

Second European Physical Society Conference on Gravitation: measuring gravity



Contribution ID: 82

Type: **talk**

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

Monday, 5 July 2021 14:23 (1 minute)

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. With this rapidly growing event rate, our chances become better to detect rare astrophysical effects on these novel cosmic messengers. One such rare effect with a long and productive history in electromagnetic astronomy and great potential for the future of GW astrophysics is gravitational lensing. 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. Several pairs of signals in the multiple-image analysis show similar parameters and, in this sense, are nominally consistent with the strong lensing hypothesis. However, taking into account population priors, selection effects, and the prior odds against lensing, these events do not provide sufficient evidence for lensing. Overall, we find no compelling evidence for lensing in the observed gravitational-wave signals from any of these analyses.

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Session Classification: Recorded Talks: Experimental Challenges in Gravitational Wave Detection

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