

The POLARBEAR-2 and Simons Array Focal Plane Fabrication Status

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Abstract

We present on the status of POLARBEAR-2 A (PB2-A) focal plane fabrication. The PB2-A is the first of three telescopes in the Simons Array, which is an array of three cosmic microwave background polarization-sensitive telescopes located at the POLARBEAR site in Northern Chile. As the successor to the PB experiment, each telescope and receiver combination is named as PB2-A, PB2-B, and PB2-C. PB2-A and -B will have nearly identical receivers operating at 90 and 150 GHz while PB2-C will house a receiver operating at 220 and 270 GHz. Each receiver contains a focal plane consisting of seven close-hex packed lenslet-coupled sinuous antenna transition edge sensor bolometer arrays. Each array contains 271 dichroic optical pixels, each of which has four TES bolometers for a total of 7588 detectors per receiver. We have produced a set of two types of candidate arrays for PB2-A. The first we call Version 11 (V11) uses a silicon oxide (SiO_x) for the transmission lines and crossover process for orthogonal polarizations. The second we call Version 13 (V13) uses silicon nitride (SiN_x) for the transmission lines and cross-under process for orthogonal polarizations. We have produced enough of each type of array to fully populate the focal plane of the PB2-A receiver. The average wirebond yield for V11 and V13 arrays is 93.2% and 95.6%, respectively. The V11 arrays had a superconducting transition temperature (T_c) of 452 $\pm$ 15 mK, a normal resistance (R_n) of 1.25 $\pm$ 0.20 Ω , and saturation powers of 5.2 $\pm$ 1.0 pW and 13 $\pm$ 1.2 pW for the 90 and 150 GHz bands, respectively. The V13 arrays had a superconducting transition temperature (T_c) of 456 $\pm$ 6 mK, a normal resistance (R_n) of 1.1 $\pm$ 0.2 Ω , and saturation powers of 10.8 $\pm$ 1.8 pW and 22.9 $\pm$ 2.6 pW for the 90 and 150 GHz bands, respectively. Production and characterization of arrays for PB2-B are ongoing and are expected to be completed by the summer of 2018. We have fabricated the first three candidate arrays for PB2-C but do not have any characterization results to present at this time.

Palabras clave

CMB; Fabrication; Instrumentation; Detectors; Transition edge sensor; Sinuous antenna; Polarization; Inflation