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Original scientific paper

ATOMIC DATA ESTIMATION FOR H AND C IV TRANSITIONS IN STRONG GRAVITATION FIELD

L. Č. Popović

Astronomical Observatory Volgina 7, 11160 Belgrade-74, Yugoslavia

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SUMMARY: The gravitational field effect on atomic data for H and C IV transitions are considered as a perturbation of initial and final energy levels. We found that this perturbation increases with the principal quantum number. Here we give several expressions for estimation of this effect and its influence on atomic data parameters. Also, the calculations of atomic data for $1s-2p$ (Ly$_\alpha$) and $2s-3p$ transitions of hydrogen atom as well as atomic data for $2s^2S_{1/2}-2p^2P^0_{1/2,3/2}$ transitions of C IV (1UV) as a function of deformation of energy levels due to gravitation field and gravitational redshift are given. The gravitational field effect should be estimated and should be taken into account in calculation of atomic data for emitters in Broad Line Regions (BLRs) of Active Galactic Nuclei (AGN).

1. INTRODUCTION

One of the effects that can influence electromagnetic radiation of massive objects is the gravitational redshift effect – where emitters are located in strong gravitational field and observed by an observer in weak gravitational field (gravitational redshift effect). This effect can influence the spectral line shapes in spectra of Active Galactic Nuclei (AGNs) (Popović et al. 1994, 1995, Atanacković-Vukmanović et al. 1994, Corbin 1995, 1997) as well as atomic data (Popović 1997, 1999). Recent observations of X-ray emission from Sy1 galaxies obtained by ASCA show that the model which includes rotating or nonrotating black hole (BH) in the center of these objects is appropriate (Nandra et al. 1997). Considering that in some AGNs we can see radiation from Broad Line Region (BLR) that is located several tens of gravitational radii from BH (Corbin 1997), the influence of gravitational field on emitters should be taken into account in modeling of this region (e.g. by including the probability of emitting a line from some parts of the Emission Line Region of AGN).

Also, the radiation from atmospheres of massive white dwarfs may be influenced by gravitational field ($\log g = 6-9$, see e.g. Werner et al. 1991, Greve et al. 1994, Unglaub and Bues 1996, etc.). The influence of gravitational field on chosen energy levels and transition probabilities for modeling of atmospheres of massive white dwarfs has not been considered.

Here we give several expressions for estimation of the influence of the strong gravitational field on atomic data (energy levels, transition probabilities, oscillator and line strengths) for an emitter in strong gravitational field. Moreover, we present calculated atomic data for $1s-2p$ (Ly$_\alpha$) and $2s-3p$ transitions of Hydrogen atom as well as atomic data for $2s^2S_{1/2}-2p^2P^0_{1/2,3/2}$ C IV (1UV) transitions as a function of energy levels deformation due to gravitational field and gravitational redshift.

2. THEORY

The hydrogen atom in strong gravitational field at the level of traditional quantum mechanics theory has been considered in several papers (Thirring 1961, Audretsch and Schäfer 1978, Paker 1980, Parker and Pimentel 1983, Gorbatsievich 1986, Gorbatsievich and Priebe 1989, Hughes 1990). Taking into account perturbation by gravitational field, the Hamilton operator (H) of the atomic electron can be written as (see e.g. Gorbatsievich and Priebe 1989, Hughes 1990)

$$H = H_0 + H_G, \tag{1}$$

where H_0 is the Hamilton operator without influence of gravitational field, H_G is the additional term due to influence of the external gravitational field on the atomic electron. This perturbation causes that the energy E_n of an electron in n state is shifted as (see e.g. Gorbatsievich and Priebe 1989, Hughes 1990, Popović 1997)

$$E_n = E_n^0 + \Delta E_n^G, \tag{2}$$

where E_n^0 is the energy of the electron in n state without influence of gravitational field. The term $\Delta E_{n\ell}^G$ depends on gravitational field magnitude. The derivation of exact expression for this term in Schwarzschild, or Kerr, metric is very complicated and the aim of this paper is not to derive such expressions. Such expressions only for two Hydrogen levels (n=1,2) are given by Gorbatsievich and Priebe (1989) for the case of Kerr metric. Considering that from celestial sources one can measure only gravitational redshift, here we derive the approximative relations which exspress $\Delta E_{n\ell}^G$ as a function of gravitational redshift.

In order to give some quantitative results and derive several equations that can be used for estimation of influence of this effect, here we take into account the assumption that the gravitational redshift has nothing to do with the "weight of photons", but rather it is a consequence of the fact that the energy levels reflect the relativistic time difference which is coupled to the gravitational field (Bell 1987). Concerning this, we assume that

$$\frac{\Delta E_n^G}{E_n} \sim \frac{\Delta\omega}{\omega} = \frac{\omega - \omega_0}{\omega} = z_G, \tag{3}$$

where z_G is gravitational redshift, $\omega_0 = (E_i - E_f)/\hbar$ is the frequency of transition between initial (E_i) and final (E_f) levels, and ω is the shifted frequency due to gravitational field.

Actually, the observer can measure the shifted frequency

$$\omega = \frac{E_i' - E_f'}{\hbar} \tag{4}$$

where E_i' and E_f' are shifted energy levels due to the strong gravitational field. Concerning Eqs. (2), (3), and (4) the gravitational shift can be written as

$$z_G = \frac{E_i' - E_f' - (E_i - E_f)}{E_i' - E_f'} =$$

$$= \frac{E_i' - E_f' - (E_i' - \Delta E_i^G - E_f' + \Delta E_f^G)}{E_i' - E_f'} =$$

$$= -\frac{\Delta E_i^G - \Delta E_f^G}{E_i' - E_f'} \tag{5}$$

where ΔE_i^G and ΔE_f^G are the deviations of the initial and the final levels, respectively.

Considering that for an emitter the gravitational shift is the same for different transitions, for the transitions where one of the levels is the ground state with $E_{GS} = 0$, from the Eq. (5) follows

$$\frac{\Delta E_1^G - \Delta E_{GS}^G}{E_1'} = \frac{\Delta E_2^G - \Delta E_{GS}^G}{E_2'} = ...$$

$$... = \frac{\Delta E_n^G - \Delta E_{GS}^G}{E_n'} = -z_G, \tag{6}$$

where $E_{1,2,..,n}$ are energies of levels for which the transition to ground state, where $E_{GS} \approx 0$ is allowed and ΔE_{GS}^G is the deformation of ground state by the strong gravitational field. From Eq. (6) we can derive a very useful expression for the estimation of levels deformation in strong gravitational field:

$$\Delta E_n^G = \frac{\Delta E_{GS}^G - E_n \cdot z_G}{1 + z_G}. \tag{7}$$

From Eq. (7) we can conclude that $\Delta E_n^G \sim E_n$, so for ground state for all emitters we have that $\Delta E_{GS}^G \approx 0$. Consequently, we have, first that $E_n' < E_n$, for the case where the gravitational field observer is smaller than gravitational field where the emitting source is located, i.e.

$$\Delta E_n^G < 0, \tag{8}$$

and, second, taking into account that

$$\frac{\Delta E_{GS}^G}{E_n} \approx 0,$$

the approximative expression for ΔE_n^G can be written as

$$\Delta E_n^G \approx -\frac{z_G}{1 + z_G} \cdot E_n. \tag{9}$$

According to Eqs. (2) and (9), the energy of shifted energy levels can be estimated as

$$E_n' \approx E_n \frac{1}{1 + z_G}. \tag{10}$$

In order to derive the expressions for calculation of atomic parameters (oscillator strengths, transition probabilities and line strengths) first, we will consider hydrogen atom. In the case of hydrogen atom, the energy of the electron in state n depends on principal quantum number as (see e.g. Sobelman 1992)

$$E_n \sim \frac{1}{n^2}. \qquad (11)$$

Using Eqs. (2) and (11) the energy of the electron in state n in strong gravitational field can be written as

$$E_n' = E_n(1 - |\frac{\Delta E_n^G}{E_n}|) = \frac{Ry}{(n + \delta n)^2}, \qquad (12)$$

where Ry is the Rydberg constant and δn is the principal quantum number defect (QND) due to strong gravitational field.

From Eq. (12) the QND can be written as

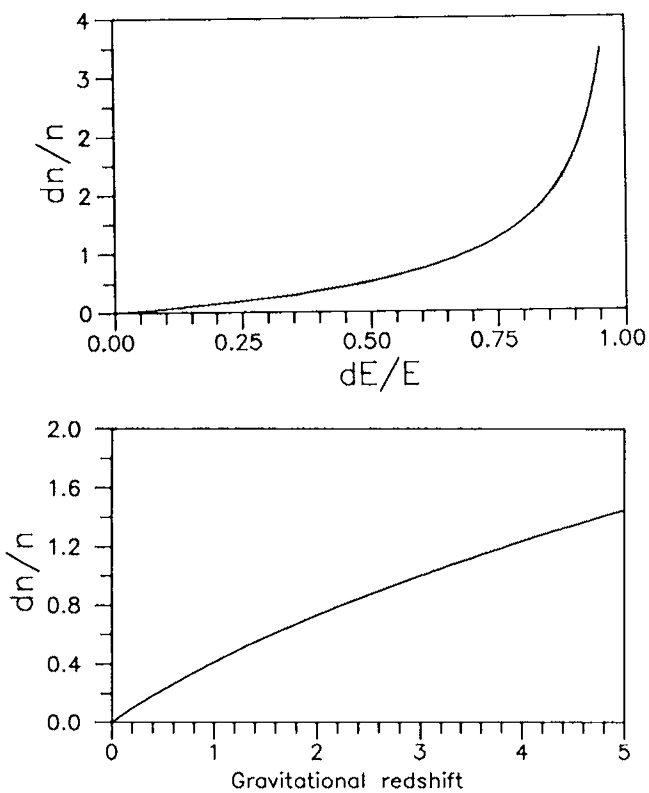

Fig. 1. *Deformation of principal quantum number as a function of $|\Delta E_n^G/E_n|$ (top) (Eq. 13) and gravitational redshift (bottom) (Eq. 14).*

$$\delta n = n \cdot \{\frac{1 - \sqrt{1 - |\frac{\Delta E_n^G}{E_n}|}}{\sqrt{1 - |\frac{\Delta E_n^G}{E_n}|}}\}. \qquad (13)$$

If we take into account the approximation in Eq. (9) the QND can be written as

$$\delta n = n \cdot \{\sqrt{1 + z_G} - 1\}, \qquad (14)$$

or the expression for the principal quantum number in gravitational field (n') is

$$n' = n \cdot \sqrt{1 + z_G}. \qquad (15)$$

In Fig. 1 we present the relative value of the quantum number ($\delta n/n$) as a function of $|\frac{\Delta E_n^G}{E_n}|$ and gravitational redshift, respecitevly. As one can see from Figs. 1a and 1b the QND due to strong gravitational field depends on the principal quantum number as well as the magnitude of the gravitation field, and sometimes this defect should be taken into account only for transitions from higher levels, when transitions from lower levels may be neglected. Also, in the case of transitions from higher levels (with higher energy) we can use Eqs. (9), (10) and (14) for taking into account the strong gravitational field effect in calculation of atomic data if the gravitational redshift is known.

