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Measurement of Spin Correlation Coefficients in $p-^3$He Scattering at 65 MeV

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Few-nucleon scattering offers good opportunities to investigate dynamical aspects of the three-nucleon forces (3NFs), such as momentum, spin, and iso-spin dependencies. The nucleon-deuteron scattering at intermediate energies ($E/A \sim 100$ MeV) has provided a solid basis to nail down detailed properties of 3NFs [1.], however, the total isospin channel of the 3NFs is limited to $T = 1/2$. Recently importance of the iso-spin dependence of 3NFs has also been pronounced for understanding of nuclear system with larger-isospin asymmetry, e.g. neutron-rich nuclei [2.] and neutron matter [3.]. The $p-^3$He scattering is an attractive probe since this system is the simplest one in which the 3NFs in the channels of total isospin $T = 3/2$ can be studied. In order to explore the properties of three-nucleon forces via $p-^3$He scattering, we have performed the measurements of spin observables at 65 MeV by using the newly developed polarized ^{3}He target and the polarized proton beam.

The experiment was performed at RCNP, Osaka University. Polarized proton beams were accelerated up to 65 MeV by the AVF cyclotron, and bombarded the polarized ^{3}He target. The typical beam polarization was $p_y^{\uparrow} \sim 50\%$, $p_y^{\downarrow} \sim 20\%$. The scattered protons were detected by $E - dE$ detectors which consisted of NaI(Tl) and plastic scintillators. The measured angles were 47, 89, and 133 degrees in the center of mass system.

The results of the spin correlation coefficient $C_{y,y}$ are shown in Fig.1. The statistical errors are shown only. The data are compared with the rigorous numerical calculation of the four-nucleon scattering based on the modern nucleon-nucleon potential [4.]. Here the INOY04 potential [5.] is taken into account. Clear differences are found around 90 degree.

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[3.] A. Gandolfi, *et al.*, Phys Rev C **85**, 032801 (2012).

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