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Plasmonic Behavior of Deep Sub-Wavelength Superconducting RF Metamaterials[1] STEVEN ANLAGE, CIHAN KURTER, LIZA SARYTCHEV, JOHN ABRAHAMS, C. BENNETT, TIAN LAN, University of Maryland, A. P. ZHURAVEL, Verkin Inst. Low Temp. Phys., NAS Ukraine, A. V. USTINOV, Karlsruhe Inst. Tech. — We have designed and built ultra-small RF metamaterials with magnetically active spiral elements made of superconducting Nb films [1]. RF transmission measurements on single, 1-D and 2-D arrays of spirals show robust magnetic response when Nb is in the superconducting state [2] at frequencies as low as 14 MHz (corresponding to wavelength $\sim$ 3000 * 'atom' size). Numerical simulations capture the main features of the experimental spectra. The resonant features are tunable via variations in temperature and RF magnetic field [3]. As temperature approaches T_c, the superconducting kinetic inductance contribution to the total inductance increases, placing this RF metamaterial in the plasmonic limit. We study this approach to the plasmonic limit and compare to the analogous situation of frequency approaching the plasma edge in normal metal metamaterials.

[1] S. M. Anlage, J. Opt. 13, 024001 (2011).
[2] C. Kurter, *et al.*, Appl. Phys. Lett. 96, 253504 (2010).
[3] C. Kurter, *et al.*, IEEE Trans. Appl. Supercond., in press. arXiv:1008.2020.

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