Contribution ID: **121**

Type: **Flash talk**

Debating the Benefits of Differentiable Cosmological Simulators for Weak Lensing Full-Field Inference (LSST Y10 case study)

Wednesday, November 29, 2023 5:03 PM (3 minutes)

Conventional cosmic shear analyses, relying on two-point functions, do not have access to the non-Gaussian information present at the full field level, thus limiting our ability to constrain with precision cosmological parameters. Performing Full-Field inference is in contrast an optimal way to extract all available cosmological information, and it can be achieved with two widely different methodologies:
Explicit high-dimensional inference through the use of Bayesian Hierarchical Model (BHM)
Implicit Inference (also known as Simulation-Based Inference or Likelihood-Free Inference)
It is evident that differentiability of the forward model is essential for explicit inference, as this approach requires exploring a very high dimensional space, which is only practical with gradient-based inference techniques (HMC, Variational Inference, etc). In this work, we consider the question of whether implicit inference approaches can similarly benefit from having access to a differentiable simulator in a cosmological full-field inference scenario. Indeed, several methods (including ours) have been developed in recent years to leverage the gradients of the simulator to help constrain the inference problem, but the benefits of these gradients are problem dependent, raising the question of their benefit for cosmological inference. To answer this question, we consider a simplified full-field weak lensing analysis, emulating an LSST Y10 setting, and benchmark state-of-the art implicit inference methods making use or not of gradients.

This setting allows us to ask a first question: "What is the best method to optimally recover cosmological parameters for an LSST full-field weak lensing analysis with the minimum number of forward model evaluations?"There, our results suggest that gradient-free SBI methods are the most effective for this particular problem, and we develop some insights explaining why.

Primary author: ZEGHAL, Justine (APC, CNRS)

Co-authors: Dr BOUCAUD, Alexandre (CNRS); Ms LANZIERI, Denise (CEA Saclay); Dr LANUSSE, François (CNRS)

Presenter: ZEGHAL, Justine (APC, CNRS)

Session Classification: Contributed talks

Track Classification: Paris