Contribution ID: **83** Type: **not specified**

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

Thursday, October 10, 2024 12:10 PM (20 minutes)

A vast ensemble of equations of state (EoSs), developed within the framework of covariant density functional theory pertaining to hadronic matter and accommodating density-dependent couplings, is deployed to scrutinize the polar f- and p-oscillations in both cold and hot compact stars. The interplay between oscillation frequencies of cold purely nucleonic neutron stars (NSs), their global parameters, and the characteristics of nuclear matter (NM) is explored by investigating a spectrum of models, which enforce a series of constraints on the saturation properties of NM, pure neutron matter, and the lower limit of the maximum NS mass within a Bayesian framework. The influences of finite temperature and the presence of exotic particle degrees of freedom, such as hyperons, Δ-resonances, antikaon condensates, or the transition from hadron to quark phase, are addressed through the utilization of a suite of models publicly accessible on compose, assuming idealized profiles of temperature or entropy per baryon and charge fraction. Our analysis reveals that finite temperature effects lead to a reduction in the oscillation frequencies of nucleonic stars, while an opposite trend is observed for stars harbouring exotic particle degrees of freedom. Furthermore, when employing the Γ-law to construct finite temperature EoSs, errors in the estimation of oscillation mode frequencies range from 10% to 30%, contingent upon the stellar mass. Throughout this investigation, the Cowling approximation is consistently applied.

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