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Measurement of proton- ^3He elastic scattering at intermediate energies

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The three-nucleon force (3NF) is essentially important to describe nuclear properties, such as the binding energy of light mass nuclei, the equation of state of nuclear matter and few-nucleon scattering systems. The isospin $T = 3/2$ components of the 3NF also play an important role in many-nucleon systems especially for neutron-rich nuclei as well as neutron matter properties. Proton- ^3He (p - ^3He) scattering is one of the simplest probe for studying the $T = 3/2$ components of the 3NF.

We present the measurement of p - ^3He elastic scattering at intermediate energies using the polarized beam and target systems. High precision data for the cross section $d\sigma/d\Omega$, proton and ^3He analyzing powers, and spin correlation coefficient $C_{y,y}$ at 50–100-MeV, are compared with rigorous numerical calculations of 4N scattering based on various NN potentials. Large differences are seen in the regime around the cross section minimum for almost of observables. We also compared the data with the calculations based on the CD-Bonn+ Δ potential which allows an excitation of a nucleon to a Δ isobar. As a result, the discrepancies were partially improved for some observables, but it was not resolved for most of the observables, including the cross sections. This is a different property from that of the 3N scattering, suggesting the validity of the 4N scattering as an experimental tool. In the conference we report the recent results of these experiments and discussions.

Primary author: WATANABE, Atomu (Institute of Science Tokyo)

Co-authors: Mr SAKAI, Daisuke (Tohoku University); Prof. SAKAI, Hideyuki (RIKEN Nishina Center); Prof. KANDA, Hiroki (RCNP, Osaka University); Mr UME, Hiroo (Tohoku University); Dr ONG, Hooi Jin (Chinese Academy of Sciences); Prof. MIKI, Kenjiro (Tohoku University); Prof. HATANAKA, Kichiji (RCNP, Osaka University); Prof. SEKIGUCHI, Kimiko (Institute of Science Tokyo); Mr KAMEYA, Koki (Tohoku University); Prof. ITOH, Masatoshi (RARI, Tohoku University); Ms INOUE, Minami (Tohoku University); Dr NAKAI, Shinnosuke (Tohoku University); Mr KITA, Sho (Tohoku University); Mr SHIBUYA, Shun (Tohoku University); Prof. ISHIKAWA, Souichi (Hosei University); Prof. INO, Takashi (KEK); Prof. WAKASA, Tomotsugu (Kyushu University); Mr MARUTA, Yoshiki (Tohoku University); Prof. MAEDA, Yukie (University of Miyazaki); Ms SAITO, Yuko (Tohoku University); Mr UTSUKI, Yuta (Tohoku University)

Presenter: WATANABE, Atomu (Institute of Science Tokyo)

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