$2s2p(^3P)3p[^2S_{1/2}]$	$2s2p(^3P)4d[^2P_{3/2}]$	3396.5	1.359E+08	1.0	1.359+08
19	$2s2p(^3P)3p[^2S_{1/2}]$	$2s2p(^3P)5d[^2P_{3/2}]$	2555.9	1.425E+08	1.0	1.425+08
19	$2s2p(^3P)3p[^2S_{1/2}]$	$2s2p(^3P)6d[^2P_{3/2}]$	2247.1	3.847E+08	1.0	3.847+08
19	$2s2p(^3P)3p[^2S_{1/2}]$	$2s2p(^3P)6d[^2P_{1/2}]$	2245.8	1.926E+08	1.0	1.926+08
19	$2s2p(^3P)3p[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	1752.3	4.533+07	0.966	4.379+07
19	$2s2p(^3P)3p[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1752.3	9.097+07	0.966	8.788+07
19	$2s2p(^3P)3p[^2S_{1/2}]$	$2p^2\ (^3P)3p[^2P_{3/2}]$	1229.6	1.200+09	0.00643	7.716+06
21	$2s2p(^3P)3p[^2P_{3/2}]$	$2s2p(^3P)3d[^2D_{5/2}]$	5836.7	3.449+08	0.219	7.553+07
21	$2s2p(^3P)3p[^2P_{3/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	5556.0	1.870+05	1.00	1.870+05
21	$2s2p(^3P)3p[^2P_{3/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	4923.6	1.304+08	1.00	1.304+08
21	$2s2p(^3P)3p[^2P_{1/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	4918.2	2.483+07	1.00	2.483+07
21	$2s2p(^3P)3p[^2P_{3/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	4917.8	2.570+07	1.00	2.570+07
21	$2s2p(^3P)3p[^2P_{1/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	4912.5	5.141+07	1.00	5.141+07
21	$2s2p(^3P)3p[^2P_{1/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	1449.1	1.468+07	0.966	1.419+07
21	$2s2p(^3P)3p[^2P_{1/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1449.0	7.121+06	0.966	6.879+06
21	$2s2p(^3P)3p[^2P_{3/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	1449.5	7.205+06	0.966	6.960+06
21	$2s2p(^3P)3p[^2P_{3/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1449.5	3.624+07	0.966	3.501+07
23	$2s2p(^3P)3p[^2D_{5/2}]$	$2s2p(^3P)3d[^2D_{5/2}]$	11111.9	1.733+07	0.219	3.795+06
23	$2s2p(^3P)3p[^2D_{3/2}]$	$2s2p(^3P)3d[^2D_{5/2}]$	11055.7	1.809+06	0.219	3.962+05
23	$2s2p(^3P)3p[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	10136.9	8.361+06	1.00	8.361+06
23	$2s2p(^3P)3p[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{7/2}]$	10092.8	1.558+08	1.00	1.558+08
23	$2s2p(^3P)3p[^2D_{3/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	10090.1	1.084+08	1.00	1.084+08
23	$2s2p(^3P)3p[^2D_{5/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	8212.3	1.176+07	1.00	1.176+07
23	$2s2p(^3P)3p[^2D_{3/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	8181.6	1.183+06	1.00	1.183+06
23	$2s2p(^3P)3p[^2D_{3/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	8165.7	6.628+06	1.00	6.628+06
23	$2s2p(^3P)3p[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	1716.2	1.429+08	1.00	1.429+08
23	$2s2p(^3P)3p[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1716.1	7.193+06	1.00	7.193+06
23	$2s2p(^3P)3p[^2D_{3/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1714.8	9.960+07	1.00	9.960+07
23	$2s2p(^3P)3p[^2D_{5/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1643.2	3.880+06	0.966	3.748+06
23	$2s2p(^3P)3p[^2D_{3/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	1642.0	2.144+06	0.966	2.071+06
23	$2s2p(^3P)3p[^2D_{3/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1642.0	4.493+05	0.966	4.340+05
23	$2s2p(^3P)3p[^2D_{5/2}]$	$2p^2(^3P)3p[^2P_{3/2}]$	11174.9	1.781+09	0.00624	1.111+07
27	$2s^2\ (^1S)5s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	3663.91	2.536+06	1.00	2.536+06
27	$2s^2\ (^1S)5s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	3660.72	1.269+06	1.00	1.269+06
27	$2s^2\ (^1S)5s[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1316.31	1.429+05	0.966	1.380+05
27	$2s^2\ (^1S)5s[^2S_{1/2}]$	$2s2p(^1P)5s[^2P_{1/2}]$	963.5	3.582+09	0.867	3.106+09
27	$2s^2\ (^1S)5s[^2S_{1/2}]$	$2s2p(^1P)5s[^2P_{3/2}]$	963.5	7.164+09	0.868	6.219+09

Table VI (continued)

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^3P)3d[^2D_{5/2}]$	5258.7	7.175+05	0.219	1.571+05
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	5029.7	3.225+05	1.00	3.225+05
29	$2s^2(^1S)5d[^2D_{3/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	5029.6	4.156+06	1.00	4.156+06
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{7/2}]$	5018.8	5.941+06	1.00	5.941+06
29	$2s^2(^1S)5d[^2D_{3/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	4500.9	1.363+05	1.00	1.363+05
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	4505.8	2.529+05	1.00	2.529+05
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	1464.4	1.018+08	1.00	1.018+08
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1464.4	5.102+06	1.00	5.102+06
29	$2s^2(^1S)5d[^2D_{3/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1464.4	7.137+07	1.00	7.137+07
29	$2s^2(^1S)5d[^2D_{3/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	1411.0	2.639+06	0.966	2.549+06
29	$2s^2(^1S)5d[^2D_{3/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1411.0	5.390+05	0.966	5.207+05
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1411.0	4.767+06	0.966	4.605+06
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^1P)5d[^2F_{7/2}]$	957.2	6.324+09	0.552	3.491+09
29	$2s^2(^1S)5d[^2D_{3/2}]$	$2s2p(^1P)5d[^2F_{5/2}]$	957.3	4.480+09	0.552	2.473+09
29	$2s^2(^1S)5d[^2D_{3/2}]$	$2s2p(^1P)5d[^2P_{1/2}]$	960.6	3.998+09	0.997	3.986+09
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2s2p(^1P)5d[^2P_{3/2}]$	960.6	7.196+09	0.997	7.174+09
29	$2s^2(^1S)5d[^2D_{5/2}]$	$2p^2(^1D)3p[^2F_{7/2}]$	973.7	6.412+09	0.255	1.635+09
29	$2s^2(^1S)5d[^2D_{3/2}]$	$2p^2(^1D)3p[^2F_{5/2}]$	973.8	4.465+09	0.251	1.121+09
31	$2s^2(^1S)5g[^2G_{7/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	1478.5	4.543+06	1.00	4.543+06
31	$2s^2(^1S)5g[^2G_{9/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	1478.5	1.298+05	1.00	1.298+05
31	$2s^2(^1S)5g[^2G_{7/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1478.5	3.505+06	1.00	3.505+06
31	$2s^2(^1S)5g[^2G_{7/2}]$	$2s2p(^1P)5g[^2F_{5/2}]$	963.0	1.060+10	0.536	5.682+09
31	$2s^2(^1S)5g[^2G_{9/2}]$	$2s2p(^1P)5g[^2F_{7/2}]$	963.0	1.361+10	0.538	7.322+09
31	$2s^2(^1S)5g[^2G_{7/2}]$	$2s2p(^1P)5g[^2H_{9/2}]$	963.4	1.672+10	0.978	1.635+10
31	$2s^2(^1S)5g[^2G_{9/2}]$	$2s2p(^1P)5g[^2H_{11/2}]$	963.4	2.052+10	0.978	2.007+10
32	$2s^2(^1S)6s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	5166.5	1.412+06	1.00	1.412+06
32	$2s^2(^1S)6s[^2S_{1/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	5160.2	7.359+05	1.00	7.359+05
32	$2s^2(^1S)6s[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	1469.9	5.108+05	0.966	4.934+05
32	$2s^2(^1S)6s[^2S_{1/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1469.9	1.044+06	0.966	1.009+06
32	$2s^2(^1S)6s[^2S_{1/2}]$	$2s2p(^1P)6s[^2P_{1/2}]$	964.6	3.380+09	0.604	2.041+09
32	$2s^2(^1S)6s[^2S_{1/2}]$	$2s2p(^1P)6s[^2P_{3/2}]$	964.6	6.764+09	0.607	4.106+09
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^3P)3d[^2D_{5/2}]$	7463.3	8.729+05	0.219	1.912+05
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	7010.4	2.800+05	1.00	2.800+05
34	$2s^2(^1S)6d[^2D_{3/2}]$	$2s2p(^3P)3d[^2F_{5/2}]$	7010.0	3.618+06	1.00	3.618+06
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^3P)3d[^2F_{7/2}]$	6989.3	5.100+06	1.00	5.100+06
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^3P)3d[^2P_{3/2}]$	6032.7	2.957+05	1.00	2.957+05
34	$2s^2(^1S)6d[^2D_{3/2}]$	$2s2p(^3P)3d[^2P_{1/2}]$	6023.7	1.681+05	1.00	1.681+05
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	1595.7	3.836+08	1.00	3.836+08
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1595.7	1.920+07	1.00	1.920+07

Table VI (continued)

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
34	$2s^2(^1S)6d[^2D_{3/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1595.6	2.690+08	1.00	2.690+08
34	$2s^2(^1S)6d[^2D_{3/2}]$	$2s2p(^1P)3d[^2P_{1/2}]$	1532.5	1.721+07	0.966	1.662 +07
34	$2s^2(^1S)6d[^2D_{3/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1532.4	3.426+06	0.966	3.310+06
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^1P)3d[^2P_{3/2}]$	1532.5	3.098+07	0.966	2.993+07
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^1P)6d[^2F_{7/2}]$	963.4	1.202+10	0.836	1.005+10
34	$2s^2(^1S)6d[^2D_{3/2}]$	$2p^2(^1D)3p[^2P_{1/2}]$	955.5	1.342+09	0.00164	2.201+06
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2p^2(^1D)3p[^2P_{3/2}]$	955.3	2.345+09	0.00159	3.729+06
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^1P)6d[^2P_{3/2}]$	963.4	5.578+09	0.173	9.650+08
34	$2s^2(^1S)6d[^2D_{5/2}]$	$2s2p(^1P)6d[^2F_{7/2}]$	963.4	1.857+09	0.827	1.536+09
34	$2s^2(^1S)6d[^2D_{3/2}]$	$2s2p(^1P)6d[^2F_{5/2}]$	963.4	7.235+09	0.827	5.983+09
34	$2s^2(^1S)6d[^2D_{3/2}]$	$2s2p(^1P)6d[^2P_{1/2}]$	963.5	2.880+09	0.166	4.781+08
36	$2s^2(^1S)6g[^2G_{9/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	1606.1	2.053+07	1.00	2.053+07
36	$2s^2(^1S)6g[^2G_{7/2}]$	$2s2p(^1P)3d[^2F_{7/2}]$	1606.1	5.867+05	1.00	5.867+05
36	$2s^2(^1S)6g[^2G_{7/2}]$	$2s2p(^1P)3d[^2F_{5/2}]$	1606.1	1.584+07	1.00	1.584+07
36	$2s^2(^1S)6g[^2G_{9/2}]$	$2s2p(^1P)6g[^2F_{7/2}]$	963.1	1.541+10	0.101	1.556+09
36	$2s^2(^1S)6g[^2G_{7/2}]$	$2s2p(^1P)6g[^2F_{5/2}]$	963.1	1.189+10	0.141	1.676+09
36	$2s^2(^1S)6g[^2G_{7/2}]$	$2s2p(^1P)6g[^2H_{9/2}]$	963.4	1.593+10	0.999	1.591+10
36	$2s^2(^1S)6g[^2G_{9/2}]$	$2s2p(^1P)6g[^2H_{11/2}]$	963.4	1.955+10	0.999	1.953+10

