Constraints on the nature of dark matter from quadruply-imaged quasars

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The abundance and density profiles of dark matter halos on sub-galactic scales, below $10^9 M_{\odot}$ solar masses, depend on the production mechanism, mass, and interactions of the dark matter particle(s). Galaxy-scale strong gravitational lenses provide the ideal observational platform with which to characterize the properties of low-mass halos because lensing depends only on gravity, and therefore circumvents the use of luminous matter as a tracer for unobservable dark matter. In particular, by forward modeling the relative brightness among images of quadruply-imaged quasars (quads), we can measure the halo mass function and the central densities of halos as a function of halo mass. I will discuss how we analyze lenses to extract this information, and present constraints on ultra-light and self-interacting dark matter from analyses of the existing sample of quads.

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