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NOPTREX: Polarized ^3He Neutron Spin Filter and Polarized Xenon Pseudomagnetic Precession

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The Neutron Optics Time Reversal Experiment (NOPTREX) collaboration is working towards a sensitive search for time reversal violation in polarized neutron transmission through polarized heavy nuclei. The experiment requires an intense, stable polarized neutron beam at the resonance energies of interest near 1 eV. We have recently constructed a ^3He neutron spin filter at Indiana University which makes use of the very large spin dependent neutron absorption cross-section of ^3He to polarize neutrons. We polarize ^3He gas using spin-exchange optical pumping (SEOP). We have combined our laser optics and oven with a μ -metal shielded solenoid and a ^3He gas cell from ORNL to realize our polarizer. We also discuss a planned experiment to measure neutron pseudomagnetic precession in polarized xenon gas. ^{131}Xe is one of the nuclei on interest for the NOPTREX test, and this measurement will help us determine a significant systematic error related to spin dependent components in polarized neutron-nucleus transmission and also measure the spin-dependent scattering amplitudes of both ^{129}Xe and ^{131}Xe for the first time. This experiment will use a Neutron Spin Echo spectrometer to measure pseudomagnetic precession and an existing SEOP system to polarize both ^{129}Xe and ^{131}Xe .

Summary

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