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SPIDER: Exploring the dawn of time from above the clouds and News from BICEP/Keck Array CMB program(35' + 5')

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SPIDER is a powerful balloon-borne instrument to map the polarization of the cosmic microwave background (CMB) at large angular scales. SPIDER targets the B-mode signature of primordial gravitational waves, with a focus on mapping a large sky area with high fidelity at multiple frequencies. SPIDER's six monochromatic refracting telescopes (three each at 95 and 150 GHz) feed a total of more than 2000 antenna-coupled superconducting transition-edge sensors. A sapphire half-wave plate at the aperture of each telescope modulates sky polarization for control of systematics. I will discuss SPIDER's first long-duration balloon flight in January 2015, including performance estimates and the current status of data analysis. I will also give an update on development toward SPIDER's second flight, which will feature expanded frequency coverage.

The BICEP/Keck Array program comprises a series of telescopes at the South Pole designed to measure cosmic microwave background polarization at degree angular scales, in search of imprints of inflation. This talk will describe the latest science results and recent technical improvements enabling further growth of the program. We use BICEP2 and Keck Array data collected through 2014 in 150GHz and 95GHz bands, in combination with Planck and WMAP data to constrain a model consisting of lensed-LCDM, galactic dust and synchrotron emission, and an inflationary gravitational wave (IGW) component. An excess over lensed-LCDM is detected and is consistent with dust. No significant evidence is found for synchrotron emission. We set a 95% confidence upper limit on inflationary tensor-to-scalar ratio, r<0.09 (0.07 when combined with Planck and WMAP data). This represents the first time that limits on inflationary tensors from CMB polarization have surpassed the constraining power of CMB temperature data alone. Data acquired in the 2015 season includes that from two new 220 GHz receivers deployed in the Keck Array to enhance sensitivity to dust emission. An additional two 220 GHz receivers were fielded in January 2016. We have also developed and deployed BICEP3, a 95 GHz receiver with 10x throughput compared to BICEP2. The high-throughput design of BICEP3-class receivers will be replicated to field an array replacing the current BICEP2-class receivers in the Keck Array. The resulting experiment called BICEP Array will hold ˜30,000 detectors spanning five frequency bands from 35 GHz through 270 GHz, and will perform a deep search for IGW in the presence of galactic emission and lensing foregrounds.

Primary author: FILIPPINI, Jeffrey (University of Illinois, Urbana-Champaign)

Presenter: FILIPPINI, Jeffrey (University of Illinois, Urbana-Champaign)

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