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Robust constraints on the primordial power spectrum from mini halos and the CMB anisotropies

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Although the CMB and galaxy surveys provide precise measurements of the primordial power spectrum at large scales, the small-scale power spectrum remains largely unconstrained. An enhancement in the small-scale primordial spectrum (such as a spike) can lead to the formation of Ultra-Compact-Mini-Halos (UCMH) much earlier than standard halo can form. As a result, the DM annihilation signal receives a boost than can strongly impact the CMB power spectra. In this talk, I discuss how to carefully model the effect of s- and p-wave annihilations in UCMHs onto the CMB. I quantify the impact of late-time halo mergers using excursion set theory, and argue that the associated uncertainty in the boost of energy injection is limited for the CMB, but can have serious consequences for late time probes (i.e. for the 21-cm signal). Finally, I demonstrate that the derived CMB constraints on the amplitude of the small-scale spectrum are competitive with those coming from gamma-ray observations, even for p-wave processes.

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