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Development of Microwave Kinetic Inductance Detectors for CMB B-mode polarization measurements.

A development of Microwave Kinetic Inductance Detectors (MKIDs) is
presented. Our main objective for using this novel ultra sensitive millimeter wave detector technology is the detection of the Cosmic Microwave Background (CMB) B-mode polarization, which is a smoking-gun signal of the primordial gravitational waves predicted by the cosmic inflation theory. A satellite project named LiteBIRD (Lite(light) Satellite for the studies of B-mode polarization and Inflation from cosmic background Radiation Detection) is under consideration for this purpose.

The current design of the LiteBIRD has about 2,000 millimeter wave detectors, whose frequency ranges from 50 to 250 GHz. Candidate superconducting detector technologies include transition edge sensors (TES), superconducting tunnel junction sensors (STJ) and MKIDs.

MKIDs consist of many high-Q microwave resonators coupled to the same feed line with a HEMT or SQUID amplifier for readout. With this frequency-domain multiplexing scheme, MKIDs allow much higher multiplexing factors, lower power consumption and heat load than other superconducting detectors. This is an important adtantage for use in space.

In our MKIDs design, the multichroic antenna-coupled structure is adopted to cover the required frequency range. Additionally, the transmission-type MKID is used to simplify the resonant-frequency tracking for the enhancement of the dynamic range. We fabricated MKIDs using both CPW and microstrip transmission lines for the resonator structure, and measured their performance using newly developed readout circuit.
Further the combined mulrichroic design will be presented.

Author: Dr YOSHIDA, Mitsuhiro (High Energy Research Organization)

Co-authors: Dr KIBAYASHI, Atsuko (Okayama University); Dr ISHINO, Hirokazu (Okayama University); Mr WATANABE, Hiroki (The Graduate University for Advanced Studies); Dr HATTORI, Kaori (Okayama University); Mr KAWAI, Masanori (High Energy Research Organization); Prof. HAZUMI, Masashi (High Energy Research Organization); Dr SATO, Nobuaki (High Energy Research Organization); Dr KIMURA, Nobuhiro (High Energy Research Organization); Dr TAJIMA, Osamu (High Energy Research Organization); Mr MIMA, Satoru (Okayama University); Dr OKAMURA, Takahiro (High Energy Research Organization); Dr TOMARU, Takayuki (High Energy Research Organization)

Presenter: Dr ISHINO, Hirokazu (Okayama University)

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