Table VII. *Wavelengths (WL), radiative transition probabilities (gAr), branching ratios (K) and factor intensities (Qd) for dielctronic satellite lines CII*

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	467.2	1.411+09	0.617	8.706+08
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	467.1	6.327+07	0.910	5.758+07
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	467.1	1.632+07	0.905	1.477+07
1	$2s^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	467.0	2.924+08	0.617	1.804+08
1	$2s^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	466.9	3.334+07	0.905	3.017+07
1	$2s^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	466.9	1.461+07	0.910	1.330+07
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	462.0	1.406+05	0.984	1.384+05
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	461.9	2.230+06	0.999	2.228+06
1	$2s^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	461.9	1.579+05	0.984	1.554+05
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	461.2	2.951+08	1.0	2.951+08
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	461.1	2.566+09	1.0	2.566+09
1	$2s^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	461.1	1.416+09	1.0	1.416+09
1	$2s^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	457.8	1.615+08	1.0	1.615+08
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	457.9	3.349+08	1.0	3.349+08
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)5p[^2D_{5/2}]$	437.4	2.170+09	1.0	2.170+09
1	$2s^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)5p[^2D_{3/2}]$	437.4	1.183+09	1.0	1.183+09
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)5p[^2D_{5/2}]$	437.4	2.170+09	1.0	2.170+09
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^1P)3p[^2D_{5/2}]$	427.8	1.136+09	1.0	1.136+09
1	$2s^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)6p[^2D_{5/2}]$	422.3	1.266+09	1.0	1.266+09
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	1206.0	6.353+07	0.617	3.920+07
7	$2s^2(^1S)3p[^2P_{1/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	1205.9	1.343+07	0.617	8.286+06
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	1205.4	7.322+05	0.905	6.626+05
7	$2s^2(^1S)3p[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	1205.3	1.527+06	0.905	1.382+06
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	1205.3	2.828+06	0.919	2.599+06
7	$2s^2(^1S)3p[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	1205.1	7.198+05	0.919	6.615+05
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	1171.8	3.029+05	0.999	3.026+05
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	1166.7	3.612+08	1.0	3.612+08
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	1167.3	4.102+07	1.0	4.102+07
7	$2s^2(^1S)3p[^2P_{1/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	1167.1	1.994+08	1.0	1.994+08
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	1146.0	9.218+07	1.0	9.218+07
7	$2s^2(^1S)3p[^2P_{1/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	1145.9	4.515+07	1.0	4.515+07
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^1P)3p[^2D_{5/2}]$	974.5	5.893+09	1.0	1.297+09
7	$2s^2(^1S)3p[^2P_{1/2}]$	$2s2p(^1P)3p[^2D_{3/2}]$	974.7	3.285+09	1.0	3.285+09
7	$2s^2(^1S)3p[^2P_{1/2}]$	$2s2p(^1P)6p[^2D_{3/2}]$	946.6	1.034+09	0.137	1.417+08
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^3P)6p[^2D_{5/2}]$	946.5	1.963+09	1.0	1.963+09
7	$2s^2(^1S)3p[^2P_{3/2}]$	$2s2p(^1P)3p[^2S_{1/2}]$	913.7	1.194+09	1.0	1.194+09

Table VII (continued)

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	1723.4	4.277+06	0.905	3.871+06
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	1724.7	1.408+07	0.617	8.687+06
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	1724.7	1.316+08	0.617	8.120+07
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	1723.1	6.094+06	0.910	5.546+06
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	1723.1	5.924+05	0.910	5.391+05
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	1646.5	6.511+07	1.0	6.511+07
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	1646.5	6.688+06	1.0	6.688+06
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	1645.3	1.006+08	1.0	1.006+08
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	1645.2	7.160+06	1.0	7.160+06
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2s2p(^1P)5p[^2D_{5/2}]$	959.3	5.696+09	0.255	1.452+09
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)3s[^2D_{5/2}]$	874.0	3.968+09	0.0946	3.754+08
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)3s[^2D_{3/2}]$	874.0	2.553+09	0.00946	2.415+07
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^3P)3d[^2D_{3/2}]$	774.5	2.082+09	0.00520	1.083+07
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)3d[^2D_{5/2}]$	774.4	3.301+09	0.00517	1.707+07
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)3d[^2D_{3/2}]$	715.1	8.539+09	0.605	5.166+08
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)4d[^2D_{5/2}]$	663.6	1.959+09	0.998	1.955+09
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^3P)4d[^2D_{3/2}]$	663.6	1.214+09	0.998	1.212+09
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^3P)5d[^2D_{3/2}]$	623.2	1.068+09	0.00658	7.027+06
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)5d[^2D_{5/2}]$	623.1	1.718+09	0.00658	1.130+07
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)4d[^2D_{3/2}]$	612.3	3.862+09	0.0179	6.913+07
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^1D)4d[^2D_{5/2}]$	612.3	5.944+09	0.0184	1.094+08
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^3P)6d[^2D_{5/2}]$	602.9	1.561+09	0.00746	1.165+07
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^1D)5d[^2D_{5/2}]$	574.4	2.942+09	1.47-5	4.325+04
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)5d[^2D_{3/2}]$	574.4	1.894+09	1.40-4	2.652+05
10	$2p^2(^1D)2p[^2D_{5/2}]$	$2p^2(^1D)6d[^2D_{5/2}]$	556.9	2.096+09	2.80-4	5.869+05
10	$2p^2(^1D)2p[^2D_{3/2}]$	$2p^2(^1D)6d[^2D_{3/2}]$	556.9	1.356+09	2.79-4	3.783+05
13	$2s^2(^1S)4p[^2P_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	1940.8	6.793+06	0.617	4.191+06
13	$2s^2(^1S)4p[^2P_{1/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	1940.5	1.288+06	0.617	7.947+05
13	$2s^2(^1S)4p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	1938.8	3.010+05	0.910	2.739+05
13	$2s^2(^1S)4p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	1842.4	2.078+06	1.0	2.078+06
13	$2s^2(^1S)4p[^2P_{1/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	1842.1	1.056+07	1.0	1.056+07
13	$2s^2(^1S)4p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	1840.8	1.889+07	1.0	1.889+07
13	$2s^2(^1S)4p^2[P_{3/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	1790.0	3.796+06	1.0	3.796+06
13	$2s^2(^1S)4p[^2P_{1/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	1789.7	1.912+06	1.0	1.912+06
13	$2s^2(^1S)4p[^2P_{1/2}]$	$2s2p(^1P)4p[^2D_{3/2}]$	962.1	4.484+09	0.0609	2.781+08
13	$2s^2(^1S)4p^2[P_{3/2}]$	$2s2p(^1P)4p[^2D_{5/2}]$	962.2	8.064+09	0.0609	4.911+08
13	$2s^2(^1S)4p[^2P_{1/2}]$	$2s2p(^1P)4p[^2S_{1/2}]$	949.0	1.101+09	0.195	2.147+08
13	$2s^2(^1S)4p[^2P_{3/2}]$	$2s2p(^1P)4p[^2S_{1/2}]$	949.1	2.193+09	0.195	4.276+08
13	$2s^2(^1S)4p[^2P_{3/2}]$	$2p^2(^1D)3s[^2D_{5/2}]$	926.3	1.437+09	0.00946	1.359+07

Table VII (continued)

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	2618.6	5.127+06	0.617	3.163+06
11	$2p^2(^3P)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	2618.5	1.037+06	0.617	6.399+06
11	$2p^2(^1S)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	2615.6	1.231+05	0.905	1.114+05
11	$2p^2(^1S)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	2614.9	2.349+05	0.910	2.138+05
11	$2p^2(^3P)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	2442.4	4.017+05	0.910	3.655+05
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	2439.8	7.096+05	0.932	6.613+05
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	2351.3	1.676+07	1.0	1.676+07
11	$2p^2(^3P)2p[^2P_{1/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	2351.2	8.351+06	1.0	8.351+06
11	$2p^2(^1S)2p[^2P_{1/2}]$	$2s2p(^1P)5p[^2D_{3/2}]$	959.3	3.129+09	0.253	7.916+08
11	$2p^2(^1S)2p[^2P_{3/2}]$	$2s2p(^1P)5p[^2S_{1/2}]$	956.0	1.233+09	0.215	2.651+08
11	$2p^2(^3P)2p[^2P_{1/2}]$	$2p^2(^3P)3d[^2D_{3/2}]$	914.7	1.152+09	0.00520	5.990+06
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^3P)3d[^2D_{5/2}]$	914.6	2.065+09	0.00517	1.068+07
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^1D)3d[^2D_{5/2}]$	833.0	1.683+09	0.647	1.089+09
11	$2p^2(^1S)2p[^2P_{3/2}]$	$2p^2(^1P)3d[^2S_{1/2}]$	827.6	1.333+09	0.0027	3.595+06
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^3P)4d[^2D_{5/2}]$	763.9	1.446+09	0.998	1.443+09
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^1D)4d[^2D_{5/2}]$	696.8	1.021+09	0.00184	1.779+06
11	$2p^2(^3P)2p[^2P_{1/2}]$	$2p^2(^3P)6d[^2D_{3/2}]$	684.7	1.014+09	0.00750	7.605+06
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^3P)6d[^2D_{5/2}]$	684.6	1.890+09	0.00746	1.410+07
11	$2p^2(^1S)2p[^2P_{1/2}]$	$2p^2(^1S)3d[^2D_{3/2}]$	653.0	2.549+09	8.1-6	2.065+04
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^1S)3d[^2D_{5/2}]$	653.0	4.558+09	1.01-5	4.604+04
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^1S)4d[^2D_{5/2}]$	566.4	1.617+09	3.1-5	5.013+04
11	$2p^2(^1S)2p[^2P_{1/2}]$	$2p^2(^1S)3d[^2D_{3/2}]$	653.0	2.549+09	8.1-6	2.065+04
11	$2p^2(^3P)2p[^2P_{3/2}]$	$2p^2(^1S)3d[^2D_{5/2}]$	653.0	4.558+09	1.01-5	4.604+04
16	$2s2p(^3P)3s[^4P_{5/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	2044.1	1.161+05	0.617	7.163+04
16	$2s2p(^3P)3s[^4P_{5/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	2041.8	4.441+06	0.910	4.041+06
16	$2s2p(^3P)3s[^4P_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	2042.2	2.472+06	0.617	1.525+06
16	$2s2p(^3P)3s[^4P_{1/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	2041.1	1.463+06	0.617	9.027+05
16	$2s2p(^3P)3s[^4P_{5/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	2040.9	4.063+07	0.932	3.787+07
16	$2s2p(^3P)3s[^4P_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	2040.5	7.070+06	0.905	6.398+06
16	$2s2p(^3P)3s[^4P_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	2040.0	4.546+07	0.910	4.137+07
16	$2s2p(^3P)3s[^4P_{1/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	2039.4	3.524+07	0.905	3.189+07
16	$2s2p(^3P)3s[^4P_{3/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	2039.1	9.403+07	0.932	8.764+07
16	$2s2p(^3P)3s[^4P_{1/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	2038.9	3.585+07	0.910	3.262+07
16	$2s2p(^3P)3s[^4P_{5/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	1948.4	1.652+06	0.984	1.626+06
16	$2s2p(^3P)3s[^4P_{5/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	1947.6	4.247+06	0.999	4.243+06
16	$2s2p(^3P)3s[^4P_{3/2}]$	$2s2p(^3P)4p[^4P_{1/2}]$	1947.3	1.748+06	0.953	1.666+06
16	$2s2p(^3P)3s[^4P_{3/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	1946.7	5.943+05	0.984	5.848+05
16	$2s2p(^3P)3s[^4P_{1/2}]$	$2s2p(^3P)4p[^4P_{1/2}]$	1946.3	3.871+05	0.953	3.689+05
16	$2s2p(^3P)3s[^4P_{3/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	1945.9	2.163+06	0.999	2.161+06
16	$2s2p(^3P)3s[^4P_{1/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	1945.7	2.041+06	0.984	2.008+06

