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A Bayesian Neural Network based ILC method to estimate accurate CMB polarization power spectrum over large angular scales

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Observations of the Cosmic Microwave Background (CMB) radiation have made significant contributions to our understanding of cosmology. While temperature observations of the CMB have greatly advanced our knowledge, the next frontier lies in detecting the elusive B-modes and obtaining precise reconstructions of the CMB's polarized signal in general. In anticipation of proposed and upcoming CMB polarization missions, this study introduces a novel method for accurately determining the angular power spectrum of CMB E-modes and B-modes. We have developed a Bayesian Neural Network (BNN)-based approach to enhance the performance of the Internal Linear Combination (ILC) technique. Our method is applied separately to the frequency channels of both the LiteBird and ECHO (also known as CMB-Bharat) missions and its performance is rigorously assessed for both missions. Our findings demonstrate the method's efficiency in achieving precise reconstructions of both CMB E-modes and CMB B-mode angular power spectra, with errors constrained primarily by cosmic variance.

Primary author: YADAV, Sarvesh Kumar (Raman Research Institute, Banglore, India)

Presenter: YADAV, Sarvesh Kumar (Raman Research Institute, Banglore, India)

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