Contribution ID: **50** Type: **YSF oral presentation**

Field-Level Inference with Microcanonical Langevin Monte Carlo

Monday, 30 October 2023 16:50 (10 minutes)

Extracting optimal information from upcoming cosmological surveys is a pressing task, for which a promising path to success is performing field-level inference with differentiable forward modeling. A key computational challenge in this approach is that it requires sampling a high-dimensional parameter space. In this talk I will present a new promising method to sample such large parameter spaces, which improves upon the traditional Hamiltonian Monte Carlo, to both reconstruct the initial conditions of the Universe and obtain cosmological constraints.
(Based on https://arxiv.org/abs/2307.09504 and further new results.)

Brainstorming idea [title]

Robust, optimal, and agnostic simulation-based inference in the real world

Brainstorming idea [abstract]

Simulation-based methods give us great power to do amortized inference, but are only as good as the simulations that trained them. This is a problem because simulations often do not represent the real-world data which they are used to infer from. The most simple solution is to cut out data where one doesn't trust the simulations, however, this risks obtaining biased results or throwing out valuable information, as the exact region of simulation validity is not known. Furthermore, while some more advanced methods exist to solve this problem, e.g. methods to deal with OOD data, they typically require some assumptions about the nature of the OOD data.

My brainstorming idea is to simultaneously combat all of these issues by building a robust, optimal, and agnostic method to automatically marginalize over OOD data. One potential route to achieve this is to carefully design the loss function to encode the uncertainty by considering the difference between the simulations and the data.

It would also be interesting to discuss OOD more broadly, understanding its relevance in the various fields of physics represented at this workshop, and also in the context of foundation models and LLMs, where OOD inputs can return confusing outputs.

Primary author: BAYER, Adrian (Princeton University / Simons Foundation)

Presenter: BAYER, Adrian (Princeton University / Simons Foundation)

Session Classification: Young Scientist Forum