Physics 401: Quantum Mechanics
MWF 10:30-11:30
HSC110

Dr. Craig L. Caylor
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Prerequisites: PHY 313 Modern Physics

Text: Introduction to Quantum Mechanics by David J. Griffiths (Ch 1-7, 12)

Homework: Regular homework will account for 30% of your grade. You may consult with me and/or your fellow students to make progress on the homework. There will be scores of 0, 1, or 2 on any homework problem. You should begin work early, meeting with me as necessary, and plan to reach completely correct answers before the due date of each assignment. Late homework will not be accepted.

Take-home exams: "Special" problems will account for 40% of your grade. You may consult with me but not others. My consultations will include whether your work is correct or not, possible Mathematica tips, and guidance. I will not reteach the course material during your work through the exam. Partial credit will be available. You should still begin work early, meeting with me as necessary, and plan to reach completely correct answers before the due date of each exam. Late exams will not be accepted.

Quizzes: We will have three in-class quizzes.

Ch 1-3 early October
Ch 4,5 early November
Ch 6,7,12 Monday, December 11, 8:00AM

Questions will be…the sort of questions that you can do in an in-class exam at this level. Concepts. Descriptions. Short derivations. Recalling fundamental equations. The quizzes will account for 30% of your grade.

Grades: The bottom of the A-range will be 87. The bottom of the B-range will be 75. The bottom of the C-range will be 62.

Integrity: Do your own work. Learning physics can be to some degree a cooperative enterprise. Consultation with your fellows on homework is permitted. Direct copying of work or an over-reliance on someone else's thinking is not. On the take-home portions of exams: do not work with anyone on them; do not discuss them with each other. You are never allowed to consult with published solutions to homework problems or exam problems that you might encounter. This includes online repositories. Don't even look at them. Westminster College has a detailed academic integrity policy. I will enforce it if I determine a violation has occurred, and you will fail this class. To review that policy, see the current WC handbook, available online at https://my.westminster.edu/ICS/Campus_Life/Campus_Groups/Student_Affairs/.
PHY401 (Quantum Mechanics) Mission Statement

The aims of the Quantum Mechanics course are to provide students with a detailed conceptual understanding of the precepts and implications of quantum mechanical theory, to enable students to apply rigorous mathematical techniques for solving problems in quantum mechanics, and to prepare students for graduate study in physics.

PHY401 (Quantum Mechanics) Outcomes

- Students will be able to explain important concepts of quantum mechanics, including the collapse of the wave function, sequential measurements, stationary states, the uncertainty principle, spin, symmetrization, degeneracy, and Bell’s theorem.
- Students will be able to solve the time-independent Schrodinger equation for a small selection of exactly-solvable potentials and make use of the solutions to calculate probabilities and expectation values.
- Students will be able to solve problems involving particles with multiple sources of angular momentum.
- Students will be able to apply principles of quantum mechanics to multi-particle systems.
- Students will be able to use time-independent perturbation theory and/or the variational principle to obtain information about systems with more complicated potentials.
- Students will become proficient with the use of mathematical software (e.g. Mathematica) in solving problems.
- Students will refine their abilities to work through the solving of a problem to a completely correct result.
- Students will leave the course better-prepared for graduate coursework in physics.

PHY401 (Quantum Mechanics) Assessment

- Problems will be assigned from the text as homework. Problems will directly assess students’ abilities to solve problems of some of the types listed above. Minimal partial credit (but plenty of instructor support) is given—this requires students to stick with a problem until they have reached a correct solution. Many problems will require the successful use of mathematical software. Since most problems require an understanding of fundamental concepts, this component of assessment also indirectly assesses students’ conceptual basis.
- In-class exams will more directly probe students’ conceptual understanding of important quantum mechanics concepts and approaches. Students will be scored on the correctness and thoroughness of their explanations and derivations.
- Take-home exams will consist of significant “realistic” problems from the text or designed by the professor. Student work is judged on the correctness of solutions and quality of presentation. This assessment component will evaluate students’ problem solving skills (including the use of software) and will indicate the level of their preparation for graduate work.