

Digital quantum computing for many-body simulations

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Valentina Amitrano,

(Università degli Studi di Trento - INFN, Sezione di Ferrara)

Quantum computing uses the principles of quantum mechanics to revolutionise the way we process and manipulate information. This opens up a realm of possibilities for solving complex problems that are beyond the reach of classical computers. In this talk, I will present the basic concept of quantum computing as applied to so-called Hamiltonian simulation, with a particular focus on the concept of quantum gate decomposition - a crucial ingredient needed to simulate a quantum many-body system on a quantum computer.

Valentina Amitrano will present an application of quantum computation to the simulation of neutrinos from astrophysical environments. In high neutrino density situations, such as those found in supernova explosions, the flavour Hamiltonian includes a neutrino-neutrino interaction that causes the collective flavour oscillation phenomena. This interaction adds a non-linear contribution to the equations of motion, making the exact simulation of such a system inaccessible to any current classical computational resource. I will present the quantum algorithm designed to simulate the unitary evolution of such a system on trapped-ion based quantum hardware. Finally, the promising results of the real quantum simulation run on the Quantinuum machine will be presented.

Disclaimer: The whole Trento academic community is invited to participate. However, since this space is dedicated to PhD students, we would like to maintain an informal and welcoming environment

General information: The seminar will be held at ECT*, Villa Tambosi, Strada delle Tabarelle 286, Villazzano. We are going to have a coffee break! To reach Villa Tambosi: take bus number 13 from Povo or bus number 6 from the city center. The bus stop is in front of the Villa.

In order to organize the coffee break we kindly ask you to confirm your presence through the google form that you can find scanning the QR code:

Contacts: agnech@ectstar.eu - morresi@ectstar.eu



Director of the ECT*: Professor Gert Aarts

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