
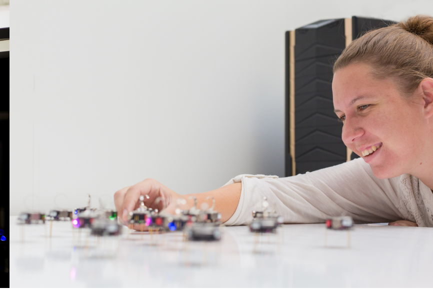


Physics colloquium

Robust and high-fidelity quantum control for quantum computing

Hsi-Sheng Goan
Department of Physics
National Taiwan University, Taipei 10617, Taiwan

Date: 5/6/19
Time: 2:00 PM
Location: SE1 270K
For more information contact

Lin Tian
ltian@ucmerced.edu

Abstract:

An essential prerequisite for quantum information processing is precise coherent control of the dynamics of quantum systems or quantum bits (qubits). Most of the control sequences implemented in quantum experiments are developed and designed based on the assumption of having ideal (closed) quantum coherent systems. However, almost every quantum system interacts inevitably with its surrounding environment resulting in decoherence and dissipation of the quantum system. We have applied the quantum optimal control theory to construct fast and high-fidelity quantum gates taking into account decoherence from dissipative environment for non-Markovian open quantum systems and for various promising physical quantum systems. Recently, we have also developed a systematic method to find pulses for quantum gate operations robust against both low and high-frequency (comparable to the qubit transition frequency) stochastic time-varying noise. Here we apply this method to construct single-qubit and two-qubit gates robust against the electrical noise with the experimentally measured $1/f$ noise spectrum and robust against uncertainty in system parameter for quantum-dot spin qubits in isotopically purified silicon, with gate fidelity enabling large-scale fault-tolerant quantum computation. If time allows, we will also discuss the ongoing project on constructing high-fidelity gates for superconducting transmon qubits.