3. METHOD OF CALCULATION

Generally, the deformation of energy levels due to strong gravitational field can be included in a method for atomic data calculation by using given expressions (Eqs. 2, 9, 10 and 14) for energy levels and principal quantum number. In order to give a quantitative result, here we will use the Coulomb approximation (Bates and Damgaard 1949, Oertel and Shomo 1968). Then for the line strength we can write

$$S = \frac{2J + 1}{a_0^2} \cdot \Re_{n,\ell}^2,$$

where $\Re_{n,\ell}$ is the matrix element for dipole transition and in the calculation of matrix element ($\Re_{n\ell}$) we take into account the deformation of the levels due to strong gravitational field as

$$\Re_{n\ell} \to \Re_{(n+\delta n)\ell}, \qquad (16)$$

where δn is taken from Eq. (14).

In the case of non-Hydrogen emitters, considering effective quantum number $- n_{eff}$ (see e.g. Griem 1974) we can obtain expression for effective quantum number in the case of gravitational field influence (n'_{eff}) as

$$n'_{eff} = n_{eff} \cdot \sqrt{1 + z_G} = Z \cdot \sqrt{\frac{E_H}{I - E_n} \cdot (1 + z_G)}. \qquad (18)$$

where E_H is ionization energy of Hydrogen atom, I is ionization energy of the emitter, and Z is the nuclear (or core) charge of the emitter (for neutrals Z=1, for single ionized Z=2, etc.).

4. RESULTS AND DISCUSSION

Using Coulomb approximation (Bates and Damgaard 1949, Oertel and Shomo 1968) and taking into account the deformation of the energy levels due to the gravitational field influence (Eqs. 1-15), we have calculated the atomic data for $1s - 2p$ (Ly$_\alpha$) and $2s-3p$ transitions of hydrogen atom as well as atomic data for $2s^2S_{1/2} - 2p^2P^0_{1/2,3/2}$ C IV transitions as a function of $|\Delta E_n^{GS}/E_n|$ and z_G. The data needed for the calculations were taken from Moore (1971) and Wiese et al. (1966). The results are presented in Tables 1 – 3 and Fig. 2. As one can see from Figs. 1 and 2, the deformation of the energy levels in strong gravitational field may be very important, especially in the case of higher levels. This deformation depends on principal quantum numbers (see Eqs. 13–15 and 17). If we have transition between levels from higher series (with large principal quantum number) we can expect that deformation of the levels will be higher, and this effect may be important for relatively weak gravitational fields (e.g. in atmospheres of massive white dwarfs).

The deformation of energy levels influences the atomic data (Tables 1-3 and Fig. 2). Generally, the transition probabilities for all considered transitions (see Fig. 2) are smaller (for z_G=0) when the gravitational field influence has been included. Also, it is interesting that for some values of $|\Delta E_n^{GS}/E_n|$ transition probabilities, oscillator and line strength for $s-p$ transitions of hydrogen atom are too small, i.e. the minimums are present (see Figs. 2 and Tables 1–3). This is not the case for $2s-2p$ transitions of C IV.

In Tables 1 – 3, the atomic data are given (line

bilities) as a function of gravitational redshift (z_G). As we can see from Tables 1 – 3 the Ly$_\alpha$ is more sensitive to the gravitational field than the resonant lines of C IV. Also, we can see that line and oscillator strengths of C IV resonant lines increase with gravitational field strength.

In the case of AGNs the gravitational effect should be considered, especially in modeling of BLR of these objects. If we take that in some cases the average distance of BLR from center of a Black Hole is about several tens of the corresponding gravitational radii (Corbin 1997), our results show that at this distances atomic data may be significantly different from data calculated without gravitational field influence. For example, if we suppose that in this case $|\Delta E_n^{GS}/E_n| \approx 0.05 \approx z_G(=0.0526)$ we have for Ly$_\alpha$ that $A_{ki}/A^0_{ki} = 0.797$ f_{ik}/f^0_{ik}=0.895 and S/S^0=0.946 and for $\lambda = 1550.77$ Å of C IV A_{ki}/A^0_{ki}=0.959 f_{ik}/f^0_{ik} =1.076 and S/S^0=1.135.

As one can see, taking into account the gravitational field influence may significantly change the atomic data and if it is not taken into account we can obtain wrong conclusions about e.g. element abundances, gas density etc. Consequently, we suggest that the gravitational field effect should be estimated and, if not negligible, taken into account in atomic data calculation for emitters in gravitational field of AGNs, especially for transitions between lev-

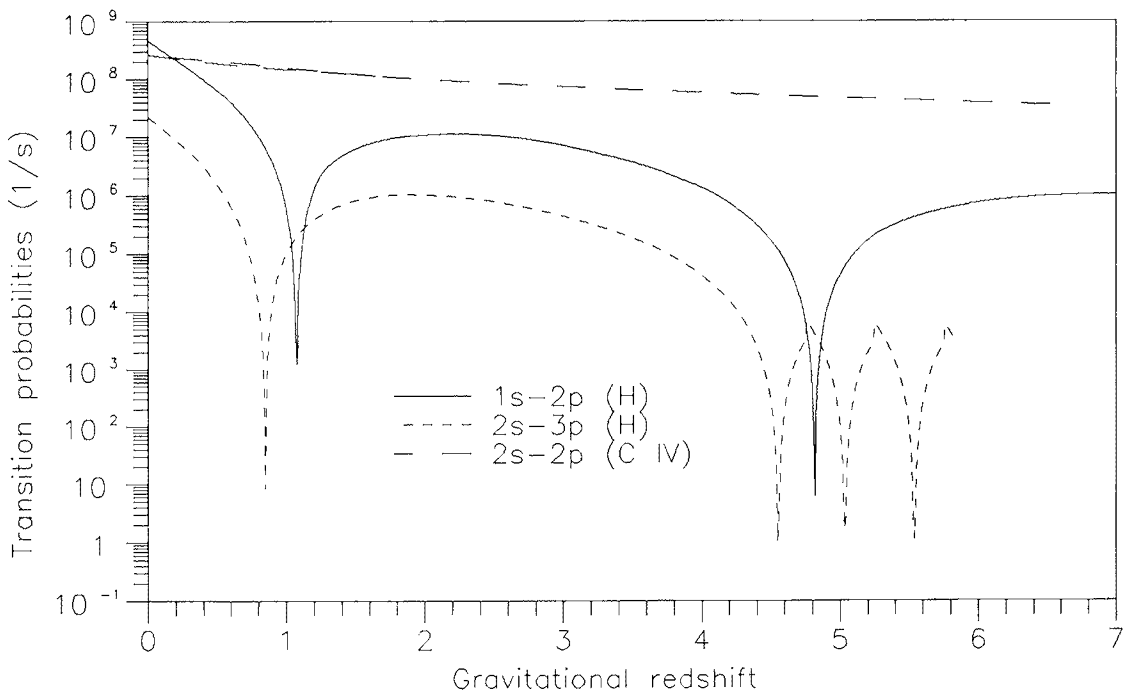

Fig. 2. *Transition probabilities for $1s-2p$ and $2s-3p$ trasitions of hydrogen atom and the resonant C IV line ($2s^2S_{1/2} - 2p^2P^0_{1/2}$) as a function of gravitational redshift.*

Table 1. The line strength (in atomic units), oscillator strength and transition probability for Ly_α as a function of gravitational potential difference. The values of the parameters where the effect of gravitational field is not taken into account are: S =3.330 at.u. f_{ik} =0.4162 A_{ki}=4.699E+08 sec^{-1}

