Contribution ID: **67** Type: **not specified**

Hierarchical inference of cosmological and population parameters from gravitational wave data with and without electromagnetic counterparts

Thursday 20 June 2024 17:15 (15 minutes)

Gravitational waves (GWs) from compact binary coalescences are standard sirens that can probe the cosmic expansion history of the late-time Universe if the source redshift is known. Methods for injecting redshift information into the inference process range from the direct detection of electromagnetic counterparts ("bright sirens") to the use of statistical properties inferred either from a catalog of possible hosts or from spectral features in the source-frame mass distribution ("dark sirens").
In this talk, I will present CHIMERA, a new code that combines these methods within a hierarchical Bayesian framework to constrain cosmological and GW population parameters simultaneously. I will discuss the constraints obtained with this code on a set of simulated O4 and O5 GW events and a complete galaxy catalog, showing that a percent-level measurement of H0 could be achieved in O5 using a spectroscopic galaxy catalog. Finally, I will describe the technical improvements we are developing to address the computational limits of the code and to accommodate the large amount of GW data coming from 3G detectors, such as the Einstein Telescope and LISA.

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Session Classification: Talks