Physics 2021
Relativity and Quantum Physics
Spring 2014

2:00 - 3:15 P.M., Tu, Th, 2:00 – 2:50 F, MWAH 191

Instructor: Sergei Katsev
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Course web site: http://d.umn.edu/~skatsev/Phys2021.htm

Text: P.A. Tipler and R.A. Llewellyn, Modern Physics, 5th edition.

Course Objectives: The objective of this course is to introduce the students to the two most influential theories of modern physics: theory of relativity and quantum mechanics. For quantum mechanics, the goal is to learn the fundamentals of the theory, become familiar with the mathematical apparatus, and to investigate some of the meanings of the quantum theory predictions. The course will also explore the consequences of the quantum theory as they appear in atomic and nuclear physics.

Grading: Course grades will be determined based on your performance in the following four areas, with their respective weights:

- Homework 20%
- In-class short quizzes 10%
- Tests (two) 40%
- Final exam 30%

Extra credit: Up to 5% in total percentage points may be earned by giving a seminar on a special topic of your choice at the end of the course. Topics should complement the course content; you should discuss the choice of your topic with the instructor. Your presentation will be assessed by your peers as well as the instructor based on the difficulty of the subject matter and quality of presentation.

Homework: Homework assignments are important. You will hear about concepts in class. It is expected that you read the book section on what will be presented in class before coming to class - lectures will be a lot more useful to you if you read in advance! In fact, reading assignments will frequently be part of your homework. You will be provided ample opportunities for asking questions and seeking explanations for the material that was difficult to you. Use them! Topics that caused difficulties to a large number of people will be explained in more detail in class.

Reading and listening alone do not make the knowledge sink in. In order to really learn about a topic, you need to practice it. Homework is this practice. In addition to helping one learn things, the homework helps the instructor see what areas need more or different explanation.

When writing your homework solutions, include not only the diagrams and equations which lead to the answer, but elaborate on the reasoning that led you to the steps in your answer. Think of the good and bad examples that you saw in your textbooks. Write your homework problems like the good ones, and remember how frustrating those "the remainder is the exercise is left to the reader" passages have been. Homework will be assigned roughly once per week. The lowest homework score will be dropped.

Class Participation: This is a small class, which allows students to more actively participate in lectures. Ask questions. Answer other people's questions. Work things out on the board. Although this is not a requirement (some people prefer working alone), see this as an opportunity to understand things better. You'd be surprised how much clearer things become when you try to explain them to someone. There is no grade for class participation, and attendance is not mandatory – do what is best for you.

Labs: The companion lab for this course is a separate course, Physics 2031 Quantum Physics Laboratory.

Note on disabilities: Individuals who have any disability, either permanent or temporary, which might affect their ability to perform in this class are encouraged to inform the instructor at the start of the quarter. Adaptation of methods, materials, or testing may be made as possible to provide for equitable participation. To learn about the services that UMD provides to students with disabilities, contact Disability Resources, 258 KSC, extension 6130.

Course Outline (subject to change)

Detailed outline is published on the course web site:
http://www.d.umn.edu/~skatsev/Phys2021/Course%20outline.htm

Review of Classical Physics topics
Special Relativity
Quantization, blackbody radiation
Structure of atom, atomic spectra, Bohr model of atom
Particle-waves, wave packets, the uncertainty principle
The Schrodinger Equation. Eigenstates. Potential wells.
Operators and expectation values.
Quantum superposition. Two-slit diffraction. Bell's inequality.
The Hydrogen Atom. Wavefunctions in 3D. All other atoms
Quantization of angular momentum and energy.
Spin, spin-orbital effects.
Molecular structure and spectra
Special topics.