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Dark matter at cosmic dawn: probing cosmological models through faint JWST high redshift galaxies

The *James Webb Space Telescope* (*JWST*) has unlocked the ability to observe the UV radiation of galaxies hundreds or thousands of times less massive and fainter than the Milky Way at "cosmic dawn," the earliest period of galaxy formation in our Universe. In the Lambda-CDM paradigm, galaxy growth occurs hierarchically through the conglomeration of these tiny structures, which hold a tenuous position at the boundary of interaction between dark matter halos and the galaxies they host. Faint galaxies at the high-redshift frontier thus trace the process by which inhomogeneities in the dark matter field collapse into dark matter halos that host primordial gas. To leverage the ongoing *JWST* observations as a probe of dark matter models, I present results from our high-resolution suite of Lambda-CDM hydrodynamics simulations, including Pop III star formation and the second-order supersonic relative velocities between dark matter and baryons. From individual star forming mini-halos to the faint end of the *JWST* UV luminosity function, I outline ways in which JWST can shed light on the complex processes of first star formation and galaxy buildup. Our work highlights that the nature of dark matter is interconnected with these observables, and novel probes of dark matter may soon be possible through space-based infrared observation.

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