826/E1

On theoretical description of the validity of a simple quantum mechanical three body model

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It is well known that the Continuum Discretized Coupled Channels method (CDCC) is very successful in describing light ion break up reactions on heavy nuclei. CDCC method, a quantum mechanical three-body model and in this model the total wave function is expanded in a complete set of projectile wave functions. The resulting set of coupled channel equations are solved using asymptotic wave boundary condition which is usually set at a small matching radius such as 20fm or so even though the coupling potentials are long range. Therefore, this practice has to be justified mathematically. It has been already shown that non diagonal potentials are fairly short-range and therefore we have to justify the model with respect to long range and decaying as $\frac{1}{R^2}$diagonal breakup channel potentials. In this respect we have shown that effects of their potentials on the corresponding s-matrix elements are very small in the presence of the Coulomb potential and for higher angular momentum values.

Keywords: Continuum Discretized Coupled Channels method (CDCC), coulomb potential, three body model

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