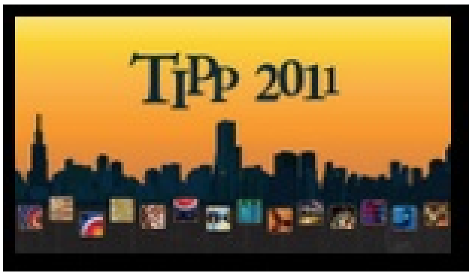

Contribution ID: **501** Type: **Oral Presentation**

Development of Superconducting Detectors for Measurements of Cosmic Microwave Background and Other Applications.

Thursday 9 June 2011 14:50 (20 minutes)

We present recent developments of Aluminum (Al) Superconducting Tunnel Junction (STJ) and Microwave Kinetic Inductance Detectors (MKIDs) for future measurements of the cosmic microwave background (CMB) polarization.

In an attempt to understand the mechanism of inflation in the early universe, we focus on observing the B-mode polarization pattern of the CMB. The pattern is known to carry information on the primordial gravitational wave which was generated during the inflation period. 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.

One of the candidate detectors is an Aluminum MKID (Microwave Kinetic Inductance Detector) consisting of many high-Q microwave resonators coupled to a readout feed line. MKIDs have much higher multiplexing factor, lower power consumption and heat load than other superconducting detectors. In our MKIDs design, the multichroic antenna-coupled structure is adopted to cover the required frequency range, and their performance is studied using newly developed readout system.

Another candidate is an antenna coupled Al STJ detector. The detector makes use of either the direct Cooper pair breaking or photon-assisted tunneling effect, and, in principle, is capable of covering a frequency range greater than 40GHz. We have newly developed the antenna coupled microstrip STJ that makes it much easier to match the impedance between the antenna and the STJ, compared with the parallel STJs widely used by the past experiments. This feature makes it possible to design the multichroic readout.

We are also fabricating Al STJ detectors that detect phonons generated in the substrate to which the energies are deposited by particles such as alpha, beta, X-ray and photon. The advantages of using STJs through phonons in the substrate instead of the TES calorimeters are that the STJ response is fast (~2us) and that the substrate can cover a large detection area. We have successfully detected alpha particles with the pure 7um diameter Al STJs on a 250x250um2 Al pad fabricated on a Si substrate.

Author: Mr MIMA, Satoru (Okayama University)

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 Accelerator Research Organization (KEK)); Prof. HAZUMI, Masashi (High Energy Accelerator Research Organization (KEK)); Dr YOSHIDA, Mitsuhiro (High Energy Accelerator Research Organization (KEK)); Dr SATO, Nobuaki (High Energy Accelerator Research Organization (KEK)); Dr KIMURA, Nobuhiro (High Energy Accelerator Research Organization (KEK)); Dr TAJIMA, Osamu (High Energy Accelerator Research Organization (KEK)); Dr OKAMURA, Takahiro (High Energy Accelerator Research Organization (KEK)); Prof. NOGUCHI, Takashi (National Astronomical Observatory of Japan); Dr TOMARU, Takayuki (High Energy Accelerator Research Organization (KEK))

Presenter: Mr MIMA, Satoru (Okayama University)

Session Classification: Astrophysics and Space Instr.

Track Classification: Astrophysics and Space Instrumentation