Title:	Exotic image formation in strong gravitational lensing by clusters of galaxies - I
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Abstract:	In a recent paper, we have discussed the higher order singularities in gravitational lensing. We have shown that a singularity map, comprising A3- lines and unstable (point) singularities (A4 and D4), is a compact representation of high magnification regions corresponding to a given lens model for all possible source redshifts. It marks all the optimal locations for deep surveys in the lens plane. Here, we present singularity maps for 10 different clusters lenses selected from the Hubble Frontier fields (HFF) and the Reionization Lensing Cluster Survey (RELICS) surveys. We have identified regions in the lens plane with a high magnification for sources up to redshift 10. To determine the dependence of unstable (point) singularities on lens mass model reconstruction techniques, we compared singularity maps corresponding to the different mass models (provided by various groups in the HFF survey) for each cluster lens. We find that the non-parametric (free-form) method of lens mass reconstruction yields the least number of point singularities. In contrast, mass models reconstructed by various groups using a parametric approach have a significantly larger number of point singularities. We also estimate the number of galaxies lying near these unstable (point) singularities, which can be observed with the James Webb Space Telescope (JWST). We find that we expect to get at least one hyperbolic umbilic and one swallowtail image formation for a source at z > 1 for every five clusters with JWST. These numbers are much higher than earlier estimates.
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