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The Fayans energy-density functional. Constraints from the equations of state. Consequences for the Gamow-Teller resonances.

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The equations of state for infinite, symmetric nuclear matter (SNM) and pure neutron matter (PNM) are analyzed in terms of the Fayans energy density functional. DF3-a functional [1] tuned via previously unused volume (isovector) parameter h-2. A quality of the previous global fit of the Fayans EDF [2] has been kept for the nuclear densities, masses of nuclei, single-particle levels and charge radii. Additional constraint is implemented from the upper bound of the giant dipole resonance energy in 208Pb. The symmetry energy slope at saturation density L(ρ0) is calculated with the relativistic corrections taken into account. Its values obtained for different h-2 (Fig.1) are compared to the ones derived from the extended set of restrictions. They were obtained in [3] making use of the data on nuclear masses, results of ab initio calculations with N3LO, ΔRnp values derived from PREXP-II, CREX experiments, as well as the latest data from the radii of neutron stars and registration of gravitational waves. As it can be seen (Fig.2), for newly tuned DF3-a functional, the SNM EOS is softer than the ones obtained from the FANDF0 functional [2], as well as from APR [4], AFDMC [5], N2LO(D2,E1) and N2LO(D2,Eτ) [6] Supported by the grant of Russian Scientific Foundation (RSF 21-12-00061).

Fig.1. Density dependence of the L(ρ) for symmetric nuclear matter. Calculation with the new version of the DF3-a functional for various values of the h−2 parameter. Fig. 2. Energy per nucleon for SNM as a function of density. Our calculation with the FaNDF0[1], new version of the DF3-a[2] as well as for APR [4], AFDMC [5], N2LO[6] functionals.

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