Lecture 4.1 (04:25-04:50)

Asymptotic expansion of the expected Minkowski functional for isotropic central limit random fields

Satoshi Kuriki (ISM)

The Minkowski functionals, including the Euler characteristic statistics, are standard tools for morphological analysis in cosmology. Motivated by cosmic research, we examine the Minkowski functional of the excursion set for an isotropic central limit random field, whose k-point correlation functions (kth-order cumulants) have the same structure as that assumed in cosmic research. Using 3- and 4-point correlation functions, we derive the asymptotic expansions of the Euler characteristic density, which is the building block of the Minkowski functional. The resulting formula reveals the types of non-Gaussianity that cannot be captured by the Minkowski functionals. As an example, we consider an isotropic chi-squared random field and confirm that the asymptotic expansion accurately approximates the true Euler characteristic density. We also compare the resulting formulas with the numerical N-body simulations.