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Search for a permanent electric dipole moment on the electron (eEDM) using BaF molecules

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As the NL-eEDM collaboration, we are searching for a permanent electric dipole moment on the electron (eEDM) in a BaF molecular beam. In preparation of such an experiment we have performed spectroscopic measurements in a supersonic BaF beam. The lifetimes of the $A^2_{1/2}$ and $A^2_{3/2}$ states were obtained using short light pulses generated from a CW laser beam with a pulsed acousto-optic modulator. An eEDM search in BaF puts stringent requirements on the fields in an interaction zone. Those include an electric field of O(10 kV/cm) and a magnetic field of O(10 nT), both with small field gradients i.e. less than 1% inhomogeneity. We are currently building the interaction zone to work with the intense supersonic BaF beam. Ultimately the sensitivity can be improved with a substantially decelerated and laser-cooled BaF molecular beam. In our experiment we aim at an eEDM sensitivity down to $5 \times 10^{-30} \text{ e cm}$.

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