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Measurement of the Xe-129 EDM

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Precision measurements of fundamental symmetry violations in atoms can be used as a test of the Standard Model of elementary particles and to search for new physics beyond it. Electric Dipole Moments (EDMs) of fundamental or composite particles are excellent candidates to look for new sources of CP violation. We describe a setup to measure the CP violating permanent EDM of the neutral 129Xe atom. Our goal is to improve the present experimental limit (dXe < 3 x 10-27 ecm [1]). The experimental approach is based on the free precession of co-located nuclear spin polarized 3He and 129Xe atoms in a homogeneous magnetic guiding field of about 400 nT [2, 3]. A finite EDM is indicated by a change in the precession frequency as an electric field is periodically reversed with respect to the magnetic guiding field. To render the experiment insensitive to fluctuations and drifts of the magnetic guiding field, the principle of co-magnetometry is used. The experiment strongly benefits from long spin-coherence times of several hours [4]. In the talk we report on technical improvements and first experimental results achieved within the MIXed collaboration.

[1] M. Rosenberry, T. Chupp; "Atomic Electric Dipole Moment Measurement Using Spin Exchange Pumped Masers of 129Xe and 3He", Phys. Rev. Lett 86 (2001).
[2] W. Heil et al., Ann. Phys. (Berlin) 525 (2013).
[3] F. Allmendinger et al., Phys. Rev. Lett 112 (2014).
[4] F. Allmendinger et al., "Precise Measurement of Magnetic Field Gradients from Free Spin Precession Signals of 3He and 129Xe Magnetometers"Eur. Phys. J. D 71 (2017).

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