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An excess of small scale strong lenses observed in galaxy clusters

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Thanks to the CLASH and Frontier Fields (FF) programs of the Hubble Space Telescope, it has been possible to identify an unprecedented number of strongly lensed sources in the central regions of several galaxy clusters. Complementing these observations with MUSE spectroscopy, we obtain high fidelity mass models for MACSJ1206, MACSJ0416, and AS1063. The models are consistent with the presence of massive and compact dark matter halos in cluster galaxies. Consequently, we estimate large cross-sections for galaxy-galaxy strong lensing (GGSL) in these clusters. Indeed, to confirm these expectations, we discover several multiple images of distant sources lensed by cluster members. Besides, eight additional CLASH and FF clusters with lens models available from the literature have similarly high GGSL cross-sections. We compare these observations with theoretical expectations in the concordance Λ CDM model with the aid of state-of-the-art N-body and hydrodynamical simulations. We find that the simulated clusters have GGSL cross-sections ~ 10 times smaller than measured in observations. We suggest that hitherto undiagnosed systematic issues with simulations or incorrect assumptions about dark matter properties could explain our results.

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