



Contribution ID: 102

Type: Oral presentation

Nuclear response to electromagnetic probes: toward spectroscopically accurate many-body theory

Tuesday, October 7, 2025 2:00 PM (30 minutes)

I will present selected results on nuclear giant and pygmy resonances at zero and finite temperatures, based on recent advancements in nuclear many-body theory [1-6]. The theory will be compactly introduced in the most general quantum field theory formalism with only the bare fermionic interaction input. A special focus will be placed on the emergent scale of the quasiparticle-vibration coupling (qPVC) with the order parameter associated with the qPVC vertex. An efficient treatment of the nuclear many-body problem is thus organized around the qPVC hierarchy, which takes over the power counting, dominating the bare nucleon-nucleon interaction and few-body systems [1-3].

Self-consistent solutions of the relativistic Bethe-Salpeter-Dyson equation (BSDE) for the nuclear response function in medium-heavy nuclei will be presented and discussed. In this formulation, the dynamical interaction kernel of the BSDE is the source of the richness of the nuclear wave functions in terms of their configuration complexity and the major ingredient for an accurate description with quantified uncertainties. Low-multipolarity resonances in calcium, nickel, and tin mass regions will be analyzed in the context of the role of high-complexity configurations in reproducing spectral data [2,3,7]. Finite-temperature theory and implementations will be discussed in light of their astrophysical relevance [4-6]. Finally, I will outline the prospect of the quantum equation of motion to generate complex configurations, based on the example of the solvable Lipkin Hamiltonian [3].

- [1] E. Litvinova and Y. Zhang, Microscopic response theory for strongly-coupled superfluid fermionic systems, *Phys. Rev. C* 106, 064316 (2022).
- [2] E. Litvinova, On the dynamical kernels of fermionic equations of motion in strongly-correlated media, *Eur. Phys. J. A* 59, 291 (2023).
- [3] J. Novak, M. Q. Hlatshwayo, and E. Litvinova, Response of strongly coupled fermions on classical and quantum computers, *arXiv:240502255*.
- [4] E. Litvinova and H. Wibowo, Finite-temperature relativistic nuclear field theory: an application to the dipole response, *Phys. Rev. Lett.* 121, 082501 (2018).
- [5] E. Litvinova, C. Robin, and H. Wibowo, Temperature dependence of nuclear spin-isospin response and beta decay in hot astrophysical environments, *Phys. Lett. B* 800, 135134 (2020).
- [6] S. Bhattacharjee and E. Litvinova, Finite-temperature microscopic response theory for strongly-coupled superfluid fermionic systems, *arXiv:2412.20751*.
- [7] M. Markova, P. von Neumann-Cosel, and E. Litvinova, Systematics of the low-energy electric dipole strength in the Sn isotopic chain, *Phys. Lett. B* 860, 139216 (2025).

Primary author: Prof. LITVINOVA, Elena (Western Michigan University)

Presenter: Prof. LITVINOVA, Elena (Western Michigan University)

Session Classification: Session III