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Dual Co-Magnetometer using Xe129 for Measurement of the Neutron's Electron Dipole Moment

Monday 15 June 2015 17:00 (15 minutes)

A new high-density ultra cold neutron source is being constructed and developed at TRIUMF in Vancouver, BC with collaborators from Japan and several Canada research groups. One of the first goals of this collaboration is to measure the electric dipole moment (EDM) of the neutron to an uncertainty of $<10^{-27}$ e-cm.

To measure the nEDM, a magnetic resonance (MR) experiment on polarized neutrons is performed and the uncertainty of these measurements is limited by how well the magnetic field surrounding the neutrons is known. Previous nEDM experiments relied on a precise in-situ measurement of the homogeneous magnetic field using a Ramsey fringe measurement of the spin precession of Hg^{199} (co-habituating with the cold neutrons).

Our efforts are to develop a co-magnetometer for nEDM measurements in which both Hg^{199} and a second atomic species (Xe^{129}) are introduced into the same region as the neutrons and measured simultaneously to better characterize the geometric phase effects which dominate the systematic uncertainties in the magnetic field determination. Xe^{129} was chosen, in part, due to its negligible interactions with the neutrons and the Hg^{199}.

The spin precession of Xe^{129}will be detected by measuring the fluorescence decay following a spin-selective 2-photon transition (driven by 252 nm light) from the ground $5p^6(^1S0)$ state to the $5p^5(^2P_{3/2})6p$ excited state. For this purpose, we have first developed a high power (˜200 mW) continuous wave UV laser. In this talk we will discuss the next steps in our co- magnetometer development: our latest results on characterizing the precision of Xe^{129}in the excited state using this laser and subsequently measuring the Larmor frequency of the polarized Xe^{129} in a magnetic field.

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