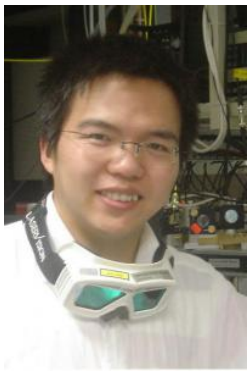
THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

COLLOQUIUM

Quantum Manipulation with Ultracold Atoms

by



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Date: *May 10, 2024 (Friday)*
Time: *4:00 - 5:00 p.m.*
Place: *L2, Science Centre, CUHK*

(Light refreshments will be served at SCNB 1/F lobby from 3:30 to 3:50 p.m.)

ALL INTERESTED ARE WELCOME
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Abstract

Manipulating quantum phenomena of microscopic particles to emulate novel states of matter and establish high-precision time standards promises to greatly advance future technological developments. Techniques involving ultracold atoms have formed a nexus between disciplines such as quantum information science, condensed matter physics, and quantum precision measurement, positioning them at the forefront of hot research areas in physics.

In quantum simulation, systems comprising hundreds up to millions of atoms can be artificially created and controlled to mimic complex systems found in condensed matter physics and quantum field theory. This facilitates the validation or prediction of novel quantum phenomena, exploration of the underlying microscopic mechanisms, and fosters the next generation of technological and industrial revolutions. Utilizing small-scale and manageable ultracold fermionic systems, important unsolved models in condensed matter physics like the Fermi-Hubbard model can be simulated, aiming to acquire phase diagrams of strongly correlated fermionic systems at low temperatures.

In the field of quantum metrology, ultracold atomic optical lattice clocks have achieved the highest time measurement accuracy to date. To overcome limitations such as gravitational fluctuations in terrestrial and near-Earth environments, there is an urgent need to develop optical frequency standards based on high-orbit space platforms. Ultracold atomic optical lattice clocks on medium-to-high orbit space platforms, integrated with quantum communication and time-frequency transfer technologies, will enable precise star-to-ground clock comparisons and become a key component in the next generation of optical clock-based second definitions.

In this talk, I will introduce the latest developments in quantum manipulation based on ultracold fermionic systems for quantum simulation and quantum metrology in USTC.

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