Neutron rich nuclear matter Equation of State in nuclear physics

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Teaching staff

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Reception hours: Tuesday, Thursday : 10-11 and upon request.

Program of the course:

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The equation of state (EOS) of nuclear matter will be investigated in different regions of nuclear densities, analyzing several aspects connected with heavy ion collisions from Fermi toward relativistic energies.
Some aspects and properties of resonances and collective motions in nuclear physics will also be discussed. A special focus on the experimental tools used to extract the resonances and the connection with the EOS will be given.

Syllabus

- Equation of state of infinite nuclear matter
- Symmetry energy in finite system
- Eos of asymmetric nuclear matter
- Experimental investigation of the equation-of-state in isospin-asymmetric matter at low densities.
- Experimental investigation of the equation-of-state in isospin-asymmetric matter at high densities.
- Connection of EOS with multi-messenger astrophysics

- Basic Resonances in nuclei
- Giant and Pygmy resonances
- Experimental techniques to measure resonances and extract information on EOS

Bibliography:

1. P. Russotto, M. D. Cozma, E. De Filippo et al*." Studies of the equation-of-state of nuclear matter by heavy-ion collisions at intermediate energy in the multi-messenger era",* La Rivista del Nuovo Cimento (2023) 46:1–70
2. A. Sorensen et al., "Dense nuclear matter equation of state from heavy-ion collisions" Progress in Particle and Nuclear Physics, 134 (2024) 104080
3. B.A. Li, À. Ramos, G. Verde, I. Vidaña, *Topical issue on nuclear symmetry energy*. Eur. Phys. J. A 50(2), 9 (2014).
4. M. Harakeh and A. van der Woude, *Giant Resonances, Fundamental High- Frequency Modes of Nuclear Excitation*, Oxford University Press
5. P.F. Bortignon and A. Bracco and A. Broglia *Giant Resonances* , Routledge Edition
6. X. Roca Maza, N. Paar *Nuclear equation of state from ground and collective excited state properties of nuclei,* Progress in Particle and Nuclear Physics, Volume 101, 2018, Pages 96-176, ISSN 0146-6410
7. Scientific papers and slides provided by the teacher