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Statistical distribution of electrical breakdown in liquid helium

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Realization of large electric fields is an important goal for neutron electric dipole moment (nEDM) experiments. For a nEDM experiment performed in superfluid helium such as the SNS nEDM experiment, it is vital to understand the behavior of high electric fields in this medium. The electrical breakdown, which limits the applicable electric potential and field, in liquid helium is poorly understood, but the breakdown is thought to be initiated at electrode surfaces. In order to obtain insight into this phenomenon, we collected data on the distribution of the breakdown voltage and the time before breakdown for small electrodes (effective area ~ 1 cm in diameter) immersed in liquid helium, at various temperature and pressures. In order to study the effect of the surface properties, both electro-polished and mechanically polished stainless steel electrodes were studied. In this talk, we will describe the measurement, present the results, and our interpretation of the results.

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