Table VII (continued)

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
15	$2s^2\,(^1S)4f[^2F_{5/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	2096.1	5.570+05	1.0	5.570+05
15	$2s^2\,(^1S)4f[^2F_{7/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	2094.1	7.980+05	1.0	7.980+05
15	$2s^2\,(^1S)4f[^2F_{5/2}]$	$2s2p(^1P)4f[^2G_{7/2}]$	966.2	1.247+10	0.898	1.120+10
15	$2s^2\,(^1S)4f[^2F_{7/2}]$	$2s2p(^1P)4f[^2G_{9/2}]$	966.2	1.618+10	0.980	1.586+10
15	$2s^2\,(^1S)4f[^2F_{7/2}]$	$2s2p(^1P)4f[^2D_{5/2}]$	962.4	1.053+10	0.0012	1.218+07
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	2288.7	1.857+08	0.617	1.146+08
17	$2s2p(^3P)3s[^2P_{1/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	2287.1	3.766+07	0.617	2.324+07
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	2286.6	2.200+06	0.905	1.991+06
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	2285.9	8.580+06	0.910	7.808+06
17	$2s2p(^3P)3s[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	2285.0	4.387+06	0.905	3.970+06
17	$2s2p(^3P)3s[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	2284.3	1.719+06	0.910	1.564+06
17	$2s2p(^3P)3s[^2P_{1/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	2151.7	9.766+06	1.0	9.766+06
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	2153.1	2.329+06	1.0	2.329+06
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	2150.9	1.770+07	1.0	1.770+07
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	2081.9	1.306+07	1.0	1.306+07
17	$2s2p(^3P)3s[^2P_{1/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	2080.6	6.924+06	1.0	6.924+06
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2s2p(^1P)4p[^2D_{5/2}]$	1040.6	1.397+09	0.0609	8.508+07
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^3P)3d[^2D_{5/2}]$	870.7	1.919+09	0.00517	9.921+06
17	$2s2p(^3P)3s[^2P_{1/2}]$	$2p^2(^3P)3d[^2D_{3/2}]$	870.6	1.058+09	0.00520	5.502+06
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^1D)3d[^2D_{5/2}]$	796.5	1.548+09	0.647	1.002+09
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^3P)4d[^2D_{5/2}]$	733.1	1.331+09	0.998	1.328+09
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^1S)3d[^2D_{5/2}]$	630.4	4.120+09	1.01-5	4.161+04
17	$2s2p(^3P)3s[^2P_{1/2}]$	$2p^2(^1S)3d[^2D_{3/2}]$	630.2	2.275+09	0.0129	2.936+07
17	$2s2p(^3P)3s[^2P_{3/2}]$	$2p^2(^1D)4d[^2D_{5/2}]$	549.3	1.783+09	3.1-5	5.527+04
24	$2s2p(^3P)3d[^4P_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	5818.6	4.367+05	0.617	2.694+05
24	$2s2p(^3P)3d[^4P_{1/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	5809.0	3.644+06	0.905	3.298+06
24	$2s2p(^3P)3d[^4P_{1/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	5804.7	3.902+06	0.910	3.551+06
24	$2s2p(^3P)3d[^4P_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	5804.6	7.349+05	0.905	6.651+05
24	$2s2p(^3P)3d[^4P_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	5800.4	4.498+06	0.910	4.093+06
24	$2s2p(^3P)3d[^4P_{5/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	5793.0	5.531+05	0.910	5.033+05
24	$2s2p(^3P)3d[^4P_{3/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	5793.2	1.013+07	0.932	9.441+06
24	$2s2p(^3P)3d[^4P_{5/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	5785.9	4.105+06	0.932	3.826+06
24	$2s2p(^3P)3d[^4P_{1/2}]$	$2s2p(^3P)4p[^4P_{1/2}]$	5112.6	1.156+06	0.953	1.102+06
24	$2s2p(^3P)3d[^4P_{3/2}]$	$2s2p(^3P)4p[^4P_{1/2}]$	5109.2	5.749+06	0.953	5.479+06
24	$2s2p(^3P)3d[^4P_{1/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	5108.7	6.757+06	0.984	6.649+06
24	$2s2p(^3P)3d[^4P_{3/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	5105.3	2.546+06	0.984	2.505+06
24	$2s2p(^3P)3d[^4P_{3/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	5099.3	6.853+06	0.999	6.846+06
24	$2s2p(^3P)3d[^4P_{5/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	5099.6	5.126+06	0.984	5.044+06
24	$2s2p(^3P)3d[^4P_{5/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	5093.6	1.588+07	0.999	1.586+07

Table VII (continued)

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
25	$2s2p(^3P)3d[^4D_{5/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	5276.9	1.933+05	0.617	1.193+05
25	$2s2p(^3P)3d[^4D_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	5274.6	6.431+05	0.617	3.968+05
25	$2s2p(^3P)3d[^4D_{1/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	5273.1	3.211+05	0.617	1.981+05
25	$2s2p(^3P)3d[^4D_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	5263.1	4.883+06	0.905	4.419+06
25	$2s2p(^3P)3d[^4D_{5/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	5262.0	5.694+06	0.910	5.186+06
25	$2s2p(^3P)3d[^4D_{1/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	5261.6	6.658+06	0.905	6.025+06
25	$2s2p(^3P)3d[^4D_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	5259.6	1.252+07	0.910	1.139+07
25	$2s2p(^3P)3d[^4D_{7/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	5259.3	3.578+06	0.932	3.335+06
25	$2s2p(^3P)3d[^4D_{1/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	5258.1	6.616+06	0.910	6.021+06
25	$2s2p(^3P)3d[^4D_{5/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	5256.1	2.900+07	0.932	2.702+07
25	$2s2p(^3P)3d[^4D_{3/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	5253.7	1.001+07	0.932	9.329+06
25	$2s2p(^3P)3d[^4D_{3/2}]$	$2s2p(^3P)4p[^4P_{1/2}]$	4684.9	2.418+07	0.953	2.304+07
25	$2s2p(^3P)3d[^4D_{1/2}]$	$2s2p(^3P)4p[^4P_{1/2}]$	4683.8	2.420+07	0.953	2.306+07
25	$2s2p(^3P)3d[^4D_{5/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	4683.5	6.044+07	0.984	5.947+07
25	$2s2p(^3P)3d[^4D_{3/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	4681.7	3.070+07	0.984	3.021+07
25	$2s2p(^3P)3d[^4D_{7/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	4681.0	1.141+08	0.999	1.140+08
25	$2s2p(^3P)3d[^4D_{1/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	4680.5	4.800+06	0.984	4.723+06
25	$2s2p(^3P)3d[^4D_{5/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	4678.5	2.560+07	0.999	2.557+07
25	$2s2p(^3P)3d[^4D_{3/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	4676.6	2.844+06	0.999	2.841+06
26	$2s2p(^3P)3d[^4F_{5/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	5197.8	5.267+06	0.617	3.250+06
26	$2s2p(^3P)3d[^4F_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	5193.9	1.184+06	0.617	7.305+05
26	$2s2p(^3P)3d[^4F_{7/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	5183.2	1.768+08	0.932	1.648+08
26	$2s2p(^3P)3d[^4F_{5/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	5183.2	1.114+08	0.910	1.014+08
26	$2s2p(^3P)3d[^4F_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	5182.8	6.804+07	0.905	6.158+07
26	$2s2p(^3P)3d[^4F_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	5179.4	2.500+07	0.910	2.275+07
26	$2s2p(^3P)3d[^4F_{5/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	5177.5	3.211+07	0.932	2.993+07
26	$2s2p(^3P)3d[^4F_{3/2}]$	$2s2p(^3P)4p[^4D_{5/2}]$	5173.7	1.574+06	0.953	1.500+06
26	$2s2p(^3P)3d[^4F_{5/2}]$	$2s2p(^3P)4p[^4P_{3/2}]$	4621.1	2.515+05	0.984	2.475+05
26	$2s2p(^3P)3d[^4F_{7/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	4620.7	5.461+05	0.999	5.456+05
26	$2s2p(^3P)3d[^4F_{5/2}]$	$2s2p(^3P)4p[^4P_{5/2}]$	4616.1	1.070+05	0.999	1.069+05
30	$2s^2(^1S)5f[^2F_{5/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	2655.2	8.472+05	1.0	8.472+05
30	$2s^2(^1S)5f[^2F_{7/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	2651.9	1.211+06	1.0	1.211+06
30	$2s^2(^1S)5f[^2F_{5/2}]$	$2s2p(^1P)5f[^2G_{7/2}]$	966.3	1.222+10	0.906	1.107+10
30	$2s^2(^1S)5f[^2F_{7/2}]$	$2s2p(^1P)5f[^2G_{9/2}]$	966.3	1.592+10	0.964	1.535+10
30	$2s^2(^1S)5f[^2F_{7/2}]$	$2s2p(^1P)5f[^2D_{5/2}]$	962.9	1.091+10	0.0045	4.910+07
30	$2s^2(^1S)5f[^2F_{5/2}]$	$2s2p(^1P)5f[^2D_{3/2}]$	962.9	7.638+09	0.0483	3.689+08

Table VII (continued)

