Cal Poly Pomona, Physics 235

Instructor: Dr. Nina Abramzon	**email**:nabramzon@csupomona.edu
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Office Hours: Mon, Fri 11:00-12:00, **Office Hours by appointment** : Wed. 11:00-12:00, Mon 1:00-2:00	
Learning assistants: Conor Rowland Office hours: Tue, Thur 11:00-12:00 room 3-2011	
Primary Text: K.S. Krane, *Modern Physics*, 2nd ed., Wiley, 1996. **Supplementary Text:** R. Eisberg and R. Resnick, *Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles*, 2nd ed., Wiley, 1985. (A copy is on reserve in the library and in the physics club room) **Calculator:** Bring this to class Class web page: **On BlackBoard**	

Course Description: This course is a quarter-long introduction to quantum mechanics and the tremendous impact that it has had on our understanding of physical phenomena. It is meant to be an introduction for physics majors, who will take a more rigorous quantum mechanics course and other specialized courses later on, and to provide a full overview of modern physics for physics minors. Students will learn basic principles of quantum mechanics. Emphasis will be put on the experimental observations that led to the birth of modern physics.

Course Organization: In addition to the traditional presentation of lecture and demonstration material, each lecture will involve interactive learning sessions. During these sessions students will work in groups on a specific assigned question and will discuss the results with other students and with the instructors. These questions are meant to provide a form of continuous self-assessment for you and also give me important feedback.

Course objectives:

- Students should gain knowledge of basic principles of quantum mechanics, such as wave-particle duality, the uncertainty principle and its probabilistic interpretation.
- Students should acquire modern physics tools (Schrodinger mechanics) for use in a variety of simple applications.
- Students should recognize the importance of the experimental observations that led to the birth of modern physics.
- Students should gain an understanding of how basic ideas of quantum mechanics apply to modern applications.
- Students should develop the ability to research, read, understand and critically discuss a scientific article.
- Through oral presentation, students should improve their ability to coherently present complex material to others.

Prerequisites: PHY 234

Corequisites: PHY 235 L (for Physics Majors)

Grading:

Homework	15%
In-Class Problems	10%
Midterm Exam	20%
Midterm Exam	20%
Final Exam (cumulative)	25%
Presentation	10%
Extra credit	5%

Homework: Because physics is a very hierarchical subject (later topics cannot be learned without the foundation provided by earlier ones), it is essential that you keep up with the course material. To encourage you to do so, and to provide you with a gauge of how well you understand the material, regular homework sets will be assigned. You may discuss the homework with classmates. The grade will be determined based on one, two, or three problems that I will pick randomly. I will provide you with full solutions to all problems. HW and solutions will be posted on the web site. I am planning to give out a HW assignment every week, which will be due one week later.

In Class Problems: Often there will be in-class problems. The problems are open book, open notes and you may ask the instructor for help. You are encouraged to work with other students.

Exams: All exams are in class, closed book. You are allowed to bring a calculator and a 3"x5" index card with FORMULAS ONLY to all exams.

Presentation: Towards the end of the quarter each student will participate in a 20 minute group presentation about an article published in the American Journal of Physics (AJP) that pertains to a subject in quantum mechanics (as a general guideline, each group will consist of 3 students, with each student speaking for 7 min during the presentation). I will provide you with a list of papers that you may choose from, but you are welcome to browse through AJP archives yourself and find a paper that is interesting to you. Absences are not acceptable. **Each unexcused absence from a presentation will result in a half letter grade reduction**. See the instructor promptly with your excuse should you miss a presentation. More information about this activity will be provided during the quarter. **You must form a group by 4/16 and have a topic approved by 5/7.**

Extra credit A maximum of 5 extra credit points will be awarded to students who demonstrate an effort which is not necessarily reflected in their quizzes/hw/exams. Such efforts might include *contributions to class discussions, answering concept questions correctly, or effective use of office hours*. This extra credit is subjective, based on my general impression.

Academic Integrity: Every student is expected to be familiar with the university policy on academic integrity. Copying and cheating are serious offenses.

Any student who feels s/he may need an accommodation based on the impact of a disability may contact me privately to discuss your specific needs, or may contact Disable Student Services at 909-869-3333 in room 126 of the University Library to coordinate reasonable accommodations for students with documented

Course Outline:

Week		Topic	Chapters	
1				**Historical overview-wave like properties of particles**
	4/2	1 Introduction		
	4/4	Black Body radiation	Krane 3.3 Eisberg and Resnick ch 1	
2	4/7	Black Body radiation		
	4/9	Photoelectric effect	Krane 3.2 (Eisberg and Resnick 2.1,2.2,2.3)	
	4/11	Photoelectric effect		
3	4/14	Compton Scattering	Krane 3.4 Eisberg and Resnick 2.4	
	4/16	Compton Scattering		
	4/18	Bohr Model of the Atom	Krane ch 6 (Eisberg and Resnick 4.1-4.6)	**Historical overview- The Bohr Model**
4	4/21	Bohr Model of the Atom		
	4/23	Matter waves – Debroglie and Davidson Germer experiment	Krane ch 4.1 (Eisberg and Resnick 3.1)	**Historical overview- particle like properties of waves**
	4/25	Wave-particle Duality and Uncertainty Relationships	Krane ch 4.2-4.6 (Eisberg and Resnick 3.2-3.6)	
5	4/28	1-D Schrodinger Equation	Krane 5.1-5.3 (Eisberg and Resnick 5.1-5.6)	**1-D Schrodinger Equation**
	4/30	**MIDTERM 1**		
	5/2	Applications of Schrodinger Equation The free particle	Krane 5.4 (Eisberg and Resnick 6.2)	
6	5/5	Applications of Schrodinger Equation The free particle	Krane 5.4 (Eisberg and Resnick 6.2)	
	5/7	Applications of Schrodinger Equation: The infinite square well potential	Krane 5.4 (Eisberg and Resnick 6.8)	
	5/9	Applications of Schrodinger Equation: The Finite square well potential	(Eisberg and Resnick 6.7)	
7	5/12	Applications of Schrodinger Equation: The Finite square well potential		
	5/14	Applications of Schrodinger Equation: The step potential	Krane 5.7 (Eisberg and Resnick6.3, 6.4)	

	5/16	Applications of Schrodinger Equation: The step potential		**1-D Schrodinger Equation**
8	5/19	Applications of Schrodinger Equation: The barrier potential/tunnel effect	Krane 5.7 (Eisberg and Resnick 6.5)	
	5/21	**MIDTERM 2**		
	5/23	**Selected topics** Student Presentations		
9	5/26	**HOLIDAY**		**Selected topics/ Student Presentations**
	5/28	Student Presentations		
	5/30	Student Presentations		
10	6/2	Student Presentations		
	6/4	Student Presentations		
	6/6	Review for final		

Final exam: 6/12 Wed 11:30-1:30