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Signal Drop in Mass Density Profiles: Combining Lensing Simulations and Observations

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Gravitational lensing magnification bias is a valuable tool for studying mass density profiles, with submillimetre galaxies (SMGs) serving as ideal background sources. The satellite distribution in galaxy clusters also provides insights into their mass distribution. This study aims to investigate the signal drop in mass density profiles from magnification bias measurements, assessing the role of satellite galaxies through observational data and lensing simulations. Using a stacking technique, we analyze the radial distribution of satellites in clusters from the Zou et al. (2021, 2022) catalog and measure the magnification bias on background SMGs via angular cross-correlations. A gravitational lensing simulator aids in interpreting the results. Our analysis confirms that satellite distributions align with a Navarro-Frenk-White profile on large scales. However, a signal
drop at ~10 arcseconds suggests strong lensing effects from massive central galaxies or interacting groups. The study provides new insights into the mass density profiles derived from gravitational lensing and their relation to satellite distributions within galaxy clusters. The introduction of a gravitational lensing simulator helps to explain the emergence of an "Einstein Gap"induced by strong lensing effects that suppresses the expected signal. These findings provide a deeper understanding of how satellite galaxies influence gravitational lensing and offer a framework for improving mass density profile estimations in future studies

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