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Nuclear symmetry energy in dilute and dense matter

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The properties of neutron-rich nuclear systems are largely determined by the density dependence of the nuclear symmetry energy. Experiments aiming to measure the neutron skin thickness [1,2] and astronomical observations of neutron stars and gravitational waves [3,4] offer valuable information on the symmetry energy at sub- and supra-saturation densities, respectively.

The KIDS theoretical framework for the nuclear equation of state (EoS) and energy density functional (EDF) [5-7] offers the possibility to explore the symmetry-energy parameters such as J (value at saturation density), L (slope at saturation), Ksym (curvature at saturation), independently of each other and independently of assumptions about the in-medium effective mass. Within this versatile and physically motivated framework, any set of EoS parameters can be transposed into a corresponding EDF and readily tested in microscopic calculations of nuclear properties [6-8]. Related studies of symmetry-energy parameters have utilized both astronomical observations and bulk nuclear properties [8,9] and a comprehensive Bayesian analysis of both isoscalar and isovector nuclear observables including giant resonances [10,11].

I plan to discuss high-order parameters such as Ksym, indications for a model decoupling of the nucleonic fluid from dense and dilute regimes, and first attempts to extend the framework to quarkionic matter [12].

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