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BICEP/Keck: Constraining the primordial gravitational-wave signal with CMB polarization observations from the South Pole

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Theories of inflation generically predict the existence of primordial gravitational waves over a wide range of amplitudes. Currently the most promising pathway for constraining inflationary gravitational waves is to search for the imprint these tensor perturbations would leave on the cosmic microwave background (CMB) as a B-mode polarization pattern. The BICEP/Keck experiments 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 an instrument with exquisite sensitivity and tight control of systematics. Bright Galactic emission at the same observing frequencies, along with polarization distortion due to gravitational lensing of CMB photons by large-scale structure, make this measurement extremely challenging. Distinguishing the primordial signal from these "foregrounds"requires a wide frequency coverage. I will present the latest constraints on the tensor-to-scalar ratio "r" from the BICEP/Keck experiments, using data taken from 2010 up to 2015 (BK15) in combination with data from the Planck and WMAP satellites. Future observations with the "Stage-3"BICEP Array experiment will expand in frequency range, steadily improving our sensitivity to r by an order of magnitude over the next few years and thus constraining natural inflation and most single-field models. Finally, I will outline how these efforts inform CMB "Stage 4"experiments, which will also probe the thermal history of our Universe, investigate Dark energy and general relativity, and study neutrino properties.

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