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Development of Superconducting Tunnel Junction Photon Detector with Cryogenic Preamplifier for COBAND experiment

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We present the status of the development of Superconducting Tunnel Junction (STJ) detector with the cryogenic preamplifier as a far-infrared single photon detector for the COsmic BAckground Neutrino Decay search (COBAND) experiment. The photon energy spectrum from the radiative decay of cosmic background neutrino is expected to have a sharp cutoff at high energy end in a far-infrared region ranging from 15meV to 30meV. The detector is required to measure an individual photon energy with a sufficient energy resolution less than 2% for identifying the cutoff structure, and to be designed for a rocket or satellite experiment. We develop a diffraction grating and an array of Nb/Al-STJ pixels, where each pixel can detect a single far-infrared photon delivered by the grating according to its wavelength. An amplifier is required to have a level of 10 electron equivalent-noise for the Nb/Al-STJ. To achieve high signal-to-noise ratio of the STJ, we use a preamplifier made with the Silicon on Insulator (SOI) technique that can be operated at low temperature around 0.3K. We have developed the Nb/Al-STJ with the SOI cryogenic preamplifier and have tested the detector performance around 0.3K. The present status of this STJ detector development is reported in details.

Summary

We present the status of the development of Superconducting Tunnel Junction (STJ) detector with the cryogenic preamplifier as far-infrared single photon detector for the COsmic BAckground Neutrino Decay search (COBAND) experiment.We have developed the Nb/Al-STJ with the SOI cryogenic preamplifier and have tested the detector performance around 0.3K. The present status of the development of this STJ detector with the SOI cryogenic preamplifier is reported in details.

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