Studies of the Three-Nucleon System Dynamics in the Deuteron-Proton Breakup Reaction

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Experimental study of deuteron-proton breakup reaction can serve as a valid tool for investigation of details of interaction between nucleons. Especially, the differential cross section for the breakup process is very sensitive to different pieces of the system dynamics like three-nucleon force (3NF), Coulomb interaction or relativistic effects, which reveal their influence at various parts of the phase-space. In medium energy domain the properties of few-nucleon systems are described mainly by pairwise nucleon-nucleon (NN) interaction and can be modeled with the use of the realistic potentials, coupled-channel (CC) method or Chiral Perturbation Theory (ChPT), which are very succesful in predicting observables for the system. However, at certain level of precision, much subtle effects can be studied. The calculations, which describe those additional dynamics include the model of 3NF (like Tucson Melbourn TM force) and/or the long-range Coulomb force. Experiment devoted to study such subtle ingredients of nuclear dynamics were carried out in KVI Groningen [1,2] and FZ-Jülich [3] with the use of the ${}^1H(\vec{d}, pp)n$ breakup reaction at 130 MeV deuteron beam energy.

The obtained high precision data of the diffrential cross sections will be confronted with the AV18+UIX [4] potential in which recently the Coulomb interaction was succesfully implemented [5,6]. Moreover, the results will be compared to the set of models: NN realistic potentials, with the TM99 3NF included, CC potentials with and without Coulomb interaction included and calculations based on the ChPT at the N2LO and N3LO.

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