Inductor Noise Study in Kinetic Inductance Detectors Made of TiN

Main author:

WANG Yiwen

Co-authors:

Austermann Jason, Department of Astrophysical and Planetary Sciences, CASA, University of Colorado

Cho Hsiao-mei, National Institute of Standards and Technology

Devlin Mark J., Department of Physics and Astronomy, University of Pennsylvania

Dober Brad, Department of Physics and Astronomy, University of Pennsylvania

Gao Jiansong, National Institute of Standards and Technology

Hilton Gene C., National Institute of Standards and Technology

Hubmayr Johannes, National Institute of Standards and Technology

Irwin Kent D., Department of Physics, Stanford University

Li Dale, National Institute of Standards and Technology

Vale Leila, National Institute of Standards and Technology

Vissers Mike R., National Institute of Standards and Technology

Wang Yiwen, National Institute of Standards and Technology

Wei Lianfu, Quantum Optoelectronics Laboratory, Southwest Jiaotong University

TiN is a promising material for superconducting microwave circuits. We are developing TiN/Ti/TiN films with Tc ~ 1.4 K for implementation as dual-polarization sensitive kinetic inductance detector (KID) arrays for the next-generation BLAST instrument. BLAST is a balloon-borne, sub-millimeter imaging polarimeter slated for launch in December 2016. We recently showed photon-noise limited sensitivity in lumped-element KIDs fabricated from these TiN/Ti/TiN films. Here, we report on a systematic study of the intrinsic noise (dark) in these devices with various inductor and interdigitated capacitor (IDC) geometries. We find that the low-frequency noise decreases with the inductor width in the range of 1 to 30 μm. However, the noise is independent of the IDC geometries (area, finger width and spacing), microwave power and bath temperature. The observed noise properties indicate that the noise is coming from the inductor instead of the capacitor and the main noise source is not the dielectric

two-level systems. We are investigating into new noise mechanisms that may lead to inductance fluctuations.