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Application of the Convergent Close-Coupling method to collisions of electrons, positrons, and protons with light atomic and molecular targets

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The Convergent Close-Coupling (CCC) method for electron-atom collisions has been applied successfully for around two decades for quasi one- and two-electron atomic targets. The underlying engine is the complete Laguerre basis for treating to convergence the target discrete and continuous spectra via a square-integrable approach, together with a formulation of the close-coupling equations in momentum space. The method has continued to be extended, and now incorporates collisions with positrons with allowance for positronium formation. This is a major advancement because it addresses the complexity associated with treating multi-center collision problems. These techniques have then been readily transferred to collisions with protons, where charge-exchange can be a substantial scattering outcome. The latter also required a move to solving the CCC equations using an impact parameter formalism. Most recently, in addition to the extension of the variety of projectiles, the collision targets have been generalized to molecules. Presently, just the H_2^+ and the H_2 molecules have been implemented. In the talk a broad range of applications of the CCC method will be discussed and future developments will be indicated.

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