

Challenges of the world-wide experimental search for the electric dipole moment of the neutron



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SNS magnetic field

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The nEDM experiment at the Spallation Neutron Source (SNS) will search for a neutron electric dipole moment (EDM) with a sensitivity of $<5 \cdot 10^{-28}$ e-cm. Polarized neutrons will precess in a constant magnetic field while the electric field is varied, with a non-zero neutron EDM appearing as a variation in the precession frequency correlated with the electric field. Geometric phase and neutron polarization lifetime effects constrain the allowed magnetic field gradients to below 0.1 uG/cm. Gradients nearly satisfying this requirement have been measured using a $\cos(\theta)$ coil operated at design magnetic fields inside an open-ended superconducting lead shield. I will describe the cryogenic operation of the coil and shield, the three-axis fluxgate magnetometer field-mapping system, and further efforts to improve the magnet design by partially closing the end of the superconducting shield.

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