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Phase-sensitive measurements of harmonic response in high-Tc superconducting thin films by means of local microwave microscopy DRAGOS MIRCEA, STEVEN ANLAGE, Center for Superconductivity Research, Department of Physics, University of Maryland — The microscopic origins of Meissner-state nonlinearities in superconductors are still not clear. Traditionally, microwave nonlinear measurements of superconducting thin films employ a spectrum analyzer to measure the power carried by the harmonic signals ($P_{2f}$and P_{3f}). Such measurements have provided strong evidence for the Nonlinear Meissner Effect (NLME) at the critical temperature T_c in cuprates [PRB 71, 014507 (2005)]. Investigations of the NLME in underdoped $YBa_2Cu_3O_{7-\delta}$ (YBCO) thin films have revealed the existence of an additional nonlinear mechanism that onsets at T_c and leads to the persistence of P_{3f} above T_c, a feature which has not been observed in optimally-doped samples. A possible nonlinear source active at and slightly above T_c is the current-dependent normal conductivity, as proposed earlier by Mishonov and co-workers [PRB 65, 064519 (2002)]. The measurements performed with a spectrum analyzer do not provide phase information about the harmonic signals and therefore the nature of the nonlinear source (inductive vs. resistive) remains undetermined. However, nonlinear phase-sensitive measurements can be carried out with a network analyzer in the frequency offset mode and such data are instrumental in disentangling the effects of different types of nonlinear mechanisms. Work supported by NSF-GOALI , grant no. DMR-0201261

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