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Development of the low-frequency detectors for BICEP Array

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The BICEP/Keck (BK) experiment aims to detect the imprint of primordial gravitational waves in the Cosmic Microwave Background polarization, which would be direct evidence of the inflation theory. While the tensor-to-scalar ratio r has been constrained to be <0.06 at 95% c.l., further improvements on this upper limit are hindered by polarized Galactic foreground emissions. The 30/40 GHz receiver of the BICEP Array (BA), targeting to constrain the synchrotron foreground with unprecedented accuracy within the BK sky patch, will be deployed at the end of 2019. The receiver has a focal plane with 11 single-band detector tiles and one dual-color tile with the newly designed broad-band planar antenna. In this talk, I will show the full development path of the 30/40 GHz detectors from design to tests results. The low optical and atmospheric loading at these frequencies requires our TES detectors to have low saturation power in order to be photon-noise dominated. To achieve that, we have explored new leg designs for low island-to-bath thermal conductivity (G). To boost detector fabrication throughput, we have moved from 4" to 6" wafers, which introduced new challenges in the fabrication process, such as thickness uniformity across the tile. I will discuss how we overcame these issues and will present the measured detector parameters (G, Tc, Psat etc.) and optical performance (responsivity, beam, spectra). I will present on-sky noise performance estimates based on the lab measurements and will discuss the sensitivity forecast for the constraints on synchrotron amplitude and spectral index.

Less than 5 years of experience since completion of Ph.D

N

Student (Ph.D., M.Sc. or B.Sc.)

Y

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