Contribution ID: **151** Type: **Oral Presentation**

A Diagrammatic Monte Carlo approach for nuclear structure and reactions

The calculation of many-body correlations in atomic nuclei using ab initio approaches requires accounting for virtual excitations, whose number grows factorially with the perturbative order.
Diagrammatic Monte Carlo (DiagMC) is a promising method that efficiently includes high-order excitations. It has been particularly successful in condensed matter physics [1, 2], where it enables the resummation of contributions in infinite systems at finite temperature.
I will present the first application of DiagMC to a nuclear structure problem: the pure pairing Richardson model. Our results surpass the precision of the state-of-the-art ADC(3) approximation, incorporating diagrams up to eighth order in the ladder expansion [3].
The extension of this approach to realistic Hamiltonians is under development and will be discussed. This will allow the calculation of reliable optical potentials with minimal use of phenomenology, providing more robust results in the study of reactions with radioactive ion beams.

[1]: Van Houcke, K. et al., Feynman diagrams versus Fermi-gas Feynman emulator, Nat. Phys. 8, 366–370 (2012).
[2]: Van Houcke, K. et al., Diagrammatic Monte Carlo algorithm for the resonant Fermi gas, Phys. Rev. B 99, 035140 (2019).
[3]: SB, Barbieri, C., and Vigezzi, E., Diagrammatic Monte Carlo for finite systems at zero temperature, https://arxiv.org/abs/2501.02646 and submitted to PRL.

Author: Mr BROLLI, Stefano (Università degli Studi di Milano, INFN - Sezione di Milano)

Presenter: Mr BROLLI, Stefano (Università degli Studi di Milano, INFN - Sezione di Milano)

Session Classification: Parallel session

Track Classification: Nuclear Structure, Spectroscopy and Dynamics