Three-body wave functions in the continuum. 
Application to the Coulomb case

Garrido E. (Instituto de Estructura de la Materia, CSIC, Madrid, Spain) 
Kievsky A. Viviani M.

In this work we investigate the connection between discretized three-body continuum wave functions, in particular via a box boundary condition, and the wave functions computed with the correct asymptotic behaviour. The three-body wave functions are in both cases obtained by means of the adiabatic expansion method. The information concerning all the possible incoming and outgoing channels, which appears naturally when the continuum is not discretized, seems to be lost when the discretization is implemented. In this work we show that both methods are fully equivalent, and the full information contained in the three-body wave function is actually preserved in the discrete spectrum. Therefore, in those cases when the asymptotic behaviour of the wave function is not known analytically, i.e., when the Coulomb interaction is involved, the discretization technique can be safely used.

Also, when applied to three-body systems interacting only through the Coulomb potential, this method provides the regular three-body Coulomb wave functions for the problem under investigation. A method to obtain the corresponding irregular Coulomb wave functions is also described. These regular and irregular Coulomb functions can be used in order to extract the $S$-matrix for reactions where, together with some short-range potential, the Coulomb interaction is also present. The method is illustrated with the three-alpha system.