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# Exploring Galaxy Mass Profiles in Strongly Lensed Quasars Observed by the Roman Space Telescope

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Strong gravitational lensing of quasars is a powerful technique for probing cosmological parameters, tracing galaxy evolution, and investigating the internal structure of quasars. In this work, we explore the galaxy mass profile in lensed quasars expected to be detected by the Roman Space Telescope. Relying on estimates from previous studies, it is expected that approximately one in every 180 observed quasars will be strongly lensed by foreground galaxies, with about 85% of these events involving a single lensing galaxy. To simulate such systems, we employ Monte Carlo techniques, generating quasar–galaxy pairs based on observed redshift distributions, galaxy stellar masses, and the empirical relation between stellar mass and velocity dispersion. We model the lensing using three mass density profiles: the Singular Isothermal Sphere (SIS), Non-Singular Isothermal Sphere (NIS), and Singular Isothermal Ellipsoid (SIE). For each configuration, we compute the resulting image geometries, time delays, and magnification ratios. Our results show that the SIS and NIS models yield comparable time delays, typically ranging from a few hours to several years. In contrast, the SIE model —accounting for galactic ellipticity—produces a broader range of time delays, double-image configurations generally exhibiting longer delays. We also compute the magnification for each image and calculate their magnification ratios, which span several orders of magnitude across the three models. Notably, the largest magnification contrasts occur in double quasar systems. These findings are valuable for constraining galaxy mass distributions in lensed quasars and enhancing our understanding of large-scale cosmic structure.

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