Contribution ID: **404** Type: **talk**

Probing the early universe through the polarization of the Cosmic Microwave Background

Tuesday, 13 July 2021 15:30 (15 minutes)

In the inflationary paradigm, a background of primordial gravitational waves is predicted to be produced. These perturbations would leave a unique signature in the curl component of the cosmic microwave background (CMB) polarization (B-modes). A detection of B-modes spectrum power at degree angular scale would constrain the intensity of the tensor perturbations generated during inflation . This information is encoded in the tensor to scalar ratio r.
The B-modes power spectrum is dominated by foregrounds such as synchrotron emission and polarized dust at small angular scales and by lensed curl-free CMB polarization (E-modes) at large angular scales. To isolate the large angular scale primordial B-modes signal, small aperture telescopes such as Bicep/Keck BK must work in conjunction with Large aperture telescopes (LAT) telescopes such as the South Pole Telescope that have higher resolution and are more sensitive to smaller angular scales to be able to pristinely remove the non-primordial signals.
To date we only have upper limits on r.
Several other collaborations are measuring stringent upper limits with state of the art instruments.
The combined efforts of the SPT and the BK collaboration joint analysis group, South Pole Observatory (SPO), will significantly improve the constraint (⊠(r)˜0.003 SPO) that could come from BK data alone (⊠(r)˜0.02 BK15).
The SPO r limit will hold until the CMB-S4 results (⊠(r)˜5e−4 forecast).
Moreover, thanks to its large number of sensitive detectors, scan strategy and sky coverage on a foreground clean patch of the sky, SPT-3G will give us the capability to deliver an independent constraint on r, that will be informative on the performances of the Large Aperture Telescope design for CMB-S4.

Are you are a member of the APS Division of Particles and Fields?

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Session Classification: Astoparticles and CMB

Track Classification: Astroparticles & CMB