PHOT 301: Quantum Photonics
LECTURE 00

Michaël Barbier, Summer (2024-2025)

COURSE INFORMATION

Instructor

Dr. Michaël Barbier
e-mail: michaelbarbier@iyte.edu.tr
Office: door on the right of Z5
Hours: 9:00-17:00 (via appointment)

Course Schedule

Tuesday	09:45 – 16:15	Building F, lecture room D5
Friday	13:30 – 16:15	Building F, lecture room D5

CONTENTS OF THE COURSE

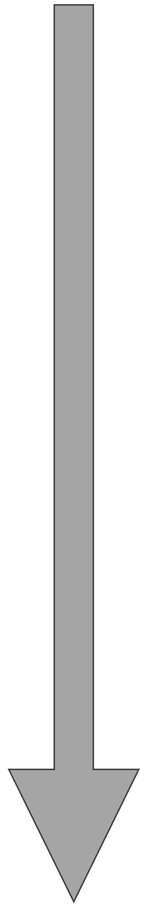
- Wave function & Schrödinger’s equation
- (Mathematical) Dirac notation

- Bound states and scattering

- Hydrogen atom, Multi-electron atoms

- Molecules and materials

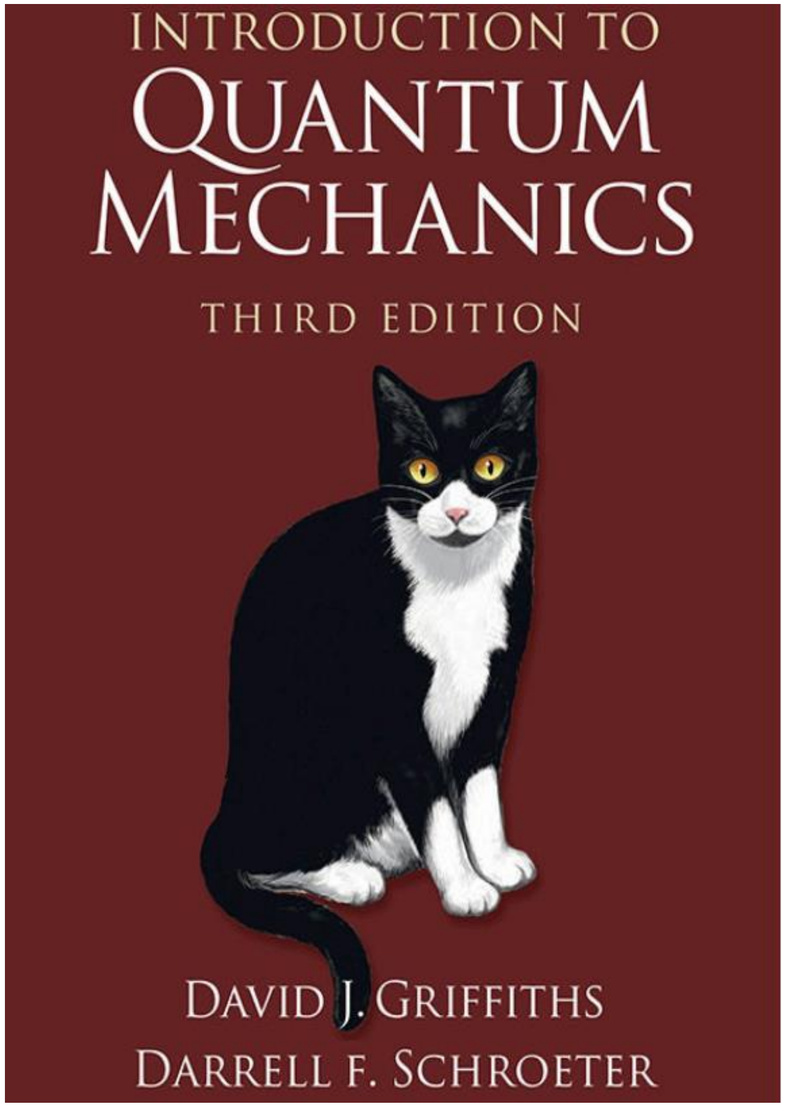
- Electromagnetic-field, absorption/emission



