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Семинар
"ТЕОРИЯ АДРОННОГО ВЕЩЕСТВА ПРИ ЭКСТРЕМАЛЬНЫХ УСЛОВИЯХ"

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Symmetry energy in the neutron star equation of state and astrophysical observations

A systematic study of the role of the nuclear symmetry energy $E_s(n)$ for the description of neutron star (NS) matter is presented. In a first part, the behavior of $E_s(n)$ at subsaturation densities is discussed which is relevant for the location of the crust-core transition inside the star and thus for the crust thickness. We discuss how observations of glitches for the Vela pulsar constrain the fraction of the crustal moment of inertia and thus $E_s(n)$ at low densities.

In a second part the conjecture of a *universal symmetry energy contribution* to the NS equation of state (EoS) at supersaturation densities is presented. Ths result is derived from the finding that for NS matter the asymmetry contribution to the energy per nucleon (in the parabolic approximation) has a maximum bound as a function of baryon density which corresponds to a proton fraction being almost constant and below the value for the threshold of the Direct Urca (DU) cooling mechanism, i.e., around $x_{\rm DU} \sim 1/8$. As we have safe knowledge that the DU process cannot be operative in a large class of NS, the EoS describing the matter their interior cannot allow proton fractions exceeding $x_{\rm DU}$. This implies the universal behaviour of the symmetry energy contribution which can be exploited for linking the EoS determination by NS observations with that by heavy-ion collision experiments.

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