Kashiwa-no-ha park next to Kavli IPMU

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Understanding halo substructure for indirect dark matter searches

Tuesday, 4 June 2019 10:30 (45 minutes)

It is believed that the dark matter structures were formed hierarchically through mergers and accretions of smaller structures. This means that larger dark matter halos host many smaller subhalos. Cosmological N-body simulations have been performed to probe properties of the subhalos. However, because of finite computational resources, it is not possible to resolve the subhalos all the way down to their mass spectrum (which might be on the order of the Earth mass). Here I propose analytic models of dark matter subhalos, which combine extended Press-Schechter formalism that describes the subhalo accretion history with tidal stripping processes after the accretion. I show that the models provide extremely good fits to the subhalo mass functions found in numerical simulations of various scales. I then apply the models to indirect searches for particle dark matter through self-annihilation. First, I will compute the annihilation "boost" factor due to the subhalos, i.e., overall enhancement of the annihilation rate in the host halo. Second I will predict the number of dwarf galaxies that might be discovered with future surveys such as LSST. Third, I will provide new estimates of dark matter annihilation rates in known dwarf galaxies. Lastly, I will discuss implications for Fermi unassociated sources from the Gaia searches for possibly associated dwarf galaxies.

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