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Projectile Interactions and Electron Correlation in Four-Body Collisions

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The few-body problem is one of the most fundamental unsolved problems in physics, and arises from the fact that the Schrödinger equation is not analytically soluble for more than two mutually interacting particles. As a result, theory must resort to approximations, the validity of which are determined by comparison with experiment. There has been much work done on the three-body problem, and in many cases, theory and experiment agree very well. Recent advancements in experimental techniques and computing capabilities now allow for the study of more complicated collision systems, such as four-body collisions. The simplest four-body problem is a charged particle collision with a helium atom, in which both atomic electrons change state. This type of collision can result in many different outcomes, such as double excitation, excitation-ionization, double ionization, transfer-excitation, transfer-ionization, and double charge transfer. Many body interactions will be discussed in the context of several different four-body processes.