

## Minkowski Tensors in Cosmology

*Monday, 4 March 2024 15:00 (1 hour)*

The tensor Minkowski functionals or Minkowski tensors (MTs) are generalizations of the usual Minkowski Functionals, which are scalar quantities. The MTs are a set of statistics defined as integrals over the boundary of an excursion set, with integrands related to symmetric tensor products of position vectors and normals to the boundary. They provide directional or anisotropy information that is not present in the scalar Minkowski functionals. Since 2017, the MTs have been used in cosmology. Efficient and accurate algorithms have been developed for calculation of MTs for analyses of cosmic microwave background radiation anisotropy on the surface of the celestial sphere, and matter and galaxy density fluctuations in 3D space or in 2D slice. Extensive studies have been made to examine the impacts of the nonlinear gravitational evolution, galaxy bias, and redshift space distortion on the MTs of large-scale structures in the universe. The recent developments in the application of the MTs in cosmology are reviewed.

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**Session Classification:** Chair: Chiaki Hikage