



ENRICO FERMI INSTITUTE COLLOQUIUM

A TABLETOP-SCALE PROBE FOR MULTI-TeV SCALE PHYSICS: THE ELECTRIC DIPOLE MOMENT OF THE ELECTRON

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Violation of time-reversal (T) symmetry is observed in K- and B-meson systems, and these measurements are explained within the standard model (SM) of electroweak interactions. However, additional sources of T violation are needed to explain the cosmological asymmetry between matter and antimatter. In the presence of T-violation, elementary particles such as the electron can have an electric dipole moment (EDM) along their spin axis. The SM prediction for the electron EDM is nonzero, but too small to detect. By contrast, extensions to the SM frequently predict EDMs within experimental reach. Our tabletop-scale experiment, ACME, uses methods of atomic and molecular physics to detect the electron EDM. Our recent result for the EDM is consistent with zero, but sets a limit ten times smaller than any previous work. Remarkably, this limit sets strong constraints on theories of physics beyond the SM. In many specific models, ACME probes physics associated with new particles whose mass is well above the few-TeV scale explored directly at the Large Hadron Collider. With excellent prospects for dramatic future improvements in sensitivity, EDM searches have the promise to probe plausible models of new physics even at the PeV scale.