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The Fate of Twin Stars on the Unstable Branch: Implications for the Formation of Twin Stars PEDRO ESPINO, VASILEIOS PASCHALIDIS, University of Arizona — We consider the dynamics of compact stars with hybrid hadron-quark equations of state. When the surface tension between the hadronic and quark phases is sufficiently strong, a first-order phase transition can be sustained over a large range of energy densities, leading to the emergence of a third family of stable compact stars (hybrid hadron-quark stars). The branch of stable hybrid stars is separated from the stable neutron star branch by a branch of *unstable* hybrid stars. Of particular interest are hybrid stars with the same masses as neutron stars but different radii (twin stars). We study the dynamics of unstable hybrid stars all the way down to the minimum mass twin star through 3-dimensional general relativistic hydrodynamic simulations of non-rotating and rotating unstable-branch twin stars. We find that unstable hybrid stars naturally migrate toward the hadronic regime and undergo strong (quasi)radial oscillations in the process. Our study suggests that it may be difficult to form stable twin stars, and hence it may be more likely that astrophysical hybrid stars have masses above the twin star regime. The oscillations between the two phases could provide a unique gravitational wave signature for a Quantum Chromodynamics deconfinement in hybrid star progenitors.

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