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Applications of Polarized Deuteron Beams for Studies of Few-Nucleon Dynamics in d-p Breakup.

Tuesday, 15 September 2015 15:00 (30 minutes)

A large set of high precision vector and tensor
analyzing power data of $^1H(\vec{d}, pp)n$ breakup reaction was obtained at energies of 100 and 130 MeV [1-3].
The polarized deuteron beams were produced with the use of the ion sources of the AGOR (KVI Groningen, The Netherlands) and COSY (IKP FZ-Juelich, Germany) accelerators.
The deuteron breakup in collision with proton, leading to a final state of three-nucleon (3N) continuum is one of the simplest precesses to study dynamics of few nucleons. The process is characterised by a rich kinematics of the final state what makes it selective regarding the employed model of interaction. Experiments with polarized targets or beams give access to a large number of observables, which are sensitive to the dynamical ingredients, hidden in the unpolarized case, when one averages over spin states. The polarization observables, e.g. the analyzing powers, are sensitive to spin-dependent part of the interaction, what makes them interesting for testing theoretical calculations based on various approaches to model the interaction in few-nucleon systems.
In a medium energy domain the properties of few-nucleon systems are successfully modeled with the use of the realistic potentials, coupled-channel (CC) calculations with realistic potential including non-nucleonic degrees of freedom [4] or Chiral Perturbation Theory (ChPT) [5]. At a certain level of experimental precision, subtle effects can be studied, for example Three Nucleon Force (3NF). The calculations, in order to correctly describe the system dynamics include the model of 3NF (e.g. Tucson Melbourne TM force [6]) and/or the Coulomb force [7].
The experimental studies of the breakup process allow one to test the nuclear force structure with possible feedback on the force models.
The vector and tensor analyzing power data were confronted with the set of the modern calculations.
In the presentation, the comparison will be extended to variables based on Lorentz-invariants.
As the outlook plans of utilizing polarized ^3He target at the new facility - Cyclotron Center Bronowice in Poland - will be presented.

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[3] I. Ciepal at al., Phys. Rev. C 85 (2012) 017001.

[4] A. Deltuva at al., Phys. Rev. C 68 (2003) 024005.

[5] E. Epelbaum at al., Phys. Rev. C 66 (2002) 064001.

[6] S.A. Coon and H.K. Han, Few-Body Syst. 30 (2001) 131.

[7] A. Deltuva at al., Phys. Rev. C 80 (2009) 064002.

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