Search for the electric dipole moment of the electron using BaF molecules

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The search for the permanent electric dipole moment of the electron (eEDM) is intimately connected to CP-violation. While the Standard Model (SM) predicts the latter to occur, it is insufficient to account for the large matter-antimatter asymmetry observed in the Universe. The eEDM might be a probe to observe extended CP violation for which there exist numerous theories beyond the SM. Various experiments have been conducted, first focusing on atoms, but more recently the focus has shifted to molecules, where the effect of an eEDM on the quantum level structure is greatly enhanced. Besides ongoing experiments on YbF (Imperial College), ThO (ACME collaboration) and HfF^+ (Jila, Boulder) we have started an endeavor in the Netherlands to use BaF molecules as a probe [1]. While the P,T-odd enhancement factor for BaF is somewhat smaller than for the other target species [2] due to the fact that it is lighter (lower Z), this species is amenable to both laser cooling [3] and Stark deceleration, so that in principle longer coherence times could be achieved.

On the poster we will describe some of the recent activities and results on the preparation of a BaF eEDM experiment performed within a Netherlands based collaboration. A buffer gas cell-based slow molecular beam is built and characterized, and the Stark deceleration technique is demonstrated, on SrF molecules [4] and BaF molecules. In addition a novel spin-precession method is developed to analyze multi-level coherences between hyperfine levels in the ground state of barium monofluoride, in order to extract a constraint on an eEDM from long-term averaged data [5].

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