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.918E+00	0.4698E+00	0.4804E-02	0.3633E+05
0.916E+00	0.1576E+00	0.1650E-02	0.1308E+05
0.914E+00	0.1320E-01	0.1415E-03	0.1176E+04
0.912E+00	0.2653E-01	0.2911E-03	0.2532E+04
0.910E+00	0.1825E+00	0.2048E-02	0.1865E+05
0.908E+00	0.4572E+00	0.5248E-02	0.4998E+05
0.906E+00	0.8437E+00	0.9902E-02	0.9860E+05
0.904E+00	0.1253E+01	0.1503E-01	0.1564E+06
0.902E+00	0.1674E+01	0.2053E-01	0.2231E+06
0.900E+00	0.2119E+01	0.2655E-01	0.3013E+06
0.898E+00	0.2520E+01	0.3225E-01	0.3818E+06
0.895E+00	0.2871E+01	0.3752E-01	0.4634E+06
0.893E+00	0.3185E+01	0.4251E-01	0.5474E+06
0.891E+00	0.3467E+01	0.4723E-01	0.6339E+06
0.889E+00	0.3708E+01	0.5156E-01	0.7208E+06
0.886E+00	0.3895E+01	0.5527E-01	0.8046E+06
0.884E+00	0.3995E+01	0.5784E-01	0.8764E+06
0.882E+00	0.4016E+01	0.5930E-01	0.9350E+06
0.879E+00	0.3981E+01	0.5995E-01	0.9831E+06
0.877E+00	0.3880E+01	0.5958E-01	0.1016E+07
0.875E+00	0.3716E+01	0.5818E-01	0.1031E+07
0.872E+00	0.3502E+01	0.5589E-01	0.1029E+07
0.870E+00	0.3257E+01	0.5297E-01	0.1013E+07
0.867E+00	0.2978E+01	0.4936E-01	0.9800E+06
0.865E+00	0.2694E+01	0.4548E-01	0.9372E+06
0.862E+00	0.2400E+01	0.4127E-01	0.8825E+06
0.860E+00	0.2107E+01	0.3690E-01	0.8185E+06
0.857E+00	0.1816E+01	0.3239E-01	0.7450E+06
0.855E+00	0.1534E+01	0.2786E-01	0.6643E+06
0.852E+00	0.1267E+01	0.2343E-01	0.5790E+06
0.849E+00	0.1020E+01	0.1920E-01	0.4914E+06
0.847E+00	0.7966E+00	0.1526E-01	0.4045E+06
0.844E+00	0.5988E+00	0.1167E-01	0.3204E+06
0.841E+00	0.4282E+00	0.8489E-02	0.2413E+06
0.839E+00	0.2719E+00	0.5485E-02	0.1613E+06
0.836E+00	0.1431E+00	0.2935E-02	0.8930E+05
0.833E+00	0.5620E-01	0.1173E-02	0.3691E+05
0.830E+00	0.9671E-02	0.2052E-03	0.6678E+04
0.827E+00	0.1417E-02	0.3058E-04	0.1029E+04
0.824E+00	0.2987E-01	0.6552E-03	0.2278E+05
0.822E+00	0.9278E-01	0.2068E-02	0.7432E+05
0.819E+00	0.1862E+00	0.4220E-02	0.1566E+06
0.816E+00	0.3066E+00	0.7060E-02	0.2707E+06
0.813E+00	0.4503E+00	0.1054E-01	0.4171E+06
0.810E+00	0.6169E+00	0.1467E-01	0.5993E+06
0.807E+00	0.8031E+00	0.1940E-01	0.8181E+06
0.804E+00	0.1001E+01	0.2457E-01	0.1069E+07

Table 1. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.801E+00	0.1183E+01	0.2947E-01	0.1323E+07
0.797E+00	0.1351E+01	0.3420E-01	0.1583E+07
0.794E+00	0.1520E+01	0.3906E-01	0.1865E+07
0.791E+00	0.1704E+01	0.4447E-01	0.2189E+07
0.788E+00	0.1885E+01	0.4994E-01	0.2533E+07
0.785E+00	0.2054E+01	0.5524E-01	0.2888E+07
0.782E+00	0.2211E+01	0.6036E-01	0.3251E+07
0.778E+00	0.2358E+01	0.6532E-01	0.3624E+07
0.775E+00	0.2494E+01	0.7012E-01	0.4007E+07
0.772E+00	0.2621E+01	0.7478E-01	0.4399E+07
0.768E+00	0.2743E+01	0.7939E-01	0.4809E+07
0.765E+00	0.2860E+01	0.8399E-01	0.5236E+07
0.762E+00	0.2972E+01	0.8852E-01	0.5678E+07
0.758E+00	0.3076E+01	0.9295E-01	0.6134E+07
0.755E+00	0.3173E+01	0.9724E-01	0.6601E+07
0.751E+00	0.3261E+01	0.1014E+00	0.7077E+07
0.748E+00	0.3331E+01	0.1050E+00	0.7535E+07
0.744E+00	0.3378E+01	0.1079E+00	0.7966E+07
0.741E+00	0.3408E+01	0.1104E+00	0.8375E+07
0.737E+00	0.3422E+01	0.1124E+00	0.8762E+07
0.734E+00	0.3421E+01	0.1139E+00	0.9124E+07
0.730E+00	0.3407E+01	0.1149E+00	0.9460E+07
0.726E+00	0.3380E+01	0.1156E+00	0.9770E+07
0.723E+00	0.3343E+01	0.1159E+00	0.1006E+08
0.719E+00	0.3307E+01	0.1161E+00	0.1035E+08
0.715E+00	0.3257E+01	0.1159E+00	0.1060E+08
0.711E+00	0.3196E+01	0.1152E+00	0.1082E+08
0.708E+00	0.3125E+01	0.1141E+00	0.1100E+08
0.704E+00	0.3045E+01	0.1126E+00	0.1114E+08
0.700E+00	0.2958E+01	0.1108E+00	0.1124E+08
0.696E+00	0.2864E+01	0.1087E+00	0.1131E+08
0.692E+00	0.2766E+01	0.1063E+00	0.1134E+08
0.689E+00	0.2669E+01	0.1038E+00	0.1136E+08
0.685E+00	0.2569E+01	0.1012E+00	0.1135E+08
0.681E+00	0.2464E+01	0.9829E-01	0.1130E+08
0.677E+00	0.2356E+01	0.9514E-01	0.1121E+08
0.673E+00	0.2248E+01	0.9188E-01	0.1110E+08
0.669E+00	0.2149E+01	0.8889E-01	0.1100E+08
0.665E+00	0.2048E+01	0.8577E-01	0.1087E+08
0.661E+00	0.1948E+01	0.8255E-01	0.1072E+08
0.657E+00	0.1848E+01	0.7924E-01	0.1053E+08
0.653E+00	0.1750E+01	0.7595E-01	0.1034E+08
0.649E+00	0.1657E+01	0.7274E-01	0.1013E+08
0.644E+00	0.1563E+01	0.6944E-01	0.9903E+07
0.640E+00	0.1471E+01	0.6608E-01	0.9644E+07
0.636E+00	0.1379E+01	0.6268E-01	0.9360E+07
0.632E+00	0.1289E+01	0.5926E-01	0.9053E+07
0.628E+00	0.1201E+01	0.5583E-01	0.8725E+07
0.624E+00	0.1115E+01	0.5242E-01	0.8379E+07
0.619E+00	0.1032E+01	0.4905E-01	0.8016E+07

Table 1. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.615E+00	0.9509E+00	0.4572E-01	0.7640E+07
0.611E+00	0.8733E+00	0.4245E-01	0.7252E+07
0.607E+00	0.8003E+00	0.3933E-01	0.6867E+07
0.602E+00	0.7309E+00	0.3631E-01	0.6479E+07
0.598E+00	0.6642E+00	0.3336E-01	0.6082E+07
0.594E+00	0.6005E+00	0.3048E-01	0.5678E+07
0.589E+00	0.5398E+00	0.2769E-01	0.5270E+07
0.585E+00	0.4823E+00	0.2500E-01	0.4859E+07
0.581E+00	0.4280E+00	0.2242E-01	0.4450E+07
0.576E+00	0.3770E+00	0.1996E-01	0.4044E+07
0.572E+00	0.3293E+00	0.1762E-01	0.3645E+07
0.567E+00	0.2851E+00	0.1541E-01	0.3253E+07
0.563E+00	0.2442E+00	0.1333E-01	0.2873E+07
0.559E+00	0.2067E+00	0.1140E-01	0.2507E+07
0.554E+00	0.1680E+00	0.9362E-02	0.2101E+07
0.550E+00	0.1262E+00	0.7100E-02	0.1625E+07
0.545E+00	0.9078E-01	0.5159E-02	0.1204E+07
0.541E+00	0.6160E-01	0.3536E-02	0.8419E+06
0.536E+00	0.3840E-01	0.2225E-02	0.5404E+06
0.532E+00	0.2091E-01	0.1223E-02	0.3029E+06
0.527E+00	0.8854E-02	0.5231E-03	0.1320E+06
0.523E+00	0.1979E-02	0.1181E-03	0.3037E+05
0.518E+00	0.1775E-04	0.1069E-05	0.2802E+03
0.513E+00	0.2705E-02	0.1644E-03	0.4392E+05
0.509E+00	0.9780E-02	0.6001E-03	0.1633E+06
0.504E+00	0.2099E-01	0.1300E-02	0.3603E+06
0.500E+00	0.3607E-01	0.2254E-02	0.6365E+06
0.495E+00	0.5478E-01	0.3455E-02	0.9935E+06
0.491E+00	0.7688E-01	0.4893E-02	0.1433E+07
0.486E+00	0.1020E+00	0.6548E-02	0.1952E+07
0.481E+00	0.1299E+00	0.8419E-02	0.2555E+07
0.477E+00	0.1606E+00	0.1050E-01	0.3243E+07
0.472E+00	0.1937E+00	0.1278E-01	0.4016E+07
0.468E+00	0.2292E+00	0.1524E-01	0.4876E+07
0.463E+00	0.2667E+00	0.1790E-01	0.5824E+07
0.458E+00	0.3062E+00	0.2072E-01	0.6860E+07
0.454E+00	0.3474E+00	0.2371E-01	0.7984E+07
0.449E+00	0.3902E+00	0.2686E-01	0.9197E+07
0.444E+00	0.4344E+00	0.3015E-01	0.1050E+08
0.440E+00	0.4799E+00	0.3358E-01	0.1189E+08
0.435E+00	0.5265E+00	0.3715E-01	0.1337E+08
0.431E+00	0.5741E+00	0.4084E-01	0.1494E+08
0.426E+00	0.6226E+00	0.4465E-01	0.1660E+08
0.421E+00	0.6717E+00	0.4856E-01	0.1835E+08
0.417E+00	0.7215E+00	0.5258E-01	0.2018E+08
0.412E+00	0.7718E+00	0.5669E-01	0.2211E+08
0.407E+00	0.8224E+00	0.6088E-01	0.2412E+08
0.403E+00	0.8733E+00	0.6515E-01	0.2621E+08
0.398E+00	0.9244E+00	0.6949E-01	0.2839E+08
0.394E+00	0.9756E+00	0.7390E-01	0.3066E+08
0.389E+00	0.1027E+01	0.7837E-01	0.3301E+08

