



Modulated Blackbody Polarization Source for Characterization of CMB Detectors at 0.1 K

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We developed a calibration system with a modulated blackbody polarization source for detectors mounting on the 0.1 K stage in a dilution cooler. Our target application is characterization of detector for observations of the cosmic microwave background (CMB) polarization. This application requires a well-characterized polarization signal in a wide frequency range; e.g., 20--300 GHz. The system is attached at the bottom of the 0.1 K stage where we attach the detector on it. Radio absorbers, which are attached to the inner wall of a cylindrical metal shield, emit unpolarized black-body radiation (5 K). The radiation reflects off a stainless steel mirror at 115 K, which induces a linearly polarized component because of the finite emissivity of the mirror; the magnitude of the polarization is about 400 mK at 220 GHz frequency range in this configuration. Rotation of the mirror varies the axis of polarization signal. Therefore, the detectors measure the modulated polarization.

We succeeded in cooling the system properly; the sample stage for setting the detector achieved a temperature below 0.1 K under the load condition of 5 K [1]. We also

confirmed modulated signal by using microwave kinetic inductance detectors (MKIDs) which couple with double-slot antenna [2].

This system provides an absolute responsivity of the detector as well as the noise level under the loading of 5 K. They are results in noise equivalent temperature of each detector. We will apply this system to the characterization of MKIDs for CMB polarization experiment, GroundBIRD [3].

[1] K. Takahashi et al., J. Low Temp. Phys. 176, 822-828 (2014).

[2] K. Karatsu, S. Mima, S. Oguri, et al., IEICE Trans. Electron. E98-C, No. 3, (2015).

[3] S. Oguri et al., J. Low Temp. Phys. 176, Issue 5-6, pp. 691-697 (2014), S. Oguri, this conference.