Physics 162b: Quantum Mechanics II

Spring 2016

Instructor: Prof. Matthew Headrick
E-mail: mph@brandeis.edu
Office: Abelson 310
Office hours: Thursday 11-12, and by appointment. You are also welcome to knock on my door at any time, and I will meet with you if I can.

Time and place: Tuesday and Friday, 9:30–10:50am in Abelson 229.

Credits: Four-Credit Course (with three hours of class-time per week). Success in this 4 credit-hour course is based on the expectation that students will spend a minimum of 9 hours of study time per week in preparation for class (readings, problem sets, preparation for exams, etc.).

Content: This course is a continuation of Physics 162a, covering more advanced methods and applications of quantum mechanics. Many of the mathematical methods we will study are also useful in other areas of physics. The course will cover the following topics: symmetries in classical and quantum mechanics; the path integral formulation of quantum mechanics; time-dependent perturbation theory; quantization of the electromagnetic field and emission and absorption of radiation; scattering theory; and (as time permits) quantum non-locality, decoherence, and elementary quantum information theory. For most of the material we will follow the assigned textbook, Shankar’s “Principles of Quantum Mechanics” (second edition). This will be supplemented by other sources.

Weekly assignments: An assignment will be due approximately weekly, usually on Friday, which will generally include a reading and a problem set. The problem set will include some relatively straightforward exercises based directly on the reading, as well as some harder problems based on the previous week’s material. You are encouraged to work together in solving the problems (or at least to check your solutions), but you must write the problem set up by yourself (no copying). Problem sets will be graded based on both the correctness of the physics and the quality of the presentation. Late problem sets (or portions thereof) will be given 50% credit if handed in within one week of the original due date.

You are also required to submit one thought or question (TQ) on the reading assignment each week on Latte, which can be about something you didn’t understand, something you found particularly interesting, or a possible extension or application of the material. The TQ is due 24 hours before the problem set (usually 9:30am on Thursday).

Mock quals: Every other week, usually on a Tuesday, there will be a mock oral qualifying exam. This is not graded.

Colloquium reports: Each student will prepare a written report (around 5 pages in PRL format) and give a 30-minute oral presentation on the topic of one of the departmental colloquia. The report and presentation should give a preview of the colloquium while explaining the necessary background material to understand it. You will hand in a draft of the written report on Tuesday one week before the colloquium; meet with me to discuss it on Thursday; send out the final version to your classmates by Sunday; and give your presentation in class on Tuesday on the day of the colloquium. The schedule for the reports will be drawn up after the first day of class.

Exam: There will be a 24-hour take-home final exam, tentatively scheduled for May 3–4. There will not be a midterm.

Grade: Your grade for the course will be calculated as follows: 10% on attendance, class participation, and submission of TQs; 40% on problem sets; 20% on the colloquium report; 30% on the final exam.