

TALENT Course 6: Theory for exploring nuclear reaction experiments

Outline project proposal

Project name: Studying the effect of continuum couplings in fusion of ^{11}Be on ^{208}Pb at energies near the Coulomb barrier.

Researcher(s): Maddalena Boselli

Affiliation: ECT*, Trento, Italy

Supervisor(s): F. Nunes

Project outline and aims:

Reproduce results obtained in [1].

Methodology:

With the development of radioactive ion beam facilities, the investigation of collision dynamics and many body nuclear structure became a relevant problem in order to plan and interpret measurements. In [1] it was studied the effect of breakup of a weakly bound projectile in complete fusion, analysing in particular the role of coupling between projectile states in the continuum.

The final goal is to compute the complete fusion cross section which in [1] is defined as the absorption cross section from bound states of the projectile (elastic and inelastic). This choice comes from the fact that complete fusion occurs when the full projectile is captured by the target and this is more likely to happen in absence of breakup. Coupling between continuum states of the projectile is expected to affect significantly the role of breakup processes reducing the flux in channels involving bound states which will then lead to a suppression of the complete fusion cross section. The calculation is based on the continuum discretized coupled channel (CDCC) formalism [2] and is performed with the code FRESKO [3]. Among the inputs required for the calculation, the key quantities consist in the parameters describing the various potentials acting between core - target, valence - target and core - valence, those concerning the discretisation scheme of the continuum (such as maximum number of partial waves, maximum excitation energy) and the number of terms included in the multipole expansion of the projectile - target potential (monopole, dipole..).

I will employ the same numerical values that were used in [1]. If possible, I plan to try to increase the maximum number of partial waves and multipoles to check their contribution as, when the calculation in [1] was performed, those were limited by the computational power available.

Key references:

1. A. Diaz-Torres and I. J. Thompson, Phys. Rev. C, **65** 024606
2. M. Kawai, Prog. Theor. Phys. Suppl. **89**, 11 (1986).
3. I. J. Thompson, Comput. Phys. Rep. **7**, 167 (1988); FRESKO users' manual (version FRXX.09g), University of Surrey, UK (unpublished)