Second generation measurement of the electric dipole moment of the electron using trapped ThF$^+$ ions

KIA BOON NG, YAN ZHOU, DANIEL GRESH, WILLIAM CAIRNCROSS, MATTHEW GRAU, YIQI NI, JUN YE, ERIC CORNELL, JILA, NIST and Department of Physics, University of Colorado, Boulder CO 80309-0440, USA — ThF$^+$ has been chosen as the candidate for a second generation measurement of the electric dipole moment of the electron (eEDM). Compared to the current HfF$^+$ eEDM experiment, ThF$^+$ has several advantages: (i) the eEDM-sensitive state ($^3\Delta_1$) is the ground state, which facilitates a long coherence time$^1$; (ii) its effective electric field (38 GV/cm) is 50% larger than that of HfF$^+$, which promises a direct increase of the eEDM sensitivity$^2$; and (iii) the ionization energy of neutral ThF is lower than its dissociation energy, which introduces greater flexibility in rotational state-selective photoionization via core–nonpenetrating Rydberg states$^3$. Here, we present progress of our experimental setup, preliminary spectroscopic data of multi–photon ionization, and discussions of new features in ion trapping, state preparation and population readout.