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Electron Impact Ionization of the Rare Gases

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Detailed information about the electron impact ionization process can be obtained from fully differential cross section measurements, in which the ionized electron is detected in coincidence with the outgoing scattered projectile electron. Incident and outgoing electron momenta are completely determined in these measurements. A considerable body of experimental and theoretical data exists for H and He targets, and the level of agreement between theory and experiment for these simple atoms is exceptional. However, there are still significant discrepancies between theory and experiment in the case of ionization of more complex atomic targets such as the heavier rare gas atoms. In this talk I will present recent measurements and theoretical predictions of fully differential cross sections for ionization of a range of rare gas targets: He, Ne, Ar and Xe. The talk will concentrate primarily on experiments which have been performed by two experimental groups, our group in Australia [1-3] and that of Lahmam-Bennani [3-5] in France. The experimental conditions span two different kinematic regimes, one with intermediate incident electron energy and low ejected electron energy, and the other with higher incident electron energy, and ejected electron energies which correspond to large energy transfer in the collision process. All experiments have been performed in a coplanar asymmetric configuration in which the scattered electron is detected at a small forward scattering angle. The experimental apparatus used in Australia is of quite different design to that in France, and I will present the results of an experiment in which the two groups have collaborated to produce data under identical kinematic conditions and for the same targets, using these two very different experimental approaches. This comprehensive set of experimental data has provided an interesting challenge to theory, and I will discuss the state of play with regard to the alignment between curent state-ofthe-art theoretical models and the experimental results.

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