Contribution ID: **10** Type: **not specified**

Multi-messenger Bayesian analysis of binary neutron start mergers

Thursday, 6 October 2022 10:45 (30 minutes)

The joint detection of the GW170817 and its electromagnetic counterparts is a milestone in multi-messenger astronomy and it can provide constraints on the neutron star equation of state.
The LIGO-Virgo data of GW170817 are analyzed using different template models focusing on the implications for neutron star matter properties.
We study AT2017gfo using semi-analytical model showing that observational data favor multi-component anisotropic geometries to spherically symmetric profiles.
By joining the GW170817 and AT2017gfo information with the NICER measurements, we constrain the radius of a neutron star of 1.4 M⊙ to 12.4±0.7 km (90% confidence level).
Finally, we explore future extreme-matter constraints delivered by postmerger gravitational-waves from binary neutron star remnants with next-generation detectors.
Postmerger remnants can probe the high-density regimes of the nuclear equation of state, allowing the inference of the maximum neutron star mass with an accuracy of 12% (90% confidence level).
Moreover, these transients can be used to infer the presence of non-nucleonic matter phases through the inference of softening of the equation of state.

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