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Radial Oscillations in Hybrid Stars with Slow Quark Phase Transition

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This study investigates the radial oscillations of hybrid neutron stars, characterized by a composition of hadronic external layers and a quark matter core. Utilizing a density-dependent relativistic mean-field model that incorporates hyperons and Δ baryons for describing hadronic matter, and a density-dependent quark model for quark matter, we analyze the ten lowest eigenfrequencies and their corresponding oscillation functions. Our focus lies on neutron stars with equations-of-state involving N, N+Δ, N+H, and N+H+Δ, featuring a phase transition to quark matter. Emphasizing the effects of a slow phase transition at the hadron-quark interface, we observe that the maximum mass is attained before the fundamental mode's frequency diminishes for slow phase transitions. This observation implies the stability of stellar configurations with higher central densities than the maximum mass, called Slow Stable Hybrid Stars (SSHSs), even under small radial perturbations. The length of these SSHS branch depends upon the energy density jump between two phases and the stiffness of the quark EoS.

References

[1]Radial Oscillations of Hybrid Stars and Neutron Stars including Delta baryons:The Effect of a Slow Quark Phase Transition, arXiv:2401.07789 (2024).

session

H. Equation of State and Neutron Stars

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