Contribution ID: **70** Type: **Poster**

Unlocking Next-Generation Dark Siren Cosmology and General Relativity Tests with CHIMERA 2.0

Gravitational waves (GWs) from merging compact binaries have opened a new window into cosmology and fundamental physics, allowing precise tests of General Relativity (GR) and measurements of cosmic expansion. However, with the advent of future GW observatories, it is necessary to develop efficient and robust tools capable of handling the growing volume of data. In this talk, we present CHIMERA 2.0, a next-generation, GPU-accelerated, and fully differentiable pipeline for hierarchical Bayesian inference of cosmological, modified GW propagation, and population hyperparameters using dark sirens and galaxy catalogs. This code enables the analysis of several thousands of events, a crucial step for next-generation interferometers, such as the Einstein Telescope. Using CHIMERA 2.0, we analyze three mock populations of 300 dark sirens detected at SNR>20, assuming the nominal O5 sensitivity of the LIGO-Virgo-KAGRA network. Each population is characterized by a different value of the modified gravity parameter Ξ_0: 0.6, 1 (corresponding to GR), and 1.8. Taking advantage of the code's computational efficiency, we perform several Markov Chain Monte Carlo (MCMC) tests - analyzing ~5000 sources while varying MCMC configurations and galaxy redshift error assumptions. Using spectroscopic galaxy catalogs, we recover the fiducial Ξ_0 with accuracies of 22%, 7.5%, and 10% for Ξ_0 = 0.6, 1, and 1.8, respectively. At the same time, the precision on the Hubble constant H_0 is 2-7 times worse than when Ξ_0 is not marginalized. Photometric redshifts degrade the constraints by 3.5 times on average and fail to reduce parameter correlations that spectroscopic redshifts can resolve, underscoring the importance of future spectroscopic surveys to fully exploit the potential of standard sirens.

For talks:

I want to present a poster if I cannot get a talk slot

Primary author: TAGLIAZUCCHI, Matteo

Co-authors: MORESCO, Michele; BORGHI, Nicola

Presenter: TAGLIAZUCCHI, Matteo

Session Classification: Poster Session

Track Classification: Observational Science (OSB): Div2