Contribution ID: **12** Type: **not specified**

Hunting for the host galaxy groups of binary black holes and the application in constraining Hubble constant

Friday, 10 December 2021 14:00 (20 minutes)

The discovery of gravitational-wave (GW) signals, produced by the coalescence of stellar-mass binary black holes (SBBHs), opens a new window to study the astrophysical origins and dynamical evolutions of compact binaries. In addition, these GW events can be treated as the standard sirens to constrain various cosmological parameters. Both issues require the host identification for these GW events, with help of the spatial resolution of GW detector networks. In this paper, we investigate the capabilities of various detector networks for identifying the SBBHs' host galaxy groups, rather than their host galaxies, which can overcome the influence of galaxies' proper motions in dark matter haloes for measuring the cosmological parameters. In our analysis, the group catalogue of SDSS DR7 with redshift $z \in (0.01, 0.1)$ is considered as an example of the application. We find that for the second-generation (2G) detector network, the host galaxy groups of around (0.7–6.9) SBBHs can be identified per year assuming all sources are 30–30 M⊠ binaries, and that all five detectors in the network are in lock 100 per cent of the time. For the 3G detector network, this number becomes (3.9–40.0) yr−1. We also investigate the potential constraint on the Hubble constant H0 by these GW events, if their redshift information is extracted from the candidates of host galaxy groups. We find that, by 5-yr full time observations, 2G detector network is expected to give a constraint of ⊠H0/H0 ~ (1 per cent, 4 per cent), which can be more than two order smaller if considering the 3G detector network.

Primary authors: YU, Jiming; Prof. WANG, Yu; Prof. ZHAO, Wen; Prof. LU, Youjun

Presenter: YU, Jiming

Session Classification: Astro Session II