CQSE-NCTS-CASTS-CTP

Joint Seminar

「Apr. 16, 2021 (Friday)」

- Time : 14:30~15:30
- Place : Rm104, New Physics Building
- Speaker: Dr. Kai-Min Chung 鐘楷閔
  IIS, Academia Sinica
  中央研究院資訊科學研究所
- Title : On the Power of Hybrid Classical and Low-depth Quantum Computation

▲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), National Center for Theoretical Sciences (NCTS)-Physics Division- Themetical Group TG1.1, Center for Advanced Study in Theoretical Sciences (CASTS), and Center for Theoretical Sciences (CTP), NTU

Joint CQSE-NCTS-CASTS-CTP Seminar

2021
April 16, Friday

TIME Apr. 16, 2021, 2:30~3:30pm
TITLE On the Power of Hybrid Classical and Low-depth Quantum Computation
SPEAKER Dr. Kai-Min Chung
Institute of Information Science, Academia Sinica
PLACE Rm104, Chin-Pao Yang Lecture Hall,
CCMS & New Physics Building, NTU

Abstract:

It is foreseeable that in the near term, quantum computation will be restricted to have low depth. Hence, it is natural to consider hybrid computation models of classical and low-depth quantum computation, which captures the computation power available in the near term. However, the power of such hybrid models is not clear. On one hand, it is known that Shor's factoring algorithm can be done in such hybrid models with poly-logarithmic quantum depth, and Richard Jozsa conjectured in 2006 that any polynomial-time quantum computation can be simulated in a hybrid model motivated by measurement-based quantum computation. On the other hand, Scott Aaronson conjectured an oracle separation between BQP and another type of hybrid model (first mentioned in 2005, and also in 2011 and 2014).

In this talk, I will present our oracle separations between BQP and both hybrid models, which proved Aaronson's conjecture and showed that Jozsa's conjecture cannot hold relative to oracles. In fact, we prove a stronger statement that for any depth parameter d, there exists an oracle that separates quantum depth d and $2d+1$ in the presence of classical computation. As a side note, the same conclusion is independently proved by Coudron and Menda using a different oracle problem, but we showed a shaper separation that doubling the quantum depth is strictly more powerful for both hybrid models relative to some oracles.

Joint work with Nai-Hui Chia and Ching-Yi Lai.

Biography Brief:

Kai-Min Chung received a bachelor"s degree from National Taiwan University in 2003, and a Ph.D. from Harvard University in 2011. His advisor was Salil Vadhan. After his Ph.D., he was a postdoctoral researcher at Cornell University for three years and supported by Simons postdoctoral fellowship in 2010-2012. He joined the Institute of Information Science, Academia Sinica as an assistant research fellow in Sept., 2013, and became an research fellow in Feb., 2020.

His research interests lie in the field of cryptography and its interplay with complexity and quantum theory. He has published works in these fields at major conferences such as STOC, FOCS, CRYPTO, Eurocrypt, CCC, QIP, and QCrypt. He has served on the program committees of major cryptography conferences such as CRYPTO, Eurocrypt, Asiacrypt, TCC, and QCrypt.

- N O T I C E -
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▲ Both faculty members and participants are required to wear sanitary masks all the time.
▲ All participants and event workers should stay at designated areas and minimize contact at short distances.
▲ We collect personal info during covid-19 only for contact tracing purposes.