ID de Contribution: **7** Type: **Non spécifié**

On the finite-size imprints on waveforms of binary neutron star mergers

jeudi 10 octobre 2024 10:10 (20 minutes)

Gravitational waves provide a pure probe for fundamental physics that manifests in coalescing binaries, supplementing the electromagnetic counterparts to form multimessenger signals. Precise measurement of waveforms can help us learn about the yet-fully-explored tidal response of neutron stars in late inspiral stages and about effects beyond general relativity (GR). In particular, the waveform of GW170817 has yielded certain constraints on the nuclear equation of state and the tolerance of non-standard gravitational models. However, the waveform detected in that event is only up to 500 Hz or so, and thus, future observation of higher-frequency bands is promising to further our understanding of these two aspects. In this talk, I will discuss how the tidally-excited fundamental mode of neutron stars may affect the late-time binary waveform by using a harmonic model for dynamic tides and a post-Newtonian treatment of orbital motion. In addition, I will also discuss the imprints of non-GR effects while focusing on massive scalar-tensor theories. Since we are interested in high scalar masses, such effects can only be noticeable in the band of several hundred Hz, for which a numerical survey is a unique way to model it. As a first step, we construct quasi-equilibrium sequences of binary neutron stars to estimate the size of scalar effects for different theory parameters.

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Classification de Session: Contributed talks