Contribution ID: **78** Type: **Talk**

Measurement of ^{3}He analyzing power for $p-^3$He scattering using the polarized ^{3}He target

Tuesday 3 September 2019 15:20 (20 minutes)

The three-nucleon force (3NF) is essentially important to clarify various nuclear phenomena, such as the binding energy of light mass nuclei [1], the equation of state of nuclear matter [2] and few-nucleon scattering systems [3]. 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. The $p-^3$He scattering is one of the simplest prove for studying the $T = 3/2$ components of the 3NF. With the aim of exploring the properties of the 3NF we are planning the measurement of ^{3}He analyzing power for $p-^3$He scattering with the polarized ^{3}He target at intermediate energies ($E/A \geq 65$ MeV). Polarized ^{3}He was produced by the alkali-hybrid spin-exchange optical pumping method. To measure the ^{3}He polarization and control ^{3}He spin directions, we used the adiabatic fast passage-NMR method. We obtained the absolute value of the ^{3}He polarization and calibrated the NMR signal by the electron spin resonance measurement of Rb. The maximum ^{3}He polarization was ~ 50 % in our system.

Using the polarized ^{3}He target, we performed the measurement of ^{3}He analyzing power at CYRIC ($E_p = 70$ MeV) and RCNP ($E_p = 100$ MeV) in Japan. Measured angles were $\theta_{\rm lab.} = 35^\circ - 125^\circ$ ($\theta_{\rm c.m.} = 46^\circ - 141^\circ$) at CYRIC and $\theta_{\rm lab.} = 35^\circ - 135^\circ$ ($\theta_{\rm c.m.} = 47^\circ - 149^\circ$) at RCNP respectively. Proton beams were injected to the target, and scattered protons were detected by using $E - \Delta E$ detectors which consisted of plastic and NaI(Tl) scintillators. During the experiment, we measured the ^{3}He polarization and flipped the spin directions of ^{3}He nucleus by using the AFP-NMR method. We extracted ^{3}He analyzing power by measuring the asymmetry of elastically scattered protons from the polarized ^{3}He target. In the conference we report recently results of the experimental data.

[1] S. C. Pieper *et al.*, Phys. Rev. C **64**, 014001 (2001).
[2] A. Akmal *et al.*, Phys. Rev. C **58**, 1804 (1998).
[3] N. Kalantar-Nayestanaki *et al.*, Rep. Prog. Phys. **75**, 016301 (2012).

Author: Mr WATANABE, Atomu (Tohoku University)

Co-authors: Mr NAKAI, Shinnosuke (Tohoku University); Prof. SEKIGUCHI, Kimiko (Tohoku University); Ms AKIEDA, Tomomi (Tohoku University); Mr ETOH, Daijiro (Tohoku University); Ms INOUE, Minami (Tohoku University); Mr INOUE, Yoshinori (Tohoku University); Mr KAWAHARA, Kenta (Tohoku University); Mr KON, Hiroshi (Tohoku University); Prof. MIKI, Kenjiro (Tohoku University); Mr MUKAI, Tomoyuki (Tohoku University); Mr SAKAI, Daisuke (Tohoku University); Mr SHIBUYA, Shun (Tohoku University); Mr SHIOKAWA, Yuta (Tohoku University); Mr TAGUCHI, Takahiro (Tohoku University); Mr UTSUKI, Yuta (Tohoku University); Mr WADA, Yasunori (Tohoku University); Mr WATANABE, Morihiro (Tohoku University); Prof. ITOH, Masatoshi (CYRIC, Tohoku University); Prof. HATANAKA, Kichiji (RCNP, Osaka University); Mr KANDA, Hiroki (RCNP, Osaka University); Mr ONG, Hooi Jin (RCNP, Osaka University); Mr TRAN, Dinh Trong (RCNP, Osaka University); Mr GOTO, Shuhei (Kyushu University); Mr HIRAI, Yuma (Kyushu University); Mr INOMOTO, Daiki (Kyushu University); Ms KASAHARA, Hina (Kyushu University); Mr MITSUMOTO, Shinji (Kyushu University); Mr OSHIRO, Hisanori (Kyushu University); Prof. WAKASA, Tomotsugu (Kyushu University); Prof. MAEDA, Yukie

(University of Miyazaki); Mr NONAKA, Kotaro (University of Miyazaki); Prof. SAKAI, Hideyuki (RIKEN Nishina center); Mr WAKUI, Takashi (NIRS); Mr INO, Takashi (KEK)

Presenter: Mr WATANABE, Atomu (Tohoku University)

Session Classification: Parallel Session Tuesday: Few-Nucleon Systems

Track Classification: Nuclei