Table 1. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.384E+00	0.1078E+01	0.8290E-01	0.3544E+08
0.380E+00	0.1129E+01	0.8748E-01	0.3796E+08
0.375E+00	0.1180E+01	0.9210E-01	0.4056E+08
0.371E+00	0.1231E+01	0.9676E-01	0.4324E+08
0.366E+00	0.1281E+01	0.1014E+00	0.4600E+08
0.362E+00	0.1331E+01	0.1062E+00	0.4883E+08
0.357E+00	0.1373E+01	0.1103E+00	0.5147E+08
0.352E+00	0.1411E+01	0.1142E+00	0.5403E+08
0.348E+00	0.1449E+01	0.1181E+00	0.5666E+08
0.343E+00	0.1487E+01	0.1220E+00	0.5936E+08
0.339E+00	0.1524E+01	0.1259E+00	0.6211E+08
0.334E+00	0.1561E+01	0.1299E+00	0.6493E+08
0.330E+00	0.1598E+01	0.1338E+00	0.6782E+08
0.325E+00	0.1634E+01	0.1378E+00	0.7076E+08
0.321E+00	0.1670E+01	0.1417E+00	0.7377E+08
0.316E+00	0.1706E+01	0.1457E+00	0.7684E+08
0.312E+00	0.1741E+01	0.1497E+00	0.7997E+08
0.307E+00	0.1776E+01	0.1537E+00	0.8316E+08
0.303E+00	0.1812E+01	0.1578E+00	0.8650E+08
0.299E+00	0.1849E+01	0.1621E+00	0.8996E+08
0.294E+00	0.1886E+01	0.1663E+00	0.9345E+08
0.290E+00	0.1921E+01	0.1704E+00	0.9700E+08
0.285E+00	0.1956E+01	0.1746E+00	0.1006E+09
0.281E+00	0.1990E+01	0.1787E+00	0.1042E+09
0.277E+00	0.2023E+01	0.1828E+00	0.1079E+09
0.272E+00	0.2055E+01	0.1868E+00	0.1116E+09
0.268E+00	0.2087E+01	0.1908E+00	0.1154E+09
0.264E+00	0.2118E+01	0.1948E+00	0.1191E+09
0.260E+00	0.2149E+01	0.1988E+00	0.1230E+09
0.255E+00	0.2179E+01	0.2027E+00	0.1269E+09
0.251E+00	0.2208E+01	0.2066E+00	0.1308E+09
0.247E+00	0.2236E+01	0.2104E+00	0.1347E+09
0.243E+00	0.2264E+01	0.2143E+00	0.1387E+09
0.238E+00	0.2292E+01	0.2181E+00	0.1427E+09
0.234E+00	0.2319E+01	0.2218E+00	0.1468E+09
0.230E+00	0.2345E+01	0.2255E+00	0.1509E+09
0.226E+00	0.2371E+01	0.2292E+00	0.1550E+09
0.222E+00	0.2396E+01	0.2329E+00	0.1591E+09
0.218E+00	0.2420E+01	0.2365E+00	0.1633E+09
0.214E+00	0.2445E+01	0.2402E+00	0.1675E+09
0.210E+00	0.2468E+01	0.2437E+00	0.1718E+09
0.206E+00	0.2491E+01	0.2473E+00	0.1761E+09
0.202E+00	0.2514E+01	0.2508E+00	0.1804E+09
0.198E+00	0.2536E+01	0.2543E+00	0.1847E+09
0.194E+00	0.2558E+01	0.2577E+00	0.1891E+09
0.190E+00	0.2580E+01	0.2611E+00	0.1935E+09
0.186E+00	0.2601E+01	0.2645E+00	0.1979E+09
0.182E+00	0.2621E+01	0.2679E+00	0.2023E+09
0.178E+00	0.2641E+01	0.2712E+00	0.2068E+09
0.174E+00	0.2661E+01	0.2746E+00	0.2113E+09
0.170E+00	0.2679E+01	0.2776E+00	0.2156E+09

Table 1. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.167E+00	0.2695E+01	0.2807E+00	0.2200E+09
0.163E+00	0.2712E+01	0.2837E+00	0.2244E+09
0.159E+00	0.2729E+01	0.2867E+00	0.2288E+09
0.155E+00	0.2746E+01	0.2898E+00	0.2333E+09
0.152E+00	0.2762E+01	0.2928E+00	0.2378E+09
0.148E+00	0.2778E+01	0.2958E+00	0.2423E+09
0.144E+00	0.2795E+01	0.2988E+00	0.2469E+09
0.141E+00	0.2810E+01	0.3018E+00	0.2515E+09
0.137E+00	0.2826E+01	0.3047E+00	0.2561E+09
0.133E+00	0.2842E+01	0.3077E+00	0.2607E+09
0.130E+00	0.2857E+01	0.3106E+00	0.2654E+09
0.126E+00	0.2873E+01	0.3135E+00	0.2700E+09
0.123E+00	0.2888E+01	0.3164E+00	0.2747E+09
0.119E+00	0.2902E+01	0.3193E+00	0.2794E+09
0.116E+00	0.2917E+01	0.3222E+00	0.2842E+09
0.112E+00	0.2931E+01	0.3250E+00	0.2889E+09
0.109E+00	0.2946E+01	0.3279E+00	0.2937E+09
0.106E+00	0.2960E+01	0.3307E+00	0.2984E+09
0.102E+00	0.2973E+01	0.3335E+00	0.3032E+09
0.990E-01	0.2987E+01	0.3362E+00	0.3080E+09
0.957E-01	0.3000E+01	0.3390E+00	0.3127E+09
0.925E-01	0.3013E+01	0.3417E+00	0.3175E+09
0.892E-01	0.3026E+01	0.3444E+00	0.3223E+09
0.860E-01	0.3039E+01	0.3470E+00	0.3271E+09
0.828E-01	0.3052E+01	0.3497E+00	0.3319E+09
0.797E-01	0.3064E+01	0.3523E+00	0.3367E+09
0.765E-01	0.3076E+01	0.3549E+00	0.3415E+09
0.734E-01	0.3088E+01	0.3574E+00	0.3462E+09
0.704E-01	0.3099E+01	0.3599E+00	0.3510E+09
0.673E-01	0.3110E+01	0.3624E+00	0.3558E+09
0.643E-01	0.3122E+01	0.3649E+00	0.3605E+09
0.613E-01	0.3133E+01	0.3674E+00	0.3653E+09
0.583E-01	0.3143E+01	0.3698E+00	0.3700E+09
0.554E-01	0.3154E+01	0.3722E+00	0.3747E+09
0.525E-01	0.3164E+01	0.3745E+00	0.3794E+09
0.496E-01	0.3174E+01	0.3769E+00	0.3841E+09
0.468E-01	0.3184E+01	0.3792E+00	0.3887E+09
0.440E-01	0.3193E+01	0.3814E+00	0.3934E+09
0.412E-01	0.3203E+01	0.3837E+00	0.3980E+09
0.384E-01	0.3212E+01	0.3859E+00	0.4026E+09
0.357E-01	0.3221E+01	0.3881E+00	0.4072E+09
0.330E-01	0.3230E+01	0.3902E+00	0.4117E+09
0.303E-01	0.3238E+01	0.3923E+00	0.4162E+09
0.277E-01	0.3247E+01	0.3944E+00	0.4207E+09
0.251E-01	0.3255E+01	0.3964E+00	0.4251E+09
0.226E-01	0.3263E+01	0.3984E+00	0.4295E+09
0.201E-01	0.3271E+01	0.4004E+00	0.4338E+09
0.176E-01	0.3278E+01	0.4023E+00	0.4381E+09
0.152E-01	0.3285E+01	0.4042E+00	0.4423E+09
0.129E-01	0.3292E+01	0.4060E+00	0.4465E+09
0.106E-01	0.3299E+01	0.4078E+00	0.4505E+09

Table 1. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.836E-02	0.3306E+01	0.4095E+00	0.4544E+09
0.626E-02	0.3312E+01	0.4111E+00	0.4581E+09
0.430E-02	0.3317E+01	0.4126E+00	0.4616E+09
0.256E-02	0.3322E+01	0.4140E+00	0.4647E+09
0.117E-02	0.3326E+01	0.4150E+00	0.4672E+09
0.300E-03	0.3328E+01	0.4157E+00	0.4688E+09
0.213E-04	0.3329E+01	0.4159E+00	0.4693E+09
0.967E-07	0.3329E+01	0.4159E+00	0.4693E+09

Table 2. Same as in Table 1, but for $\lambda = 1548.2$ Åof C IV.

