Time Dependent Studies of Atomic Ionization

J. Colgan, M. S. Pindzola, and F. Robicheaux

Auburn University, Auburn, Alabama, 36849

In principle, the full solution of the time-dependent Schrödinger equation can yield maximum information about the scattering process for many atomic ionization problems. However it has only been recently that this has been attempted due to the large computational resources necessary for such an undertaking. Even with the exponential increase in computer speed and storage capacities in recent times such problems are still a computationally intensive task.

The time-dependent close-coupling formalism has, in the past 6 years [1, 2, 3], been successful in solving, to a high degree of accuracy, problems in electron-impact ionization and photoionization of light atomic species. This has almost always been carried out for the case where the final process involves two electrons moving away in the field of the residual ion, the three-body Coulomb problem. In recent years it has become possible to extract maximum information about the scattering process from these calculations in the form of angular differential cross sections for the processes [4, 5].

These advances will be discussed and examples given of recent progress. Future directions of this work will be explored. This work is supported in part by the U.S. Department of Energy, including a SciDAC award.

1. M. S. Pindzola and D. R. Schultz, Phys. Rev. A **53**, 1525 (1996).
2. M. S. Pindzola and F. J. Robicheaux, Phys. Rev. A **54**, 2142 (1996).
3. M. S. Pindzola and F. J. Robicheaux, Phys. Rev. A **57**, 318 (1998), Phys. Rev. A **58**, 779 (1998).
4. J. Colgan, M. S. Pindzola and F. Robicheaux, J. Phys. B: At. Mol. Opt. Phys., **34** L457 (2001).
5. J. Colgan, M. S. Pindzola, F. Robicheaux, D. C. Griffin, and M. Baertschy, Phys. Rev. A **65**, 042721 (2002).