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Minimizing Environmental Magnetic Field Sources for nEDM[1]
ALEX BRINSON, BRADLEY FILIPPONE, SIMON SLUTSKY, CHARLES OSTHELDER, Caltech — Measurement of the neutron's Electric Dipole Moment (nEDM) could potentially explain the Baryon Asymmetry Problem, and would suggest plausible extensions to the Standard Model. We will attempt to detect the nEDM by measuring the electric-field-dependent neutron precession frequency, which is highly sensitive to magnetic field gradients. In order to produce fields with sufficiently low gradients for our experiment, we eliminate environmental effects by offsetting the ambient field with a Field Compensation System (FCS), then magnetically shielding the reduced field with a Mu-Metal cylinder. We discovered that the strongest environmental effect in our lab came from iron rebar embedded in the floor beneath the proposed experiment location. The large extent and strength of the floor's magnetization made the effect too large to offset with the FCS, forcing us to relocate our apparatus. The floor's magnetic field was mapped with a Hall probe in order to determine the most viable experiment locations. A 3-axis Fluxgate magnetometer was then used to determine the floor field's drop-off and shape at these locations, and a final apparatus position was determined which minimized the floor's effect such that it could be effectively offset and shielded by our experiment.

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