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Probing the nature of dark matter with galaxy-galaxy strong gravitational lensing

While a direct detection of the dark-matter particle remains very challenging, the nature of dark matter can potentially be constrained indirectly – by comparing the properties of substructure in galactic haloes with predictions from the phenomenological dark-matter models, such as the cold, warm or hot dark matter. Whereas these models are practically indistinguishable with respect to the predicted characteristics of high-mass substructure, the critical difference lies in the abundance and statistical properties of low-mass galactic substructure. Galaxy-galaxy strong gravitational lensing provides a unique opportunity to search for gravitational signatures of such low-mass substructure in lens galaxies beyond the Local Group. In this talk, I will present a novel approach to observationally constrain the statistical nature of low-mass sub-galactic structure in the inner regions of massive elliptical lens galaxies, based on the power spectrum of surface-brightness anomalies measured in highly-magnified galaxy-scale Einstein rings and gravitational arcs. A future comparison of these results with the predictions from hydrodynamical simulations might either verify the CDM paradigm or require its substantial revision.

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