Invited talk

Sweating the small stuff: Or how I learned to START worrying and love the smallest galaxies

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The currently favored cosmological paradigm, Lambda Cold Dark Matter Theory (LCDM), has been widely successful in predicting the counts, clustering, colors, morphologies, and evolution of galaxies on large scales, as well as a variety of cosmological observables. Despite these successes, several challenges have arisen to this model in recent years, most of them occurring at the smallest scales — those of dwarf galaxies (Mstar $<$ 10^9 Msun). To investigate these challenges, I will introduce a suite of extremely high-resolution cosmological (GIZMO/FIRE2) simulations of dwarf galaxies (Mhalo 10^{10} Msun), run to z = 0 with 30 Msun and sub-pc resolution, sufficient (for the first time) to resolve the internal structure of individual supernovae remnants within the cooling radius. Every halo with Mhalo $> 10^{8.6}$ Msun is populated by a resolved stellar galaxy, suggesting very low-mass dwarfs may be ubiquitous in the field. This new generation of simulations allows us to probe smaller physical scales than previously possible in cosmological simulations, and to make more detailed predictions for the counts, star formation histories, and chemical composition of the lowest mass galaxies ever observed. My simulations confirm many results at lower resolution, suggesting they are numerically robust (for a given physical model), but I also discover several intriguing discrepancies with observations. I will also discuss the implications of my work for t the emerging low surface-brightness sky.