Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Nonlinear Near-Field Microwave Microscopy for RF Defect Localization in Nb-Based Superconducting Radio Frequency Cavities[1]
TAMIN TAI, University of Maryland — Niobium Superconducting Radio Frequency (SRF) cavities are very sensitive to localized defects that give rise to quenches at high accelerating gradients. In order to identify these defects via scanning microscopy, and to further understand the origins of the quench under high radio frequency excitation (1-3 GHz), a scanning probe with localized and up to ∼200 mT RF magnetic field is required for low temperature microscopy to achieve sub-micron resolution. For this purpose, we developed a micro loop probe on silicon substrate with outer diameter 20 μm and inner diameter 17 μm and successfully fabricated it by lithography. The probe has been used to identify a signal arising from the nonlinear Meissner effect in a Nb thin film. In addition, a magnetic write head is another promising candidate to achieve this goal of understanding localized defect behavior under high RF magnetic field at low temperatures [1]. We will discuss and compare both types of probe for nonlinear scanning microscopy and RF defect localization in superconductors.

[1] Tamin Tai, X. X. Xi, C. G. Zhuang, Dragos I. Mircea and Steven M. Anlage, "Nonlinear Near-Field Microwave Microscope For RF Defect Localization in Superconductors" (http://arxiv.org/abs/1008.2948)

[1]We acknowledge the support of DOE/HEP.

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Date submitted: 16 Dec 2010 Electronic form version 1.4