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## Novel measurement method for responsivity of microwave kinetic inductance detector by changing a power of readout microwaves

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Microwave Kinetic Inductance Detector (MKID) is one of cutting edge superconducting detectors. Its principle is based on a superconducting resonator circuit. A signal transferred to the MKID breaks Cooper pairs in the superconducting resonator. As a result, we detect an intensity of the signal as a variation of the resonant condition. It is important to calibrate the variation of the resonant condition i.e resonant phase with respect to the number of Cooper-pair breaks (quasiparticles). Changing a physical temperature of a MKID device has been used to derive its responsivity in the calibration. However, the difference between measured temperature and detector temperature causes a systematic effect. We propose a novel method for the responsivity calibration to reduce contamination of such systematics. Microwaves used for the detector readout locally raise the temperature in each resonator, and it creates quasiparticles. Since the increase of the temperature depends on a power of readout microwaves, the number of quasiparticles also depends on the power of microwaves. By changing the power of the readout microwaves, we are able to measure the phase difference and lifetime of quasiparticles simultaneously. This measurement results in a relation between the phase response as a function of the number of quasiparticles which is calculated from the measured lifetime. We demonstrate this responsivity measurement. We also confirm consistency among this method and conventional calibration methods within accuracy for each method.

### Less than 5 years of experience since completion of Ph.D

N

### Student (Ph.D., M.Sc. or B.Sc.)

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