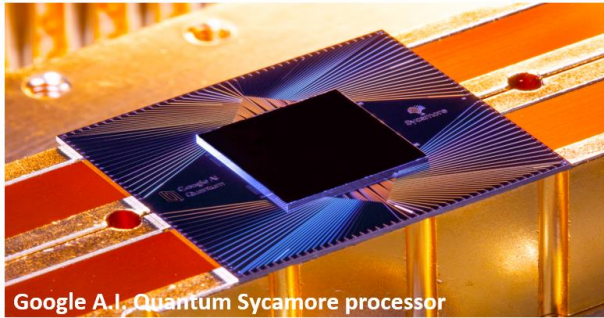
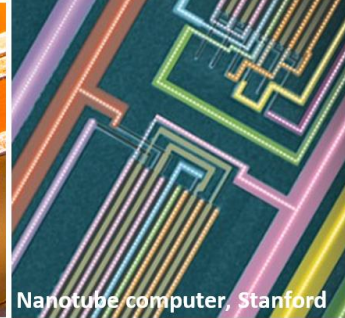


Quantum Mechanics & Quantum Computing Basics for Engineers



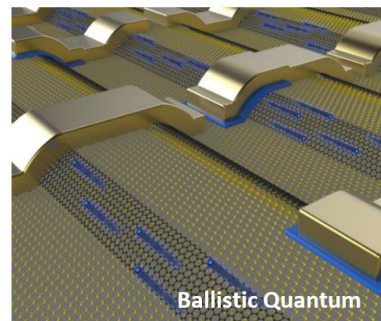
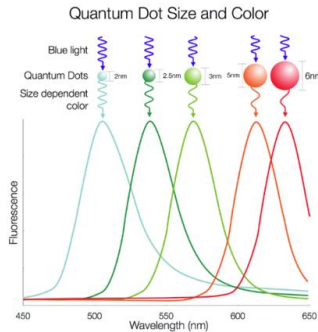
Google A.I. Quantum Sycamore processor



Nanotube computer, Stanford



IBM Quantum Computer



Ballistic Quantum

This course is designed for professional students who are interested in applied quantum mechanics. Students will be introduced to the physical and mathematical aspects of quantum mechanics, quantum gates and quantum computing.

Apply principles of:

- quantization,
- uncertainty principle
- superposition principle

Quantum Information / Comp:

- qubits
- entangled States
- Bell's Theorem
- Grover's Algorithm

Engineer:

- light emitters
- conductors
- Bandgap

Materials:

- quantum dots,
- graphene / nanotubes
- quantum wires

Learning objectives: *think quantum*

- A mathematical introduction to quantum mechanics
- Develop an engineer's perspective of emerging quantum technologies
- Interpret and use the solutions of Schrodinger's equation
- Fundamentals of Quantum Computing
- Basic expressions for tunneling
- Role of quantization in technological relevant examples
- Learn to use qiskit (pending approval of TA)

Grading

- Participation: Attend 60% of lectures (20%)
- 5 HWs or Mini Projects (65%)
 - Either one or a max of two students per group
- Final project (15%)
 - Either one or a max of two students per group
- Average GPA: 3.8

Quantum Mechanics References

Main Book:

- Quantum Mechanics for Engineers, M. P. Anantram and Daryoush Shiri

Reference books:

- 1) Quantum Mechanics: For Engineering, Materials Science, and Applied Physics, by Herbert Kroemer, Prentice Hall
- 2) Quantum Computing, Michael Nielsen and Isaac Chuang, Cambridge University Press

Prerequisites

Review material will be provided to help students with basic math and physics concepts.

Basic math concepts:

- Linear equations
- Matrices and Matrix Algebra
- Eigenvalue problems
- Orthogonal vectors
- Second order differential equations

Basic Computer skills:

- Ability to download and run packages on a PC
- Operation of student-owned PC

Basic physics concepts:

- Wave phenomena (standing waves and traveling waves only)
- Kinetic energy, potential energy, momentum

Have questions about the quantum course?

Please send e-mail to the instructor:

M. P. Anantram (Anant)

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