

Cavity Optomechanics

Course Outline:

600K

- ① Introduction
 - ② History
 - ③ Mechanical Oscillators
 - ④ Optical Cavities
 - ⑤ Lab Tour (Basic Photodetection)
 - ⑥ Canonical Cavity Optomechanical System
 - ⑦ Dynamical Backaction
 - ⑧ Semi-classical Optomechanics - Gedankenexperiment
 - ⑨ Quantum Harmonic Oscillator
 - ⑩ Optomechanical Hamiltonians
 - ⑪ Quantum Noise, Fermi's Golden Rule
 - ⑫ Radiation Pressure Shot Noise
 - ⑬ The Standard Quantum Limit
 - ⑭ Ground State Cooling
 - ⑮ Exam
- HW # 1
- HW # 2
- HW # 3

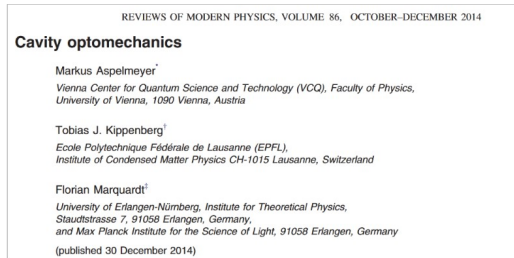
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Seminar Course: Project → 1 presentation, 1 written report

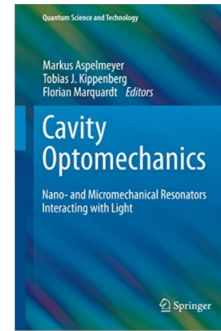
- Topics:
- Cavity Optomechanics with
 - photonic crystals
 - whispering gallery mode resonators
 - gram-scale mirrors
 - "membrane-in-the-middle"
 - levitated nanospheres
 - Atomic Ensembles
 - Carbon Nanotubes
 - Microwave circuit optomechanics
 - Gravitational wave interferometry
 - Tests of gravitational decoherence (MACRO)
 - Macroscopic Superposition States
 - Optomechanical Humberg-Brown-Twist Experiment
 - Optomechanical Entanglement
 - Dissipative optomechanics
 - Quadratic optomechanical coupling
- Ultra-high-Q mechanical oscillators
 - Nanofabrication, Issues of principle
 - Single photon optomechanics
 - Nonlinear optomechanics
 - Optomechanical Arrays
 - Photothermal Optomechanics
 - Brillouin Optomechanics
 - Acoustic-wave Optomechanics
 - Hybrid Optomechanics
 - Atom/NV/Ion
 - Electro-opto-mechanics
 - Fock State Generation
 - Applications
 - Accelerometry
 - Electro-optic Conversion
 - Quantum memory

Resources:

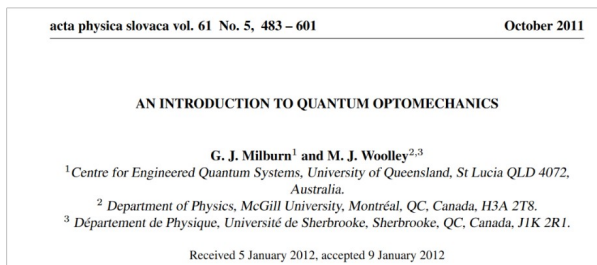
"Cavity Optomechanics" RMP (2014)
+ references therein



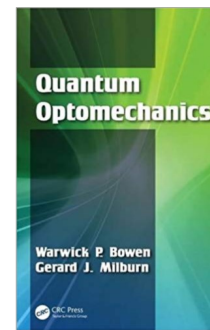
"Cavity Optomechanics", Springer (2014)



"Introduction to Quantum Optomechanics", Acta Phys (2011)



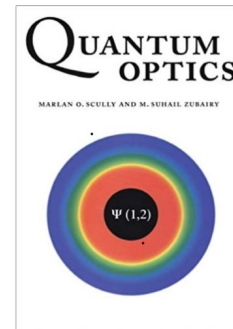
"Quantum Optomechanics", Springer (2014)



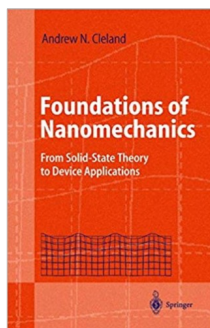
"Lasers", Siegman



"Quantum Optics", Scully & Zubairy



"Foundations of Nanomechanics", Cleland



"Vibration Problems in Engineering", Timoshenko & Weaver

