

Black-hole - neutron-star mergers: new numerical-relativity simulations and multipolar effective-one-body model with spin precession and eccentricity

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In this talk, we present 52 new numerical-relativity (NR) simulations of black-hole-neutron-star merger (BHNS) mergers and employ the data to inform TEOBResumS-Dalí: a multipolar effective-one-body model also including precession and eccentricity. Our simulations target quasicircular mergers and the parameter space region characterized by significant tidal disruption of the star. Convergent gravitational waveforms are produced with a detailed error budget after extensive numerical tests. We study in detail the multipolar amplitude hierarchy and identify a characteristic tidal signature in the $(\ell,m)=(2,0)$, and $(3,0)$ modes. We also develop new NR-informed models for the remnant black hole and for the recoil velocity. The numerical data is then used to inform next-to-quasicircular corrections and the ringdown of TEOBResumS-Dalí for BHNS. We show an overall order of magnitude improvement in the waveform's amplitude at merger and more consistent multipoles over our older TEOBResumS-GIOTTO for BHNS. TEOBResumS-Dalí is further validated with a new 12 orbit precessing simulation, showing phase and relative amplitude differences below ~ 0.5 (rad) throughout the inspiral. The computed mismatches including all the modes lie at the one percent level for low inclinations. Finally, we demonstrate for the first time that TEOBResumS-Dalí can produce robust waveforms with both eccentricity and precession, and use the model to identify the most urgent BHNS to simulate for waveform development. Our new numerical data are publicly released as part of the CoRe database.

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