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# Correlations between properties of nuclear matter and neutron stars

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Over the last decades, our knowledge on Neutron Stars (NS) has been greatly advanced: NS with large masses were discovered, radii of a number of NS were measured, and a gravitational signal from the merger of two NS was observed. These data establish significant restrictions on the equation of state of the NS matter and pose new problems for the theory of nuclear matter [1,2].

Many authors have been suggested the interplay between the properties of effective nucleon interactions used to calculate the equation of state and characteristics of NS. In this work, an attempt is made to put the study of such interplay on a quantitative footing. We analyze a large number of sets of parameters of the Skyrme nucleon-nucleon potential [3] and of the Lagrangian of the relativistic mean field theory [4] and calculate the coefficients of correlation between the saturation quantities of the nuclear matter and the NS properties.

The calculation indicates a strong correlation between the derivative of the symmetry energy and other quantities, which describe the nuclear matter energy dependence on the isospin asymmetry, on the one hand, and the radius and central density of NS with a mass of 1.4MSun, on the other hand. The significance of nuclear symmetry effects for NS structure is obvious and has been numerously discussed. However, we did not find a meaningful correlation between the symmetry properties and the maximum NS mass. There is also almost no correlation between the characteristics of NS and the incompressibility of the infinite symmetric nuclear matter. This shows that the stiffness of the equation of state of the NS matter is not directly related to the incompressibility. The correlations in the non-relativistic the Skyrme approach and the relativistic mean field theory are similar, therefore, we observe real (non-model) relationships between physical quantities.

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