PROGRESS OF THE JILA ELECTRON EDM EXPERIMENT

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Molecules can be advantageous for the search for the electron electric dipole moment (eEDM) due to the large effective electric field experienced by a bound, unpaired electron. Furthermore, the closely-spaced states of opposite parity make the molecules easy to polarize in the lab frame. The JILA eEDM experiment currently uses HfF^+ molecules in an ion trap to achieve long coherence times to reduce systematics.[a] When an electric field is applied the eEDM signal is proportional to the shift in energy splitting between two Zeeman levels in a low-lying, metastable $^3\Delta_1$ state. We have previously shown efficient preparation of trapped HfF^+ molecules in the rovibronic ground state, $X^1\Sigma^+(v = 0, J = 0)$.[b] Here, we demonstrate coherent transfer of population from the ground state to the $a^3\Delta_1(v = 0, J = 1)$ state through an intermediate $^3\Pi_{0+}$ state and efficient state read-out using photodissociation. In addition, we have begun to take spectroscopy data of the hyperfine and Zeeman structure of the eEDM science state in the presence of a rotating bias electric field and a magnetic field.

[a] A. E. Leanhardt et. al., Journal of Molecular Spectroscopy 270, 1-25 (2011).
[b] H. Loh et. al., Journal of Chemical Physics 135, 154308 (2011).