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.920E+00	0.2603E+03	0.2041E+01	0.1814E+08
0.918E+00	0.2508E+03	0.2014E+01	0.1878E+08
0.916E+00	0.2417E+03	0.1987E+01	0.1943E+08
0.914E+00	0.2329E+03	0.1961E+01	0.2008E+08
0.912E+00	0.2245E+03	0.1934E+01	0.2075E+08
0.910E+00	0.2165E+03	0.1908E+01	0.2142E+08
0.908E+00	0.2088E+03	0.1882E+01	0.2210E+08
0.906E+00	0.2015E+03	0.1857E+01	0.2280E+08
0.904E+00	0.1945E+03	0.1832E+01	0.2351E+08
0.902E+00	0.1877E+03	0.1808E+01	0.2423E+08
0.900E+00	0.1813E+03	0.1784E+01	0.2496E+08
0.898E+00	0.1751E+03	0.1760E+01	0.2570E+08
0.895E+00	0.1692E+03	0.1736E+01	0.2644E+08
0.893E+00	0.1635E+03	0.1713E+01	0.2720E+08
0.891E+00	0.1579E+03	0.1689E+01	0.2795E+08
0.889E+00	0.1525E+03	0.1665E+01	0.2870E+08
0.886E+00	0.1473E+03	0.1641E+01	0.2946E+08
0.884E+00	0.1423E+03	0.1618E+01	0.3023E+08
0.882E+00	0.1375E+03	0.1595E+01	0.3100E+08
0.879E+00	0.1329E+03	0.1572E+01	0.3178E+08
0.877E+00	0.1285E+03	0.1549E+01	0.3257E+08
0.875E+00	0.1242E+03	0.1527E+01	0.3337E+08
0.872E+00	0.1201E+03	0.1506E+01	0.3418E+08
0.870E+00	0.1163E+03	0.1485E+01	0.3502E+08
0.867E+00	0.1126E+03	0.1465E+01	0.3587E+08
0.865E+00	0.1090E+03	0.1445E+01	0.3672E+08
0.862E+00	0.1055E+03	0.1425E+01	0.3758E+08
0.860E+00	0.1022E+03	0.1406E+01	0.3846E+08
0.857E+00	0.9903E+02	0.1387E+01	0.3934E+08
0.855E+00	0.9594E+02	0.1368E+01	0.4022E+08
0.852E+00	0.9297E+02	0.1350E+01	0.4112E+08
0.849E+00	0.9010E+02	0.1331E+01	0.4203E+08
0.847E+00	0.8733E+02	0.1313E+01	0.4294E+08
0.844E+00	0.8461E+02	0.1295E+01	0.4383E+08
0.841E+00	0.8197E+02	0.1276E+01	0.4472E+08
0.839E+00	0.7942E+02	0.1258E+01	0.4562E+08
0.836E+00	0.7696E+02	0.1240E+01	0.4652E+08

Table 2. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.833E+00	0.7459E+02	0.1222E+01	0.4743E+08
0.830E+00	0.7231E+02	0.1205E+01	0.4835E+08
0.827E+00	0.7011E+02	0.1188E+01	0.4927E+08
0.824E+00	0.6798E+02	0.1171E+01	0.5020E+08
0.822E+00	0.6594E+02	0.1154E+01	0.5115E+08
0.819E+00	0.6397E+02	0.1138E+01	0.5209E+08
0.816E+00	0.6206E+02	0.1122E+01	0.5305E+08
0.813E+00	0.6023E+02	0.1107E+01	0.5402E+08
0.810E+00	0.5845E+02	0.1091E+01	0.5499E+08
0.807E+00	0.5679E+02	0.1077E+01	0.5601E+08
0.804E+00	0.5519E+02	0.1063E+01	0.5705E+08
0.801E+00	0.5363E+02	0.1049E+01	0.5809E+08
0.797E+00	0.5213E+02	0.1036E+01	0.5914E+08
0.794E+00	0.5068E+02	0.1023E+01	0.6020E+08
0.791E+00	0.4927E+02	0.1009E+01	0.6127E+08
0.788E+00	0.4791E+02	0.9966E+00	0.6234E+08
0.785E+00	0.4659E+02	0.9838E+00	0.6342E+08
0.782E+00	0.4532E+02	0.9713E+00	0.6451E+08
0.778E+00	0.4409E+02	0.9590E+00	0.6561E+08
0.775E+00	0.4289E+02	0.9469E+00	0.6671E+08
0.772E+00	0.4174E+02	0.9349E+00	0.6782E+08
0.768E+00	0.4062E+02	0.9231E+00	0.6894E+08
0.765E+00	0.3953E+02	0.9115E+00	0.7007E+08
0.762E+00	0.3848E+02	0.9001E+00	0.7120E+08
0.758E+00	0.3745E+02	0.8886E+00	0.7232E+08
0.755E+00	0.3643E+02	0.8765E+00	0.7338E+08
0.751E+00	0.3543E+02	0.8647E+00	0.7444E+08
0.748E+00	0.3447E+02	0.8530E+00	0.7552E+08
0.744E+00	0.3354E+02	0.8415E+00	0.7659E+08
0.741E+00	0.3264E+02	0.8303E+00	0.7768E+08
0.737E+00	0.3177E+02	0.8192E+00	0.7876E+08
0.734E+00	0.3093E+02	0.8084E+00	0.7986E+08
0.730E+00	0.3011E+02	0.7977E+00	0.8096E+08
0.726E+00	0.2932E+02	0.7872E+00	0.8206E+08
0.723E+00	0.2855E+02	0.7769E+00	0.8317E+08
0.719E+00	0.2781E+02	0.7668E+00	0.8428E+08
0.715E+00	0.2709E+02	0.7568E+00	0.8540E+08
0.711E+00	0.2640E+02	0.7471E+00	0.8652E+08
0.708E+00	0.2572E+02	0.7374E+00	0.8765E+08
0.704E+00	0.2507E+02	0.7280E+00	0.8878E+08
0.700E+00	0.2443E+02	0.7187E+00	0.8992E+08
0.696E+00	0.2382E+02	0.7096E+00	0.9106E+08
0.692E+00	0.2322E+02	0.7006E+00	0.9221E+08
0.689E+00	0.2264E+02	0.6918E+00	0.9335E+08
0.685E+00	0.2209E+02	0.6833E+00	0.9453E+08
0.681E+00	0.2157E+02	0.6755E+00	0.9578E+08
0.677E+00	0.2106E+02	0.6678E+00	0.9705E+08
0.673E+00	0.2057E+02	0.6602E+00	0.9831E+08
0.669E+00	0.2009E+02	0.6527E+00	0.9959E+08
0.665E+00	0.1963E+02	0.6454E+00	0.1009E+09
0.661E+00	0.1918E+02	0.6381E+00	0.1021E+09

Table 2. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.657E+00	0.1874E+02	0.6310E+00	0.1034E+09
0.653E+00	0.1831E+02	0.6239E+00	0.1047E+09
0.649E+00	0.1790E+02	0.6170E+00	0.1060E+09
0.644E+00	0.1750E+02	0.6102E+00	0.1073E+09
0.640E+00	0.1710E+02	0.6035E+00	0.1086E+09
0.636E+00	0.1672E+02	0.5968E+00	0.1099E+09
0.632E+00	0.1635E+02	0.5903E+00	0.1112E+09
0.628E+00	0.1599E+02	0.5839E+00	0.1125E+09
0.624E+00	0.1564E+02	0.5776E+00	0.1138E+09
0.619E+00	0.1530E+02	0.5713E+00	0.1151E+09
0.615E+00	0.1497E+02	0.5652E+00	0.1165E+09
0.611E+00	0.1465E+02	0.5591E+00	0.1178E+09
0.607E+00	0.1434E+02	0.5532E+00	0.1191E+09
0.602E+00	0.1403E+02	0.5473E+00	0.1204E+09
0.598E+00	0.1373E+02	0.5415E+00	0.1218E+09
0.594E+00	0.1344E+02	0.5358E+00	0.1231E+09
0.589E+00	0.1316E+02	0.5302E+00	0.1244E+09
0.585E+00	0.1289E+02	0.5247E+00	0.1258E+09
0.581E+00	0.1262E+02	0.5193E+00	0.1271E+09
0.576E+00	0.1236E+02	0.5139E+00	0.1284E+09
0.572E+00	0.1211E+02	0.5087E+00	0.1298E+09
0.567E+00	0.1185E+02	0.5028E+00	0.1309E+09
0.563E+00	0.1159E+02	0.4970E+00	0.1321E+09
0.559E+00	0.1135E+02	0.4914E+00	0.1333E+09
0.554E+00	0.1110E+02	0.4858E+00	0.1344E+09
0.550E+00	0.1087E+02	0.4803E+00	0.1356E+09
0.545E+00	0.1064E+02	0.4749E+00	0.1367E+09
0.541E+00	0.1042E+02	0.4696E+00	0.1379E+09
0.536E+00	0.1021E+02	0.4644E+00	0.1390E+09
0.532E+00	0.9995E+01	0.4593E+00	0.1402E+09
0.527E+00	0.9791E+01	0.4542E+00	0.1414E+09
0.523E+00	0.9592E+01	0.4493E+00	0.1425E+09
0.518E+00	0.9399E+01	0.4444E+00	0.1437E+09
0.513E+00	0.9211E+01	0.4396E+00	0.1448E+09
0.509E+00	0.9028E+01	0.4349E+00	0.1460E+09
0.504E+00	0.8849E+01	0.4303E+00	0.1471E+09
0.500E+00	0.8676E+01	0.4258E+00	0.1482E+09
0.495E+00	0.8507E+01	0.4213E+00	0.1494E+09
0.491E+00	0.8342E+01	0.4169E+00	0.1505E+09
0.486E+00	0.8182E+01	0.4126E+00	0.1517E+09
0.481E+00	0.8026E+01	0.4083E+00	0.1528E+09
0.477E+00	0.7873E+01	0.4041E+00	0.1539E+09
0.472E+00	0.7725E+01	0.4000E+00	0.1551E+09
0.468E+00	0.7581E+01	0.3960E+00	0.1562E+09
0.463E+00	0.7440E+01	0.3920E+00	0.1573E+09
0.458E+00	0.7303E+01	0.3881E+00	0.1584E+09
0.454E+00	0.7169E+01	0.3842E+00	0.1595E+09
0.449E+00	0.7039E+01	0.3804E+00	0.1607E+09
0.444E+00	0.6912E+01	0.3767E+00	0.1618E+09
0.440E+00	0.6789E+01	0.3730E+00	0.1629E+09
0.435E+00	0.6668E+01	0.3694E+00	0.1640E+09

