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# Using small-scale lensing anisotropies to constrain dark matter.

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Strong gravitational lensing provides a promising way to look for clues to the elusive particle nature of dark matter. Indeed, subtle perturbations to lensed images can reveal the dark-matter distribution on sub-galactic scales. In addition to the subhalos of the main lens, a significant contribution to these perturbations comes from dark matter halos along the line-of-sight between the observer and the source. Handling these multiplane lensing effects is computationally expensive. Here we introduce a new approach called "effective multiplane gravitational lensing" to study the collective effect of line-of-sight halos and main-lens dark matter substructure on extended lensed arcs. In this approach, the lens mapping between the source and image planes can be fully characterized by two "effective" lensing potentials encompassing the complete structure of the deflection field, and the line-of-sight halos and main-lens substructure contribute differently to each potential. Using this approach, we point out that line-of-sight halos between the observer and the source imprint a previously unstudied quadrupolar signature in the two-point correlation function of the effective convergence field. Our approach based on this anisotropic signal has the potential to statistically distinguish the line-of-sight halo contribution to lensing perturbations from that of main-lens subhalos in a strongly lensed system, hence significantly improving the constraint on dark matter from strong gravitational lensing.

## Collaboration name

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