ASPIRE Quantum Kick-off Workshop (UTokyo-UChicago)

Report of Contributions

Contribution ID: **1** Type: **not specified**

Introduction

Friday, 26 July 2024 09:15 (5 minutes)

Presenter: TERASHI, Koji (University of Tokyo (JP))

Contribution ID: **2** Type: **not specified**

Quantum acoustics

Friday, 26 July 2024 09:20 (15 minutes)

Presenter: CLELAND, Andrew (UChicago)

Contribution ID: **3** Type: **not specified**

Design of diamond optomechanical system for quantum transaction

Friday, 26 July 2024 09:40 (15 minutes)

Presenter: NOMURA, Masahito (UTokyo)

Contribution ID: **4** Type: **not specified**

Quantum Advantage and Robust Quantum Information Processing

Friday, 26 July 2024 10:00 (15 minutes)

Presenter: JIANG, Liang (UChicago)

Contribution ID: **5** Type: **not specified**

Early Fault-tolerant Quantum Computing in Practice

Friday, 26 July 2024 10:20 (15 minutes)

Presenter: YOSHIOKA, Nobuyuki

Contribution ID: **6** Type: **not specified**

Quantum sensing: Novel probes for sub-cellular processes

Friday, 26 July 2024 11:00 (15 minutes)

Presenter: MAURER, Peter (UChicago)

Contribution ID: **7** Type: **not specified**

Quantum-ready single-particle platforms for biosensing

Friday, 26 July 2024 11:20 (15 minutes)

Presenter: SQUIRES, Alison (UChicago)

Contribution ID: **8** Type: **not specified**

Elucidating the unsolved biology of exosomes with quantum technology

Friday, 26 July 2024 11:40 (15 minutes)

Presenter: GODA, Keisuke (UTokyo)

Contribution ID: **9** Type: **not specified**

Creating and integrating quantum states with semiconductors

Friday, 26 July 2024 13:30 (15 minutes)

Presenter: AWSCHALOM, David (UChicago)

Contribution ID: **10** Type: **not specified**

State tomography and Persistent coherence of magnetization

Friday, 26 July 2024 15:50 (15 minutes)

We have developed two spectroscopic methods: Magnetization State Tomography, which measures the Wigner function of magnetization fluctuations, and Magnetization Parametric Projection Measurement, which selectively amplifies the phase information of magnetization. As applications of these methods, we introduce the realization of magnetization squeezing, the direct measurement of magnetization parametric oscillation, and the discovery of hidden coherence in magnetization.

Presenter: SAITO, Eiji (UTokyo)

Contribution ID: **11** Type: **not specified**

Pseudoentanglement

Friday, 26 July 2024 14:10 (15 minutes)

In this talk we will discuss to what extent entanglement is a "feelable" (or efficiently observable) quantity of quantum systems. Inspired by recent work of Gheorghiu and Hoban, we define a new notion which we call "pseudoentanglement", which are ensembles of efficiently constructible quantum states which hide their entanglement entropy. We show such states exist in the strongest form possible while simultaneously being pseudorandom states. Consequently, we prove that there is no efficient algorithm for measuring the entanglement of an unknown quantum state, under standard cryptographic assumptions. We will talk about applications of this construction to diverse areas of physics and computer science.

Presenter: GHOSH, Soumik (UChicago)

Contribution ID: **12** Type: **not specified**

Mechanical control of a single nuclear spin in diamond

Friday, 26 July 2024 14:30 (15 minutes)

Nuclear spins interact weakly with their environment and therefore exhibit long coherence times. This has led to their use as memory qubits in quantum information platforms, where they are controlled via electromagnetic waves. Scaling up such platforms comes with challenges in terms of power efficiency, as well as cross-talk between devices. Here, we demonstrate coherent control of a single nuclear spin using surface acoustic waves. We use mechanically driven Ramsey and spin-echo sequences to show that the nuclear spin retains its excellent coherence properties. We estimate that this approach requires 2–3 orders of magnitude less power than more conventional control methods. Furthermore, this technique is scalable because of the possibility of guiding acoustic waves and reduced cross-talk between different acoustic channels. This work demonstrates the use of mechanical waves for complex quantum control sequences, offers an advantageous alternative to the standard electromagnetic control of nuclear spins, and opens prospects for incorporating nuclear spins in mechanically interfaced hybrid quantum architectures.

Presenter: PINGAULT, Benjamin (UChicago)

Contribution ID: **13** Type: **not specified**

Have we seen a demonstration of experimental quantum advantage?

Friday, 26 July 2024 15:10 (15 minutes)

Presenter: FEFFERMAN, Bill (UChicago)

Contribution ID: **14** Type: **not specified**

Tensor network and quantum computation

Friday, 26 July 2024 15:30 (15 minutes)

Presenter: TODO, Synge (UTokyo)

Contribution ID: **15** Type: **not specified**

Development of magnetic field tolerant superconducting qubits

Friday, 26 July 2024 13:50 (15 minutes)

Presenter: NITTA, Tatsumi (UTokyo)

Contribution ID: **16** Type: **not specified**

Poster session

Friday, 26 July 2024 16:15 (1h 15m)

Contribution ID: **17** Type: **not specified**

Concluding

Friday, 26 July 2024 18:00 (5 minutes)

Contribution ID: **18** Type: **not specified**

Casual dinner?

Contribution ID: **19** Type: **not specified**

Discussion

Friday, 26 July 2024 17:30 (30 minutes)