Title: Direct interaction effects on the nuclear data evaluation for deuteron-induced reactions

Efectele interactiilor directe asupra evaluarii datelor nucleare pentru reactii induse de deuteroni

(DIEDIR)

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Abstract

The deuteron-induced reactions at low and medium energies are of great importance for several on-going strategic research programmes at large-scale international level (ITER, IFMIF, NFS/SPIRAL-2). However, there are significant discrepancies between the existing experimental data and the latest version of the evaluated data library TENDL-2015 based on calculations with the widely-used computer code TALYS.

The high complexity of the deuteron-nucleus interaction due to the deuteron weak binding energy of 2.224 MeV is also related to a variety of reactions induced by the deuteron-breakup (BU) nucleons. Thus, specific noncompound processes as BU and direct reactions (DR) make the deuteron-induced reactions so different from reactions with other incident particles. The scarce consideration of only pre-equilibrium emission (PE) and compound-nucleus (CN) mechanisms, as within TALYS, led to significant discrepancies with experimental results so that recommended reaction cross sections of high-priority elements have mainly been obtained by fit of the data.

On the other hand, recent basic studies of deuteron-induced reactions around the Coulomb barrier pointed out that numerical calculations for these reactions are beyond current capabilities while their case might contain interesting physics. However, we have just proved that it was not paid the due attention to the specific noncompound processes.

Overall, this proposal aims, in addition to the results obtained within the UEFISCDI project PN-II-ID-PCE-2011-3-0450, at further improvements of the theoretical description of deuteron interactions with nuclei. Thus, we plan to continue the series of recent studies looking for the consistent inclusion of the deuteron BU contribution within activation cross-section calculations by using (i) consistent input parameters determined by analysis of various independent data, and (ii) systematic account of whole body of related data for isotope chains and/or nearby atomic elements.