Table 2. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.431E+00	0.6550E+01	0.3659E+00	0.1651E+09
0.426E+00	0.6436E+01	0.3624E+00	0.1662E+09
0.421E+00	0.6324E+01	0.3590E+00	0.1673E+09
0.417E+00	0.6215E+01	0.3556E+00	0.1683E+09
0.412E+00	0.6109E+01	0.3523E+00	0.1694E+09
0.407E+00	0.6005E+01	0.3490E+00	0.1705E+09
0.403E+00	0.5904E+01	0.3458E+00	0.1716E+09
0.398E+00	0.5805E+01	0.3427E+00	0.1726E+09
0.394E+00	0.5709E+01	0.3396E+00	0.1737E+09
0.389E+00	0.5615E+01	0.3365E+00	0.1748E+09
0.384E+00	0.5523E+01	0.3335E+00	0.1758E+09
0.380E+00	0.5438E+01	0.3308E+00	0.1770E+09
0.375E+00	0.5356E+01	0.3282E+00	0.1783E+09
0.371E+00	0.5276E+01	0.3257E+00	0.1795E+09
0.366E+00	0.5197E+01	0.3232E+00	0.1807E+09
0.362E+00	0.5121E+01	0.3207E+00	0.1819E+09
0.357E+00	0.5046E+01	0.3183E+00	0.1831E+09
0.352E+00	0.4973E+01	0.3159E+00	0.1843E+09
0.348E+00	0.4901E+01	0.3136E+00	0.1855E+09
0.343E+00	0.4831E+01	0.3112E+00	0.1867E+09
0.339E+00	0.4763E+01	0.3089E+00	0.1879E+09
0.334E+00	0.4696E+01	0.3067E+00	0.1891E+09
0.330E+00	0.4631E+01	0.3044E+00	0.1903E+09
0.325E+00	0.4566E+01	0.3022E+00	0.1914E+09
0.321E+00	0.4504E+01	0.3001E+00	0.1926E+09
0.316E+00	0.4442E+01	0.2979E+00	0.1937E+09
0.312E+00	0.4383E+01	0.2958E+00	0.1949E+09
0.307E+00	0.4324E+01	0.2937E+00	0.1960E+09
0.303E+00	0.4266E+01	0.2917E+00	0.1972E+09
0.299E+00	0.4210E+01	0.2897E+00	0.1983E+09
0.294E+00	0.4155E+01	0.2877E+00	0.1994E+09
0.290E+00	0.4101E+01	0.2857E+00	0.2005E+09
0.285E+00	0.4049E+01	0.2838E+00	0.2016E+09
0.281E+00	0.3997E+01	0.2819E+00	0.2027E+09
0.277E+00	0.3946E+01	0.2800E+00	0.2038E+09
0.272E+00	0.3897E+01	0.2782E+00	0.2049E+09
0.268E+00	0.3849E+01	0.2763E+00	0.2060E+09
0.264E+00	0.3801E+01	0.2745E+00	0.2070E+09
0.260E+00	0.3755E+01	0.2728E+00	0.2081E+09
0.255E+00	0.3709E+01	0.2710E+00	0.2091E+09
0.251E+00	0.3665E+01	0.2693E+00	0.2102E+09
0.247E+00	0.3621E+01	0.2676E+00	0.2112E+09
0.243E+00	0.3579E+01	0.2659E+00	0.2122E+09
0.238E+00	0.3537E+01	0.2642E+00	0.2133E+09
0.234E+00	0.3496E+01	0.2626E+00	0.2143E+09
0.230E+00	0.3456E+01	0.2610E+00	0.2153E+09
0.226E+00	0.3416E+01	0.2594E+00	0.2163E+09
0.222E+00	0.3378E+01	0.2579E+00	0.2173E+09
0.218E+00	0.3340E+01	0.2563E+00	0.2182E+09
0.214E+00	0.3303E+01	0.2548E+00	0.2192E+09
0.210E+00	0.3267E+01	0.2533E+00	0.2202E+09

Table 2. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.206E+00	0.3232E+01	0.2518E+00	0.2211E+09
0.202E+00	0.3197E+01	0.2504E+00	0.2221E+09
0.198E+00	0.3163E+01	0.2490E+00	0.2230E+09
0.194E+00	0.3129E+01	0.2475E+00	0.2240E+09
0.190E+00	0.3097E+01	0.2462E+00	0.2249E+09
0.186E+00	0.3065E+01	0.2448E+00	0.2258E+09
0.182E+00	0.3033E+01	0.2434E+00	0.2267E+09
0.178E+00	0.3002E+01	0.2421E+00	0.2276E+09
0.174E+00	0.2972E+01	0.2408E+00	0.2285E+09
0.170E+00	0.2942E+01	0.2395E+00	0.2294E+09
0.167E+00	0.2913E+01	0.2382E+00	0.2302E+09
0.163E+00	0.2885E+01	0.2369E+00	0.2311E+09
0.159E+00	0.2857E+01	0.2357E+00	0.2320E+09
0.155E+00	0.2830E+01	0.2345E+00	0.2328E+09
0.152E+00	0.2803E+01	0.2333E+00	0.2336E+09
0.148E+00	0.2777E+01	0.2321E+00	0.2345E+09
0.144E+00	0.2751E+01	0.2309E+00	0.2353E+09
0.141E+00	0.2725E+01	0.2298E+00	0.2361E+09
0.137E+00	0.2701E+01	0.2286E+00	0.2369E+09
0.133E+00	0.2676E+01	0.2275E+00	0.2377E+09
0.130E+00	0.2652E+01	0.2264E+00	0.2385E+09
0.126E+00	0.2629E+01	0.2253E+00	0.2393E+09
0.123E+00	0.2606E+01	0.2242E+00	0.2401E+09
0.119E+00	0.2583E+01	0.2232E+00	0.2408E+09
0.116E+00	0.2561E+01	0.2221E+00	0.2416E+09
0.112E+00	0.2540E+01	0.2211E+00	0.2423E+09
0.109E+00	0.2518E+01	0.2201E+00	0.2431E+09
0.106E+00	0.2497E+01	0.2191E+00	0.2438E+09
0.102E+00	0.2477E+01	0.2181E+00	0.2446E+09
0.990E-01	0.2457E+01	0.2172E+00	0.2453E+09
0.957E-01	0.2437E+01	0.2162E+00	0.2460E+09
0.925E-01	0.2418E+01	0.2153E+00	0.2467E+09
0.892E-01	0.2399E+01	0.2143E+00	0.2474E+09
0.860E-01	0.2380E+01	0.2134E+00	0.2481E+09
0.828E-01	0.2362E+01	0.2125E+00	0.2487E+09
0.797E-01	0.2344E+01	0.2116E+00	0.2494E+09
0.765E-01	0.2326E+01	0.2108E+00	0.2501E+09
0.734E-01	0.2309E+01	0.2099E+00	0.2507E+09
0.704E-01	0.2292E+01	0.2090E+00	0.2514E+09
0.673E-01	0.2276E+01	0.2082E+00	0.2520E+09
0.643E-01	0.2259E+01	0.2074E+00	0.2527E+09
0.613E-01	0.2243E+01	0.2066E+00	0.2533E+09
0.583E-01	0.2228E+01	0.2058E+00	0.2539E+09
0.554E-01	0.2212E+01	0.2050E+00	0.2545E+09
0.525E-01	0.2197E+01	0.2042E+00	0.2551E+09
0.496E-01	0.2182E+01	0.2035E+00	0.2557E+09
0.468E-01	0.2168E+01	0.2027E+00	0.2563E+09
0.440E-01	0.2154E+01	0.2020E+00	0.2569E+09
0.412E-01	0.2140E+01	0.2012E+00	0.2574E+09
0.384E-01	0.2126E+01	0.2005E+00	0.2580E+09
0.357E-01	0.2112E+01	0.1998E+00	0.2585E+09

Table 2. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.330E-01	0.2099E+01	0.1991E+00	0.2590E+09
0.303E-01	0.2086E+01	0.1984E+00	0.2595E+09
0.277E-01	0.2073E+01	0.1977E+00	0.2600E+09
0.251E-01	0.2060E+01	0.1970E+00	0.2605E+09
0.226E-01	0.2048E+01	0.1964E+00	0.2610E+09
0.201E-01	0.2036E+01	0.1957E+00	0.2615E+09
0.176E-01	0.2024E+01	0.1951E+00	0.2620E+09
0.152E-01	0.2013E+01	0.1945E+00	0.2624E+09
0.129E-01	0.2002E+01	0.1939E+00	0.2629E+09
0.106E-01	0.1991E+01	0.1933E+00	0.2633E+09
0.836E-02	0.1981E+01	0.1927E+00	0.2637E+09
0.626E-02	0.1972E+01	0.1922E+00	0.2641E+09
0.430E-02	0.1963E+01	0.1917E+00	0.2645E+09
0.256E-02	0.1955E+01	0.1913E+00	0.2648E+09
0.117E-02	0.1949E+01	0.1909E+00	0.2650E+09
0.300E-03	0.1945E+01	0.1907E+00	0.2652E+09
0.213E-04	0.1943E+01	0.1906E+00	0.2652E+09
0.967E-07	0.1943E+01	0.1906E+00	0.2653E+09

Table 3. Same as in Table 1, but for $\lambda = 1550.77$ Åof C IV.

