

# Measurement of analyzing powers for $p - {}^3\text{He}$ scattering with polarized ${}^3\text{He}$ target

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One of the main interest of nuclear physics is to understand nuclear properties based on bare nuclear forces. Recently, it is indicated that the three-nucleon forces (3NFs) is essential to clarify various nuclear phenomena. Few-nucleon scattering at intermediate energies ( $\sim 100$  MeV/nucleon) is one of good approach to investigate dynamical aspects of 3NFs. In the last decade study of nucleon-deuteron (three-nucleon system) as well as deuteron breakup channels has been extensively performed both experimentally and theoretically. Direct comparison between the data and the rigorous numerical calculations in terms of Faddeev theory showed clear evidence of 3NFs effects [1].

In order to explore the properties of the 3NFs in four-nucleon systems, we are planning measurements of  $p - {}^3\text{He}$  elastic scattering at intermediate energies. As a first experiment, we performed the measument of  ${}^3\text{He}$  analyzing power at 70 MeV/nucleon with polarized  ${}^3\text{He}$  target at the Cyclotron and Radioisotope Center (CYRIC), Tohoku University. Proton beams were injected to polarized  ${}^3\text{He}$  target, and scattered protons were detected by using  $E - \Delta E$  detectors which consisted of plastic and NaI(Tl) scintillators. Measured angles were from  $50^\circ$  to  $110^\circ$  in the laboratory system. Polarized  ${}^3\text{He}$  was produced by the spin-exchange optical pumping (SEOP) method, and typical values of  ${}^3\text{He}$  polarizations were 10 %.

In the conference we will report a recent result of this experiment.

## References

- [1] See, e.g., K. Sekiguchi *et al.*, Phys. Rev. C **65**, 034003 (2002); *ibid.* **89**, 064007 (2014).