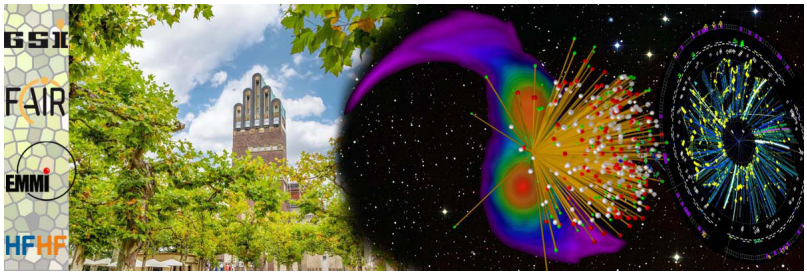

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Robust universal relations in neutron star asteroseismology

Wednesday, 20 September 2023 10:01 (3 minutes)

The non-radial oscillations of the neutron stars (NSs) have been suggested as an useful tool to probe the composition of neutron star matter (NSM). With this scope in mind, we consider a large number of equations of states (EOSs) that are consistent with nuclear matter properties and pure neutron matter EOS based on a chiral effective field theory (chEFT) calculation for the low densities and perturbative QCD EOS at very high densities. This ensemble of EOSs is also consistent with astronomical observations, gravitational waves in GW170817, mass and radius measurements from Neutron star Interior Composition ExploreR (NICER). We analyze the robustness of known universal relations (URs) among the quadrupolar f mode frequencies, masses and radii with such a large number of EOSs and we find a new UR that results from a strong correlation between the f mode frequencies and the radii of NSs. Such a correlation is very useful in accurately determining the radius from a measurement of f mode frequencies in the near future. We also show that the quadrupolar f mode frequencies of NS of masses 2.0 $M_\odot$ and above lie in the range $\sim$ 2-3 kHz in this ensemble of physically realistic EOSs. A NS of mass $2M_\odot$ with a low f mode frequency may indicate the existence of non-nucleonic degrees of freedom.

Primary authors: Dr KUMAR, Deepak (Indian Institute of Science Education and Research Bhopal); MALIK, TUHIN (CFisUC, Department of Physics, University of Coimbra, 3004-516 Coimbra, Portugal); Prof. MISHRA, Hiranmaya (School of Physical Sciences, National Institute of Science Education and Research, Jatni, 752050 India); PROVIDÊNCIA, Constança (Universidade de Coimbra)

Presenter: Dr KUMAR, Deepak (Indian Institute of Science Education and Research Bhopal)

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