Contribution ID: **10** Type: **not specified**

Learning from Topology: Cosmological Parameter Inference from the Large-scale Structure

Tuesday, 5 March 2024 11:00 (1 hour)

A challenge common to different scientific areas is to effectively infer from big, complex, higher-dimensional datasets the underlying theory. Persistent homology is a tool in computational topology developed for recognizing the "shape"of data. Such topological measures have the advantages that 1) they are stable against experimental noise, 2) they probe multiscale, non-local characteristics of a dataset, 3) they provide interpretable statistics that encode information of all higher-point correlations. In this talk, I will focus on the applications of persistent homology to cosmological inference. I'll show how the constraints on primordial non-Gaussianities and cosmological parameters derived from persistent homologies are generally tighter than those from the redshift-space power spectrum and bispectrum combined. I'll also present a recent work in which we proposed a neural network model to map persistence images to cosmological parameters. Through a parameter recovery test, we demonstrate that our model makes accurate and precise estimates, considerably outperforming conventional Bayesian inference approaches. This provides a proof-of-concept that topological data analysis (via persistent homology) and machine learning can be combined for cosmological inference.

Presenter: SHIU, Gary

Session Classification: Chair: Takahiro Nishimichi