Sixteenth Marcel Grossmann Meeting



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Search for lensing signatures in the gravitational-wave observations from the first half of LIGO-Virgo's third observing run

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The Advanced LIGO and Advanced Virgo detectors are now observing large numbers of gravitational-wave signals from compact binary coalescences, with 50 entries in the latest transient catalogue GWTC-2. The next detector upgrades will continue bringing rapidly growing event rates and redshift range, so our chances become better both to detect rare astrophysical effects on these novel cosmic messengers and to employ them as cosmological probes. Gravitational lensing, with its long and productive history in electromagnetic astronomy, holds particularly great potential for the future of GW astrophysics and cosmology. This presentation covers the first LIGO-Virgo collaboration search for signatures of gravitational lensing in data from O3a, the first half of the third advanced detector observing run. We study: 1) the expected rate of lensing at current detector sensitivity and the implications of a non-observation of strong lensing or a stochastic gravitational-wave background on the merger-rate density at high redshift; 2) how the interpretation of individual high-mass events would change if they were found to be lensed; 3) the possibility of multiple images due to strong lensing by galaxies or galaxy clusters; and 4) possible wave-optics effects due to point-mass microlenses. Overall, we find no compelling evidence for lensing in the observed GW signals from any of these analyses on current data, but we also highlight the future prospects of lensed GWs with the current detector network at design sensitivity and future detectors.

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