N	Down level	Upper level	WL(A)	gAr(s^{-1})	K	Qd(s^{-1})
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	2792.7	1.115+08	0.617	6.880+07
28	$2s^2(^1S)5p[^2P_{1/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	2791.6	2.270+07	0.617	1.401+07
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	2789.5	1.298+06	0.905	1.175+06
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	2788.5	5.052+06	0.910	4.597+06
28	$2s^2(^1S)5p[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	2788.4	2.612+06	0.905	2.364+06
28	$2s^2(^1S)5p[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	2787.4	1.093+06	0.910	9.946+05
28	$2s^2(^1S)5p[^2P_{1/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	2592.4	5.041+07	1.0	5.041+07
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	2593.4	1.070+07	1.0	1.070+07
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	2590.3	9.153+07	1.0	9.153+07
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	2490.8	1.780+07	1.0	1.780+07
28	$2s^2(^1S)5p[^2P_{1/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	2489.9	8.540+06	1.0	8.540+06
28	$2s^2(^1S)5p[^2P_{1/2}]$	$2s2p(^1P)5p[^2D_{3/2}]$	981.6	2.451+09	0.253	6.201+08
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^1P)5p[^2D_{5/2}]$	981.7	4.367+09	0.255	1.114+09
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2s2p(^1P)5p[^2S_{1/2}]$	978.3	1.200+09	0.215	2.580+08
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^1D)3d[^2S_{1/2}]$	844.3	1.102+09	0.0027	2.975+06
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^1D)3d[^2D_{5/2}]$	849.9	1.782+09	0.647	1.152+09
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^3P)4d[^2D_{5/2}]$	778.1	1.173+09	0.998	1.171+09
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^3P)6d[^2D_{5/2}]$	695.9	1.860+09	0.00746	1.388+07
28	$2s^2(^1S)5p[^2P_{1/2}]$	$2p^2(^1S)3d[^2D_{3/2}]$	663.3	1.937+09	8.1-6	1.569+04
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^1S)3d[^2D_{5/2}]$	663.3	3.469+09	1.01-5	3.504+04
28	$2s^2(^1S)5p[^2P_{3/2}]$	$2p^2(^1S)4d[^2D_{5/2}]$	574.2	1.344+09	3.1-5	4.166+04
33	$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	3253.5	1.604+07	0.617	9.897+06
33	$2s^2(^1S)6p[^2P_{1/2}]$	$2s2p(^3P)4p[^2P_{3/2}]$	3253.3	3.301+06	0.617	2.037+06
33	$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	3249.2	1.893+05	0.905	1.713+05
33	$2s^2(^1S)6p[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{1/2}]$	3248.9	3.725+05	0.905	3.371+05
33	$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	3247.9	7.202+05	0.910	6.554+05
33	$2s^2(^1S)6p[^2P_{1/2}]$	$2s2p(^3P)4p[^4D_{3/2}]$	3247.6	1.648+05	0.910	1.500+05
33	$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	2986.1	3.625+06	1.0	3.625+06
33	$2s^2(^1S)6p[^2P_{1/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	2985.9	1.736+07	1.0	1.736+07
33	$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	2982.0	3.153+07	1.0	3.153+07
33	$2s^2(^1S)6p[^2P_{1/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	2850.7	3.219+05	1.0	3.219+05
33	$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^3P)4p[^2S_{1/2}]$	2850.9	5.850+05	1.0	5.850+05
33	$2s^2(^1S)6p[^2P_{1/2}]$	$2s2p(^1P)6p[^2D_{3/2}]$	966.2	5.691+09	0.137	7.780+08
33	$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^1P)6p[^2D_{3/2}]$	966.2	1.134+09	0.137	1.554+08
33	$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^1P)6p[^2D_{5/2}]$	966.2	1.023+10	0.136	1.392+09
33	$2s^2(^1S)6p[^2P_{1/2}]$	$2s2p(^1P)6p[^2S_{1/2}]$	964.5	1.296+09	0.229	2.968+08
33	$2s^2(^1S)6p[^2P_{3/2}]$	$2s2p(^1P)6p[^2S_{1/2}]$	964.5	3.065+09	0.229	7.019+08
35	$2s^2(^1S)6f[^2F_{5/2}]$	$2s2p(^3P)4p[^2D_{3/2}]$	3104.9	2.092+06	1.0	2.092+06
35	$2s^2(^1S)6f[^2F_{5/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	3100.4	1.494+05	1.0	1.494+05
35	$2s^2(^1S)6f[^2F_{7/2}]$	$2s2p(^3P)4p[^2D_{5/2}]$	3100.4	2.988+06	1.0	2.988+06
35	$2s^2(^1S)6f[^2F_{7/2}]$	$2s2p(^1P)6f[^2D_{5/2}]$	963.2	1.123+10	0.0645	7.243+08
35	$2s^2(^1S)6f[^2F_{7/2}]$	$2s2p(^1P)6f[^2G_{9/2}]$	966.1	1.585+10	0.928	1.471+10
35	$2s^2(^1S)6f[^2F_{5/2}]$	$2s2p(^1P)6f[^2D_{3/2}]$	963.2	7.859+09	0.0714	5.611+08

Table VIII. Energy excitation (E_S), radiative transition probabilities (gAr), autoionization rate (Aa) and factor intensities (Qd)

Down level Upper level	Aa s^{-1}	sumAa s^{-1}	sum(gAr) s^{-1}	gAr s^{-1}	Qd s^{-1}	E_S eV
$2s^26s[^2S_{1/2}]$-$2s2p(^3P)6s[^2P_{1/2}]$	0.3316+14	0.3316+14	0.6498+09	0.1514+07	0.1514+07	4.628
$2s^26s[^2S_{1/2}]$-$2s2p(^3P)6s[^2P_{3/2}]$	0.3312+14	0.3312+14	0.1288+10	0.3161+07	0.3161+07	4.634
$2s^26s[^2S_{1/2}]$-$2s2p(^1P)6s[^2P_{1/2}]$	0.3073+13	0.5090+13	0.3915+10	0.3380+10	0.2040+10	10.98
$2s^26s[^2S_{1/2}]$-$2s2p(^1P)6s[^2P_{3/2}]$	0.3071+13	0.5060+13	0.7830+10	0.6764+10	0.4104+10	10.98
$2s^26p[^2P_{1/2}]$-$2s2p(^3P)6p[^2S_{1/2}]$	0.9839+13	0.9839+13	0.2170+10	0.1311+08	0.1311+08	4.710
$2s^26p[^2P_{3/2}]$-$2s2p(^3P)6p[^2S_{1/2}]$	0.9839+13	0.9839+13	0.2170+10	0.3122+08	0.3122+08	4.710
$2s^26p[^2P_{1/2}]$-$2s2p(^3P)6p[^2D_{3/2}]$	0.5940+14	0.5940+14	0.2573+10	0.1601+08	0.1601+08	4.976
$2s^26p[^2P_{3/2}]$-$2s2p(^3P)6p[^2D_{3/2}]$	0.5940+14	0.5940+14	0.2573+10	0.3400+07	0.3400+07	4.976
$2s^26p[^2P_{3/2}]$-$2s2p(^3P)6p[^2D_{5/2}]$	0.6341+14	0.6341+14	0.3992+10	0.3098+08	0.3098+08	4.978
$2s^26p[^2P_{1/2}]$-$2s2p(^1P)6p[^2S_{1/2}]$	0.2198+14	0.9593+14	0.5877+10	0.1296+10	0.2969+09	11.20
$2s^26p[^2P_{3/2}]$-$2s2p(^1P)6p[^2S_{1/2}]$	0.2198+14	0.9593+14	0.5877+10	0.3065+10	0.7022+09	11.20
$2s^26p[^2P_{1/2}]$-$2s2p(^1P)6p[^2D_{3/2}]$	0.2560+13	0.1870+14	0.7311+10	0.5691+10	0.7789+09	11.18
$2s^26p[^2P_{3/2}]$-$2s2p(^1P)6p[^2D_{3/2}]$	0.2560+13	0.1870+14	0.7311+10	0.1134+10	0.1552+09	11.18
$2s^26p[^2P_{3/2}]$-$2s2p(^1P)6p[^2D_{5/2}]$	0.2549+13	0.1872+14	0.1197+11	0.1023+11	0.1393+10	11.18
$2s^26d[^2D_{3/2}]$-$2s2p(^3P)6d[^2P_{1/2}]$	0.1043+13	0.1043+13	0.3284+10	0.2098+06	0.2095+06	5.007
$2s^26d[^2D_{5/2}]$-$2s2p(^3P)6d[^2P_{3/2}]$	0.1063+13	0.1063+13	0.6570+10	0.3502+06	0.3497+06	5.004
$2s^26d[^2D_{3/2}]$-$2s2p(^3P)6d[^2F_{5/2}]$	0.6000+11	0.6000+11	0.6550+10	0.2685+07	0.2637+07	4.954
$2s^26d[^2D_{5/2}]$-$2s2p(^3P)6d[^2F_{5/2}]$	0.6000+11	0.6000+11	0.6550+10	0.3047+06	0.2993+06	4.954
$2s^26d[^2D_{5/2}]$-$2s2p(^3P)6d[^2F_{7/2}]$	0.6130+12	0.6130+12	0.8805+10	0.3758+07	0.3751+07	4.959
$2s^26d[^2D_{3/2}]$-$2s2p(^1P)6d[^2P_{1/2}]$	0.4120+13	0.2488+14	0.4636+10	0.2880+10	0.4769+09	11.34
$2s^26d[^2D_{3/2}]$-$2s2p(^1P)6d[^2P_{3/2}]$	0.4237+13	0.2451+14	0.9384+10	0.2785+09	0.4813+08	11.34
$2s^26d[^2D_{5/2}]$-$2s2p(^1P)6d[^2P_{3/2}]$	0.4237+13	0.2451+14	0.9384+10	0.5578+10	0.9640+09	11.34
$2s^26d[^2D_{3/2}]$-$2s2p(^1P)6d[^2F_{5/2}]$	0.4668+14	0.5642+14	0.1049+11	0.7235+10	0.5986+10	11.34
$2s^26d[^2D_{5/2}]$-$2s2p(^1P)6d[^2F_{5/2}]$	0.4668+14	0.5642+14	0.1049+11	0.1857+10	0.1537+10	11.34
$2s^26d[^2D_{5/2}]$-$2s2p(^1P)6d[^2F_{7/2}]$	0.4830+14	0.5777+14	0.1373+11	0.1202+11	0.1005+11	11.34
$2s^26f[^2F_{5/2}]$-$2s2p(^1P)6f[^2D_{3/2}]$	0.4000+10	0.4700+11	0.8749+10	0.7859+10	0.6391+09	11.38
$2s^26f[^2F_{5/2}]$-$2s2p(^1P)6f[^2D_{5/2}]$	0.4000+10	0.4900+11	0.1313+11	0.5609+09	0.4383+08	11.38
$2s^26f[^2F_{7/2}]$-$2s2p(^1P)6f[^2D_{5/2}]$	0.4000+10	0.4900+11	0.1313+11	0.1123+11	0.8775+09	11.38
$2s^26f[^2F_{5/2}]$-$2s2p(^1P)6f[^2G_{7/2}]$	0.7258+13	0.2674+14	0.1320+11	0.1222+11	0.3316+10	11.34
$2s^26f[^2F_{7/2}]$-$2s2p(^1P)6f[^2G_{9/2}]$	0.7258+13	0.7820+13	0.1650+11	0.1585+11	0.1471+11	11.34
$2s^26f[^2F_{7/2}]$-$2s2p(^1P)6f[^2G_{7/2}]$	0.7258+13	0.2674+14	0.1320+11	0.4615+09	0.1252+09	11.34
$2s^26g[^2G_{7/2}]$-$2s2p(^1P)6g[^2F_{5/2}]$	0.2000+10	0.2000+10	0.1223+11	0.1189+11	0.5889+10	11.39
$2s^26g[^2G_{9/2}]$-$2s2p(^1P)6g[^2H_{9/2}]$	0.9690+12	0.9690+12	0.1672+11	0.3620+09	0.3614+09	11.39
$2s^26g[^2G_{7/2}]$-$2s2p(^1P)6g[^2H_{9/2}]$	0.9690+12	0.9690+12	0.1672+11	0.1593+11	0.1590+11	11.39
$2s^26g[^2G_{9/2}]$-$2s2p(^1P)6g[^2H_{11/2}]$	0.1031+13	0.1031+13	0.2006+11	0.1955+11	0.1952+11	11.39

Table IX. Dielectronic recombination rate coefficients ($T_e=10^4$K) for separate transitions. a-present result, b-Badnell [23], c-Nusbaumer&Storey [26]

Transition		α_d in cm^3/s		
		a	b	c
$2s^22p(^2P)$	$2s2p[^3P\ ]4p(^2P)$	1.69-14	1.85-14	
$2p^22s(^2D)$	$2s2p[^3P\ ]3d(^2F)$	4.53-12	3.86-12	4.27-12
$2p^22s(^2S)$	$2s2p[^3P\ ]3d(^2P)$	8.94-13		6.45-13
$2p^22s(^2P)$	$2s2p[^3P\ ]3d(^2P)$	3.55-13		3.49-13
$2s2p[^3P\ ]3p(^2D)$	$2s2p[^3P\ ]3d(^2F)$	3.52-14		5.3-14

Table X Fitting parameters for $a_d(k)$ in eq. (20)

