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Search for a permanent electric dipole moment of ^{129}Xe

MIXed-collaboration

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A permanent electric dipole moment (EDM) of the isotope ^{129}Xe would imply a breakdown of both parity P and time-reversal symmetry T and, through the CPT theorem, a breakdown in CP, the combined symmetries of charge conjugation C and parity P. Our goal is to improve the present experimental limit ($d_{\mathrm{Xe}} < 3 \cdot 10^{-27}$ ecm) by about three orders of magnitude. The most precise EDM limit on diamagnetic atoms was measured on ^{199}Hg ($d_{\mathrm{Hg}} < 7 \cdot 10^{-30}$ ecm). To get more stringent limits, we perform a ^{3}He/^{129}Xe clock comparison experiment with the detection of free spin precession of gaseous, nuclear polarized ^{3}He or ^{129}Xe samples with a SQUID as magnetic flux detector. The precession of co-located ^{3}He/^{129}Xe nuclear spins are used as an ultra-sensitive probe for non-magnetic spin interactions of type $\Delta\nu \sim d_{Xe} \cdot E$. With our experimental setup at the Jülich research center we are able to observe spin coherence times of about 1 day for both species. We report on first experimental results achieved within the MIXed-collaboration.