SAPIENZA
UNIVERSITÀ DI ROMA

Contribution ID: **16** Type: **not specified**

Design and Electrical Performance of the Kinetic Inductance Detectors of the OLIMPO experiment

Thursday, 6 April 2017 14:50 (25 minutes)

In this contribution, we are going to show the design and the electrical performance of the horn-coupled lumped element kinetic inductance detectors (LEKIDs) for the OLIMPO experiment. OLIMPO is a balloon borne mission, devoted to the study of the largest structures in the Universe, by detecting the Sunyaev-Zel' Dovich effect of the Comsic Microwave Background (CMB) photons crossing clusters of galaxies. The multi-band focal planes (centered at 0.15, 0.20, 0.35 and 0.48 THz), large aperture telescope (2.6 m),
photometric and spectrometer configuration (OLIMPO is equipped with a plug-in differential Fourier transform spectrometer) make OLIMPO able to characaterize all the components of the Sunyaev-Zel'dovich effect with unprecedented precision. The design of the LEKIDs has been optimized to cope with a wide range of optical loadings (corresponding to both photometric and spectrometric configurations). The electrical characterization of the LEKID arrays was performed in the OLIMPO cryostat, at a temperutare around 300 mK and under a constant optical load lower than 500 fW. The readout electronics is a customized ROACH-2 coupled to a MUSIC DAC/ADC board. The averaged reasponsivities for the arrays, measured from the phase readout, are 1.18×10^(11) rad/W for the 0.15 THz array, 4.10×10^(10) rad/W for the 0.20 THz array, 1.09×10^(12) rad/W for the 0.35 THz array, and 4.41×10^(11) rad/W for the 0.48 THz array. Therefore, measuring the spectral noise density for each pixels of the arrays, whose average values are 2.5×10^(−5) rad/sqrt(Hz) for the 0.15 THz array, 3.6×10^(−5) rad/sqrt(Hz) for the 0.20 THz array, 5.1×10^(−5) rad/sqrt(Hz) for the 0.35 THz array, and 1.9×10^(−9) rad/sqrt(Hz) for the 0.48 THz array, we obtained the values of the averaged electrical noise equivalent power (NEP) over all the arrays: 2×10^(−16) W/sqrt(Hz), 9×10^(−16) W/sqrt(Hz), 5×10^(−17) W/sqrt(Hz), and 4×10^(−17) W/sqrt(Hz) respectively for the four OLIMPO arrays.

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Session Classification: Detectors THz and sub-THz