Excited state k	$A_1 (cm^3 s^{-1})$	E_1 (eV)	$A_2 (cm^3 s^{-1})$	E_2 (eV)
$2s2p^2$ ^4P	4.535E-17	2.503E-01	1.543E-15	1.543E-15
$2s2p^2$ ^2S	2.532E-12	3.421E+00	1.683E-12	5.316E-01
$2s2p^2$ ^2P	6.709E-13	5.356E-01	1.970E-12	3.811E+00
$2s2p^2$ ^2D	6.119E-12	2.485E-01	1.253E-11	4.476E+00
$2s^22p$ ^2P	1.092E-12	2.487E+00	2.487E+00	4.254E+00
$1s^22p^3$ ^2D	7.342E-14	2.521E+00	2.386E-12	1.078E+01
$1s^22p^3$ ^2P	1.169E-13	2.564E+00	7.650E-13	8.338E+00
$2s^23s$ ^2S	3.996E-14	5.309E-01	1.733E-12	2.713E+00
$2s^23p$ ^2P	2.962E-12	4.674E+00	2.070E-13	2.499E+00
$2s^23d$ ^2D	1.854E-14	2.511E-01	4.270E-12	6.188E+00
$2s2p3s$ ^4P	3.220E-16	3.021E+00	3.749E-15	4.251E+00
$2s2p3s$ ^4F	8.115E-16	4.294E+00	9.135E-16	3.021E+00
$2s2p3s$ ^4D	1.047E-14	4.293E+00	1.500E-14	3.021E+00
$2s2p3p$ ^4S	2.071E-17	5.421E-01	1.041E-16	3.009E+00
$2s2p3p$ ^2S	8.988E-15	5.586E-01	1.580E-13	3.884E+00
$2s2p3p$ ^4P	1.616E-20	9.561E+00	1.248E-19	9.568E+00
$2s2p3p$ ^2P	4.223E-14	5.410E-01	1.918E-13	2.954E+00
$2s2p3p$ ^4D	2.352E-17	4.956E+00	4.866E-16	4.294E+00
$2s2p3p$ ^2D	5.271E-14	2.660E-01	5.195E-13	3.274E+00
$2s2p3d$ ^2P	6.704E-14	2.648E+00	2.743E-13	3.236E+00
$2s2p3d$ ^4P	7.141E-14	3.021E+00	3.864E-14	4.260E+00
$2s2p3s$ ^2D	1.201E-13	5.660E+00	4.126E-14	2.637E+00
$2s^22p3s$ ^2P	3.132E-14	2.567E+00	4.111E-13	6.998E+00
$2s^24s$ ^2S	2.644E-15	5.617E-01	8.102E-13	7.544E+00
$2s^24p$ ^2P	1.151E-14	2.513E+00	2.598E-13	7.905E+00
$2s^24d$ ^2D	4.150E-15	2.525E-01	4.200E-12	9.205E+00
$2s^24f$ ^2F	2.390E-16	2.518E+00	4.656E-12	9.244E+00
Total(n=7-500)	3.078E-12	4.777E+00	1.572E-09	1.126E+01

Figure Captions

Fig.1 Dielectronic Recombination Rate Coefficient $\alpha_d(\gamma' | 2s^2)$ for even states as function of T_e

a) γ'=$2s2p^2$ (^4P), $2s2p^2$ (^2D), $2s2p^2$ (^2S), $2s2p^2$ (^2P), $2s^23s$ (^2S), $2s^23d$ (^2D), $2s^24s$ (^2S), $2s^24d$ (^2D),

b) γ'=$2s2p(^3P)3p$ (^2P), $2s2p(^3P)3p$ (^4S), $2s2p(^3P)3p$ (^2D), $2s2p(^3P)3p$ (^2S), $2s2p(^3P)3p$ (^4D),

c) γ'=$2s^25s$ (^2S), $2s^26s$ (^2S), $2s^25d$ (^2D), $2s^26d$ (^2D), $2s^25g$ (^2G), $2s^26g$ (^2G)

Fig.2 Dielectronic Recombination Rate Coefficient $\alpha_d(\gamma' | 2s^2)$ for odd states as function of T_e

a) γ'=$2s^22p$ (^2P), $2s^23p$ (^2P), $2p^3$ (^2D), $2s^24p$ (^2P), $2p^3$ (^2P), $2s^24f$ (^2F)

b) γ'=$2s2p(^3P)3s$ (^2P), $2s2p(^3P)3s$ (^4P), $2s2p(^3P)3d$ (^4F), $2s2p(^3P)3d$ (^4D), $2s2p(^3P)3d$ (^4P),

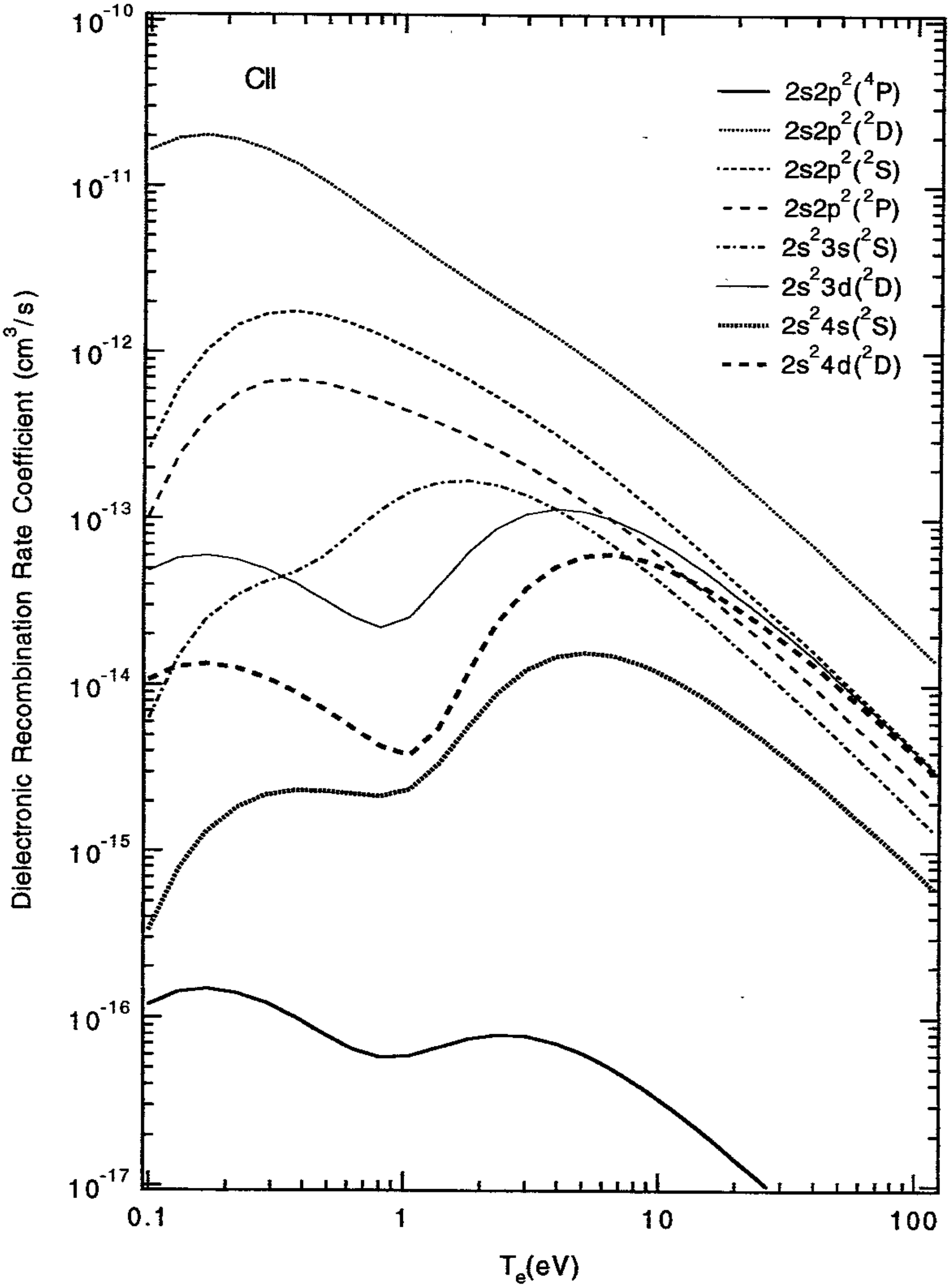
c) γ'=$2s^25p$ (^2P), $2s^26p$ (^2P), $2s^25f$ (^2F), $2s^26f$ (^2F)

Fig.3. Dielectronic Recombination Rate Coefficient $\alpha_d(2s^2nl | 2s^2)$ as function of n for T_e =6 eV.

Fig.4. Total Dielectronic Recombination Rate Coefficient $\alpha_d^N(2s^2\ell | 2s^2)$ as function of N for T_e =6 eV.

Fig.5. Dielectronic Recombination Rate Coefficient $\alpha_d(\gamma' | 2s^2)$ as function of T_e

Fig.6. The effective dielectronic recombination rate coefficient for CIII $\rightarrow$CII.



CII
2s2p^2(^4P)
2s2p^2(^2D)
2s2p^2(^2S)
2s2p^2(^2P)
2s^2 3s(^2S)
2s^2 3d(^2D)
2s^2 4s(^2S)
2s^2 4d(^2D)
Dielectronic Recombination Rate Coefficient (cm^3/s)
T_e(eV)
10^-10
10^-11
10^-12
10^-13
10^-14
10^-15
10^-16
10^-17
0.1
1
10
100

Fig. 1(a)

