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Development of a polarized proton target for spin-correlation coefficient measurements

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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). With the aim of pinning down the 3NF effects in comparison with the rigorous numerical calculation based on the chiral EFT, we plan to measure the complete set of spin-correlation coefficients for deuteron-proton elastic scattering at intermediate energies (~ 100 MeV/nucleon). For the measurement of spin-correlation coefficients, we develop the polarized proton target.

We require the following conditions for the polarized proton target system: 1) covering a wide angular range in the horizontal and vertical scattering plane, 2) high polarization ($> 20\%$), and 3) a low magnetic field (~ 0.1 T). We adopt a dynamic nuclear polarization (DNP) with photo-excited triplet electron spins (so-called triplet DNP method) to produce polarized protons. The polarized target is a single crystal of naphthalene doped with pentacene and has a size of $\phi 10 \times 3$ mm³. In this conference, we report the newly developed polarized proton target system.

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