Contribution ID: **41** Type: **Poster presentation**

Understanding of Systematic Effects in eEDM Searches with diatomic molecules

Doing high-precision measurements on molecules is a promising way to explore physics beyond the Standard Model of particle physics. One such measurement is the search for the P,T-violating electric dipole moment of the electron (eEDM). The effect if the eEDM is expected to be strongly enhanced in diatomic molecules with one heavy atom, because of small rotational splittings and an enhanced electron density near a highly charged nucleus. Indeed, currently the best limit of d_e<1.1×〖10〗^(-29) e cm is measured in the diatomic molecule ThO [1]. In the NL-eEDM collaboration, the eEDM induced contribution to the ground state of BaF is investigated [2]. The eEDM manifests itself as a splitting between the magnetic substates due to the electric field, in addition to the Zeeman effect in magnetic fields. To measure the effect of a possible eEDM, a spin prec ession experiment is set up in well-controlled electric and magnetic fields. A superposition of two eEDM-sensitive hyperfine substates is created with a two-photon transition. In the magnetic and electric field, a phase difference between the two hyperfine states is accumulated, which has an extra contribution due to the electric field if the eEDM exists. The contributions to this phase from known-physics, in particular from the magnetic moment, require understanding of the molecular structure. The derived value for the eEDM is limited by statistics and the understanding of systematic effects.
To increase the statistical sensitivity, an intense source of ultracold BaF molecules will be used, produced in a cryogenic source. The molecules will be transversely laser cooled and decelerated with a Stark decelerator [3].
To have control over the systematics, it is crucial to understand how the eEDM signal depends on the experimental parameters, such as the magnetic field and laser intensities. For this a description of the dynamics of our spin-precession experiment is developed, based on the Optical Bloch Equations. With this tool the precision to which the experimental parameters need to be controlled and measured during the experiment can be calculated.

`ACME Collaboration. Improved limit on the electric dipole moment of the electron, Nature 562, 355–360 (2018).`

`The NL-eEDM collaboration., Aggarwal, P., Bethlem, H.L. et al. Measuring the electric dipole moment of the elec`

`P. Aggarwal, Y. Yin, K. Esajas, H. L. Bethlem, A. Boeschoten, A. Borschevsky, S. Hoekstra, K. Jungmann, V. R. Ma`

Scientific topic

Symmetries

Author: BOESCHOTEN , Alexander (1Van Swinderen Institute, Groningen, The Netherlands)

Presenter: BOESCHOTEN , Alexander (1Van Swinderen Institute, Groningen, The Netherlands)

Session Classification: Poster Session