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Jordan C. The ionization equilibrium of elements between carbon and nickel. *Mon. Notic. Roy. Astron. Soc.* **142**:501-21, 1969.
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The ionization equilibrium N(ion)/N(element), for ions of elements abundant in the Sun, has been calculated as a function of temperature between $T_e \sim 10^4$ °K and $\sim 10^8$ °K. [The *SCI*® indicates that this paper has been cited in over 495 publications, the most for any paper in this journal to date.]

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"During the early 1960s, quantitative measurements of the fluxes of solar emission lines in the far ultraviolet and soft X-ray regions of the spectrum became available. A range of atomic data was needed in order to interpret line fluxes in terms of the physical conditions in the solar atmosphere. In particular, ion populations were required as a function of the electron temperature. By about 1964, work by Seaton[1,2] on radiative recombination and collisional ionization allowed widely applicable approximations to the rate coefficients of these processes to be proposed. House[3] computed a set of populations for cosmically abundant elements including atomic processes then known to be important. The field was changed by the realization[4] that dielectronic recombination is far more important than radiative recombination under the conditions of the solar corona and transition region to the chromosphere. The additional ionization process of collisional excitation followed by autoionization was also found to be important for some ions.[5] Thus, the early sets of calculations rapidly became out-of-date.

"In 1964 and 1965, I was modelling the solar atmosphere from EUV line fluxes as part of my thesis research and, finding that no suitable ion balance calculations were available in the literature, decided to carry out my own. Although general approximations for the processes had been published,[1,2,4] extensive calculations of oscillator strengths and extrapolations of then-unknown energy levels were needed to establish the dielectronic recombination rate and to estimate the autoionization component.

"For low ions, the relatively high electron density in the solar atmosphere causes a reduction in the total dielectronic rate, and this aspect could be treated only very crudely. In fact, the density correction I applied is now known to be too large and the density-dependent calculations have been superceded by the work of Summers.[6]

"From about 1966 to 1968, I kept my set of calculations up-to-date and gradually other workers came to hear about them and to ask for copies. Eventually, after circulating various handwritten sets of the calculations, I realized they were of sufficient general interest to be published.

"Other developments have taken place since, but mostly for states of ionization higher than were treated in my 1969 paper. There has also been discussion about the magnitude of the collisional ionization rate, but recent work suggests that the early simple approximation[2] is still acceptable. Thus, one reason the 1969 paper is still used is that the density-independent calculations are still applicable. No discrepancies have been revealed by the comparisons with observations that can be made. The calculations are given in a convenient tabular form, although nowadays an algorithm would be better for inclusion in a general computer programme. There is also something to be said for the adoption of an agreed set of calculations to reduce the sources of differences when analyses by different workers are compared. Finally, people are reluctant to change what they have used unless there are very good reasons for doing so."

1. **Seaton M J.** Radiative recombination of hydrogenic ions. *Mon. Notic. Roy. Astron. Soc.* **119**:81-9, 1959. (Cited 235 times since 1959.)
2. --------------. The spectrum of the solar corona. *Planet. Space Sci.* **12**:55-74, 1964. (Cited 145 times.)
3. **House L L.** Ionization equilibrium of the elements from H to Fe. *Astrophys. J. Suppl. Ser.* **8**:307-28, 1964. (Cited 70 times.)
4. **Burgess A.** Dielectronic recombination and the temperature of the solar corona. *Astrophysical J.* **139**:776-80, 1964. (Cited 180 times.)
5. **Goldberg L, Dupree A K & Allen J W.** Collisional excitation of autoionizing levels. *Ann. Astrophys.* **28**:589-93, 1965.
6. **Summers H P.** The ionization equilibrium of hydrogen-like to argon-like ions of elements. *Mon. Notic. Roy. Astron. Soc.* **169**:663-80, 1974. (Cited 65 times.)

