

Abstract Submitted
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Comparison of local electrodynamic responses of superconducting materials—from bulk Nb to MgB₂ and Nb thin films¹ TAMIN TAI, BEHNOOD GHAMSARI, University of Maryland-College Park, TENG TAN, XIAOXING XI, Temple University, STEVEN ANLAGE, University of Maryland-College Park — A near-field magnetic field microwave microscope that enables mapping of the local electrodynamic response in the GHz frequency regime at liquid helium cryogenic temperatures was successfully built using the combination of a magnetic writer and a near field-microwave microscope [1]. Many superconducting materials, especially the candidate materials for superconducting RF cavities, were tested at a fixed location to analyze the local electromagnetic response, including both the intrinsic and extrinsic nonlinearities. The bulk Nb materials only show extrinsic nonlinearity, consistent with vortex generation and annihilation in the material. The measurements on Nb and MgB₂ thin film materials show not only the extrinsic nonlinearity due to the vortex mechanism, but also intrinsic nonlinearity. The intrinsic nonlinearity comes from the modulation of the superconducting order parameter near T_c, but behaves differently for single band gap (Nb) and two-gap (MgB₂) superconductors. Quantitatively analyzing the nonlinear mechanisms will enable the microscope to extract many material parameters and image the superconducting properties by raster scanning.

[1] Tamin Tai, *et al.*, IEEE Trans. Appl. Supercond. 21, 2615 (2011).

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Tamin Tai
University of Maryland-College Park

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