Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Position-Dependent Optical Response of a Superconducting Resonator at 15 mK[1] K. D. VOIGT, J. B. HERTZBERG, J. E. HOFFMAN, J. A. GROVER, J. LEE, P. SOLANO, R. P. BUDOYO, C. BALLARD, J. R. ANDERSON, C. J. LOBB, L. A. OROZCO, S. L. ROLSTON, F. C. WELLSTOOD, JQI and CNAM Dept. of Physics, University of Maryland, College Park
— We have studied the optical and dielectric response of a translatable thin-film lumped-element superconducting Al microwave resonator cooled to 15 mK. The resonator has a resonance frequency of 6.14 GHz, a quality factor Q of 2.59 x 10^5 and is mounted inside a superconducting aluminum 3D cavity. A tapered optical fiber enters and exits the 3D cavity through two small holes in opposite sides of the cavity, placed so that the fiber can pass close to the resonator. The 3D cavity is mounted on an x-z piezo-translation stage that allows us to change the relative position of the lumped-element resonator and fiber. When the resonator is brought near to the fiber, we observe a shift in resonance frequency due to the presence of the fiber dielectric. When light is sent through the fiber, Rayleigh scattering causes a position-dependent illumination of the resonator, generating quasiparticles and thereby affecting its resonance frequency and Q. Our model of the resonator response includes the generation, diffusion, and recombination of quasiparticles in the resonator and shows that the frequency response allows us to track the position of the fiber in situ.

[1]Work supported by NSF through the Physics Frontier Center at the Joint Quantum Institute, Dept. of Physics, Univ. of Maryland.

Kristen Voigt
JQI and CNAM Dept. of Physics, University of Maryland, College Park

Date submitted: 14 Nov 2014 Electronic form version 1.4