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Design and performance of the BICEP Array receivers

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The inflationary scenario generically predicts the existence of primordial gravitational waves, though over a wide range of amplitudes from slow-roll to multi-field models. The presence of these tensor perturbations at the last scattering surface imprinted the cosmic microwave background (CMB) polarization with a unique parity-odd "B-mode"pattern at 1-degree angular scale. The BICEP/Keck (BK) Collaboration targets this primordial signature, which is parametrized by the tensor-to-scalar ratio "r", by observing the polarized microwave sky from the exceptionally clean and stable South Pole environment. Attempting to observe the primordial B-mode signal requires an instrument with exquisite sensitivity and tight control of systematics as well as a wide frequency coverage in order to disentangle the primordial signal from the Galactic foregrounds.

BICEP Array represents the "Stage-3" instrument of the BK program and it comprises four BICEP3-class receivers observing at 30/40, 95, 150 and 220/270GHz. The 30/40GHz receiver will be deployed at the South Pole during the 2019/2020 austral summer. The full instrument is projected to reach $\sigma(r) < 0.005$ by the end of a five years observation campaign with a 30000+ full detectors count. In this talk I will give an overview of the instrument, highlighting the design features in terms of cryogenics, magnetic shielding, detectors and readout architecture. I will also report on the integration and tests that are ongoing with the first receiver at 30/40GHz as well as the design upgrades we implemented for the more challenging 10k-detectors 150GHz receiver.

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

N

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

N

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