Joint CQSE & CASTS Seminar

「Jan. 15, 2021 (Friday)」

- Time : 14:30~15:30
- Place : Rm104, New Physics Building
- Speaker: Dr. Tzu-kan Hsiao 蕭子綱
  QuTech,
  TU Delft & TNO, Netherlands
- Title : Quantum simulation of an antiferromagnetic Heisenberg spin chain with gate-defined quantum dots

▲The seminar is also open to non-NTU members; hence all participents must wear a mask. (Following Fall and Winter Precautionary Measures)

**Sponsored by Center for Quantum Science and Engineering (CQSE) 量子科學與工程研究中心
and Center for Advanced Study in Theoretical Sciences (CASTS) 理論科學高等研究中心, NTU
**Course: 109-1 (Phys8146) Applications of Quantum Computation
**Supports for seminar lunch from Dept. Physics and seminar tea from Center for Theoretical Physics are greatly acknowledged

Joint CQSE and CASTS Seminar

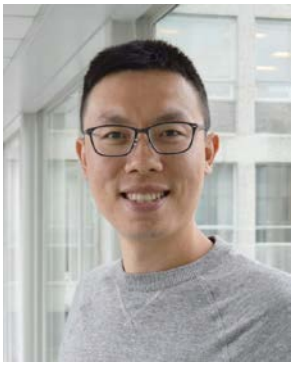
2021
January 15, Friday

TIME Jan. 15, 2021, 2:30~3:30pm
TITLE Quantum simulation of an antiferromagnetic Heisenberg spin chain with gate-defined quantum dots
SPEAKER Dr. Tzu-kan Hsiao
QuTech, TU Delft & TNO, Netherlands
PLACE Rm104, Chin-Pao Yang Lecture Hall,
CCMS & New Physics Building, NTU

Abstract:

Emergent phases of strongly-correlated fermions are of central interest in condensed matter physics. Quantum systems with engineered Hamiltonians can be used as simulators of such many-body systems to provide insights beyond the capabilities of classical computers. Magnetism naturally arises in the Mott-insulator regime of the Fermi-Hubbard model, where charges are localized and the spin degree of freedom remains. In this regime the occurrence of phenomena such as resonating valence bonds, frustrated magnetism, and spin liquids are predicted. However, to study such magnetic behaviour low-entropy, many-body spin states have to be prepared, and characterized.

In this experiment we show that gate-defined semiconductor quantum dots can be used to simulate quantum magnetism in the Mott-insulator regime. For this purpose we develop several experimental techniques including many-body spin-state preparation, singlet-triplet correlation measurements, and characterization of the quantum system with energy spectroscopy and global coherent oscillations. We use these techniques to tune and probe a homogeneously coupled Heisenberg spin chain formed in a linear array of four single-electron quantum dots, and find good agreement between experiment and numerical simulation. Our demonstrated control and techniques combined with flexibility of the quantum dot lattice geometry design opens new opportunities to simulate quantum magnetism, including spin liquid physics and quantum phase transitions.



Biography Brief:

Tzu-Kan Hsiao received his B.S. in Physics from National Tsing Hua university in 2008, M.S. in applied physics from National Taiwan university in 2012, and PhD in physics from University of Cambridge in 2018. He is currently a postdoc researcher in Professor Lieven Vandersypen's group at TU Delft. His current research topic is analog quantum simulation using semiconductor quantum-dot arrays.

- N O T I C E -
▲Please swipe NTU card / ID card when entering CCMS-Phys. Building.
▲The seminar is also open to non-NTU members; hence all participants must wear a mask. ▲We provide alcohol sanitizer to keep your hands clean.

Center for Quantum Science and Engineering (CQSE) 國立臺灣大學 量子科學與工程研究中心 National Taiwan University