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Latest Developments in the Theoretical Calculation of Atomic Ionization by Charged Particle Impact

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The ionization of atoms by electron or ion impact for highly differential scattering has primarily concentrated on the traditional (e, 2e) scattering plane. The initial and final momentum vectors of the projectile define the scattering plane. The assumption has been that all the important physical effects would be observed in the scattering plane due to symmetry. Previous work on ion impact ionization of helium showed that experiment and theory are in good agreement in the scattering plane and in poor agreement out-of-the-scattering plane for C6+ projectile ions. In this presentation, we will show that the same out-of-plane effects can be observed for electron-impact ionization of magnesium. Proper quantum mechanical distorted wave treatment of electron-impact ionization involves fewer approximations than heavy ion ionization. These electron-impact ionization results can be used to determine the physical effects causing the unexplained out-of-the-plane structure for heavy particle collisions. This process revealed that the out-of-plane structure was caused by very close collisions between the projectile and nucleus.