The 6th international conference on particle physics and astrophysics



Contribution ID : 250

Type : Oral talk

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

Wednesday, 30 November 2022 19:00 (15)

I.N. Borzov 1,2, S.V. Tolokonnikov1,3 1 National Research Centre "Kurchatov Institute", Moscow, Russia 2Bogolubov Laboratory of Theoretical Physics, Joint Institute of Nuclear Research, Dubna, Russia 3 Moscow Institute of Physics and Technology (National Research University), Dolgoprudny, Russia †E-mail: Borzov_IN@nrcki.ru, cc: ibor48@mail.ru

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 $L(\rho 0)$ 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, Δ Rnp 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,E τ) [6] Supported by the grant of Russian Scientific Foundation (RSF 21-12-00061).

Fig.1. Density dependence of the $L(\rho)$ 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.

- 1. S.V. Tolokonnikov, E.E. Saperstein, Phys. At. Nucl. 74, 1277 (2011).
- 2. S.A. Fayans, JETP Lett. 68, 169 (1998).
- 3. J. Lattimer in "The Modern Physics of Compact Stars and Relativistic Gravity", Yrevan, Armenia, 2021.
- 4. A. Akmal, V. R. Pandharipande, and D. G. Ravenhall, Phys. Rev. C 58, 1804 (1998).
- 5. S. Gandolfi, A. Yu. Illarionov, K. E. Schmidt, et.al. Phys. Rev. C 79, 054005 (2009).
- 6. D. Lonardoni, I. Tews, S. Gandol_, and J. Carlson, arXiv:1912.09411 [nucl-th] (2019).

Primary author(s): Dr. BORZOV, Ivan (NRC KI); Dr. TOLOKONNIKOV, Sergei (NRC KI)

Presenter(s) : Dr. BORZOV, Ivan (NRC KI)

Session Classification : Nuclear Physics

Track Classification : Nuclear physics