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Studies of Three-Nucleon System Dynamics via Deuteron-Proton Breakup

abstract: Interaction of nucleons below pion production threshold is studied in three-nucleon (3N) system. First extensive investigations of the deuteron-proton breakup process in a large fraction of the phase space were performed at KVI with the polarized deuteron beam at energy of 130 MeV. Nearly 1800 high precision data points for differential cross sections were obtained and compared with predictions of several theoretical approaches to modeling of the interaction dynamics. Importance of the so-called 3N forces for the correct description of the data has been demonstrated. At low relative energy of the two outgoing protons strong influence of Coulomb force on the cross section values is observed. First results for tensor analyzing power suggest that in the theoretical models some ingredients in the spin part of the interaction are still missing. Further analysis of vector and tensor analysing powers is under way.

The studies are continued at 100 MeV deuteron beam energy with the new detections system BINA. The aim is to obtain high precision data for cross section and analyzing powers for breakup reaction in almost complete phase space. Such rich data sets are needed to constrain the theoretical models of few-nucleon system dynamics. Therefore, further experimental investigations should be undertaken, covering various energies and reaction channels (neutron induced and photodesintegration reactions in parallel to the proton and deuteron induced processes).