# University of Maryland
# Department of Physics

## Spring 2019 Prof. Steven Anlage Physics 401

**Title:**
Physics 401: Quantum Physics I: Introduces some quantum phenomena leading to wave-particle duality. Schrödinger theory for bound states and scattering in one dimension. One-particle Schrödinger equation and the hydrogen atom. The first semester of the two-term sequence on introduction to quantum physics for physics majors. This is a 4-credit course.

**Prerequisite:**
PHYS371 and PHYS373. A good working knowledge of linear algebra and differential equations is essential.

**Instructor:**
Prof. Steven Anlage, Room 1363 (Physics/CNAM). You can find the CNAM either by 1) going through the blue door labeled "Center for Nanophysics and Advanced Materials" in the basement of the physics building, or 2) entering CNAM from the plaza between the Math and Physics buildings.
Phone: 5-7321, e-mail: anlage@umd.edu, web site: anlage.umd.edu

**Schedule:**
Three lectures weekly, M....... 10:00am - 11:50am (PHY 1201), WF....... 11:00am - 11:50am (PHY 1201) which includes a 1 hour discussion /lecture.

**Required Text:**
David Griffiths and Darrell Schroeter, Introduction to Quantum Mechanics 3rd Edition (Cambridge University Press, 2018) ISBN-13: 978-1107189638. Suggested for background reading: Alexandre Zagoskin, Quantum Theory: A Complete Introduction 1st Edition (Teach Yourself, 2015) ISBN-13: 978-1473602410.

**Lectures:**
You will be responsible for material presented in lecture that is not in the book. If you miss a lecture you are responsible for finding out from a classmate what we did in class.

**Homework:**
The homework assignments will be given on the (open) class website and on ELMS. The assignment will be due at the beginning of class on Fridays. Please staple papers and show your name, assignment number and date due. Two homework problems will be graded quantitatively (0-10) and the rest will be graded qualitatively (0-2). The choice of the two problems to grade quantitatively will be made *after* the homework is collected.

Doing the homework is a very important part of this course! Homework will be returned by the following week. Late homework will not be accepted. As compensation, the lowest homework grade from the semester will be dropped.

**Quizzes**:
There will be quizzes in class, generally on Mondays. The quiz will cover topics in the homework assignment due the previous Friday, and should be considered as part of the homework assignment. There will be no makeups for these quizzes! As compensation, the lowest quiz score from the semester will be dropped.

**Exams:**
There will be two "mid-term" exams and a final exam. All exams will be counted towards your final grade. Make-up exams (for any of the exams) must be requested well in advance of the exam; the reason for the absence must be documented and in accord with University policy (see p. 109 of https://catalogundergraduate.umd.edu/files/2017-2018-UGCatalog.pdf). If an exam is unexpectedly canceled (due to inclement weather, etc.) it is automatically rescheduled for the next class period.

In grading, we are looking more at the reasoning that you use, rather than the final number you arrive at. So remember to carefully set up the problem on paper, even if you cannot see the way through to the solution.

The final exam is Saturday, May 18 from 8 to 10 AM.

**Computers**

Developing a working knowledge of numerical techniques in the context of physics problem solving is an important skill. You are encouraged to solve problems using programs such as Mathematica. Note that a student version of Mathematica is available for download from TERPware: http://terpware.umd.edu/Windows/Title/1837

**Dropping the Course:**

Note: the last day to drop with a "W" is April 12.

**Final Grade:**

Based *approximately* on homework (~20%), quizzes (~20%), mid-terms (~40%), and final (~20%).

**Academic Dishonesty (cheating):**

Academic dishonesty is a serious offense that may result in suspension or expulsion from the university. In addition to any other action taken, the normal sanction is a grade of "XF", denoting "failure due to academic dishonesty," and will normally be recorded on the transcript of the offending student. Note that general university course policies are posted at http://www.ugst.umd.edu/courserelatedpolicies.html.

**Office Hours**

You are strongly encouraged to attend office hours to ask questions, discuss the homework problems, and talk about physics in general. The office hours will be held 4:00-5:30 PM on Thursdays, just before the homework is due.

**(Open) Class Web Site:**

**http://www.physics.umd.edu/courses/Phys401/AnlageSpring19/**

**Tips For Doing Well In This Course:**

1) Read the assignment in the book *before* and *after* the material is covered in lecture.

2) Freely ask questions in lecture, after lecture, and during office hours. Also discuss problems with your friends and classmates.

3) Work all of the homework questions and problems. You are allowed and encouraged to discuss homework with anyone you wish. However, in order to really learn, don't just copy solutions from somewhere or someone else; rather, work through them in detail yourself. Afterwards, make use of the solution sets, your TA's office hours, and me to make certain you understand all of the solutions. The quizzes are based on the homework and the exams will sometimes involve homework problems.

4) Seek help immediately if you do not understand the material or can't solve the problems. Help is available from your TA, and from me. Don't wait until just before the exams! If you are experiencing difficulties in keeping up with the academic demands of this course, contact the Learning Assistance Service (http://www.counseling.umd.edu/las/). Their educational counselors can help with time management, reading, note-taking and exam preparation skills.

5) Remember that you are responsible for material discussed in class, even if it does not appear in the textbook.

**What Should You Learn in this Class?**

Physics 401 will introduce you to the concepts and analytical skills required to understand quantum mechanics. The course is taught in the 'Schrodinger Picture,' which is relatively easy to grasp, but we will also delve into the abstract representation of quantum states as vectors in Hilbert space. Both of these perspectives are needed to go deeper into the subject and understand the unique and sometimes counter-intuitive world of quantum mechanics.

**Physics GRE**

There is an emphasis on both historical aspects of quantum physics, as well as many general concepts from one-dimensional quantum mechanics on the Physics GRE exam. The textbooks by Krane or Tipler/Llewellyn will be of great help in preparing for the historical aspects, while Griffiths is ideal for the analytical part of the exam. The more practice you have solving problems in quantum mechanics, the better you will do on the Physics GRE.