Abstract Submitted
for the DNP20 Meeting of
The American Physical Society

**Understanding electrical breakdown in liquid helium with a statistical distribution-based study**[1] NGUYEN PHAN, Los Alamos National Laboratory, BEN BEAUMONT, North Carolina State University, NATHAN BOUMAN, Valparaiso University, STEVEN CLAYTON, SCOTT CURRIE, TAKEYASU ITO, JOHN RAMSEY, Los Alamos National Laboratory, GEORGE SEIDEL, Brown University, WANCHUN WEI, Los Alamos National Laboratory, NEDM@SNS COLLABORATION — The neutron electric dipole moment (nEDM) experiment currently being developed to be mounted at the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory will perform measurements in superfluid helium at a field of 75 kV/cm. Vital to achieving this high field is a better understanding of the electrical breakdown phenomenon, which limits the applicable potential and field. To that end, we have collected data on the distribution of the breakdown voltages for small electrodes immersed in liquid helium under varying conditions. We will show how the electrode area scaling of the breakdown field is determined from a statistical analysis of the data. The predicted scaling agrees well with the results obtained by our group for larger sized electrodes as well as those obtained by other investigators, and, importantly, can be extended to other noble liquids. We will show that the dependence of the probability of breakdown on field strength, extracted from the data, closely resembles that of field emission, giving a strong indication that the initial process involves field emission from the cathode. Lastly, a discussion of the many parameters affecting the breakdown including temperature, pressure, electrode surface polish, and electrode gap separation will be presented.

[1]This work supported by the DOE Office of Nuclear Physics

Nguyen Phan
Los Alamos National Laboratory

Date submitted: 26 Jun 2020 Electronic form version 1.4