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Studies of three-nucleon force effects via deuteron-proton breakup at 160 MeV

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Collaboration

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Abstract content

Investigation of three-nucleon system provides basis for understanding details of interaction between nucleons, going also beyond simple pairwise forces. Modern realistic nucleon-nucleon (NN) interaction models describe well systems composed of the two nucleons. They are able to predict observables of the deuteron-proton breakup reaction only if combined with additional component of the dynamics - the three nucleon force (3NF). Studies of this effect can be done quantitatively by comparing observables calculated with the use of Faddeev equations with results of precise measurements. 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. Alternatively, contribution of NN and 3NF to the dynamics may come from Chiral Perturbation Theory. All the approaches describing the system of at least 3 nucleons should include not only 3NF model but also the Coulomb interactions or the relativistic component. All the effects reveal in different parts of the phase space with different magnitude what can be noticed in the observables. Experiments devoted to study such subtle ingredients of the nuclear dynamics in the 3-nucleon systems were carried out at KVI Groningen and FZ-Juelich with the use of the $^1H(d,pp)n$ breakup reaction at intermediate energy deuteron beams. Present studies are continuation of a wide research program aimed at investigations of the few-nucleon system dynamics and focuses on measurement done with unpolarised deuteron beam at 80 MeV/nucleon energy impinging on liquid hydrogen target. Goal of the work presented here is to determine the breakup differential cross-sections and verify the currently developed theoretical predictions. Current status of the data analysis of the deuteron-proton reaction at 160 MeV will be presented, including preliminary results of the cross-sections for the breakup channel.

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