

# **DETERMINING MODERN ENERGY DENSITY FUNCTIONAL FOR NUCLEAR MANY-BODY SYSTEMS**

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## **Abstract**

The development of a modern and more realistic nuclear energy density functional (EDF) for accurate predictions of properties of nuclei is the subject of enhanced activity, since it is very important for the study of properties of rare nuclei with unusual neutron-to-proton ratios that are difficult to produce experimentally and likely to exhibit interesting new phenomena associated with isospin, clusterization and the continuum.

We will describe a method for determining the parameters of the EDF, associated with the Skyrme type effective interaction, by carrying out a Hartree-Fock based fit to extensive set of data of ground state properties and giant resonances and imposing additional constraints, such as the Landau stability conditions.

We will then present results of our calculations of properties of nuclei and nuclear matter (NM) by employing our newly obtained EDF and address, in particular, the equation of state (EOS) of symmetric and asymmetric NM. The EOS of NM is an important ingredient in the study of various properties of nuclei, heavy-ion collisions, supernovae and neutron stars. Accurate values of the NM incompressibility coefficient,  $K$ , and the symmetry energy coefficient,  $J$ , are needed in order to extend our knowledge of the EOS in the vicinity of the saturation point of the symmetric NM and for asymmetric NM. We will discuss the current status of  $K$  and  $J$ , as deduced from properties of isoscalar and isovector giant resonances of various multipolarities.