# ENEE 789M: Quantum technology

This class covers the physical principles behind emerging quantum technologies, from quantum-limited amplifiers to atomics clocks to quantum simulators. We will examine current and emerging platforms for quantum technologies, including neutral atom, ion trap, superconducting circuit, photonic, and spin-based approaches. Our focus will be on hurdles for implementing quantum devices for new applications, rather than exploration of the application space itself.

Prerequisite: A good grounding in electromagnetism and quantum mechanics should be considered a prerequisite for this course; familiarity with density matrices and master equations will be helpful.

## Homework and exams

- Bi-weekly problem sets will be assigned on Wednesdays and due two weeks afterwards in class. They comprise 80% of your final grade. You are encouraged to work in groups of 3-4, though you must each turn in your own homework and list your group members' names.

- There will be a final paper in lieu of an exam. Topics will be chosen the first week in April, and the paper will be due in class on the final day.

## Probable course structure

- Introduction to quantum bits

- Neutral atom qubits

- Superconductor-based qubits

- Cavity QED

- Hybrid quantum systems

- Quantum-limited sensors

- Quantum cryptography

- Quantum simulation

## Supplementary texts

- *Quantum Mechanics* Messiah

- *Lecture Notes on Quantum Information* Preskill

- *Quantum Optics* Meystre

- *Atom-Photon Interactions* Cohen-Tannoudji, Dupont-Roc & Grynberg