

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



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High Electric field development for the SNS nEDM experiment

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The SNS nEDM collaboration is developing an experiment to search for the neutron's electric dipole moment (EDM), using ultracold neutrons (UCNs) stored in superfluid liquid helium, to be run at the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory. In this experiment, being able to achieve a strong and stable electric field in superfluid liquid helium in the region where UCNs are stored is of critical importance, because in EDM searches in general the sensitivity depends linearly on the strength of the applied electric field. However, the phenomenon of electric breakdown in liquid helium is poorly understood, and as such a major R&D effort is under way. The SNS nEDM collaboration has developed an apparatus to study electrical breakdown in liquid helium at temperatures as low as 0.4 K at pressures between the saturated vapor pressure and 1 atm for electrodes 12 cm in diameter with a gap size of a few cm. In this talk, the current status of the high electric field R&D and the implications of the findings on the SNS EDM experiment will be discussed.

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