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Studies of Electrical Breakdown in Pressurized Superfluid Helium-4 for the SNS Neutron Electric Dipole Moment Experiment
MACIEJ KAR CZ, CRAIG HUFFER, YOUNG JIN KIM, CHEN-YU LIU, JOSH LONG, Indiana University — Investigation of the dielectric strength of liquid helium (LHe) is motivated by the search for the electric dipole moment of the neutron (nEDM) at the Spallation Neutron Source (SNS). The SNS nEDM experiment uses a magnetic resonance technique on neutrons in a working medium of LHe. To achieve sensitivity of nEDM to the level of 10^{-28} e-cm, it requires an electric field of 50 kV/cm applied inside LHe. Prior results indicated that sustaining such a field in superfluid LHe at sub-Kelvins might be problematic. We are carrying out detailed electrical breakdown studies at Indiana University Cyclotron Facility. Results of measurements show that the specified field can be repeatedly applied to de-pressurized superfluid helium at temperatures as low as 1.7 K using a pressurization cycle. The observed hysteretic behavior has never been reported and we are working towards understanding the mechanism.

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