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# Frequency deviations in neutron star universal relations: Additional equation of state information

Gravitational wave observations are crucial in the effort to determine the high-density equation of state. Fluid modes in neutron stars can lead to the emission of gravitational waves. Various empirical relations have been proposed between the frequencies of such modes and stellar properties of the system. In this talk we focus on two distinct systems and their oscillation modes. On the one hand the quadrupolar fluid mode in isolated, cold, non-rotating neutron stars and on the other hand the dominant fluid oscillation in binary neutron star merger remnants. We examine empirical relations with respect to the radius and tidal deformability for both systems. We show that there is a striking similarity between the two systems in the way points, i.e. individual stellar models, distribute with respect to the corresponding fits to all data. We quantify these deviations and demonstrate that they encode additional equation of state information. We discuss how these deviations can be employed for improved gravitational wave observations in the future.

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