Department of Physics
Condensed Matter Physics
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UNIVERSITY OF OXFORD

CONDENSED MATTER SEMINAR

Thursday 17 November at 14.30

"Simple and high-precision eigenstate property and eigenenergy estimation"

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Estimating eigenstate energy and properties of a quantum many-body system is a fundamental problem in quantum physics. In this talk, I will introduce a universal and deterministic method for this task by utilizing a dual phase representation of projection functions, such as exp(-Ht) or a Gaussian function of H [1]. Compared to the existing quantum algorithms, such as phase estimation, quantum signal processing [2], etc, our method has a logarithmic circuit complexity with respect to the simulation accuracy, and achieves near-optimal system-size dependence for lattice Hamiltonians, with at most one ancillary qubit. I will further present the resource requirement at a gate level and compare our method with existing advanced ones for typical examples, such as spins, condensed-phase electrons and chemistry problems, targeting the practical applications with noisy and error-corrected quantum computers [3].

[1] P Zeng, J Sun, X Yuan, Universal quantum algorithmic cooling on a quantum computer, arXiv:2109.15304
[2] L Lin, Y Tong, Near-optimal ground state preparation, Quantum, 2020, 4: 372
[3] J Sun, V Vedral, M Kim, X Yuan, P Zeng, High-precision eigenstate property and eigenenergy estimation: a framework and resource estimation, under preparation

Host: Prof Andrew Boothroyd