

Abstract Submitted
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**Study of f-mode Oscillations in Numerical Relativity Simulations
of Perturbed Neutron Stars and Highly Eccentric Binary Neutron Star
Mergers**

SHAWN ROSOFSKY, Univ of Illinois - Urbana, ROMAN GOLD, Goethe-University Frankfurt, CECILIA CHIRENTI, Universidade Federal do ABC, COLE MILLER, University of Maryland — We discuss results from high-resolution numerical relativity (NR) simulations of neutron star (NS) f-mode oscillations obtained with the Einstein Toolkit. We excited isolated NSs in one of their eigenmodes, evolved the system via NR simulations and compared different reconstruction methods, space-time evolution formalisms, perturbation amplitudes and grid spacings. We identify settings that resolve the physical damping time of the f-mode oscillations due to gravitational wave (GW) losses on a secular time scale via convergence analysis and comparison to linear results. Informed by the former idealized models, we performed NR simulations of highly eccentric binary NS mergers studying GWs from tidally excited f-mode oscillations that may be observable with third generation GW detectors. We compared the f-modes in the binary case to the perturbed isolated NS cases. These initial studies form the basis for more realistic models with different equations of state and compactness, which we will study in the near future to investigate our capability to constrain the equation of state of matter at supranuclear densities.

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