Search for the Permanent Electric Dipole Moment of Xenon.

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A permanent electric dipole moment (EDM) implies breakdown of P (parity) and T (time reversal) symmetries. Provided CTP holds, this implies CP violation. Observation of an EDM at present and near future achievable experimental sensitivity would provide unambiguous evidence for physics beyond the Standard Model. This could give a hint towards understanding the observed matter-antimatter asymmetry in the universe. Experimental searches for atomic and particle EDMs have ruled out more speculative models than other individual experimental approaches. We aim to improve the current experimental limit on an EDM in ^{129}Xe ($|d_{\mathrm{Xe}}| < 3{\times}10^{-27}$ ecm [1]) by some 4 orders of magnitude.

A sensitive experimental approach is a spin clock, in our case co-located spin polarized ^{3}He and ^{129}Xe. SQUID detectors are used to monitor the free spin precession. With a co-magnetometer the spin precession can be exploited as an ultra-sensitive probe for nonmagnetic spin interactions [2]. A possible Xenon EDM results in a contribution to the spin precession frequency of $\triangle\nu \propto d_{\mathrm{Xe}} \cdot E$. The magnetic dipole interaction drops out due to the use of ^{3}He as a co-magnetometer [3,4].

The achievable spin coherence times and measurement sensitivity will provide for obtaining $|d_{\mathrm{Xe}}| < 10^{-29}$ ecm in one day.

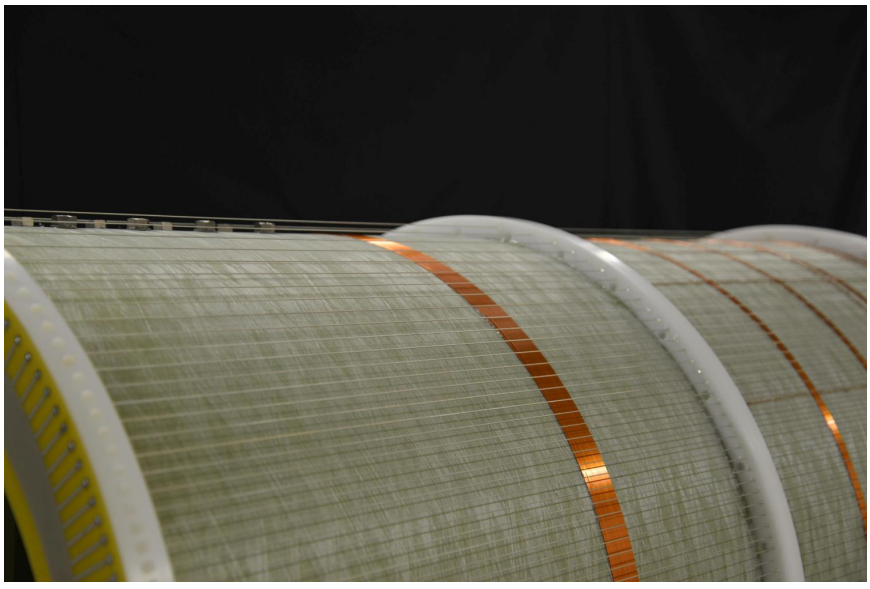

Figure 1: *A sensitive ^{129}Xe EDM search requires a magnetic field coil configuration to produce a field of high homogeneity.*

References

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