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# The high-redshift tail of stellar reionization in LCDM is beyond the reach of the low-ell CMB

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The first generation (Pop-III) stars can ionize 1-10% of the universe by z=15, when the metal-enriched (Pop-II) stars may contribute negligibly to the ionization. This low ionization tail might leave detectable imprints on the large-scale CMB E-mode polarization. However, we show that physical models for reionization are unlikely to be sufficiently extended to detect any parameter beyond the total optical depth through reionization. This result is driven in part by the total optical depth inferred by Planck 2018, indicating a reionization midpoint around z=8, which in combination with the requirement that reionization completes by z~5.5 limits the amplitude of an extended tail. To demonstrate this, we perform semi-analytic calculations of reionization including Pop-III star formation in minihalos with Lyman-Werner feedback. We find that standard Pop-III models need to produce very extended reionization at z>15 to be distinguishable at 2-sigma from Pop-II-only models, assuming a cosmic variance-limited measurement of the low-ell EE power spectrum. However, we show that unless appealing to extreme Pop-III scenarios, structure formation makes it quite challenging to produce high enough Thomson scattering optical depth from z>15, tau(z>15), and still be consistent with other observational constraints on reionization.

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