

Abstract Submitted
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In situ measurement of the permittivity of helium using microwave NbN resonators LOREN SWENSON, GRIGORIJ GRABOVSKIJ, OLIVIER BUISSON, CHRISTIAN HOFFMANN, ALESSANDRO MONFARDINI, Institut Neel, CNRS - Grenoble, France and University Joseph Fourier, JEAN-CLAUDE VILLEGIER, CEA-INAC, CEA - Grenoble, France — Due to their high quality-factors and ease of fabrication, superconducting microwave resonators are increasingly being recognized as ideal sensors in ultra-sensitive, low-temperature measurements. In this talk, we will discuss the design and characterization of superconducting NbN quarter-wave resonators implemented as a high-speed and spatially-sensitive detector for the permittivity of a surrounding helium bath. Measurements of a device with a $\sim 10^{-3}$ mm³ spatial resolution, a $\sim 6 \times 10^{-11}$ $\epsilon_0/\text{Hz}^{1/2}$ sensitivity to changes in the permittivity of helium, and a bandwidth of 300 kHz will be presented in the temperature range from 1.8 to 8.8 K. Potential applications, including operation as a fast, localized helium thermometer and as a transducer in superfluid hydrodynamic experiments, will be discussed.

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