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.920E+00	0.1303E+03	0.1020E+01	0.1808E+08
0.918E+00	0.1256E+03	0.1007E+01	0.1871E+08
0.916E+00	0.1210E+03	0.9932E+00	0.1936E+08
0.914E+00	0.1166E+03	0.9799E+00	0.2001E+08
0.912E+00	0.1124E+03	0.9665E+00	0.2067E+08
0.910E+00	0.1084E+03	0.9533E+00	0.2134E+08
0.908E+00	0.1045E+03	0.9403E+00	0.2201E+08
0.906E+00	0.1009E+03	0.9279E+00	0.2271E+08
0.904E+00	0.9734E+02	0.9155E+00	0.2342E+08
0.902E+00	0.9397E+02	0.9032E+00	0.2413E+08
0.900E+00	0.9074E+02	0.8912E+00	0.2486E+08
0.898E+00	0.8765E+02	0.8793E+00	0.2559E+08
0.895E+00	0.8467E+02	0.8675E+00	0.2634E+08
0.893E+00	0.8181E+02	0.8559E+00	0.2709E+08
0.891E+00	0.7900E+02	0.8438E+00	0.2783E+08
0.889E+00	0.7630E+02	0.8318E+00	0.2858E+08
0.886E+00	0.7371E+02	0.8199E+00	0.2934E+08
0.884E+00	0.7121E+02	0.8082E+00	0.3010E+08
0.882E+00	0.6881E+02	0.7966E+00	0.3087E+08
0.879E+00	0.6651E+02	0.7852E+00	0.3165E+08
0.877E+00	0.6429E+02	0.7740E+00	0.3244E+08
0.875E+00	0.6216E+02	0.7629E+00	0.3323E+08
0.872E+00	0.6011E+02	0.7520E+00	0.3403E+08
0.870E+00	0.5818E+02	0.7418E+00	0.3487E+08
0.867E+00	0.5632E+02	0.7317E+00	0.3571E+08
0.865E+00	0.5453E+02	0.7217E+00	0.3656E+08
0.862E+00	0.5281E+02	0.7119E+00	0.3742E+08

Table 3. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.860E+00	0.5114E+02	0.7022E+00	0.3829E+08
0.857E+00	0.4954E+02	0.6927E+00	0.3916E+08
0.855E+00	0.4800E+02	0.6833E+00	0.4005E+08
0.852E+00	0.4651E+02	0.6740E+00	0.4094E+08
0.849E+00	0.4507E+02	0.6649E+00	0.4184E+08
0.847E+00	0.4369E+02	0.6559E+00	0.4275E+08
0.844E+00	0.4233E+02	0.6466E+00	0.4364E+08
0.841E+00	0.4100E+02	0.6373E+00	0.4452E+08
0.839E+00	0.3973E+02	0.6281E+00	0.4541E+08
0.836E+00	0.3850E+02	0.6191E+00	0.4631E+08
0.833E+00	0.3731E+02	0.6103E+00	0.4721E+08
0.830E+00	0.3617E+02	0.6016E+00	0.4813E+08
0.827E+00	0.3507E+02	0.5930E+00	0.4905E+08
0.824E+00	0.3400E+02	0.5846E+00	0.4997E+08
0.822E+00	0.3298E+02	0.5764E+00	0.5091E+08
0.819E+00	0.3199E+02	0.5683E+00	0.5185E+08
0.816E+00	0.3104E+02	0.5604E+00	0.5281E+08
0.813E+00	0.3012E+02	0.5526E+00	0.5376E+08
0.810E+00	0.2924E+02	0.5449E+00	0.5473E+08
0.807E+00	0.2840E+02	0.5378E+00	0.5575E+08
0.804E+00	0.2760E+02	0.5308E+00	0.5678E+08
0.801E+00	0.2682E+02	0.5240E+00	0.5782E+08
0.797E+00	0.2607E+02	0.5172E+00	0.5887E+08
0.794E+00	0.2534E+02	0.5106E+00	0.5992E+08
0.791E+00	0.2464E+02	0.5040E+00	0.6098E+08
0.788E+00	0.2396E+02	0.4976E+00	0.6205E+08
0.785E+00	0.2330E+02	0.4912E+00	0.6312E+08
0.782E+00	0.2266E+02	0.4850E+00	0.6421E+08
0.778E+00	0.2205E+02	0.4788E+00	0.6530E+08
0.775E+00	0.2145E+02	0.4727E+00	0.6640E+08
0.772E+00	0.2087E+02	0.4668E+00	0.6750E+08
0.768E+00	0.2031E+02	0.4609E+00	0.6861E+08
0.765E+00	0.1977E+02	0.4551E+00	0.6973E+08
0.762E+00	0.1924E+02	0.4494E+00	0.7086E+08
0.758E+00	0.1873E+02	0.4436E+00	0.7197E+08
0.755E+00	0.1822E+02	0.4376E+00	0.7302E+08
0.751E+00	0.1772E+02	0.4317E+00	0.7408E+08
0.748E+00	0.1724E+02	0.4258E+00	0.7515E+08
0.744E+00	0.1677E+02	0.4201E+00	0.7622E+08
0.741E+00	0.1632E+02	0.4145E+00	0.7730E+08
0.737E+00	0.1589E+02	0.4090E+00	0.7838E+08
0.734E+00	0.1546E+02	0.4036E+00	0.7947E+08
0.730E+00	0.1506E+02	0.3982E+00	0.8056E+08
0.726E+00	0.1466E+02	0.3930E+00	0.8166E+08
0.723E+00	0.1428E+02	0.3878E+00	0.8276E+08
0.719E+00	0.1391E+02	0.3828E+00	0.8387E+08
0.715E+00	0.1355E+02	0.3778E+00	0.8498E+08
0.711E+00	0.1320E+02	0.3729E+00	0.8610E+08
0.708E+00	0.1286E+02	0.3681E+00	0.8722E+08
0.704E+00	0.1253E+02	0.3634E+00	0.8835E+08

Table 3. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.700E+00	0.1222E+02	0.3588E+00	0.8948E+08
0.696E+00	0.1191E+02	0.3542E+00	0.9061E+08
0.692E+00	0.1161E+02	0.3497E+00	0.9175E+08
0.689E+00	0.1132E+02	0.3453E+00	0.9289E+08
0.685E+00	0.1104E+02	0.3411E+00	0.9406E+08
0.681E+00	0.1078E+02	0.3372E+00	0.9531E+08
0.677E+00	0.1053E+02	0.3333E+00	0.9657E+08
0.673E+00	0.1029E+02	0.3295E+00	0.9783E+08
0.669E+00	0.1005E+02	0.3258E+00	0.9909E+08
0.665E+00	0.9814E+01	0.3221E+00	0.1004E+09
0.661E+00	0.9589E+01	0.3185E+00	0.1016E+09
0.657E+00	0.9370E+01	0.3150E+00	0.1029E+09
0.653E+00	0.9156E+01	0.3114E+00	0.1042E+09
0.649E+00	0.8949E+01	0.3080E+00	0.1055E+09
0.644E+00	0.8748E+01	0.3046E+00	0.1068E+09
0.640E+00	0.8552E+01	0.3012E+00	0.1081E+09
0.636E+00	0.8362E+01	0.2979E+00	0.1094E+09
0.632E+00	0.8177E+01	0.2947E+00	0.1107E+09
0.628E+00	0.7996E+01	0.2914E+00	0.1120E+09
0.624E+00	0.7821E+01	0.2883E+00	0.1133E+09
0.619E+00	0.7651E+01	0.2852E+00	0.1146E+09
0.615E+00	0.7485E+01	0.2821E+00	0.1159E+09
0.611E+00	0.7324E+01	0.2791E+00	0.1172E+09
0.607E+00	0.7167E+01	0.2761E+00	0.1185E+09
0.602E+00	0.7014E+01	0.2732E+00	0.1198E+09
0.598E+00	0.6866E+01	0.2703E+00	0.1211E+09
0.594E+00	0.6721E+01	0.2675E+00	0.1225E+09
0.589E+00	0.6581E+01	0.2647E+00	0.1238E+09
0.585E+00	0.6444E+01	0.2619E+00	0.1251E+09
0.581E+00	0.6311E+01	0.2592E+00	0.1264E+09
0.576E+00	0.6181E+01	0.2565E+00	0.1278E+09
0.572E+00	0.6054E+01	0.2539E+00	0.1291E+09
0.567E+00	0.5923E+01	0.2510E+00	0.1303E+09
0.563E+00	0.5796E+01	0.2481E+00	0.1314E+09
0.559E+00	0.5672E+01	0.2452E+00	0.1326E+09
0.554E+00	0.5552E+01	0.2425E+00	0.1337E+09
0.550E+00	0.5434E+01	0.2397E+00	0.1349E+09
0.545E+00	0.5320E+01	0.2370E+00	0.1360E+09
0.541E+00	0.5210E+01	0.2344E+00	0.1372E+09
0.536E+00	0.5102E+01	0.2318E+00	0.1383E+09
0.532E+00	0.4997E+01	0.2292E+00	0.1395E+09
0.527E+00	0.4895E+01	0.2267E+00	0.1406E+09
0.523E+00	0.4795E+01	0.2242E+00	0.1418E+09
0.518E+00	0.4699E+01	0.2218E+00	0.1429E+09
0.513E+00	0.4605E+01	0.2194E+00	0.1441E+09
0.509E+00	0.4513E+01	0.2171E+00	0.1452E+09
0.504E+00	0.4424E+01	0.2148E+00	0.1463E+09
0.500E+00	0.4337E+01	0.2125E+00	0.1475E+09
0.495E+00	0.4253E+01	0.2103E+00	0.1486E+09
0.491E+00	0.4170E+01	0.2081E+00	0.1498E+09