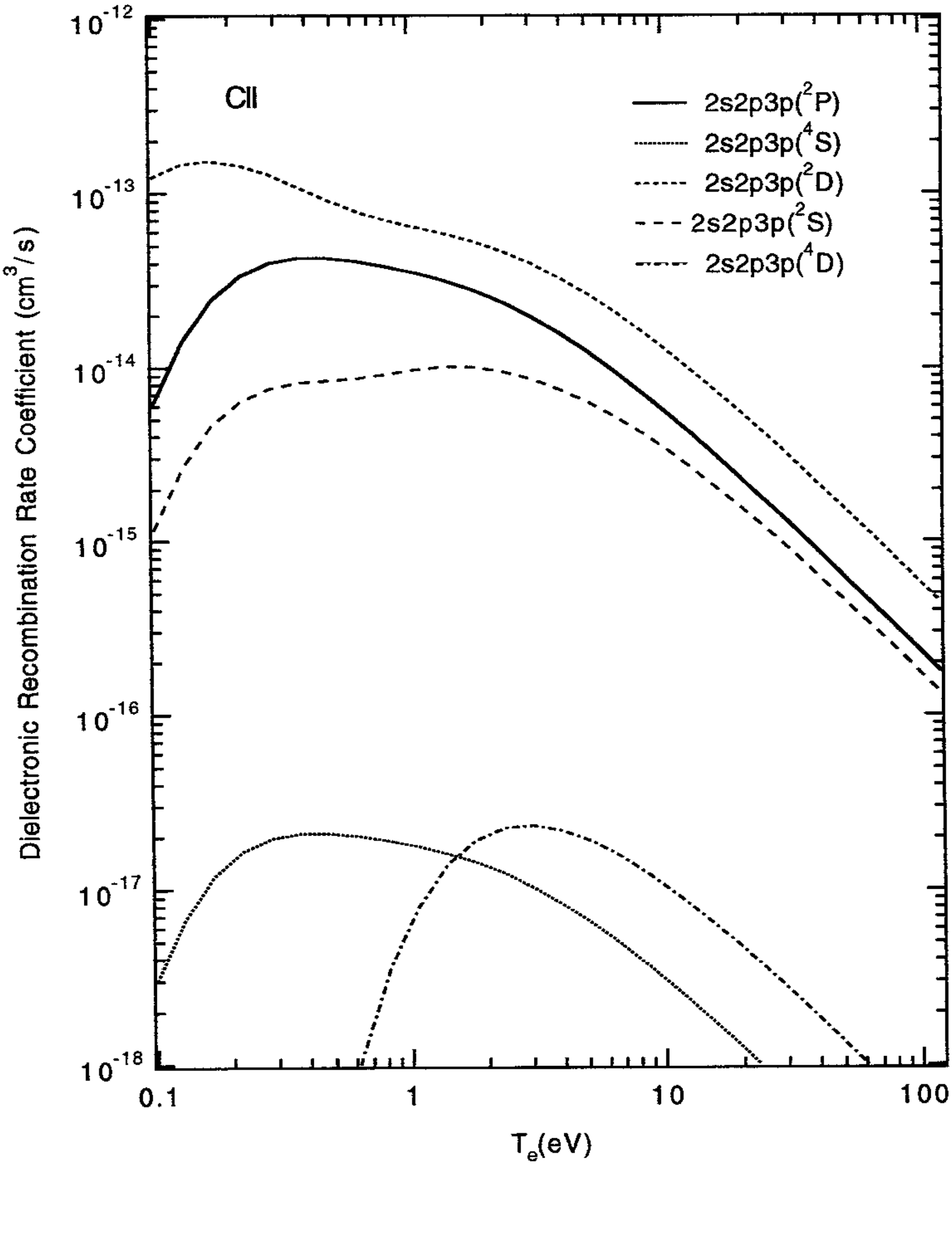

CII
2s2p3p(²P)
2s2p3p(⁴S)
2s2p3p(²D)
2s2p3p(²S)
2s2p3p(⁴D)
Dielectronic Recombination Rate Coefficient (cm³/s)
10⁻¹²
10⁻¹³
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
0.1
1
10
100
Tₑ(eV)

Fig. 1(b)

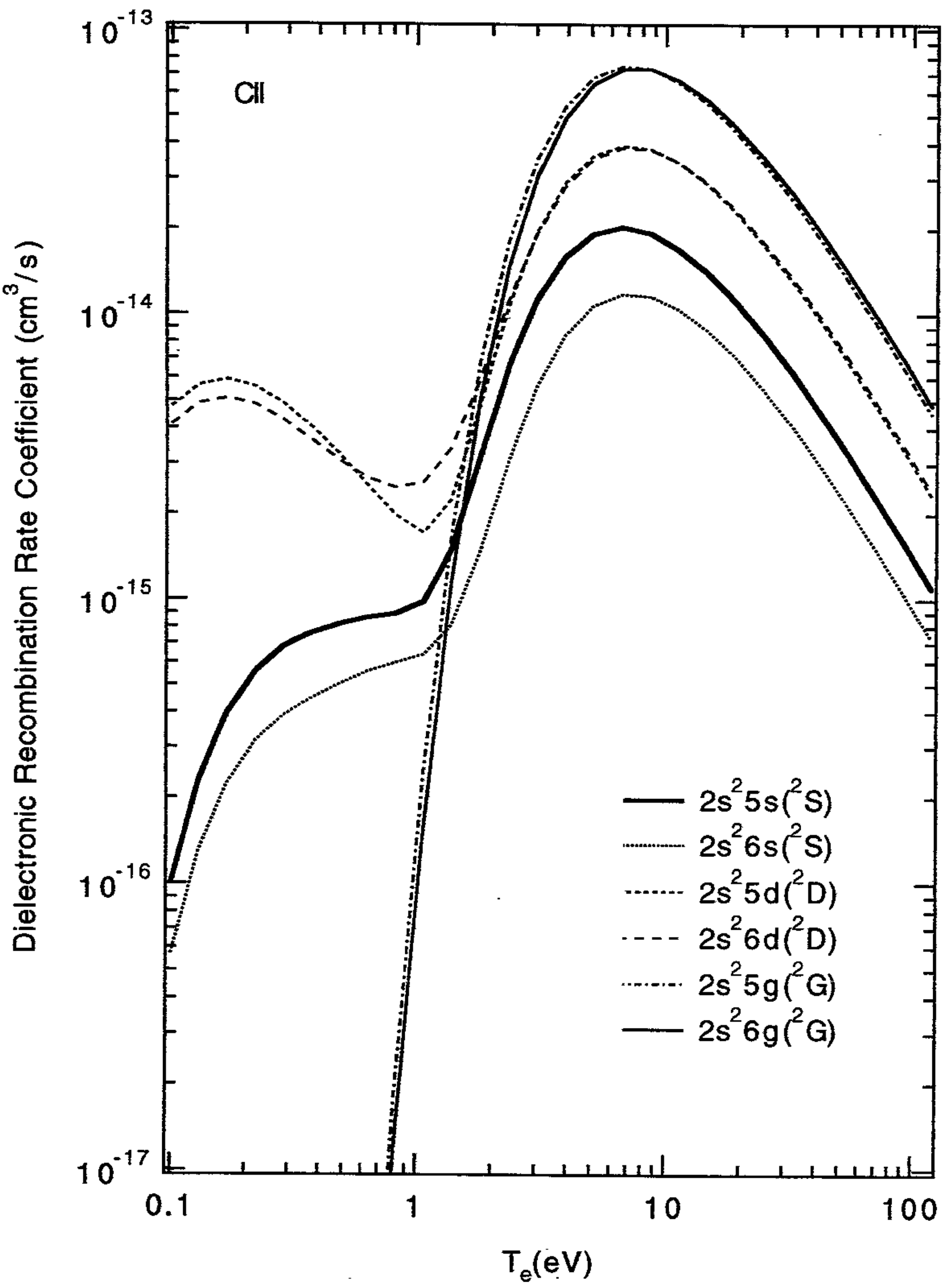

CII
Dielectronic Recombination Rate Coefficient (cm3/s)
10-13
10-14
10-15
10-16
10-17
0.1
1
10
100
Te(eV)
2s25s(2S)
2s26s(2S)
2s25d(2D)
2s26d(2D)
2s25g(2G)
2s26g(2G)

Fig. 1(c)

