

Dark-Sirens : How to explore the cosmology with gravitational waves

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The LIGO-Virgo-Kagra (LVK) collaboration has detected 90 gravitational-wave (GW) events since September 2015, over three observing runs. These GW events can be used to infer the cosmological parameters of our Universe and peculiarly the Hubble constant H_0 . The Hubble constant is constrained using the luminosity distance estimated from each GW signals of compact binary coalescence, combined with an estimation of their corresponding redshift. The redshift is obtained via two approaches : The first method uses galaxy catalog information and the second one investigates the mass-redshift degeneracy. By breaking this degeneracy, the cosmological parameters are inferred jointly along with the population of binary black hole systems. When combined with the binary neutron star event GW170817, the Hubble constant was estimated at $H_0 = 68^{(+12)}_{(-8)} \text{ km.s}^{-1}\text{Mpc}^{-1}$ (68% CL) during the 3rd observing run.

This work presents the method that has been developed to perform such analysis, as well as the inclusion of binary black hole spin models, that could help constraining the cosmology. Moreover, I will also expose my new project, related to the induced bias in the Hubble constant in presence of a realistic population of binary black hole.

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