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# Systematic analysis of the impacts of symmetry energy parameters on neutron star properties

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The impacts of various symmetry energy parameters on the properties of neutron stars (NSs) have been recently investigated, and the outcomes are at variance, as summarized in Table III of Phys. Rev. D 106, 063005 (2022). We have systematically analyzed the correlations of slope and curvature parameters of symmetry energy at the saturation density ($\rho_0 = 0.16\text{fm}^{-3}$) with the tidal deformability and stellar radius of non-spinning neutron stars in the mass range of $1.2 - 1.6 M_\odot$ using a large set of minimally constrained equations of state (EoSs). The EoSs at low densities correspond to the nucleonic matter and are constrained by empirical ranges of a few low-order nuclear matter parameters from the finite nuclei data and the pure neutron matter EoS from chiral effective field theory. The EoSs at high densities ($\rho > 1.5 - 2\rho_0$) are obtained by a parametric form for the speed of sound that satisfies the causality condition. Several factors affecting the correlations between the NS properties and the individual symmetry energy parameters usually encountered in the literature are considered. These correlations are quite sensitive to the choice of the distributions of symmetry energy parameters and their interdependence. But, variations of NS properties with the pressure of $\beta-$ equilibrated matter at twice the saturation density remain quite robust which maybe due to the fact that the pressure depends on the combination of multiple nuclear matter parameters that describe the symmetric nuclear matter as well as the density dependence of the symmetry energy. Our results are practically insensitive to the behavior of EoS at high densities.

**Authors:** Mr VENNETI, Anagh (Department of Physics, BITS-Pilani, Hyderabad Campus, Hyderabad - 500078, India); Prof. MUKHERJEE, Arunava (Saha Institute of Nuclear Physics, 1/AF Bidhannagar, Kolkata 700064, India.); Prof. AGRAWAL, B. K. (Saha Institute of Nuclear Physics, 1/AF Bidhannagar, Kolkata 700064, India.); KUMAR PATRA , Naresh; Mr IMAM, Sk Md Adil (Saha Institute of Nuclear Physics, 1/AF Bidhannagar, Kolkata 700064, India.)

**Presenter:** KUMAR PATRA , Naresh

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