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Probing hybrid stars with gravitational waves via interfacial modes

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A hybrid star consisting of a defined quark matter core and a hadronic matter envelope has a unique internal structure that can have some influence on its observable properties. One possibility is the tidal effect during binary compact star coalescence, which is encoded in the phase of the emitted gravitational wave signal. In particular, the dynamical part of the tide which comes from the excitations of non-radial pulsation modes depends on the detailed features of the stellar internal structure. Out of the many pulsation modes, we focus on the interfacial mode of hybrid stars with a crystalline quark matter core and fluid nuclear matter envelope. This mode originates from the discontinuities in density and shear modulus at the interface separating the quark matter and nuclear matter phase. It is of interest due to its relatively large overlap integral with the external tidal field, which implies a significant excitation amplitude, and its resonant frequency might lie within the sensitive region of ground-based gravitational-wave detectors depending on the EOS. In this talk, I will describe how the interfacial mode affects the waveform of a binary hybrid star coalescence and show that the effects can potentially be detected with advanced LIGO and next-generation detectors based on a Fisher analysis.

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