



Old Dominion University Department of Physics

Colloquium

Tuesday, September 12, 2023

"Where is All the Antimatter? Electron EDM Search in Cold Molecules Edges Closer"

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Abstract:

The Standard Model of particle physics accurately describes all fundamental particles discovered so far. However, it is unable to address two great mysteries in physics, the nature of dark matter and why matter dominates over antimatter throughout the Universe. Novel theories beyond the Standard Model may explain these phenomena. These models predict very massive particles whose interactions violate time-reversal (T) symmetry and would give rise to an electric dipole moment (EDM) along the spin of electron and nucleon. Thus, searching for EDM provides a powerful probe to these new physics and sheds light on the mystery of the matter-antimatter asymmetry of the Universe.

Here, I share with you the recent progress of the ACME electron EDM search that sets one of the best limits on the value of electron EDM, measured by spin precession in a superposition of quantum states in cold molecules. New upgrades employing various quantum control and atomic physics techniques are recently demonstrated, projecting to constrain T -violating new physics in 10~100 TeV energy range, exceeding what the Large Hadron Collider can reach. In the meantime, a new generation of nuclear EDM search using radioactive molecules is also underway at FRIB, combining the state-of-the-art quantum metrology techniques and the nuclear enhancement from the octupole deformation in the nucleus. It projects to outperform the best EDM searches by several orders of magnitude in sensitivity to physics beyond the Standard Model.

Presentation: **OCNPS 200 @ 3:00 pm**

Refreshments: **OCNPS Atrium @ 2:30 pm**

All interested persons are cordially invited to attend.