Joint CQSE & CASTS Seminar

「Jan. 8, 2021 (Friday)」

- Time : 14:30~15:30
- Place : Rm104, New Physics Building
- Speaker: Chi-Fang Chen 陳麒方
  California Institute of Technology
  加州理工學院
- Title : Quantum simulation via product of random unitaries: Low gate complexity with accuracy guarantees

▲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 8, Friday

TIME Jan. 8, 2021, 2:30~3:30pm
TITLE Quantum simulation via product of random unitaries: Low gate complexity with accuracy guarantees
SPEAKER Chi-Fang Chen
California Institute of Technology, USA
PLACE Rm104, Chin-Pao Yang Lecture Hall,
CCMS & New Physics Building, NTU

Abstract:

Quantum simulation has wide applications in quantum chemistry and physics. Recently, randomized methods have been proposed to accelerate Hamiltonian simulation. The advantage from randomization can be demonstrated by a simple algorithm called qDRIFT: iteratively evolve a random term in the Hamiltonian, and provably the average quantum channel approximates the ideal evolution. Today, I will present a comprehensive analysis of a single realization of the random product formula produced by qDRIFT. Our main results [arxiv:2008.11751] prove that a typical realization of the randomized product formula approximates the ideal unitary evolution up to a small diamond-norm error. Remarkably, the same random evolution starting from an arbitrary, but fixed, input state yields a much shorter circuit suitable for that input state. Numerical experiments verify the theoretical accuracy guarantees.

The proofs depend on analyzing product of random unitaries through concentration inequalities for vector and matrix martingales. With similar probabilistic methods I will also show bounds on propagation of stochastic noises in quantum computers, which is modeled by brownian circuits.

About the Speaker:

I am Chi-Fang Chen（陳麒方), a physics Phd Student at California Institute of Technology advised by Fernando G.S.L Brandao. My research focuses on the interplay between math and physics in quantum information theory and quantum dynamics, where vague phenomena in physics become provable in simple concrete models. My other works include Lieb-Robinson bounds, product of random matrices, tensor network theory, and quantum information aspects of AdS/CFT. The math I use includes non-commutative analysis, matrix concentration inequalities, von Neumann Algebra, quantum channel theory. Before Caltech, I studied at NTU physics in the last year of high school. I was a physics (but defacto math) major at Stanford University and worked in Patrick Hayden's group.

- 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.

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