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Scattering experiment using polarized deuteron beam and polarized proton target/偏極重陽子ビームと偏極陽子標的の衝突実験

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The study of three-nucleon forces (3NFs) is essential for clarifying various nuclear phenomena. The 3NFs arise naturally in the meson exchange model as well as in the framework of chiral effective field theory (EFT) [1]. In this framework, consistent two-, three- and many nucleon forces are derived on the same footing. The first non-vanishing 3NF diagrams appear at the third order, so called next-to-next leading order. At high orders, there are variety of spin and iso-spin dependent term of 3NFs as well as short range interaction terms. These short-range interactions involve unknown low energy constants determined from the experimental data. Few-nucleon scattering is one of a good probe to investigate in detail the properties of nuclear forces including 3NFs. The TOMOE project aims to pin down the chiral-EFT-based 3NFs from three nucleon scattering and establish the high-precision nuclear potential. We plan to measure the complete set of spin-correlation coefficients for deuteron-proton (*d*-*p*) elastic scattering at intermediate energies (approximately 100 MeV/nucleon).
The measurement of spin-correlation coefficients for *d*-*p* elastic scattering will be performed at RIKEN RI beam factory (RIBF). This measurement requires both the beam and the target to be polarized. At RIKEN RIBF, the highly polarized deuteron beam with the arbitrary spin control is available [2]. We developed the polarized proton target based on the dynamic nuclear polarization using photo-excited triplet electron (triplet-DNP) [3,4]. The triplet-DNP enables the mild operating conditions such as a low magnetic field (about 0.1 T) and high temperatures (about 100 K or more). The scattered particles are detected by the KuJyaku detector system [5] which is consisted of four multi-wired drift chambers and plastic scintillation counters. The KuJyaku system covers the scattering angles $\theta_{\mathrm{lab.}} = 10^{\circ}$–$60^{\circ}$ in the laboratory system. Using these experimental devices, we plan to perform the high-precision measurement of spin correlation coefficients.
In this talk, we explain our research backgrounds and report the details and recent developments of our experimental system.

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