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Magnetic Field Apparatus for the Oak Ridge nEDM Experiment

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A search for the neutron electric dipole moment (nEDM) will take place at the Spallation Neutron Source at Oak Ridge National Lab, aiming for a sensitivity of $<3 \times 10^{-28}$ e-cm. Polarized ultracold neutrons will precess in a 30 mG magnetic holding field inside a liquid helium cell, which will be doped with a minute amount of polarized He-3 to measure the precession frequency. Magnetic field gradients in the detector must be reduced below 3 ppm/cm relative to the holding field in order to mitigate the false nEDM signal due to the geometric phase effect and to increase the neutron and He-3 polarization lifetime. Material selection is restricted by the dual requirements of cryogenic and non-magnetic operation. I will discuss a 1/3-scale prototype magnet system that has demonstrated the required sensitivity using a nearly-hermetic, superconducting lead shield, as well as ongoing efforts to build and magnetically survey the full-scale cryostat and magnetic apparatus.

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