

Deep lensing: uniting gravity and neural networks

Strong gravitational lensing is a unique probe of dark matter substructure, which in turn provides a window into the particle physics properties of dark matter. However, dark matter subhalos produce only percent-level distortions in lensed images, thus requiring a pipeline capable of detailed source modeling. In this talk, I discuss how to tackle this problem by seamlessly combining a generative neural network model for source galaxies with a physics-based lens model. Our approach leverages automatic differentiation, a core machine learning technology, making it simple to perform accurate optimization and posterior sampling even for nearly one hundred lens and source parameters. I will also demonstrate how this approach enables detecting multiple dark matter subhalos in mock images for upcoming survey telescopes.

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