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Preparation for Spin Correlation Coefficients Measurement in Polarized Deuteron-Polarized Proton Scattering Experiment

An adequate probe to investigate detailed characteristics of the Three Nucleon Forces (3NFs) is few-nucleon scattering experiment. Comparison between high-precision data in few-nucleon scattering (differential cross sections, various spin observables) and theoretical predictions based on rigorous numerical calculations enable us to extract information within the nuclear force. From an extensive performance of deuteron-proton elastic scattering at intermediate energies (70-300 MeV/nucleon) by a group in RIKEN, clear signatures of 3NF effects were confirmed in results of the cross section, whereas deficiencies of current 3NF models were revealed by those of spin observables.

In view of determining the 3NFs, we now plan to measure the spin correlation coefficients for polarized deuteron-polarized proton scattering at 100 MeV/nucleon. Polarized deuteron-polarized proton scattering experiment will be performed at RIKEN RIBF facility, using the polarized deuteron beam provided via the polarized ion source and the polarized proton target system based on triplet dynamic nuclear polarization (triplet-DNP) method. Polarized cross sections of particles scattered in left, right, up, and down directions will be measured with a detector system incorporating multi-wired drift chambers (MWDCs) and plastic scintillators. Data taken will be utilized to fix the low energy constants (LECs) in chiral effective field theory.

The polarized proton target and the detector system, both of which have been newly developed for the polarized deuteron-polarized proton scattering experiment, underwent a beam test at HIMAC in December 2022.

The following measurements have taken place:

- Quantification of target (naphthalene) crystal's polarization decrease from bombardment of 200 MeV proton
- Efficiency measurement of the MWDCs
- Derivation of target polarization from yield asymmetry measurement.

In this presentation, details on the planned polarized deuteron-polarized proton scattering experiment at 100 MeV/nucleon and the results from the beam test at HIMAC will be given.

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