Recent Convergent Close-Coupling Progress in Atomic and Molecular Collision Theory

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The Convergent Close-Coupling (CCC) method solves Quantum Collision problems in the field of Atomic and Molecular Physics. It is based on the close-coupling expansion of the total wavefunction taken to convergence by utilizing a complete basis. During the 1990s, the CCC method was developed for electron scattering on atomic hydrogen [1], quasi one-electron atoms, which include the alkali metals [2], helium [3] and quasi two-electron atoms, which include the alkaline earths [4]. A relativistic implementation based on the Dirac Equation has also been implemented [5]. These are examples of one-centre problems. The method has been shown to yield accurate results for the major transitions, including differential ionisation, and all incident energies of interest [6].

The CCC method was then extended to two-centre problems such as positron scattering [7] and bare ion scattering [8]. In these cases, electron transfer channel forms the second centre in the problem. Most recently, the CCC method has been extended to molecular targets starting with H_2 [9].

In the talk we will describe the underlying principles of the CCC method and discuss the large variety of recent applications with the goal of modifying the approach to treat problems of interest to the Vapour Shielding Coordinated Research Project.

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