Theoretical Quantum Physics

Group Seminar

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Online (Zoom)

The role of correlations in fermionic systems

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Abstract

Traditionally, the correlation energy, which is defined as the difference between the mean-field energy and that exact one, has been a measure of the correlations within fermionic systems. Intuitively makes sense since the correlations energy is interpreted as that fraction of energy that can't be described by the non interacting description. However, with the mathematical tools coming from the Quantum Information field, it is possible to obtain a better comprehension of the role of correlations beyond the traditional approaches.

In this talk, I will present some of the results that I've obtained during my PhD concerning quantum correlations in fermionic systems.

Concretely, I will make use of quantities such as quantum discord and overall entropy in order to analyse the behaviour of the correlation energy for solvable albeit rich models. We will see that the two orbital quantum discord can be easily computed for fermionic systems and it is a good parameter in order to observe quantum phase transitions. Lastly, I will present a variational method in order to compute the quantum discord for fermionic systems and arbitrary orbital partitions, with some examples comparing and analyzing different ground state approximations such has Hartree-Fock, Hartree-Fock with symmetry restoration and Generator Coordinate Method.

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