

SEMINAR ANNOUNCEMENT

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
FACULTY OF ENGINEERING
Website: <https://www.eng.nus.edu.sg/ece/>

TOPIC	:	Quantum Supremacy And Quantum Machine Learning With Analog-Digital Near Term Quantum Computers
SPEAKER	:	Assoc Prof Angelakis, Dimitris, Principal Investigator, CQT NUS
DATE	:	Tuesday, 12 October 2021
TIME	:	4.30PM – 6.00PM
WEBINAR	:	Join Zoom Meeting https://nus-sg.zoom.us/j/84423270487?pwd=Qmx6c1BxdU5Fay9ZbzZqZGhMc2k5UT09 Meeting ID: 844 2327 0487 Passcode: 329331

ABSTRACT

I will start with an introduction on quantum simulation and computation with near term quantum processors, review the state of the art in quantum hardware and software and the notion of noisy intermediate-scale (NISQ) quantum computing.

I will then review our work with Google on quantum simulations with superconducting qubits focusing more the inner working of the superconducting qubits chips and less on the condensed matter problem simulated [1]. I will also cover the basic ideas behind the recent demonstration of quantum supremacy [3] as well our work on analog quantum supremacy [3] and quantum machine learning [4] with NISQ processors. Beyond the basic science aspects, I will also review our recent industry collaborations in the area of hybrid quantum-classical machine learning for customer segmentation for market research.

If time allows, I will briefly summarise our work on qubit efficient quadratic optimization algorithms and the plans under Quantum Engineering Program to apply these to use cases by Exxon-Mobil and the Singapore Stock Exchange [5].

The first part of the talk, as well as the industry applications, should be accessible to non-specialists.

[1] **Spectral signatures of many-body localization with interacting photons in superconducting qubits**
P. Roushan, C. Neill, [...] D.G. Angelakis, and J. Martinis. [Science, 01 Dec 2017: Vol. 358, Issue 6367, \(2017\)](#)

[2] **Quantum supremacy and quantum phase transitions**
J. Tangpanitanon, S. Thanasilp, M. A. Lemonde, N. Dangiam, D. G. Angelakis
[Phys. Rev. B 103, 165132 \(2021\)](#)

[3] **Quantum supremacy using a programmable superconducting processor**
F. Arute, Kunal Arya, [...] J. Martinis, Nature 574, 505 (2019).

[4] **Expressibility and trainability of parameterized analog quantum systems for machine learning applications**
J. Tangpanitanon, S. Thanasilp, M. A. Lemonde, N. Dangiam, D. G. Angelakis
[Phys. Rev. Research 2, 043364 \(2020\)](#)

[5] **Qubit efficient algorithms for binary optimization problems**
B. Tan, M. A. Lemonde, S. Thanasilp, J. Tangpanitanon, D. G. Angelakis [Quantum 5, 454 \(2021\)](#)

BIOGRAPHY

Dimitris G. Angelakis is a Principal Investigator (PI) and Research Associate Professor at the [Centre for Quantum Technologies](#), (CQT) where he is leading a theory group on [Quantum Computing and Quantum Simulation](#). He also a Coordinator in the Quantum Computing Pillar of the Singapore [Quantum Engineering Program Phase 2](#), where he is in charge of QEP Quantum Hardware Partnerships. He is also representing Greece in the [European Quantum Flagship QCN group](#).

He did his PhD in Imperial College, then moved to Cambridge as a St Catharine's College JRF, position he held at DAMTP Cambridge and the Centre for Quantum Computing until 2008 when he became a PI at CQT Singapore. He is known for his works in different areas in quantum computing and quantum many-body physics and has active collaborations with world leading experimental groups.

Awards he has received include the 2018 Google Quantum Innovation Award, the Valerie Myerscough Award from University of London, the Greek Ministry of Defence Scholar Prize, and UK Institute of Physics Quantum Electronics Thesis Prize 2002. In parallel to his academic work, he consults for the private sector on the uses of quantum computing and actively participates in the outreach efforts of CQT and NUS.

<https://www.eng.nus.edu.sg/ece/highlights/events/>