in the VUV visible spectral range should be available for diagnosis of the likely most abundant tungsten ion in ITER core plasma. The results were obtained using newly calculated state-selective charge transfer cross sections and a detailed collisional-radiative model including thousands of levels populated by either electron-impact or charge transfer with the neutral beam.

Finally, relevant to beam emission spectroscopy and motional Stark effect spectroscopy, data and collisional-radiative modeling were reviewed that recently showed that the typical statistical assumptions about state distributions in plasma are not valid [7], point the way toward more complete ability to utilize neutral hydrogen beam excitation in diagnostics. Data for that work [8], consisting of full density matrix elements for H^+ exciting H(1s) to levels within n=2,3, and 4, from a few hundred eV to 2 MeV collision energies, provided during work of a previous IAEA CRP.

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Charge-transfer collisions involving few-electron systems
T. Kirchner

Ion-atom collision systems that involve more than one electron constitute nonseparable few-body problems, whose full solution is difficult to say the least. At impact energies well below 1 keV/amu an expansion of the stationary scattering wave function in terms of a limited number of products of nuclear and molecular state wave functions (amended to satisfy scattering boundary conditions) is feasible and usually sufficient to obtain accurate charge-transfer cross sections provided the electronic wave functions include configuration interaction (e.g. [1]).

At energies above 1 keV/amu this approach becomes inefficient and close-coupling methods within the semi classical approximation are better suited to treat the problem. For bare-ion collisions from helium target atoms explicit solutions of the two-electron time-dependent
Schrödinger equation can be achieved, but are computationally costly and cannot be extended to problems which involve more than two electrons.

Approximate alternatives are thus necessary to deal with more general situations. The independent electron model (IEM) represents a convenient and often quite accurate framework to carry out charge-transfer calculations for many-electron collision systems. We have used the IEM, e.g., to calculate (n,l)-specific cross sections for single capture in Ne^{10+} impact collisions with He, Ne, and Ar atoms. One motivation for this work has been the availability of experimental data for Lyman α and Lyman β+ emissions after shell-specific single capture. When coupled with radiative cascade calculations our IEM results show good overall agreement with the measurements [2].

Time-dependent density functional theory provides a firm footing of the IEM and gives some hints of how to improve the calculations. In this context, we have investigated the use of correlation integrals in the final-state analysis of one- and two-electron processes in proton and He^{2+}- He collisions [3]. Particularly for the case of double capture, for which the IEM has the tendency to overestimate the cross section, this has improved the agreement with experimental data.

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