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The Inner Dark Matter Distribution in Hydrodynamic Simulations

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Understanding the dark matter distribution within a few kpc of the galactic center of the Milky Way is essential in estimating the dark matter content of the galaxy for indirect detection experiments, as well as understanding the particle nature of dark matter through the density profile in the Milky Way's core. Although it is difficult to accurately measure the inner stellar distribution in order to infer the dark matter distribution close to the galactic center, we can gain insight from cosmological simulations. However, the implementation of the baryonic physics in cosmological simulations varies between suites, making it more challenging to draw conclusions about our own Galaxy. In particular, these implementations are quite opaque at best, and for some simulation suites not publicly available. In this talk, I will discuss how we characterized the dark matter density profile in FIRE-2, Auriga, Vintergatan, and Illustris TNG50 using the adiabatic contraction algorithm from [1] to predict the dark matter density profile in the hydrodynamic simulations. I will show that Auriga, Vintergatan, and Illustris TNG50 can be well described by adiabatic contraction, while the stellar feedback in FIRE-2 dominates over the effects of the baryonic contraction. I will close by showing the dark matter annihilation/decay rates in simulations as well as predictions for the Milky Way's inner dark matter density profile and annihilation flux using observations of the stellar density profile.

[1] Oleg Y. Gnedin et al 2004 ApJ 616 16 (2004)

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