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Probing Inflation with PICO: Simulations and Delensing for CMB B-Modes

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Since its discovery in 1965, the cosmic microwave background (CMB) has been a cornerstone of our standard big bang cosmological model. Space- and ground-based experiments have precisely measured the CMB's intensity fluctuations across the sky and are improving measurements of its polarization. A current science objective is to search for the signature of an inflationary period that is thought to have occurred a fraction of second after the big bang, and that could have left an imprint on the polarization of the CMB.

The polarized CMB signal can be decomposed into parity-even E-modes and parity-odd B-modes. The inflationary signal would manifest itself as a B-mode signal. However, the signal is exceedingly faint, only one part in 100 million relative to the nearly uniform glow of the CMB, and finding it requires precise subtraction of confusing foregrounds, which have much larger amplitude. One such foreground are B-modes generated by distortion of E-modes into B-modes, a process called 'lensing'. Accounting for and removing this foreground is called 'delensing'.

PICO - the Probe of Inflation and Cosmic Origin - is a proposed NASA space mission that has been endorsed for implementation by the US Astro2020 Decadal Panel. Its data will give the most sensitive probe for B-mode inflationary signal. I will describe my contributions to developing the mission through conducting simulations and validating the efficacy of delensing.

PICO report NASA
Foreground separation and constraints on primordial gravitational waves with the PICO space mission JCAP

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