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High-sensitivity atomic magnetometer for neutron EDM (student talk)

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A non-zero neutron electric dipole moment (nEDM) would indicate time reversal and consequently charge-parity violation (T and CP). Many experiments are currently being conducted or planned to measure the nEDM. At present the experimental upper bound on the nEDM is 3.0×10^{-26} e-cm. Our collaboration is developing an experiment at TRIUMF to improve the sensitivity to the nEDM by over one order of magnitude (10^{-27}e-cm). I am proposed to develop a highly sensitive atomic magnetometer based on nonlinear magneto-optical rotation (NMOR). This is a crucial tool in the nEDM apparatus, for measurements of the stability and homogeneity of magnetic fields. The NMOR magnetometer is designed to serve in an array of such sensors to characterize the magnetic field in the experiment. An NMOR magnetometer has been developed and constructed at The University of Winnipeg. In this system an atomic vapour cell containing natural rubidium with stable isotopes Rb-87 and Rb-85 is used. An NMOR resonance occurs when the optical pumping is synchronous with Larmor precession. This causes the atomic vapor to become birefringent, so that subsequent probe light experiences polarization rotation modulated at the same frequency. Currently I am working on testing the performance of this NMOR magnetometer. I will report on latest experimental results on performance and of testing magnetic field stability, current source stability, temperature stability in our prototype magnetic field generation and shielding system.

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