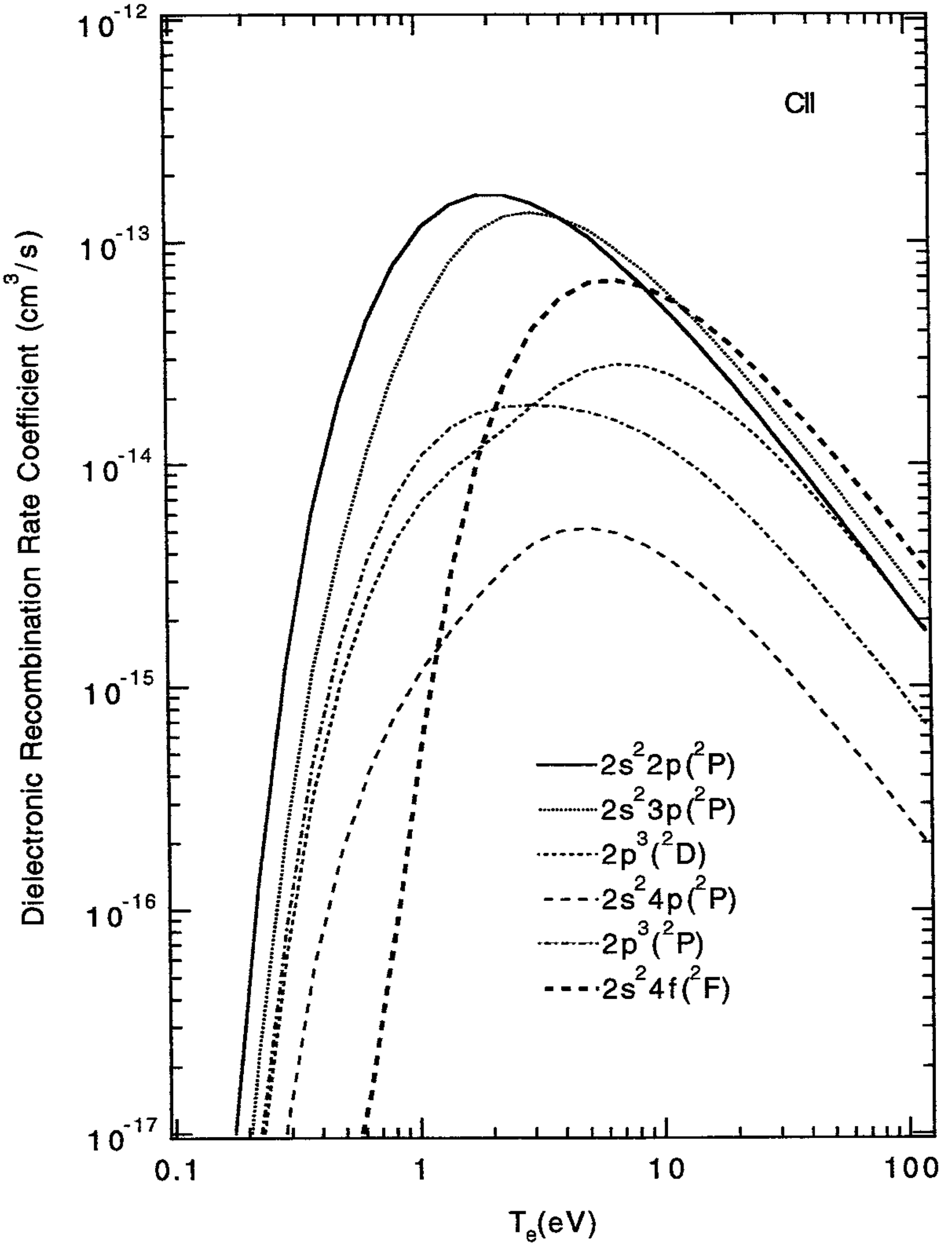
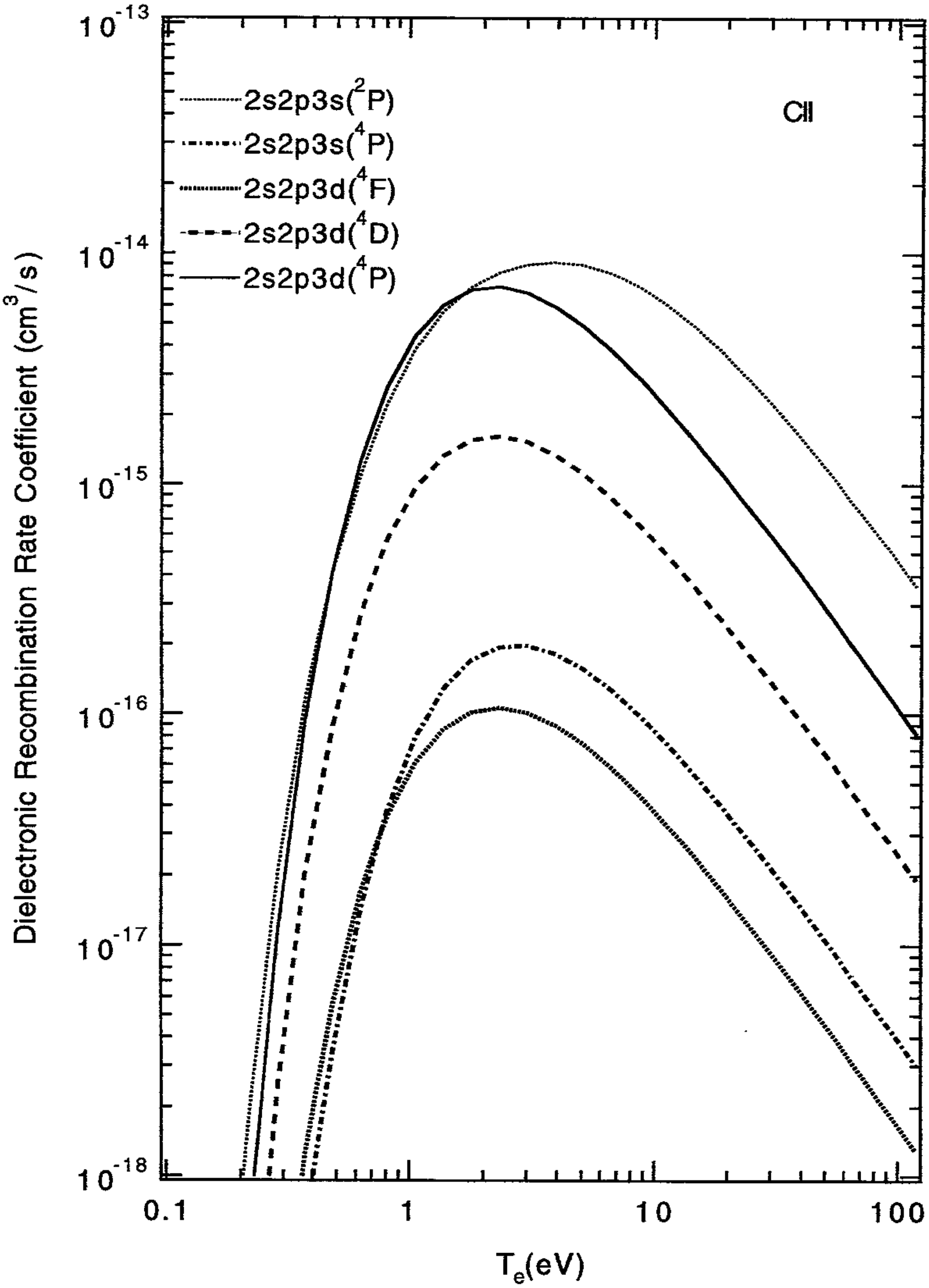
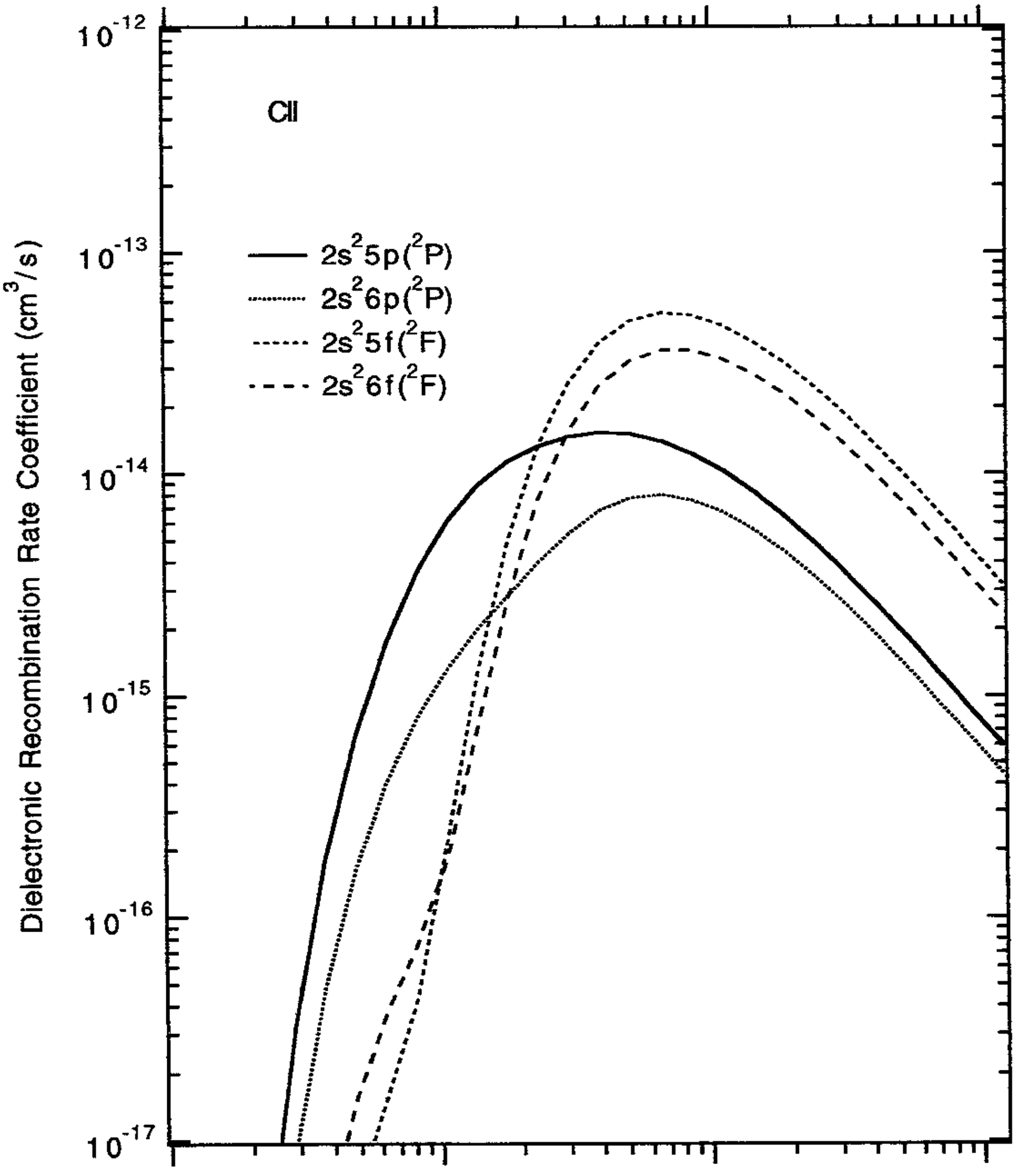

CII
Dielectronic Recombination Rate Coefficient (cm^3/s)
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
0.1
1
10
100
T_e(eV)
$2s^2 2p(^2P)$
$2s^2 3p(^2P)$
$2p^3(^2D)$
$2s^2 4p(^2P)$
$2p^3(^2P)$
$2s^2 4f(^2F)$

Fig. 2(a)



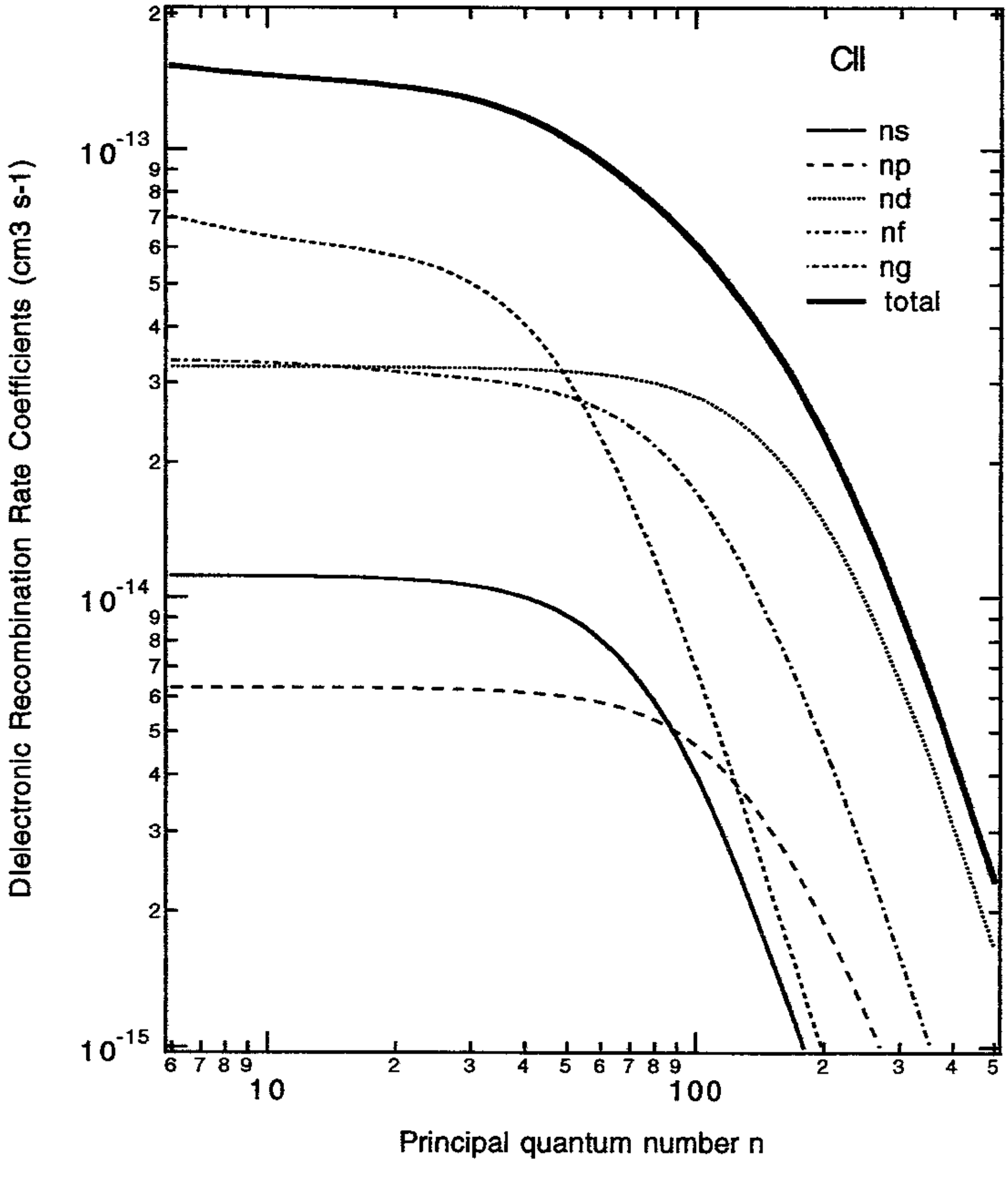
2s2p3s(2P)
2s2p3s(4P)
2s2p3d(4F)
2s2p3d(4D)
2s2p3d(4P)
CII
Dielectronic Recombination Rate Coefficient (cm3/s)
10-13
10-14
10-15
10-16
10-17
10-18
0.1
1
10
100
Te(eV)

Fig. 2(b)



