Contribution ID: **8** Type: **Talk**

Constraining Cosmological Parameters through Cross-Correlation of Galaxy and Gravitational Wave Catalogs

Future GW observatories will provide large catalogs of resolved sources. Similarly to what is done with already existing galaxy catalogs, a natural way to extract information from those consists in using their statistical properties rather than focussing on individual events. A particularly promising technique for cosmology is the use of the two-point function between gravitational waves and other tracers of large-scale structures, such as galaxies. The former trace the large-scale structure in luminosity distance space, while the latter do so in redshift space, with the mapping between the two being informative on the underlying cosmology. This presentation focuses on forecasting the applicability of this technique to a combination of data from the Einstein Telescope, both independently and in a network with the Cosmic Explorer, alongside observations from the EUCLID satellite. In particular, I will consider as probes the auto and cross angular power spectra in tomographic redshift and distance bins between resolved black hole binary coalescences and galaxies with spectroscopic redshift measurements. I will discuss methodological aspects and present forecasts on the precision this technique can achieve in measuring cosmological parameters, with the goal of contributing to our understanding of key open problems, such as the Hubble tension. The forecasts take into account realistic uncertainties on the localisation of GW sources, state-of-the-art detector configurations and population models, as well as marginalisation over a set of nuisance parameters such as the galaxy bias.

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Session Classification: Parallel

Track Classification: OSB: Div2