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A new measurement of the permanent electric dipole moment of 129-Xe using 3-He comagnetometry and SQUID detection

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Permanent electric dipole moments (EDMs) arise due to the breaking of time-reversal or, equivalently, CP-symmetry. Although EDM searches have so far only set upper limits, which are many orders of magnitude larger than Standard Model (SM) predictions, the motivation for more sensitive EDM searches is stronger than ever.
The HeXe EDM experiment is using SQUIDs to detect the freely precessing nuclear spins of 129-Xe and 3-He to form a co-magnetometer in a very low magnetic field inside a high performance magnetically shielded room. The noble gas nuclei of 129-Xe and 3-He are simultaneously polarized by spin-exchange optical pumping using the rubidium D1 line at 795 nm. The newly developed EDM cells using silicon electrodes are filled with polarized gas directly from the optical pumping cell and then transferred into the magnetically shielded room. Inside, after applying a pi/2 pulse, both species can freely precess in the presence of applied magnetic and electric fields with transverse relaxation time constants beyond 4000 s. Low frequency precession signals are detected by SQUID sensors inside a liquid helium dewar with typical magnetic field noise density below 10 fT/sqrt(Hz).
In this talk I will report on the measurements leading to an improved limit on the EDM of 129-Xe.

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