# Joint CQSE and CASTS Seminar

## Weekly Seminar
## Dec. 15, 2017 (Friday)

TIME          Dec. 15, 2017, 14:30 ~ 15:30
TITLE         Teleportation-based Fault-tolerant Quantum Computation in
              Multi-qubit Large Block Codes
SPEAKER   Dr. Ching-Yi Lai
              Institute of Information Science, Academia Sinica
PLACE        Rm716, CCMS & New Physics Building, NTU

## Abstract

A major goal for fault-tolerant quantum computation (FTQC) is to reduce the overhead needed for error correction. One approach is to use block codes that encode multiple qubits, which can achieve significantly higher rates for the same code distance than single-qubit code blocks or topological codes. We present a scheme for universal quantum computation using multi-qubit Calderbank-Shor-Steane (CSS) block codes, where codes admitting different transversal gates are used to achieve universality, and logical teleportation is used to move qubits between code blocks. All circuits for both computation and error correction are transversal. We also argue that single shot fault-tolerant error correction can be done in Steane syndrome extraction. Then, we present estimates of information lifetime for a few possible codes, which suggests that highly nontrivial quantum computations can be achieved at reasonable error rates, using codes that require significantly less than 100 physical qubits per logical qubit.