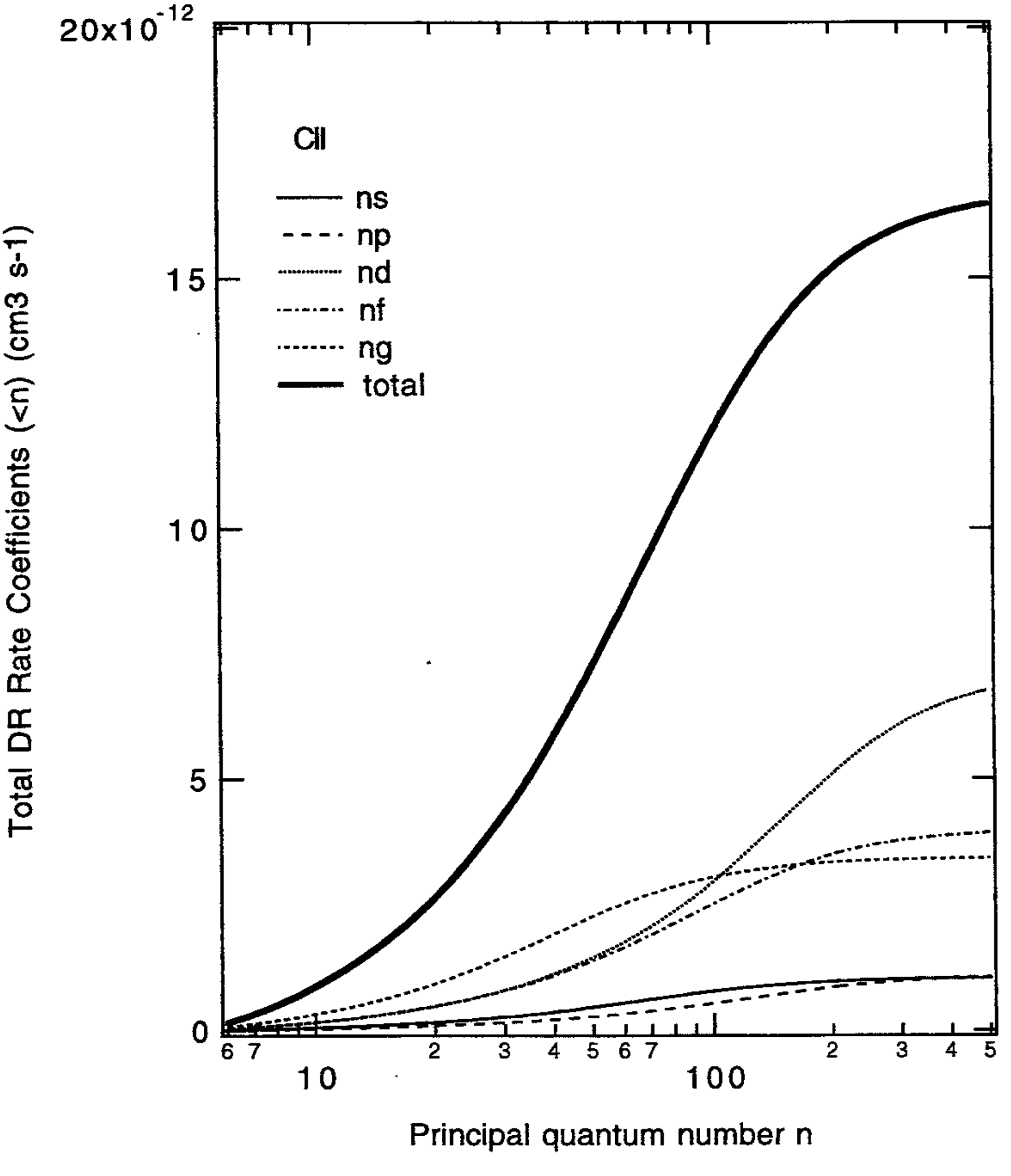
CII
2s^{2}5p(^{2}P)
2s^{2}6p(^{2}P)
2s^{2}5f(^{2}F)
2s^{2}6f(^{2}F)
Dielectronic Recombination Rate Coefficient (cm^3/s)
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
0.1
1
10
100
T$_e$(eV)

Fig. 2(c)



CII
ns
np
nd
nf
ng
total
Dielectronic Recombination Rate Coefficients (cm3 s-1)
Principal quantum number n
10^{-13}
10^{-14}
10^{-15}
10
100

Fig. 3



20x10^-12
15
10
5
0
CII
ns
np
nd
nf
ng
total
Total DR Rate Coefficients (<n) (cm3 s-1)
6 7
2
3
4
5
6 7
2
3
4
5
10
100
Principal quantum number n

Fig. 4

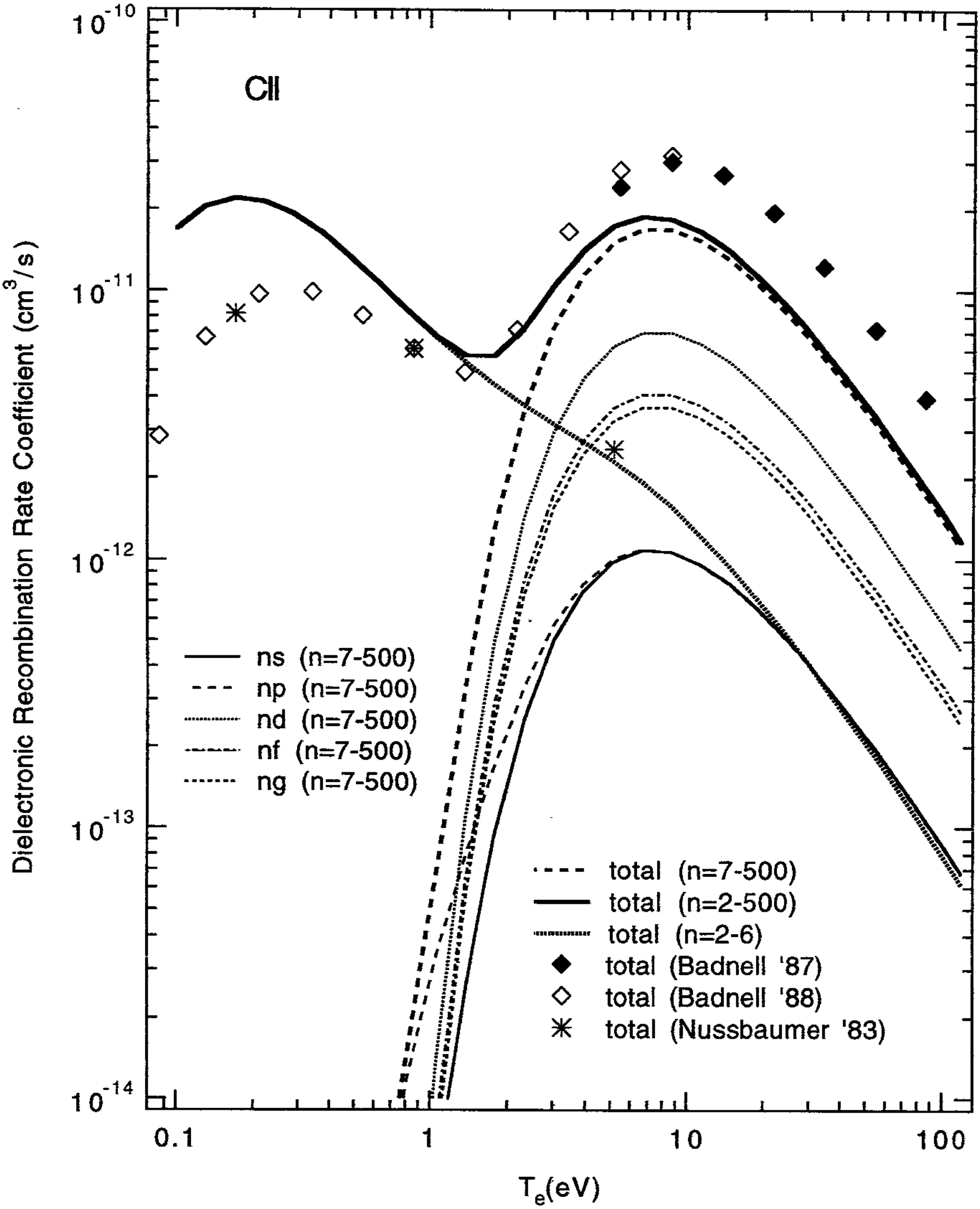

CII
Dielectronic Recombination Rate Coefficient (cm³/s)
10⁻¹⁰
10⁻¹¹
10⁻¹²
10⁻¹³
10⁻¹⁴
0.1
1
10
100
Tₑ(eV)
ns (n=7-500)
np (n=7-500)
nd (n=7-500)
nf (n=7-500)
ng (n=7-500)
total (n=7-500)
total (n=2-500)
total (n=2-6)
total (Badnell '87)
total (Badnell '88)
total (Nussbaumer '83)

Fig. 5

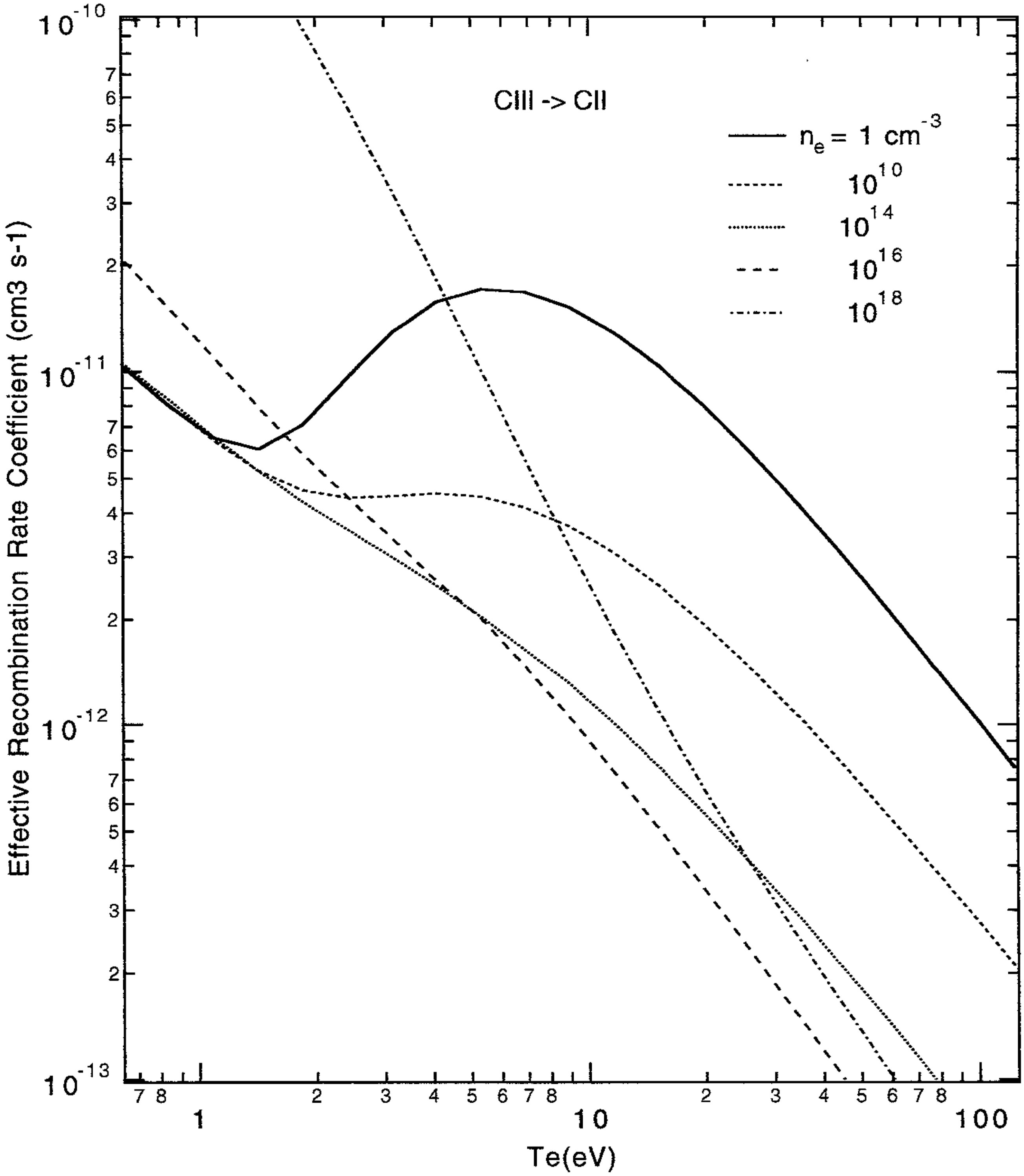

CIII -> CII
n_e = 1 cm^{-3}
10^{10}
10^{14}
10^{16}
10^{18}
Effective Recombination Rate Coefficient (cm3 s-1)
Te(eV)
10^{-10}
10^{-11}
10^{-12}
10^{-13}
1
10
100

FIg. 6

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