CROSS SECTIONS AND LINE-BROADENING

A. Dalgarno
Center for Astrophysics
Cambridge, MA

Stimulated mostly by the needs of the fusion energy programs, data centres have been established from which information can be obtained on photoionization and recombination processes, electron and ion impact excitation, ionization and charge transfer cross sections and on electron and proton line-broadening parameters. Regular reports are issued by most of the centres. A partial list follows:

(1) Atomic Data for Fusion, Ed. C.F. Barnett, D.H. Crandall and W.L. Wiese: Oak Ridge National Laboratory, P.O. Box X, Bldg, 6003, Oak Ridge, Tenn. 37830, USA.

(2) International Bulletin on Atomic and Molecular Data for Fusion, Ed. K. Katsonis: Atomic and Molecular Data Unit, Nuclear Data Section, International Atomic Energy Agency, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria.

(3) Research Information Center, Institute of Plasma Physics, Nagoya University, Nagoya, Japan, Ed. Y. Itikawa.

(4) JAERI Data Center, Division of Plasma Physics, JAERI, 319-11, Tokai-Mura, Japan. K. Ozawa.

In addition, Daresbury Laboratory, Science and Engineering Research Council, Daresbury, Warrington WA4 4AD, England, Eds., W. Eissner and C.J. Noble, publishes an Information Quarterly for Atomic Processes and Applications, which reports continuing developments particularly on calculations of electron impact cross sections.

The Culham Laboratory of the United Kingdom Atomic Energy Authority is supporting the preparation of data collections. Atomic and Molecular Data for Fusion, Part I. Recommended cross sections and ratio for electron ionization of light atomics and ions, by K.L. Bell *et al.*, has been published as Report CLM-R216, available from H.M. Stationary Office, U.K.

Computerized data banks are under development in a collaboration between the Queen's University of Belfast, N. Ireland and Daresbury Laboratory, at the Japanese Atomic Energy Research Institute with the title AMSTOR and at the Laboratoire de Physique des Gaz et des Plasmas, Universite Paris Sud, F-19405 Orsay Cedex, France and Informascience, Centre de Documentation, 25 R. Boyer, F-75971, Cedex, France, with the title GAPHYOR.

A more general survey of data sources has been prepared by Ms. J.M. Rey with the title "Abstracting Sources and Services in Astrophysics and Related Fields of the Space Sciences." Copies may be obtained from her at the Center for Astrophysics, 60 Garden St., Cambridge, Massachusetts 01238, USA.

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These data sources are extremely valuable for astronomy and we should voice our appreciation and seek to find support for them. Despite their clear value, data centers, at least in the United States, have to struggle to survive.

Data on neutral particle excitation and neutral particle line-broadening are of lesser interest to the fusion community and are less readily available. The best source for astronomers is probably the tri-annual report of Commission 14. The section on line-broadening by Dr. Sahal-Brechot which should appear this year is particularly useful. Also of note are the regular conferences on Spectral Line Shapes. The last, the sixth, was held in July 1982 in Boulder, Colorado and its proceedings edited by Dr. K. Burnett will be published next year by de Greyter, Berlin - New York.

I draw your attention to the increasing precision of the theory of heavy particle line broadening and to the lack of appropriateness of the Van de Waals broadening and shift, so widely adopted by astronomers.

In the remainder of the presentation, I discussed the role of charge transfer recombination and ionization processes on the ionization balance in astrophysical plasmas and pointed to the utility of certain emission lines as diagnostics of charge transfer in high excitation sources. A list of quantum mechanical calculations of rate coefficients for charge transfer is appended to this summary.

Table 1

$$X^{n+} + H \rightarrow X^{(n-1)+} + H^{+}$$

k ($cm^3\ s^{-1}$) at 10,000 K

C^{2+} 1.0×10^{-12} (1,2)	C^{3+} 3.6×10^{-9} (2,3,4)	C^{4+} 2.1×10^{-9} (5)
N^{2+} 1.0×10^{-9} (2)	N^{3+} 5.1×10^{-9} (2,4,6)	O^{2+} 7.7×10^{-10} (2)
O^{3+} 8.6×10^{-9} (2)	Ne^{2+} $\sim 1 \times 10^{-14}$ (2)	Ne^{3+} 5.7×10^{-9} (2)
Si^{2+} 5.3×10^{-9} (6)	S^{2+} $\sim 1 \times 10^{-14}$ (7)	

Finally, I mentioned the occurrence of molecular constituents, even in highly ionized plasmas, and stressed the need for a wide range of cross section data on ground and vibrationally excited species.

References

[1] McCarroll and Valiron: 1975, Astron and Ap. 44, p. 465.
[2] Butler, Heil and Dalgarno: 1980, Ap. J. 241, p. 442.
[3] Blint, Watson and Christensen: 1976, Ap. J. 205, p. 634.
[4] Watson and Christensen: 1979, Ap. J. 231, p. 627.
[5] Gargaud, Hanssen, McCarroll and Valiron: 1981, J. Phys. B. 14, p. 2259.
[6] Christensen, Watson and Blint: 1977, Ap. J. 213, p. 712.; McCarroll and Valiron: 1976, Astron. and Ap. 53, p. 83; Gargaud, McCarroll and Valiron: 1982, Astron. and Ap. 106, p. 197.
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