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Study of neutron–nuclear spin correlation term with a polarized Xe target

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Study of a correlation term, **s**·**I**, of a neutron spin **s** and a target nuclear spin **I** is important in investigating fundamental symmetry breaking in neutron-nuclear interactions, because it interferes with parity and time reversal non-conserving terms. Xe is an interesting material because a large parity non-conserving effect around neutron resonance peak has been observed, and also because its spin can be polarize to 10^{-2}–10^{-1} at pressures of 10^{-1}–10^{0} atm by using a spin-exchange optical-pumping method. For this study, we plan to measure the spin-dependent cross section and neutron spin rotation, which are predicted to depend on neutron energy around the resonance peaks. As a first step, we measured a neutron polarizing ability caused by the spin-dependent cross section at a 9.6 eV s-wave resonance peak of ^{129}Xe when unpolarized neutrons transmit through the polarized Xe target, and obtained a significant value of ~10^{-2} as a preliminary result.

KEYWORDS: SEOP, neutron polarizing ability, polarized Xe target, DB effect

1. Introduction

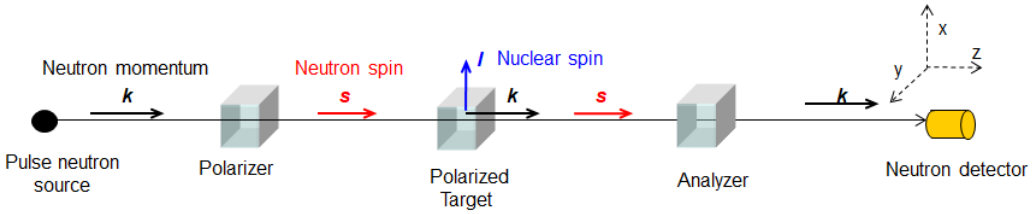

Figure 1. Propagation of polarized neutron through polarized target.

Polarized Xe has been utilized as a probe for investigating nuclear electric dipole moment by precisely measuring its Larmor precession, a standard sample for nuclear magnetic resonance (NMR), blood flow tracing, etc. [1, 2] In neutron science, it is interesting to study neutron–nuclear spin correlation terms using a polarized Xe target for studying the neutron optical theorem (NOPT). According to the NOPT, the propagation of a low-energy neutron through a target can be described using the forward-scattering