Dual Species Co-Magnetometer using $^{129}$Xe and $^{199}$Hg for Measurement of the Neutron’s Electron Dipole Moment

EMILY ALTIERE, JOSHUA WIENANDS, ERIC MILLER, TOMOHIRO HAYAMIZU, KIRK MADISON, TAKAMASA MOMOSE, DAVID JONES, University of British Columbia — A new ultra cold neutron (UCN) facility is under development with a flagship experiment of measuring the neutrons electric dipole moment (EDM) with a precision of $10^{-27}$ e-cm. Construction of the main apparatus is taking place at TRIUMF, with collaborators from Japan and Canada. To measure the nEDM, a magnetic resonance experiment on polarized neutrons is performed, where the uncertainty is limited by how well the magnetic field and its gradient are known. Previous nEDM experiments relied on in-situ measurements of the magnetic field using a Ramsey fringe measurement of the spin precession of $^{199}$Hg (cohabiting with the neutrons). In our work we introduce $^{129}$Xe as a second species (forming a dual co-magnetometer with $^{199}$Hg). Both species are utilized simultaneously to measure the magnetic field, thereby lowering the systematic uncertainties in the nEDM measurement. $^{129}$Xe was chosen for several reasons including its negligible interaction with the neutrons and $^{199}$Hg. The spin precession of polarized $^{129}$Xe is detected by measuring the fluorescence decay following a spin-selective 126-nm optical transition of $5p^6(1S_0) \rightarrow 5p^5(2P_{3/2})6p$. In this talk I will present our current progress in preliminary spectroscopy on $^{129}$Xe.