COURSE MATERIALS

Course book

D.J. Griffiths, Introduction to Quantum Mechanics, Pearson, 3rd edition



Supplementary material

D.A.B. Miller, Quantum Mechanics for Scientists and Engineers, Cambridge

C.C. Gerry and P.L. Knight, Introductory Quantum Optics, Cambridge, 2005

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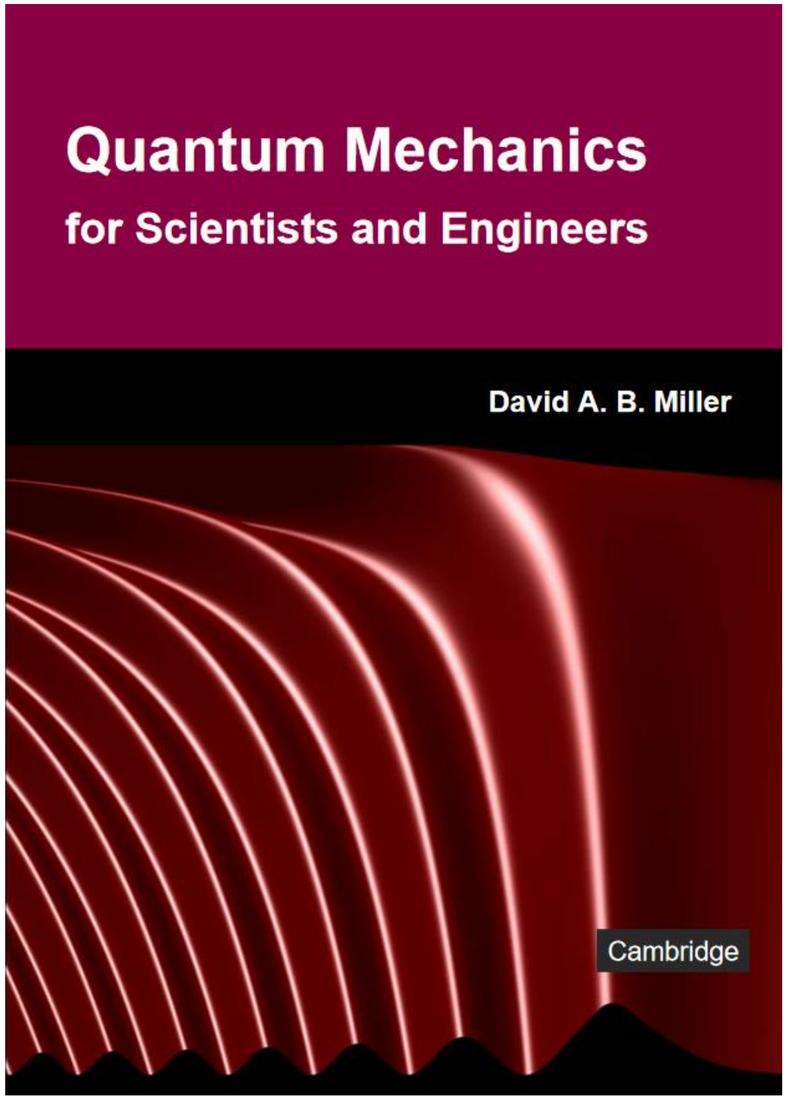

