Service de Physique Nucléaire

Séminaire

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CEA-Saclay DSM/DAPNIA/SPhN, Orme des Merisiers Bât. 703 Salle 125

Coupled-channel study of nucleon scattering from light unstable nuclei

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An algebraic formulation of the multi-channel scattering theory (MCAS) has been developed and applied to the study of nucleon scattering from light nuclei. The procedure allows accounting for the Pauli principle, even when a collective model is used to define the structure of the target nucleus. Results on the scattering of both neutrons and protons from ^{12}C gives good results compared to data for both elastic scattering and bound states of the compound nucleus (^{13}C or ^{13}N) with the same nucleon-nucleus interactions.
This method has now been extended to allow the calculation of nuclei away from the line of stability, even particle-unstable nuclei. These necessitated extending the procedure for treating the Pauli principle to include the notion of "Pauli hindrance". Thus we can take into account three situations: states that are Pauli allowed (no Pauli violation could occur), Pauli blocked (excluding states where the incoming nucleon would scatter in already filled states of the target nucleus), or Pauli hindered (the incoming nucleon can go into partially filled states of the target).
We present results from the MCAS theory on two systems involving unstable nuclei. The first deals with the mirror pair: p+ ^{14}O and n+ ^{14}C. The compound nucleus of the first of these, ^{15}F is particle unstable, but recent data have shown two shape resonances at low energy in scattering of radioactive ^{14}O from hydrogen. The MCAS theory, with Pauli hindrance, is able to give a good explanation of these resonances, and predicts more narrow resonances (of the Fano-Feshbach type) at energies just above the recent experiment. The other study investigates all mass-7 nuclides from proton drip line to neutron drip line. Again using Pauli hindrance, we can get a quite satisfactory account of all these nuclei with one and the same nucleon-nucleus interaction matrix for all. Such data as is available (in particular the spectrum of ^{7}Li) is well described by the results of our calculations, and we predict properties of the nuclides at the drip line, as well as cross sections that are, as yet, not measured.

Le café sera servi 10 minutes avant, en salle 125
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