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An Electron EDM Search Using Trapped Molecular Ions LAURA SINCLAIR, JOHN BOHN, AARON LEANHARDT, EDMUND MEYER, RUSSELL STUTZ, ERIC CORNELL, JILA, NIST, and the Department of Physics, University of Colorado, Boulder, CO 80309 USA — A sample of trapped molecular ions offers unique possibilities to search for a permanent electron electric dipole moment (EDM). Specifically, we plan to perform this search using the unpaired electron spins in the $^3\Delta_1$ state of trapped HfF^+ molecular ions. Ions are easy to trap which will provide the long coherence times necessary to measure the small energy differences associated with an electron EDM. Additionally, the internal electric fields in polarized diatomic molecules can exceed 10^{10} V/cm, which will amplify any EDM induced energy splittings. We have created HfF^+ ions in a supersonic expansion jet by ablating a Hf target with a pulsed Nd:YAG laser in a He + 1%SF_6 environment. The chemical reaction $Hf^+ + SF_6 \longrightarrow HfF^+ + SF_5$ is exothermic and proceeds rapidly. The He buffer gas in the expansion cools the molecular translational, vibrational, and rotational degrees of freedom to ~ 10 K. We have measured these temperatures via laser induced fluorescence spectroscopy on known neutral Hf atomic lines and newly identified neutral HfF molecular lines, and are currently searching for the unknown HfF^+ electronic transitions.

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