Title:	Gravitational lensing of gravitational waves: Probability of microlensing in galaxy-scale lens population
Authors:	Bagla, Jasjeet Singh (/jspui/browse?type=author&value=Bagla%2C+Jasjeet+Singh)
Keywords:	Gravitational lensing gravitational waves microlensing in galaxy
Issue Date:	2022
Publisher:	Oxford Academic
Citation:	Monthly Notices of the Royal Astronomical Society, 517(1), 872–884.
Abstract:	With the increase in the number of observed gravitational wave (GW) signals, detecting strongly lensed GWs by galaxies has become a real possibility. Lens galaxies also contain microlenses (e.g. stars and black holes), introducing further frequency-dependent modulations in the strongly lensed GW signal within the LIGO frequency range. The multiple lensed signals in a given lens system have different underlying macro-magnifications (|μ|) and are located in varied microlens densities (Σ•), leading to different levels of microlensing distortions. This work quantifies the fraction of strong lens systems affected by microlensing using realistic mock observations. We study 50 quadruply imaged systems (quads) by generating 50 realizations for each lensed signal. However, our conclusions are equally valid for lensed signals in doubly imaged systems (doubles). The lensed signals studied here have |μ| ∼ [0.5, 10] and Σ• ∼ [10, 103]M⊙ pc−2. We find that the microlensing effects are more sensitive to the macro-magnification than the underlying microlens density, even if the latter exceeds 103M⊙ pc−2. The mismatch between lensed and unlensed GW signals rarely exceeds 1 per cent for nearly all binary black hole sources in the total mass range [10M⊙, 200M⊙]. This implies that microlensing is not expected to affect the detection or the parameter estimation of such signals and does not pose any further challenges in identifying the different lensed counterparts when macro-magnification is ≤10. Such a magnification cut is expected to be satisfied by ∼50 per cent of the detectable pairs in quads and ∼90 per cent of the doubles in the fourth observing run of the LIGO–Virgo detector network.
Description:	Only IISER Mohali authors are available in the record.
URI:	https://doi.org/10.1093/mnras/stac2721 (https://doi.org/10.1093/mnras/stac2721) http://hdl.handle.net/123456789/4451 (http://hdl.handle.net/123456789/4451)
Appears in Collections:	Research Articles (/jspui/handle/123456789/9)

Show full item record (/jspui/handle/123456789/4451?mode=full)

(/jspui/handle/123456789/4451/statistics)