

The Impact of Dark Sector Physics on Large-Scale Structure Topology

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We compare the topological properties of the dark matter distribution in a number of cosmological models using hydrodynamical simulations and the cosmological genus statistic. Genus curves are computed from $z=11$ to $z=0$ for Lambda-CDM, Quintessence and Warm Dark Matter models, over a scale range of 1 to $20 h^{-1}$ Mpc. The curves are analysed in terms of their Hermite spectra to describe the power contained in non-Gaussian deformations to the cosmological density field. We find that the Lambda-CDM and Lambda-WDM models produce nearly identical genus curves indicating no topological differences in structure formation. The Quintessence model, which differs solely in its expansion history, produces differences in the strength and redshift evolution of non-Gaussian modes associated with higher cluster abundances and lower void abundances. These effects are robust to cosmic variance and are characteristically different from those produced by tweaking the parameters of a Lambda-CDM model. Given the simplicity and similarity of the models, detecting these discrepancies represents a promising avenue for understanding the effect of non-standard cosmologies on large-scale structure.

Summary

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