Advances in Radioactive Isotope Science

Contribution ID: **51** Type: **Invited Presentation**

Four-body Continuum Effects in d+11Be Elastic Scattering

Monday, 29 May 2017 14:25 (25 minutes)

The main goal of the Continuum Discretized Coupled Channel (CDCC) method is to solve the Schrödinger equation for reactions where the projectile presents a cluster structure, and a low dissociation energy. The CDCC method has been introduced forty years ago [1] to describe deuteron induced reactions. Owing to the low binding energy of the deuteron, it was shown that including continuum channels significantly improves the description of d+nucleus elastic cross sections [1, 2]. The simplest variant of CDCC describes scattering of a two-body nucleus with a structureless target, but extensions to three-body projectiles have been performed recently (see, for example, ref. [3]). The projectile continuum is approximated by a finite number of square-integrable states, up to a given truncation energy.

We present here a new development of the CDCC method, which aims at describing reactions where the projectile and the target have a low separation energy. This leads to four-body (or more) calculations. Since continuum states are included in both colliding nuclei, the number of channels can be extremely large. We solve the coupled-channel system by using the R-matrix method on a Lagrange mesh [4].

A first application is presented for d+11Be elastic scattering and breakup, which have been measured recently at Ecm=45.5 MeV [5]. The 2H and 11Be nuclei are defined by 2H=p+n and 11Be=10Be+n structures. We choose the Minnesota potential [6] as nucleon-nucleon interaction, and the Koning-Delaroche global potential [7] as nucleon-10Be optical potentials. We show that including continuum states of 2H and of 11Be is necessary to reproduce well the experimental data.

References:

[1] G. H. Rawitscher, Phys. Rev. C9 (1974) 2210.
[2] M. Yahiro et al., Prog. Theor. Phys. Suppl. 89 (1986) 32.
[3] T. Matsumoto et al., Phys. Rev. C70 (2004) 061601.
[4] P. Descouvemont and D. Baye, Rep. Prog. Phys. 73, (2010) 036301.
[5] J. Chen et al. , Phys. Rev. C94 (2016) 064620.
[6] D.R. Thompson, M. LeMere, and Y.C. Tang, Nucl. Phys. A286 (1977) 53.
[7] A.J. Koning and J.P. Delaroche, Nucl. Phys. A713 (2003) 231.

Primary author: Dr DESCOUVEMONT, Pierre (Universite Libre de Bruxelles)

Presenter: Dr DESCOUVEMONT, Pierre (Universite Libre de Bruxelles)