Abstract Submitted
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Simulations of Microhalo Formation After an Early Matter-Dominated Era[1] SHERIDAN B. GREEN, Yale University, ADRIENNE L. ERICKCEK, University of North Carolina at Chapel Hill, MARCELO A. ALVAREZ, University of California, Berkeley — The evolution of the Universe between inflation and the onset of Big Bang nucleosynthesis is largely unknown. Several theories include an early matter-dominated era (EMDE) during the Universe's first second, driven by either a massive particle or an oscillating scalar field. During the EMDE, sub-horizon perturbations in the dark matter (DM) density grow linearly with the scale factor, as opposed to logarithmically during the radiation-dominated era, dramatically enhancing the microhalo abundance below the horizon scale at the end of the EMDE and above the free-streaming cut-off scale. We analyze two suites of small-box, high-redshift cosmological simulations: one suite based on a power spectrum that includes an EMDE enhancement and a small-scale cut-off and one suite based on a power spectrum with the same cut-off scale but no enhancement. The EMDE halo mass functions are in agreement with Press-Schechter theory, and 70% of DM is bound into microhalos by $z = 20$. The EMDE microhalos have steeper inner density profiles and higher concentrations than their standard counterparts due to their earlier formation times. They also contain significantly more substructure. We use these simulations to estimate how an EMDE boosts the DM annihilation rate in dwarf spheroidal galaxies.

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