Polarization Transfer Measurement for d–p Scattering and Three Nucleon Force Effects

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One current interest of the investigations of the few-nucleon system focuses on the study of the three-nucleon force (*3NF*) properties in the three-nucleon scattering. This is partly because that tremendous advance in theoretical approach in terms of Faddeev theory has made it possible to compare the numerical calculations with the precisely measured data. First strong indication of the *3NF* effects has been predicted in the cross section minimum for the nucleon–deuteron (Nd) elastic scattering at intermediate energies ($E/A \geq 60$ MeV)[1]. Later we have confirmed experimentally that the cross section minimum for Nd elastic scattering is clear evidence of the *3NF* effects[2,3]. In order to assess further the study of *3NF* effects, we have measured the deuteron-to-proton polarization transfer coefficients for *d-p* elastic scattering, which are expected theoretically to have strong sensitivities to the spin dependent parts of *3NF*.
The experiment was performed at the RIKEN Accelerator Research Facility using tensor and vector deuteron beams of 270 MeV. A liquid hydrogen (19.8 mg/cm^2) or polyethylene (93.4 mg/cm^2) target was bombarded and scattered protons were momentum analyzed by the magnetic spectrograph SMART. The polarizations of the scattered protons were measured with the focal-plane polarimeter DPOL. The measured observables were the deuteron to proton polarization transfer coefficients ($K_y^{y'}$, $K_{xx}^{y'} - K_{yy}^{y'}$, and $K_{xz}^{y'}$) in the angular range of $\theta_{\rm c.m.} = 90^\circ - 180^\circ$. This measurement also yielded an induced polarization ($P^{y'}$) of the outgoing protons. The statistical uncertainties are smaller than 0.03 for all the polarization transfer coefficients, and 0.01 for the induced polarization $P^{y'}$. The systematic uncertainties for the polarization transfer coefficients are estimated to be 3% at most.
These new data will be compared with the Faddeev calculations in this conference.

References

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[3] K. Sekiguchi *et al.*, Phy. Rev. C **65** (2002) 034003.