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A phenomenological inspiral-merger-postmerger gravitational waveform model for binary neutron star coalescence

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Gravitational waves provide us with an extraordinary tool to study the matter of neutron stars. In particular, the postmerger signal will reveal a lot of information about matter at such high densities. Although current detectors are mainly sensitive to the signal emitted by binary neutron stars during the inspiral and merger phase, the detectors' improvements planned for the next observing runs and future generation detectors, like Einstein Telescope and Cosmic Explorer, will allow us to detect postmerger signals too. We present a new model for the inspiral-merger-postmerger signal emitted by binary neutron stars systems. The inspiral part of the model is described by one of the state-of-the-art waveform models employing a closed-form expression for the tidal contribution, while the postmerger is modeled with a three-parameters Lorentzian, with two different approaches: in one case the Lorentzian parameters are kept as free parameters, in the other one we model them via quasi-universal relations. We test the performance of both versions of our model in parameter estimation analysis, employing a set of signals obtained from hybrid waveforms, and simulated at different distances. We compare the results for the LIGO-Virgo network with aLIGO+ sensitivity to a network including also LIGO-India and KAGRA. We also study the possible improvement given by the high-frequency detector NEMO, and we finally compare results to what we will obtain for the same sources with third-generation detectors.

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