Quantum Technologies

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Plan of the course:

1. Lecture 1 (experimental platforms):

introducing the physical systems: quantum optics, trapped ions, NV centers in diamond, superconducting circuits

Bloch representation; Rabi oscillations

2. Lecture 2 (quantum computing):

qubits and gates

no-cloning theorem

Grover's algorithm

elements of error correction

3. Lecture 3 (quantum communication)

entangled states

Bell inequalities

BB84 code

4. Lecture 4 (quantum sensing and metrology)

phase-estimation protocols: general theory

standard quantum limit and the Heisenberg limit

NOON states

5. Lecture 5 (quantum devices)

squeezed states

quantum amplifiers

Haus-Caves theorem

6. Lecture 6 (commercial applications)

magnetic field detection with SQUIDs and resonators

THz detectors