Abstract Submitted
for the FWS19 Meeting of
The American Physical Society

Identifying the Quark-Hadron Phase Transition in Neutron Stars with g-modes MEGAN BARRY, PRASHANTH JAIKUMAR, THOMAS KLAEHN, California State University, Long Beach, WEI WEI, Huazhong Agricultural University — Containing the densest known matter in the universe, neutron stars provide a unique opportunity to study the properties of neutrons, protons, and possibly quarks. Their distance makes them difficult to observe, but their high density makes them good targets for gravitational wave observations. Fluid oscillations within the star, similar to earthquakes on earth, may be detectable through gravitational waves. One such type of oscillation, known as g-mode oscillations, has a frequency that depends on the material composition of the star. We propose a new dynamical signature for the presence of quark matter inside a neutron star, a steep rise in the frequency of stellar g-mode oscillations once quark matter appears in the core. The sensitivity of core g-mode oscillations to the presence of a mixed quark-hadron phase is a new finding. Based on its importance as an indicator of the QCD phase transition in neutron stars, we present an estimate for the phase shift of gravitational waveforms due to g-mode excitation during a binary merger.

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Date submitted: 07 Oct 2019 Electronic form version 1.4