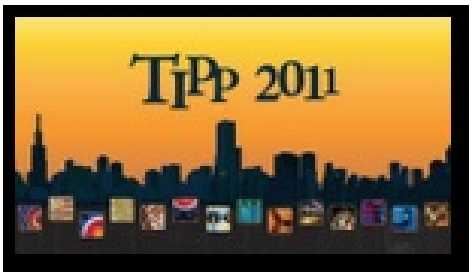

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Developments of Aluminum Superconducting Tunnel Junction (STJ) detectors for millimeter wave and particle detections

We present our recent developments of Aluminum Superconducting
Tunnel Junction (STJ) detectors for millimeter wave and particle detections.

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.
For the CMB B-mode observation, we need about 2,000 detectors capable of detecting millimeter wave.
In order to remove obstructive foregrounds, a wide frequency range of 50 to 230 GHz is necessary.
One of the detectors to satisfy the requirements 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 are newly developing antenna coupled microstrip STJ detectors.
Utilizing the microstrip STJs makes it much easier to match the impedance with the antenna
compared with the parallel STJs widely used by the past experiments.

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 detectors are able to measure the deposited energies with
the energy resolution five times better than the semiconductor detectors.
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 250x250umˆ2 Al pad fabricated on a Si substrate.

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