

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

Contribution ID: 5

Type: **not specified**

Field Level Inference with Fully Differentiable Hydrodynamical Physics

Thursday 17 July 2025 09:30 (30 minutes)

Ongoing and upcoming spectroscopic redshift surveys will reach unprecedented depths and number densities, providing a wealth of information about galaxy clustering. However, current perturbative approaches struggle to accurately model small-scale clustering due to uncertainties in galaxy formation and bias modeling. While various astrophysical probes can inform these models, no existing cosmological hydrodynamical simulation can self-consistently capture all relevant processes due to uncertainties in subgrid physics. I will present a new generation of hydrodynamical simulations which allow rapid gradient estimation through both the gas dynamics and subgrid models, facilitating efficient inference of underlying physical parameters and initial conditions. This framework opens new avenues for fully exploiting next-generation survey data at the field level.

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Session Classification: III day