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CMB Foregrounds: Problems, Parameterizations, and Progress

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The next frontiers in cosmic microwave background (CMB) science include a detailed mapping of the CMB polarization field, with goals of detecting the inflationary B-mode signal and constructing high-fidelity maps of the matter distribution via CMB lensing reconstruction, as well as a first detection of CMB spectral distortions. At these levels of precision (\sim nK), Galactic and extragalactic foregrounds may be the ultimate limiting factor in deriving cosmological constraints. In this context, I will discuss recent work focused on extending CMB foreground parameterizations in a systematic, flexible way, with applications to both polarization and spectral distortion measurements. I will apply this methodology to spectral distortion detection forecasts for the Primordial Inflation Explorer, showing that high-significance measurements of the Compton- γ and relativistic thermal Sunyaev-Zel'dovich signals can be expected. I will conclude with a discussion of foregrounds in CMB lensing measurements, focusing on the kinematic Sunyaev-Zel'dovich effect, as well as recent progress in B-mode delensing, in which the CMB lensing signal itself represents a foreground for inflationary B-mode constraints.

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