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Tidal excitation of normal modes in eccentric binary neutron stars ROMAN GOLD, University of Illinois at Urbana-Champaign, SEBASTIANO BERNUZZI, MARCUS THIERFELDER, BERND BRUEGMANN, Friedrich-Schiller University Jena, FRANS PRETORIUS, Princeton University —
Neutron star binaries offer a rich phenomenology in terms of gravitational waves and merger remnants. However, most general relativistic studies have been performed for nearly circular binaries, with the exception of head-on collisions. We present the first numerical relativity investigation of mergers of eccentric neutron-star binaries that probes the regime between head-on and circular. Upon variation of the initial eccentricity, covering cases from direct plunge to more adiabatic inspiral, we study the outcome of a binary composed of two $1.4M_\odot$ neutron stars. We characterize the gravitational wave emission, the internal dynamics of the stars and the properties of the merger remnant. In addition to gravitational waves generated by the orbital motion, we find that the signal also contains a strong component due to stellar oscillations (f-modes) induced by tidal forces, extending a classical result for Newtonian binaries. Such signatures may be used to constrain the NS equation of state. With the exception of extreme eccentricities (near head-on collisions) the merger leads generically to rather massive disks, which in some cases can be on the order of 10% of the total initial mass. All merger remnants form a black hole making such encounters a plausible SGRB engine.

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