Optimizing the Extraction of Cosmological Information from the Latest Spectroscopic Redshift Surveys

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Cosmological constraints with Vornoi Volume Function

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Voronoi Volume Function (VVF) is the distribution of cell volumes in the Voronoi tessellation of a given set of Comological tracers. It encodes information about the full clustering hierarchy of the tracer population and serves as an excellent higher-order statistic for probing non-Gaussianity in the large-scale structure. Despite its sensitivity to cosmological parameters, redshift-space effects, and tracer properties, VVF remains relatively unexplored. In this work, we use a suite of N-body simulations to perform a Fisher forecast using VVF. Our results demonstrate that combining VVF information from multiple tracer populations can yield highly precise constraints on certain cosmological parameters. This work can be further extended by integrating VVF with other statistics, such as the power spectrum, to enhance cosmological constraints. Additionally, VVF presents exciting opportunities for studying galaxy evolution and the nature of dark matter. As observational surveys continue to improve in precision and coverage, incorporating VVF into large-scale structure analyses could provide additional insights and complement traditional statistical methods.

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