# GALAXY FORMATION SIMULATIONS FOR PROBING THE NATURE OF DARK MATTER


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## Zoom Line: https://laurentian.zoom.us/j/92591146494


Several new astrophysical probes promise exquisite constraints on the nature of dark matter. The number counts of the smallest dwarf galaxies in the nearby Universe is sensitive to the small scale matter power spectrum, providing constraints on the temperature of a thermal relic dark matter particle – so-called "Warm Dark Matter" (WDM). Similarly, the statistics of holes punched in stellar streams around the Milky Way, and the statistics of additional lensing due to substructure along the line of sight to strong gravitational lenses, promise sensitive constraints on WDM models. Finally, the internal structure of dark matter halos is sensitive to wave-like and self-interacting dark matter models. However, all of these probes are reliant on accurate predictions for the distribution of dark matter inside galaxies, and for the statistics and visible properties of the smallest dark matter structures. In this talk, I discuss the numerical techniques that underpin these predictions. I discuss the successes and shortcomings of the latest techniques and explain why we have recently passed a key milestone in simulation realism: resolving the sites of star formation. I show how the latest simulations predict that dark matter is pushed out of the centres of dwarf galaxies by repeated gravitational potential fluctuations driven by gas cooling and "feedback" from exploding stars. And, I present observational evidence that suggests that this really happened in nearby dwarf galaxies. I conclude with a look to the future and the constraints on dark matter models that we can expect from a combination of new and improved theoretical models, and new upcoming survey data.


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