Contribution ID : **5** Type : **oral contribution**

Ab initio Green's functions approach for homogeneous nuclear matter

Tuesday, 28 May 2024 17:50 (20)

In this talk, we will present our work at the interface between density functional theory (DFT) and *ab initio* theory. In particular, we will focus on infinite nuclear matter, that we simulate using a description based on a finite number of nucleons, and discuss three research directions [1]:
1. a new *ab initio* Self-consistent Green's function (SCGF) approach, based on the algebraic diagrammatic construction (ADC) approximation scheme that has proved successful in finite nuclei, is applied to determine the equation of state (EOS) of nuclear matter using chiral interactions [2];
2. we go beyond homogeneous matter, and present results for nuclear matter perturbed by an external static potential, the so-called static response problem [3], within the DFT method [4] and, at a preliminary level, within Quantum Monte Carlo;
3. finally, we present our program aimed at the construction of *ab initio*-based energy density functionals (EDFs) [1,5], and discuss how the static response offers in principle the possibility to gain information on the surface terms of the EDF *ab initio*.

References:
[1] F. Marino, PhD thesis, University of Milano (2023)
[2] C. Barbieri and A. Carbone, Lect. Notes Phys. 936, 571 (2017)
[3] M. Buraczynski et al., Physics Letters B 818, 136347 (2021)
[4] F. Marino et al., Phys. Rev C. 107, 044311 (2023)
[5] F. Marino et al., Phys. Rev. C 104, 024315 (2021)

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Session Classification : Session 8