

Towards measurements of symmetry-violating nuclear properties using single molecular ions in a Penning trap

J. Karthein¹, D. DeMille², J. Dilling³, R. Garcia Ruiz¹, N. Hutzler⁴, P. Mohapatra⁵, S. Moroch¹, R. Ringle⁶, S.M. Udrescu¹

1: Massachusetts Institute of Technology, Cambridge, MA 02139, USA

2: University of Chicago, Chicago, IL 60637, USA

3: TRIUMF, Vancouver, BC V6T 2A3, Canada

4: Caltech, Pasadena, CA 91125, USA

5: University of Washington, Seattle, WA 98195, USA

6: Facility for Rare Isotope Beams, East Lansing, MI 48824, USA

This contribution presents the ongoing development of a novel Penning ion trap for precision studies of single molecular ions. The strong magnetic fields of the Penning trap will bring molecular states of trapped particles and opposite parity into near superposition. This phenomenon can be used to enhance the sensitivity to measure electroweak nuclear properties by more than 11 orders of magnitude compared to atomic systems. [Altuntas, E. et al. Phys. Rev. Lett. 120, 142501 (2018).] These so-far unknown properties are, on the one hand, critical in the understanding of the nuclear force and structure of the nuclei but also provide precise low-energy tests of the standard model of particle physics and the violation of fundamental symmetries. I will present our current developments and future plans for studies of radioactive molecules.