

CSU PHYSICS COLLOQUIUM

“Where is All the Antimatter?”

Electron EDM Search in Cold Molecules Edges Closer ”

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120 Engineering (Hammond Auditorium)

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, such as models that incorporate supersymmetry, 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 electron's spin. 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 exciting journey of the ACME electron EDM search that has set the current best limit on the value of electron EDM, measured by spin precession in a superposition of quantum states in cold molecules. This result severely constrains T -violating new physics in $3\text{--}30$ TeV energy range, exceeding what can be reached at the Large Hadron Collider. New upgrades are now underway, projecting over an order of magnitude sensitivity enhancement for the next EDM search.

Biography

Xing Wu received his B.Sc in physics from Nanyang Technological University, Singapore, in 2009, and his master's degree in engineering physics from Technical University of Munich (TUM) in 2011, and his doctorate from TUM and the Max-Planck-Institute of Quantum Optics in Germany in 2017. He invented during his thesis an unconventional and sci-fi like method for deceleration of cold molecules—without laser beams but using a centrifuge. He has then joined the ACME collaboration as a postdoctoral fellow at the Physics Department of Harvard University and Yale University, and worked on the electron electric dipole moment (EDM) search using cold molecules. His ACME result in 2018 has set the most precise bound on the value of electron EDM, constraining new physics beyond the Standard Model in the tens of TeV energy range.