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Probing dark matter substructure using gravitational strong lensing in quad lensed systems

I will illustrate the groundbreaking potential of strong gravitational lensing as a tool to probe the substructures within dark matter halos, which are integral to comprehensive cosmic formation models. I simulated and evaluated the capabilities of imminent adaptive optics systems coupled with advanced detectors on ground-based telescopes, such as the Keck Telescope systems, the Thirty Meter Telescope, and the Giant Magellan Telescope1. The simulations predict dramatic improvements over current ones in both photometric and astrometric precision. Finally, I will explore the application of current and future datasets to various dark matter models2, by looking at the properties of structure formation. I will show results of my current work on creating dark matter ‘observational classes’and deriving relations between halo and sub-halo dark matter mass functions.

1 Zelko, Nierenberg and Treu 2023, MNRAS, https://ui.adsabs.harvard.edu/abs/2023arXiv231117140Z/abstract
2 Zelko et al. 2022, PRL, https://ui.adsabs.harvard.edu/link_gateway/2022PhRvL.129s1301Z/PUB_HTML

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