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Cosmic Web Environmental Effects on Subhalo Abundance and Internal Density Profiles

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The cosmic web is the largest geometric structure in our universe, consisting of an intricate network of voids, walls, filaments, and dense nodes. Λ CDM predicts that dark matter halos, which trace this multiscale structure, form hierarchically and host smaller substructures known as subhalos. Understanding how the abundance and internal kinematics of subhalos vary across different cosmic web environments is crucial for the unbiased interpretation of observations related to small scales and satellite galaxies. Additionally, cosmological observations and N-body simulations suggest that dark matter halos may be sites of particle annihilation, potentially producing detectable Standard Model particles. In this talk, I will present our study using a high-resolution N-body simulation to investigate how subhalo abundance and internal properties depend on their cosmic web environment, with implications for dark matter searches and small-scale structure formation.

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