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Antimatter-matter scattering including rearrangement[1]

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Two distinct versions of the convergent close coupling (CCC) approach to ion-atom and ion-molecule collisions have been developed in the impact parameter representation. The first method starts from the exact three-body Schrödinger equation for the total scattering wave function and leads to coupled-channel Lippmann-Schwinger type integral equations for the transition amplitudes, with the relative motion of the heavy particles treated fully quantum mechanically. The second approach utilises a traditional semi-classical approximation. It is based on the time-dependent Schrödinger equation for the electronic part of the scattering wave function and leads to a system of coupled differential equations. This allows one to test the quality of approximations used in standard approaches to the problem. Both methods are applied to calculate antiproton collisions with inert gases and simple molecular targets in the energy range from 1 keV to 1 MeV. The methods are also applied to proton collisions including rearrangement channels. Interplay of direct ionisation and electron capture to continuum in target breakup is investigated. The first CCC calculations of the antiproton and proton stopping power in atomic and molecular hydrogen are presented.

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