

BICEP/Keck: Constraining the Primordial Gravitational-Wave Signal with CMB Polarization Observations from the South Pole

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The inflationary scenario generically predicts the existence of primordial gravitational waves (GW), though over a wide range of amplitudes from slow-roll to multi-field models. Currently the most promising method for constraining, and potentially detecting, an inflationary GW background is to search for the imprint that these tensor perturbations would leave on the cosmic microwave background (CMB) polarization as a parity-odd “B-mode” pattern. The BICEP/Keck experiments (BK) target this primordial signature by observing the polarized microwave sky at degree-scale resolution from the South Pole. Attempting to observe the very faint primordial B-mode signal requires a telescope with exquisite sensitivity and tight control of systematics. The presence of bright Galactic emission, along with the distortion of the CMB polarization field due to gravitational lensing, make this measurement extremely challenging. In order to disentangle the primordial signal from these “foregrounds”, a wide frequency coverage is necessary. I will present the latest BK constraints on the tensor-to-scalar ratio “ r ” using data taken from 2010 to 2015 at 90, 150, 220 GHz (BK15), in combination with data from the Planck and WMAP satellites. Upcoming observations with the “Stage-3” BICEP Array experiment will extend this frequency range to 30–270 GHz, ultimately improving our sensitivity to r by an order of magnitude with respect to BK15, thus constraining natural inflation and all single-field models.

E-mail

moncelsi@caltech.edu

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Primary author: Dr MONCELSI, Lorenzo (California Institute of Technology)

Presenter: Dr MONCELSI, Lorenzo (California Institute of Technology)

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