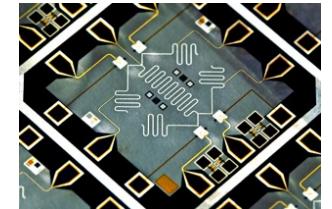


MENG 31500: Advanced Q. Eng. II



Instructor: Professor Aashish Clerk

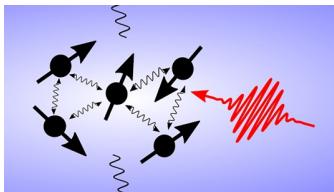
Time: Tues. & Thurs. 11:00am – 12:20pm (KPTC 105)

Discussion: Friday 1:30pm – 2:50pm (KPTC 105)
(will also use for makeup lectures)

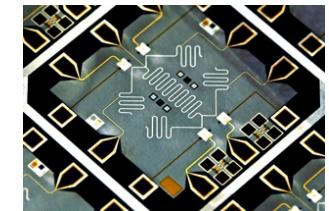
Office Hours: Thurs. 4:30pm – 5:30pm (also by appointment)

Prerequisite: PHYS 31400 (Grad QM I)
MENG 31400 (Adv. Quantum Engineering)
(+at least one semester of undergraduate QM)

Web page: Accessible through U. Chicago Canvas
(lecture notes & readings will be posted here)



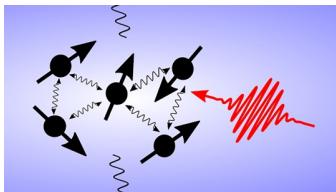
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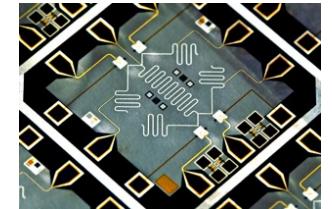
Instructor: Professor Aashish Clerk

Discussion: Friday 1:30pm – 2:50pm (KPTC 105)
(will also use for makeup lectures)

- **Discussion sessions are crucial parts of the course!**
 - Working through example problems
 - Group problem solving
 - Discussion of course material
 - Presentation of supplemental material
- **FIRST DISCUSSION SESSION THIS FRIDAY**
 - Review of density matrices



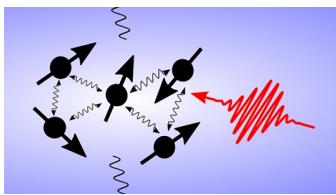
MENG 31500: Advanced Q. Eng. II



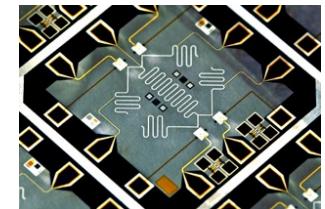
Instructor: Professor Aashish Clerk

Discussion: Friday 1:30pm – 2:50pm (KPTC 105)
(will also use for makeup lectures)

- **Course TA:**
 - Andy Chu ctchu@uchicago.edu
 - Will also setup regular office hours
- **Additional resource: PME Tutor Program**
 - Adi Gandotra
 - Mondays 9am – 11:30am (Zoom)
 - Wednesdays 1:30pm – 4:00pm (Zoom)
 - (will post link on Canvas)



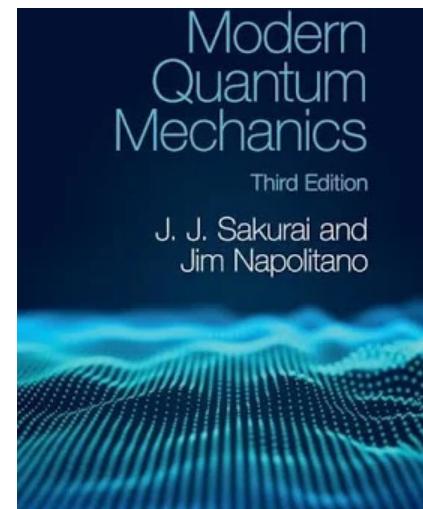
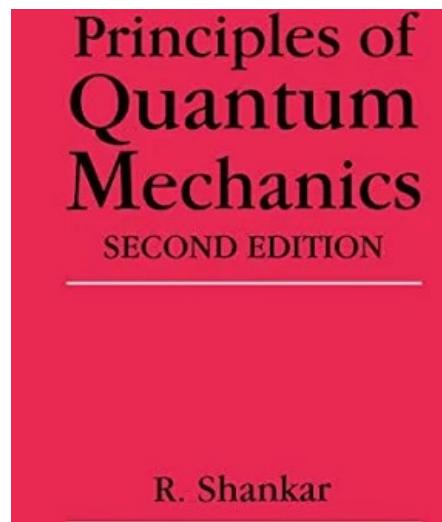
MENG 31500: Advanced Q. Eng. II



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(will also use for makeup lectures)

- **Course textbooks:**



Evaluation

- **Problem sets (20%)**
 - Roughly one per week
 - Usually posted Monday, due following Monday at midnight
 - Assignments will be submitted online via Canvas
 - Can discuss with others, but the solutions you submit must be your own work expressed using your own words
 - **First problem set posted by Monday Jan. 12, due Monday Jan. 19**
- **Midterm Exam (35%)**
 - **Wednesday Feb. 4, 5:00pm – 7pm**
 - Will cover roughly lectures 1 – 12
- **Final Exam (45%)**
 - 3 hours, during regular exam period, will cover entire course

Course goals and topics

- This course takes the place of PHYS 34200 (Grad QM II)
- Ensure mastery of basic aspects of quantum theory
- At the end of this course you should:
 - Have a thorough understanding of **standard approximation methods** used in quantum mechanics
 - Time-independent perturbation theory (*degenerate & non-degenerate*)
 - Time-dependent perturbation theory (*Fermi's Golden Rule*)
 - Other methods (e.g. variational principle)
 - Understand more **advanced aspects of angular momentum** in QM (addition of angular momentum, Wigner-Eckart theorem)
 - Understand basic features of **entanglement** & the derivation of **Bell's theorem**
 - Understand how we describe **many-particle quantum systems** (**second quantization**, exchange statistics)

Course goals and topics

- Addition of angular momentum
- Entanglement & Bell's Theorem
- Perturbation theory
- Many-particle systems & 2nd quantization

- **Connection to PHYS 31400?**
 - Continuation of graduate-level overview of quantum mechanics started in PHYS 314 (minimal overlap)
 - Content closely related to PHYS 34200
- **Connection to MENG 31400?**
 - Some overlap in topics
 - e.g. perturbation theory, entanglement,
 - We will however cover things in more depth

“Never underestimate the joy people derive from hearing something they already know”
(Enrico Fermi)

