The Modern Physics of Compact Stars and Relativistic Gravity 2019

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Book of Abstracts

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Investigation of Neutron stars structure using Energy-momentum squared gravity

Authors: Laleh Zahra Namvar[1] ; Mohsen Bigdeli[2]

[1] *Payam-Noor University*

[2] *University of Zanjan*

Corresponding Authors: moh_bigdeli@yahoo.com, lalehn94@gmail.com

The structural properties of neutron stars, namely, maximum mass is a subject that theoretical astrophysicists have desired to study. Theoretically, investigation of structure for neutron stars necessities obtaining the perfect hydrostatic equilibrium equations. Up to now, different models and metrics have been used to calculate these equations. It is expected higher order energy-momentum gravity plays crucial role in the investigation of neutron stars structure due to high density cores of neutron stars. Recently, the energy-momentum squared gravity (EMSG) is exposed [1].
In this paper, we will compute mass-radius relation for neutron stars using EMSG and employing realistic equations of state (EOS). We have obtained the EOS of neutron star matter using the lowest order constrained variational (LOCV) formalism as a microscopic approach [2, 3]. The LOCV method is a powerful tool for determination of the properties of the nucleonic matter at zero and finite temperatures [4-5].

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State and density dependence of correlation functions between nucleons and hyperons in hyper nuclear matter

Author: Mahboubeh Shahrbaf[None]

Co-authors: Hamidreza Moshfegh [1] ; Majid Modarres [1]

[1] *University of Tehran*

Corresponding Authors: hmoshfegh@ut.ac.ir, m.shahrbaf46@gmail.com

The lowest order constrained variational (LOCV) method is reformulated to calculate the equation of state of hyper nuclear matter with different asymmetry parameter as well as neutron matter. For nucleon-nucleon interaction, AV18 potential is used whereas for nucleon-hyperon and hyperon-hyperon interaction, a central potential is applied. The state-dependent correlation functions are calculated by performing a full functional minimization for each JLSTMT -channel and the resulting Euler Lagrange equations are solved up to J = 2. The Hyper nuclear matter correlation functions are compared with those coming from LOCV calculation for nuclear matter. Furthermore, the density-dependent correlation functions are discussed.

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LOCV calculation of equation of state and binary neutron stars

Authors: zahra sharifi[None] ; Mohsen Bigdeli[1]

[1] *University of Zanjan*

Corresponding Authors: moh_bigdeli@yahoo.com, z.sharifi.physics@gmail.com

The binary system of neutron stars (NSs) has drawn a lot of astrophysicists' attention in past years. Discovery of the gravitational wave (GW) signal from GW170817, the compact binary inspiral event, has resulted in the multi-messenger astronomy which indeed provides substantial data about the interior of dense matter. In addition, they have the potential of elucidating the information about the equations of state (EOSs) of NS matter.
Structural and tidal parameters of NSs in the observed binary neutron star merger are studied employing the realistic equations of state. It is notable to mention that we use the same EOS for each component of the merger in the case of low spin prior. The value of dimensionless tidal deformability Λ is calculated as $216 < \Lambda < 314$ regarding 1.4 $M_{\odot}$ configuration of NS with the EOSs of Argonne family potentials in addition to the UV14 accompanied by TNI and applying the LOCV method [1]. Fixing the chirp mass at 1.188 $M_{\odot}$, the mass ratio of components, q, is set as the recent results obtained by the PhenomPNRT wave model: (0.73, 1) for the low spin case. Therefore, our results for weighted dimensionless tidal deformability $\widetilde{\Lambda}$ agree well with the recent constraints on its lower limits: 300^{+420}_{-230} [2]. Moreover, it is found that some EOSs with Argonne family potentials such as AV6' and AV8' can be ruled out due to their consequences that are far away from the credible intervals. We have also investigated the impact of quark core and the van der Waals equation of state on the tidal deformability of neutron stars in a binary system.

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