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Distortion of gravitational-wave signals by astrophysical environments

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Measuring the mass and distance of a gravitational wave (GW) source is a fundamental problem in GW astronomy. The issue is becoming even more pressing since LIGO and Virgo have detected massive black holes that in the past were thought to be rare, if not entirely impossible. The waveform templates used in the detection are developed under the assumption that the sources are residing in a vacuum, but astrophysical models predict that the sources could form in gaseous environments, move with relatively large velocity, or reside in the vicinity of supermassive black holes. In this talk, I will show how the above environmental factors could distort the GW signals and result in a biased estimation of the physical parameters. In particular, I will highlight the ubiquity of such a bias among the LIGO/Virgo sources forming in active galactic nuclei. If not appropriately accounted for, the above bias may alter our understanding of the formation and evolution of the LIGO/Virgo black holes.

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