

CASPEN Report

Judit Prat Marti

May 14, 2024

Visit Details

Visit Dates: April 14, 2024 - April 19, 2024

Visitor: Judit Prat Marti

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Summary of activities

During my visit to the University College London (UCL) from April 14 to 19, 2024, under the CASPEN program, I engaged in several productive discussions with several members of UCL. My activities were centered around the initial goals outlined in my funding request, with significant progress made in the areas of simulation-based inference for weak lensing mass maps. I delivered a presentation on the London Cosmology meeting, discussing an overview of my current research. I also had in-depth collaboration sessions with Niall Jeffrey and Joshua Williamson, focused on implementation details of the simulation based inference pipeline. These discussions were key to advance our joint projects within the Dark Energy Survey, which was the main purpose of my visit. Additionally, I attended the Royal Society meeting at the start of the week, which provided an excellent opportunity to interact with other leading researchers and discuss potential collaborations.

Research Outcomes and Timeline

We are preparing two papers based on projects discussed during the visit, expected to be submitted for publication before the end of 2024.

The first paper is based on applying simulation-based inference with contrastive learning on weak-lensing maps and aims to advance the application of contrastive learning in simulation-based inference by integrating neural compression techniques to analyze weak-lensing map statistics. The primary objective is to compare these innovative methods against the current state-of-the-art techniques developed by Niall Jeffrey and Joshua Williamson. During my visit to UCL, I interacted with both researchers to homogenize our analysis pipelines, which is crucial for setting up a structured comparison between the new contrastive learning techniques and the standard method. This comparative approach is expected to not only validate but also potentially enhance the robustness

and efficiency of weak-lensing analyses, paving the way for more accurate cosmological interpretations.

The second project is based on applying persistent homology on weak lensing maps. The discussions during my visit were also beneficial to implement the simulation based pipeline for this project that we are currently working on.

Furthermore, we also discussed potential follow-up projects for exploring explainability in the machine learning models we employ in these projects.

Conclusion

The CASPEN visit to UCL was highly beneficial, facilitating substantive progress on existing projects and initiating new opportunities for future collaboration. The discussions and feedback have provided a clear pathway for further development of our joint projects.

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