IONIZATION EQUILIBRIUM FOR IONS OF Na, Al, P, Cl, A, K, Ca, Cr AND Mn

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Ionization equilibrium calculations, which have a number of astrophysical applications, have been computed by Jordan for the ions of C, N, O, Ne, Mg, Si, S, Fe, and Ni.

The aim of this paper is to extend the evaluation to other elements relevant to the investigation of the solar atmosphere. Ions of Na, Al, P, Cl, A, K, Ca, Cr, and Mn have been considered and the ionization balance has been computed for temperature from 10^4 to 10^7 K.

The computation is performed including collisional ionization, autoionization, radiative recombination and dielectronic recombination.

Collisional ionization is computed according to Seaton (1964); autoionization is computed following the approximation given by Jordan (1969); radiative recombination is computed according to Elwert (1952), for T_e less than 0.6×10^6 K and according to Burgess and Seaton (1964) for high temperature.

The dielectronic recombination rate has been computed via two approximated expressions developed by Landini and Monsignori Fossi (1972):

(a) $$\alpha_{diel} = 2 \times 10^{-4}\, T^{-3/2}(Z+1)^2 f W_1^{1/2}\, 10^{-4600 W_1/T}\ \mathrm{cm^3\ s^{-1}}$$

for $Z+1$ ions pertaining to the isoelectronic sequences of H, He and Ne; f is the num-

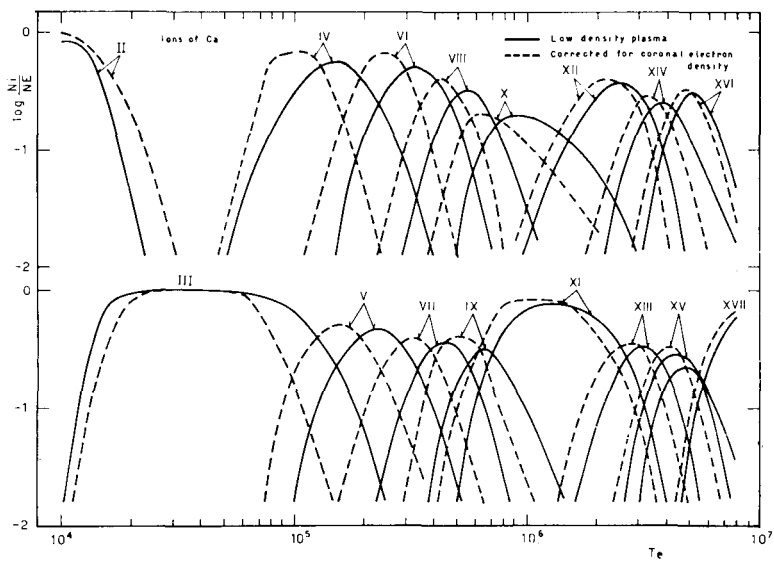

Fig. 1.

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ber of electrons of the outer shell and W_1 is the excitation potential of the first level;

(b) $$\alpha_{\text{diel}} = 2 \times 10^{-4}\, T^{-3/2}\ \ (Z+1)^2 F\, 10^{-4600\, C W_1/T}\ \text{cm}^3\ \text{s}^{-1}\,,$$

where $C = (Z+2.3)/3.3$ and F is a constant for each isoelectronic sequence not included in (a) and is given in the quoted paper.

Computations have been performed for low-density plasmas and for solar atmosphere conditions; in the last case Jordan's model of the solar atmosphere has been used.

An example of the computation is given in Figure 1 for Ca ions. The results have been used to evaluate the elctron temperature of the solar corona from the visible forbidden lines of ions of Ca, Fe, Ni, A, and K.

References

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