国立研究開発法人理化学研究所　仁科加速器科学研究センター
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RIKEN Nishina Center for Accelerator Based Science
The 319th RIBF Nuclear Physics Seminar
Co-organized with iTHEMS

An overview on the nuclear equation of state studied from ground and collective excited state properties of nuclei

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This contribution reviews a selection of available constraints to the nuclear equation of state (EoS) around saturation density from nuclear structure calculations on ground and collective excited state properties of atomic nuclei [1]. It concentrates on predictions based on self-consistent mean-field calculations, which can be considered as an approximate realization of an exact energy density functional (EDF). Mostly, EDFs are currently derived from effective interactions commonly fitted to nuclear masses, charge radii and, in many cases, also to pseudo-data such as nuclear matter properties. Although in a model dependent way, EDFs constitute nowadays a unique tool to reliably and consistently access bulk ground state and collective excited state properties of atomic nuclei along the nuclear chart as well as the EoS. The impact on the EoS of the new CREx [2] and PREx [3] measurments of the parity violating asymmetry (ground state observable) in 48Ca and 208Pb, respectively, will be also discussed [4,5] and compared to previously presented results on collective excitations. As the main conclusion, the isospin dependence of the nuclear EoS around saturation density and, to a lesser extent, the nuclear matter incompressibility remain to be accurately determined. Experimental and theoretical efforts in finding and measuring observables specially sensitive to the EoS properties are of paramount importance, not only for low-energy nuclear physics but also for nuclear astrophysics applications.

References

[1] X. Roca-Maza, N. Paar, Progress in Particle and Nuclear Physics, 101 (2018) 96-176.
[2] D. Adhikari et al. (CREx collaboration), Phys. Rev. Lett. 129, 042501 (2022).
[3] S. Abrahamyan et al. (HAPPEX and PREX Collaborations) Phys. Rev. Lett. 109, 192501 (2012).
[4] Paul-Gerhard Reinhard, Xavier Roca-Maza, Witold Nazarewicz, Phys. Rev. Lett. 127, 232501 (2021).
[5] Paul-Gerhard Reinhard, Xavier Roca-Maza, Witold Nazarewicz, Phys. Rev. Lett. 129, 232501 (2022).

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via Hybrid (Zoom + RIBF Hall)

＊ The talk will be given in English language.

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