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Cosmic web topology and the characteristics of dark matter subhaloes

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The cosmic web, a complex network of thin walls, elongated filaments, and dense clusters enclosing empty voids, provides a map of the universe's dark matter density distribution. Dark matter halos are structures that form and grow due to the gravitational instability caused by initial density perturbations in the cosmic field, vary in their characteristics, such as mass and contained galaxies, depending on their location within the cosmic web. A complete, statistical description of the abundance of dark matter haloes down to the level of subhaloes can be obtained by accurately describing the conditional subhalo mass function, which gives the number of subhaloes that reside in a parent halo. By studying the effect of the cosmic web environment on subhalo properties, like subhalo velocity function, radial distribution, and others including subhalo mass function, we can gain insights into the impact of location in the cosmic web environment on parent haloes and the galaxies they contain. Although there is some evidence that the features of dark matter halos differ based on their cosmic web location, understanding the relationship between the properties of dark matter subhalos and their cosmic web location remains elusive. In this study, we explore the subhalo mass function, velocity function, radial distribution, and other intrinsic properties of dark matter subhalos through zoom-in N-body simulations. Our findings highlight the influence of parent halo properties and cosmic web location on subhalo properties, shedding light on the connection between the cosmic
web and dark matter subhalos.

Abstract Category

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Primary author: HUNDE, Feven Markos (Center for Theoretical Physics of the Polish Academy of Sciences, Al. Lotników 32/46, 02-668 Warsaw, Poland)

Presenter: HUNDE, Feven Markos (Center for Theoretical Physics of the Polish Academy of Sciences, Al. Lotników 32/46, 02-668 Warsaw, Poland)

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