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Search for a permanent electric dipole moment of 129Xe

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In this talk we report on the results of the experimental search for a permanent electric dipole moment of 129Xe (Xe-EDM) performed by the MIXed-collaboration. Our approach is to detect the free spin precession of hyperpolarized 129Xe nuclear spins and search for frequency changes correlated with the direction of an applied electric field. To eliminate frequency changes caused by magnetic field drifts we use co-magnetometry by adding hyperpolarized 3He to the measurement volume. We are able to measure frequency shifts with a statistical sensitivity of δω ~ 6x10^-10 rad/s within one day. To achieve this accuracy, numerous experimental challenges had to be mastered. For example, the development of a remarkably homogeneous magnetic field was an important step in order to obtain long spin coherence times of several hours and to achieve a high signal-to-noise ratio. The construction of the experimental setup and the optimization of the measurement procedures, along with systematic checks will be discussed in this presentation.
In a first proof of principle measurement we were already able to lower the present upper limit of the Xe-EDM by a factor of seven to |d(Xe)| < 1.0x10^-27 ecm (95% CL). The continuous development of the experimental conditions and the operating procedures will allow us to significantly improve our present sensitivity limits.

Primary author: Dr ZIMMER, Stefan (University of Heidelberg)

Co-authors: Prof. OFFENHÄUSSER, Andreas (Forschungszentrum Jülich); Dr NIEDERLÄNDER, Benjamin (Forschungszentrum Jülich); Dr ALLMENDINGER, Fabian (University of Heidelberg); Dr KRAUSE, Hans-Joachim (Forschungszentrum Jülich); Dr ENGIN, Ilhan (Forschungszentrum Jülich); Prof. JUNGMANN, Klaus (University of Groningen); Dr WILLMANN, Lorenz (University of Groningen); Dr REPETTO, Maricel (University of Mainz); Mr GRASDIJK, Olivier (University of Groningen); Dr KARPUK, Sergei (University of Mainz); Prof. SCHMIDT, Ulrich (University of Heidelberg); Prof. HEIL, Werner (University of Mainz)

Presenter: Dr ZIMMER, Stefan (University of Heidelberg)

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