
SYSTEMATIC STUDIES OF THE THREE-NUCLEON SYSTEM DYNAMICS IN THE DEUTERON-PROTON BREAKUP REACTION

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Three-nucleon system dynamics can be investigated quantitatively by comparing results of precise measurements with observables calculated with the use of Faddeev equations. Observables for the deuteron-proton breakup reaction can be calculated on the basis of modern realistic nucleon-nucleon (NN) potentials, combined with model of 3N forces. The two- and three-nucleon interactions can also be modeled within the coupled-channel (CC) framework by an explicit treatment of the Δ -isobar excitation or by the Chiral Perturbation Theory (ChPT) at the next-to-next-to-leading order with all relevant NN and 3N contributions taken into account.

Beside leading NN interactions and three nucleon force, mentioned above calculations may include different pieces of nucleon-nucleon dynamics, like the long-range Coulomb interaction or relativistic effects, which reveal their influence at different parts of the phase space. Differential cross section is very sensitive to all these effects. The precise experimental data of the breakup reaction obtained in a wide phase space region at different incident beam energies are crucial for systematic studies of different parts of few-nucleon system dynamics and, in general, for verification of rigorous theoretical calculations which currently are vividly developed.

Experiments devoted to study such subtle ingredients of nuclear dynamics were carried out at KVI Groningen [1-4,8] and FZ-Julich [5-7] with the use of the $p(d,pp)n$ breakup reaction at 100–MeV[4], 130 MeV[1-6], 160 MeV [8] 340 MeV, 380 MeV and 400 MeV [7] deuteron beam energy. The continuation of these studies is planned with the use of the BINA detector at the new Cyclotron Center Bronowice (Kraków). The combination of large phase space coverage of this detector and wide range of accessible beam energies provides an unique possibility to study various aspects of the dynamics in three nucleon system, at regions of their maximum visibility.

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