

2008 APS April Meeting and HEDP/HEDLA Meeting

St. Louis, Missouri

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Monday, April 14, 2008 3:30PM - 5:18PM –

Session T4 GPMFC: Electric Dipole Moment Experiments Hyatt Regency St. Louis Riverfront (formerly Adam039;s Mark Hotel), Promenade B

3:30PM T4.00001 Search for a permanent electric dipole moment of the mercury atom NORVAL FORTSON, University of Washington — There has been exciting progress in recent years in the search for a spin-aligned electric dipole moment (EDM) of atoms, molecules, and the neutron. Although such a time-reversal violating dipole has not yet been detected, highly touted theories of possible new physics, such as Supersymmetry, predict the existence of EDMs within reach of modern experiments. In 2001 our group published a precise limit on the EDM of the ^{199}Hg atom: $|d(\text{Hg})| < 2.1 \times 10^{-28}$ e cm. To further refine these measurements, we switched from two to a stack of four nuclear-spin-polarized Hg vapor cells. Two lie in parallel magnetic and anti-parallel electric fields, resulting in EDM-sensitive spin precession; the other two cells, at zero electric field, serve to cancel magnetic gradient noise and limit systematics due to magnetic impurities or leakage currents. To date, the statistical uncertainty for the new EDM data is 1.7×10^{-29} e cm. Constraining systematics to similar levels will thus yield an order of magnitude improvement over our previous measurement. The talk will highlight recent work and show our current results. This research is supported by NSF Grant PHY 0457320.

4:06PM T4.00002 Measuring the electron electric dipole moment with cold Cs and Rb atoms in optical lattices¹, DAVID WEISS, Pennsylvania State University — We will describe an experiment to search for the electron electric dipole moment using laser cooled alkali atoms trapped in two parallel 1D optical lattices. We have completed the first step in the experiment, the transfer $\sim 50\%$ of the atoms from a MOT to the measurement region 90 cm above the MOT. Transfer is accomplished by a ballistic launch, using the 1D lattice as a transverse guide. Our experimental geometry minimizes many sources of possible systematic error, and we project an ultimate sensitivity of $\sim 4 \times 10^{-30}$ e^{-cm}, which would be a 400-fold improvement over the current experimental limit.

¹This work was performed in collaboration with Fang Fang.

4:42PM T4.00003 Search for the electron electric dipole moment¹, DAVID DEMILLE, Yale University — In most viable extensions to the Standard Model, the electron is predicted to have a time-reversal violating electric dipole moment (EDM) at, or within a few orders of magnitude of, the current experimental upper bound. Experimental searches for the electron EDM hence have the capability to probe CP-violation at TeV (and potentially much higher) energy scales. Our group is developing new techniques to measure the electron EDM, with the long-term potential for improved sensitivity by many orders of magnitude. We are now taking data on a first-generation experiment using electrons embedded in the polar molecule PbO, where the size of the observable effect due to the EDM is dramatically amplified by the intramolecular electric field. This talk will describe the current status of the PbO EDM experiment, as well as plans for future upgrades.

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