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LOCV calculation of equation of state and binary neutron stars

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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.

[1] Z. Sharifi, M. Bigdeli, submitted to the Journal of Physics G: Nuclear and Particle Physics.
[2] B. P. Abbott et al., Phys. Rev. X. 9, 011001 (2019).

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