EXPERIMENTAL STUDIES OF FEW-BODY INTERACTIONS

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A basic step towards full understanding of nuclear interactions is proper modeling of all details of the few-nucleon system dynamics. Modern nucleon-nucleon (NN) interaction models, most commonly based on the meson-exchange picture, are able to reproduce the bulk of all NN data with an utmost precision. Their quality can be efficiently probed in the few-nucleon environment by comparing most up-to-date theoretical predictions with the observables measured in precision experiments. Thorough studies of three-nucleon system have led to a conclusion that a proper description of the experimental data cannot be achieved with the use of NN forces alone. This indicates a necessity of including additional dynamics: subtle effects of suppressed degrees of freedom, introduced by means of genuine three-nucleon forces, or, for a long-time neglected, Coulomb force.

Those findings would not be possible without a strong improvement of the experimental methods. New generation experiments in the middle-energy region employing high-resolution, multi-detector arrangements, provide data of unprecedented accuracy – see e.g. reviews [1,2]. Progress in measuring high-rank polarization observables, in covering wide phase-space regions of the three-nucleon scattering in continuum, as well as attacking four-nucleon systems, are creating new challenges to improve modeling of all details of the interaction dynamics into still unexplored regions. In spite of theoretical and experimental improvements there still remain unresolved puzzles, which indicate that our understanding of the complexity of forces acting in the few-body system is not complete.

The talk will review most common approaches to modeling of the few-nucleon interaction dynamics and present their successes and failures in confrontation with the precise data. As a sample reference the cross section and analyzing power results from a series of new-generation experimental studies of the $^{1}H(d_{pol},pp)n$ breakup reaction at intermediate energies [3] will be used, supplemented by selected observables determined in other experiments. New possibilities for continuation of that research program at the Cyclotron Centre Bronowice of IFJ PAN Kraków will be emphasized.

REFERENCES

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