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## Quantum simulation with quantum computers, an introduction

*Thursday 1 June 2023 14:20 (50 minutes)*

In this talk I will provide a tutorial introduction to quantum simulation with quantum computers. I will review the failure of conventional computing to address many-body problems and how this prevents progress in many scientific areas. I will discuss whether and how quantum computers, either fault tolerant in the future or noisy intermediate scale state of the art, can help to solve many-body problems. I will present the main challenges for quantum simulation algorithms: quantum state preparation, dynamical evolution and post-processing, including some recent work of my group [1,2,3]

[1] Preparing valence-bond-solid states on noisy intermediate-scale quantum computers  
Bruno Murta, Pedro M. Q. Cruz, and J. Fernández-Rossier,  
Phys. Rev. Research 5, 013190 (2023)

[2] Gutzwiller wave function on a digital quantum computer  
Bruno Murta and J. Fernández-Rossier  
Phys. Rev. B 103, L241113 (2021)

[3] Optimizing quantum phase estimation for the simulation of Hamiltonian eigenstates  
P. M. Queiroz da Cruz, G. Catarina, R. Gautier and J. Fernández-Rossier  
Quantum Science and Technology 5, 044005 (2020)

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