Table 3. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.486E+00	0.4090E+01	0.2059E+00	0.1509E+09
0.481E+00	0.4012E+01	0.2038E+00	0.1520E+09
0.477E+00	0.3936E+01	0.2017E+00	0.1531E+09
0.472E+00	0.3862E+01	0.1996E+00	0.1543E+09
0.468E+00	0.3790E+01	0.1976E+00	0.1554E+09
0.463E+00	0.3719E+01	0.1956E+00	0.1565E+09
0.458E+00	0.3651E+01	0.1937E+00	0.1576E+09
0.454E+00	0.3584E+01	0.1917E+00	0.1587E+09
0.449E+00	0.3519E+01	0.1899E+00	0.1598E+09
0.444E+00	0.3455E+01	0.1880E+00	0.1609E+09
0.440E+00	0.3394E+01	0.1862E+00	0.1620E+09
0.435E+00	0.3333E+01	0.1844E+00	0.1631E+09
0.431E+00	0.3275E+01	0.1826E+00	0.1642E+09
0.426E+00	0.3217E+01	0.1809E+00	0.1653E+09
0.421E+00	0.3161E+01	0.1792E+00	0.1664E+09
0.417E+00	0.3107E+01	0.1775E+00	0.1675E+09
0.412E+00	0.3054E+01	0.1758E+00	0.1685E+09
0.407E+00	0.3002E+01	0.1742E+00	0.1696E+09
0.403E+00	0.2951E+01	0.1726E+00	0.1707E+09
0.398E+00	0.2902E+01	0.1710E+00	0.1718E+09
0.394E+00	0.2854E+01	0.1695E+00	0.1728E+09
0.389E+00	0.2807E+01	0.1679E+00	0.1739E+09
0.384E+00	0.2761E+01	0.1664E+00	0.1749E+09
0.380E+00	0.2718E+01	0.1651E+00	0.1761E+09
0.375E+00	0.2677E+01	0.1638E+00	0.1773E+09
0.371E+00	0.2637E+01	0.1625E+00	0.1786E+09
0.366E+00	0.2598E+01	0.1613E+00	0.1798E+09
0.362E+00	0.2560E+01	0.1601E+00	0.1810E+09
0.357E+00	0.2523E+01	0.1589E+00	0.1822E+09
0.352E+00	0.2486E+01	0.1577E+00	0.1834E+09
0.348E+00	0.2450E+01	0.1565E+00	0.1846E+09
0.343E+00	0.2415E+01	0.1553E+00	0.1858E+09
0.339E+00	0.2381E+01	0.1542E+00	0.1869E+09
0.334E+00	0.2347E+01	0.1530E+00	0.1881E+09
0.330E+00	0.2315E+01	0.1519E+00	0.1893E+09
0.325E+00	0.2283E+01	0.1508E+00	0.1904E+09
0.321E+00	0.2251E+01	0.1498E+00	0.1916E+09
0.316E+00	0.2221E+01	0.1487E+00	0.1927E+09
0.312E+00	0.2191E+01	0.1476E+00	0.1939E+09
0.307E+00	0.2161E+01	0.1466E+00	0.1950E+09
0.303E+00	0.2133E+01	0.1456E+00	0.1961E+09
0.299E+00	0.2105E+01	0.1446E+00	0.1973E+09
0.294E+00	0.2077E+01	0.1436E+00	0.1984E+09
0.290E+00	0.2050E+01	0.1426E+00	0.1995E+09
0.285E+00	0.2024E+01	0.1416E+00	0.2006E+09
0.281E+00	0.1998E+01	0.1407E+00	0.2017E+09
0.277E+00	0.1973E+01	0.1397E+00	0.2027E+09
0.272E+00	0.1948E+01	0.1388E+00	0.2038E+09
0.268E+00	0.1924E+01	0.1379E+00	0.2049E+09
0.264E+00	0.1900E+01	0.1370E+00	0.2060E+09

Table 3. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.260E+00	0.1877E+01	0.1361E+00	0.2070E+09
0.255E+00	0.1854E+01	0.1352E+00	0.2081E+09
0.251E+00	0.1832E+01	0.1344E+00	0.2091E+09
0.247E+00	0.1810E+01	0.1335E+00	0.2101E+09
0.243E+00	0.1789E+01	0.1327E+00	0.2111E+09
0.238E+00	0.1768E+01	0.1319E+00	0.2122E+09
0.234E+00	0.1747E+01	0.1311E+00	0.2132E+09
0.230E+00	0.1727E+01	0.1303E+00	0.2142E+09
0.226E+00	0.1708E+01	0.1295E+00	0.2152E+09
0.222E+00	0.1689E+01	0.1287E+00	0.2161E+09
0.218E+00	0.1670E+01	0.1279E+00	0.2171E+09
0.214E+00	0.1651E+01	0.1272E+00	0.2181E+09
0.210E+00	0.1633E+01	0.1264E+00	0.2190E+09
0.206E+00	0.1615E+01	0.1257E+00	0.2200E+09
0.202E+00	0.1598E+01	0.1250E+00	0.2209E+09
0.198E+00	0.1581E+01	0.1242E+00	0.2219E+09
0.194E+00	0.1564E+01	0.1235E+00	0.2228E+09
0.190E+00	0.1548E+01	0.1228E+00	0.2237E+09
0.186E+00	0.1532E+01	0.1222E+00	0.2246E+09
0.182E+00	0.1516E+01	0.1215E+00	0.2255E+09
0.178E+00	0.1501E+01	0.1208E+00	0.2264E+09
0.174E+00	0.1486E+01	0.1202E+00	0.2273E+09
0.170E+00	0.1471E+01	0.1195E+00	0.2282E+09
0.167E+00	0.1456E+01	0.1189E+00	0.2290E+09
0.163E+00	0.1442E+01	0.1182E+00	0.2299E+09
0.159E+00	0.1428E+01	0.1176E+00	0.2307E+09
0.155E+00	0.1414E+01	0.1170E+00	0.2316E+09
0.152E+00	0.1401E+01	0.1164E+00	0.2324E+09
0.148E+00	0.1388E+01	0.1158E+00	0.2332E+09
0.144E+00	0.1375E+01	0.1152E+00	0.2341E+09
0.141E+00	0.1362E+01	0.1147E+00	0.2349E+09
0.137E+00	0.1350E+01	0.1141E+00	0.2357E+09
0.133E+00	0.1338E+01	0.1135E+00	0.2365E+09
0.130E+00	0.1326E+01	0.1130E+00	0.2373E+09
0.126E+00	0.1314E+01	0.1124E+00	0.2380E+09
0.123E+00	0.1303E+01	0.1119E+00	0.2388E+09
0.119E+00	0.1291E+01	0.1114E+00	0.2396E+09
0.116E+00	0.1280E+01	0.1109E+00	0.2403E+09
0.112E+00	0.1269E+01	0.1103E+00	0.2411E+09
0.109E+00	0.1259E+01	0.1098E+00	0.2418E+09
0.106E+00	0.1248E+01	0.1093E+00	0.2425E+09

Table 3. continued

$\Delta E/E$	S (at.u.)	f_{ik}	A_{ki} (sec^{-1})
0.102E+00	0.1238E+01	0.1088E+00	0.2433E+09
0.990E-01	0.1228E+01	0.1084E+00	0.2440E+09
0.957E-01	0.1218E+01	0.1079E+00	0.2447E+09
0.925E-01	0.1209E+01	0.1074E+00	0.2454E+09
0.892E-01	0.1199E+01	0.1070E+00	0.2461E+09
0.860E-01	0.1190E+01	0.1065E+00	0.2468E+09
0.828E-01	0.1181E+01	0.1060E+00	0.2474E+09
0.797E-01	0.1172E+01	0.1056E+00	0.2481E+09
0.765E-01	0.1163E+01	0.1052E+00	0.2488E+09
0.734E-01	0.1154E+01	0.1047E+00	0.2494E+09
0.704E-01	0.1146E+01	0.1043E+00	0.2501E+09
0.673E-01	0.1137E+01	0.1039E+00	0.2507E+09
0.643E-01	0.1129E+01	0.1035E+00	0.2513E+09
0.613E-01	0.1121E+01	0.1031E+00	0.2519E+09
0.583E-01	0.1113E+01	0.1027E+00	0.2526E+09
0.554E-01	0.1106E+01	0.1023E+00	0.2532E+09
0.525E-01	0.1098E+01	0.1019E+00	0.2538E+09
0.496E-01	0.1091E+01	0.1015E+00	0.2543E+09
0.468E-01	0.1084E+01	0.1012E+00	0.2549E+09
0.440E-01	0.1076E+01	0.1008E+00	0.2555E+09
0.412E-01	0.1069E+01	0.1004E+00	0.2561E+09
0.384E-01	0.1063E+01	0.1001E+00	0.2566E+09
0.357E-01	0.1056E+01	0.9971E-01	0.2572E+09
0.330E-01	0.1049E+01	0.9935E-01	0.2577E+09
0.303E-01	0.1042E+01	0.9900E-01	0.2582E+09
0.277E-01	0.1036E+01	0.9866E-01	0.2587E+09
0.251E-01	0.1030E+01	0.9832E-01	0.2592E+09
0.226E-01	0.1024E+01	0.9799E-01	0.2596E+09
0.201E-01	0.1018E+01	0.9766E-01	0.2601E+09
0.176E-01	0.1012E+01	0.9735E-01	0.2606E+09
0.152E-01	0.1006E+01	0.9704E-01	0.2610E+09
0.129E-01	0.1001E+01	0.9674E-01	0.2615E+09
0.106E-01	0.9954E+00	0.9645E-01	0.2619E+09
0.836E-02	0.9903E+00	0.9617E-01	0.2623E+09
0.626E-02	0.9855E+00	0.9591E-01	0.2627E+09
0.430E-02	0.9810E+00	0.9566E-01	0.2631E+09
0.256E-02	0.9771E+00	0.9545E-01	0.2634E+09
0.117E-02	0.9739E+00	0.9527E-01	0.2636E+09
0.300E-03	0.9720E+00	0.9517E-01	0.2638E+09
0.213E-04	0.9714E+00	0.9513E-01	0.2638E+09
0.967E-07	0.9713E+00	0.9513E-01	0.2638E+09

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ПРОЦЕНА АТОМСКИХ ПОДАТАКА ЗА H И C IV ПРЕЛАЗЕ У ЈАКОМ ГРАВИТАЦИОНОМ ПОЉУ

Л. Ч. Поповић

Астрономска опсерваторија, Волгина 7, 11160 Београд–74, Југославија

УДК 52–355.3
Оригинални научни рад

Ефект гравитационог поља на атомске податке за H и C IV прелазе се разматра као пертурбација почетног и крајњег енергијских нивоа. Ова дејство је веће за прелазе са већим са главним квантним бројем. Овде дајемо изразе за процену овог ефекта и његовог утицаја на атомске параметре. Такође, дати су прорачуни за $1s-2p$ (Ly_α) и $2s-3p$ прелазе код атома водоника као и атомски подаци за $2s^2S_{1/2}-2p^2P^0_{1/2,3/2}$ прелазе код C IV ($1uv$) као функција деформације енергијских нивоа и гравитационог помераја. Овај ефекат би требало проценити и узети га у обзир при проучавању широколинијских региона у активним галактичким језгрима.