Three-body Coulomb Scattering Treatment by Potential Splitting Approach

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An approach based on splitting the reaction potential into a finite range part and a long range tail part to describe few-body scattering in the case of a Coulomb interaction is proposed.
The solution to the Schrödinger equation for the long range tail of the reaction potential is used as an incoming wave. This reformulation of the scattering problem into an inhomogeneous Schrödinger equation with asymptotic outgoing waves makes it suitable for solving with the exterior complex scaling technique. The validity of the approach is analyzed from a formal point of view and demonstrated numerically, where the calculations are performed with the finite element method.
The method of splitting the potential is applied to the electron and positron scattering on the hydrogen atom and the positive helium ion in energy regions where resonances appear.
Calculated data are in fairly good agreement with the most accurate results available in the literature.