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Impact of hot and cold dense matter on quasinormal oscillation modes in compact stars

A diverse array of equations of state (EoSs), formulated within the covariant density functional theory of hadronic matter and incorporating density-dependent couplings, is leveraged to scrutinize polar f- and p-oscillations in both cold and hot compact stars. We delve into the correlations between oscillation frequencies of cold purely nucleonic neutron stars (NSs), their global parameters, and properties of nuclear matter (NM) by examining a selection of models, wherein several constraints on the saturation properties of NM, pure neutron matter, and the lower limit of the maximal NS mass were enforced within a Bayesian framework. The impact of finite temperature and the presence of exotic particle degrees of freedom, such as hyperons, Δ-resonances, antikaon condensates, or a transition from hadronic to quark phase, is addressed through a suite of models publicly accessible on Compose. We consider idealized profiles of temperature or entropy per baryon and charge fraction. Our investigations reveal that finite temperature effects lead to a reduction in the oscillation frequencies of nucleonic stars, while the converse trend is observed for stars featuring exotic particle degrees of freedom. When constructing finite temperature EoSs using the Γ-law, errors in estimating oscillation mode frequencies range from approximately 10% to 30%, contingent upon the stellar mass. Throughout our study, we employ the Cowling approximation.

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