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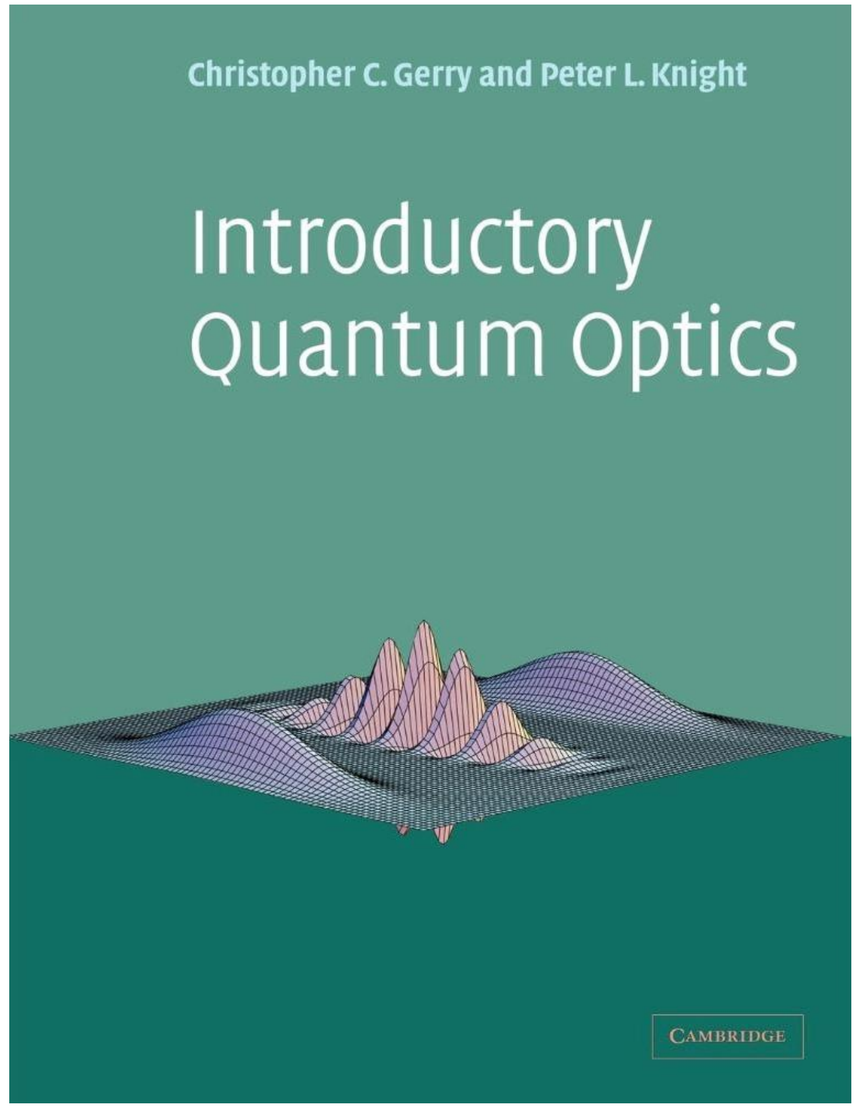

COURSE MATERIALS

Supplementary material

David Miller's webpage on quantum mechanics
https://dabm.stanford.edu/teaching/quantum-mechanics/

QuVis: Web site with quantum mechanics simulations

QuTip: Python library quantum mechanical simulations

Applet(s) by Paul Falstad for 1D quantum systems (other applets available on www.falstad.com/)

OVERVIEW OF THE COURSE

week	Topic
Week 1	Introduction & Required Mathematical Methods. Waves and Schrödinger's equation, Probability, Uncertainty and Time evolution. Infinite square well.
Week 2	The harmonic oscillator, Creation and annihilation operators. Free particle, 1D Bound states & Scattering/Transmission, Finite well
Week 3	Quantum mechanics formalism: Functions and operators, uncertainty. Approximation methods.
Week 4	Angular momentum and the Hydrogen atom, Spin Magnetic fields, The Pauli equation, Minimal Coupling, Aharonov Bohm Perturbation: Fine Structure of Hydrogen, The Zeeman Effect
Week 5	Identical particles, Periodic table, Molecular bonds, Periodic structures, Band structure, Bloch functions Time-dependent perturbation: Absorption, spontaneous emission, and stimulated emission
Week 6	Final exam

COURSE SYLLABUS AND CLASS WORKFLOW

Readings: Reading of the Chapters up front

Homework (Not graded)

- Idea is to understand the topic better
- You can submit solutions/ask questions, working together allowed

Quizzes (on Thursday morning)

- 4 quizzes – counts in total for 30% of your grade
- Topics seen the previous week, similar style of questions as on the exam
- Duration: 1 hour to complete the quiz

Final Exam

- 70% of your grade, Theoretical open questions, Exercises are important