INTRODUCTION TO MODERN PHYSICS  
COURSE 21:750:316  
FALL 2023

Instructor:  
Dr. Claudiu Stan; claudiu.stan@rutgers.edu; 369 Smith Hall  
Office Hours: Tuesday 2:30-3:30pm. Held in person in my office, 369 Smith Hall.

Class Time & Location:  
Lecture: Tuesday & Thursday 11:30am-12:50pm, Hill 215.

Final Exam Time & Location:  
The final exam is on Tuesday Dec 19, 2022; 11:45am – 2:45 pm, Hill 215. (Default scheduling)  
Note: Students must bring final exam conflicts to the attention of their dean of students at least two weeks before the first final exam day

Changes in case of mandatory remote teaching, such as COVID quarantine:  
The lectures/exams will be held using Big Blue Button (formerly Conferences) in Canvas, and the office hours will be held over Zoom. Links and instructions will be posted on Canvas.

Textbook:  
(You can get the book from Amazon starting from about $50.)

Other Required Materials:  
1) Laptop/tablet/smartphone for accessing Canvas materials and doing quizzes in class  
2) Pocket calculator. (Note: smartphone, tablets, computers, etc. may not be used on exams)  
3) In case of remote teaching: personal device(s) (smartphone, etc.) for generating and uploading written assignment files as scanned or photographed files. Please note that the files must be in one of these formats: pdf, doc, jpg, tif, bmp.

Course Description:  
Physics 316 will introduce students to some of the most important physics developed since ~1900, such as relativity and quantum physics. Also covered are the phenomena and experiments that triggered the development of modern physics. Along with the introductory 200-level Physics courses, this course will give students the preparation needed to take more advanced courses in Physics.
Learning Goals:

1. Learn a range of new physical phenomena, concepts and laws that are the core of Modern Physics.
2. Develop a physical understanding of Modern Physics concepts, which are less intuitive than those covered in General Physics.
3. Learn how to apply physical laws and mathematical tools to solve problems in the subject area of the course.

Topics:

1. Special relativity 1 .................................................. (Serway et al. Chapter 1)
2. Special relativity 2 .................................................. (Serway et al. Chapter 2)

Test 1: Chapters 1-2

3. The quantum theory of light......................... (Serway et al. Chapter 3)
4. The particle nature of matter ......................... (Serway et al. Chapter 4)
5. Matter waves ..................................................... (Serway et al. Chapter 5)

Midterm: Chapters 1-5

6. Quantum mechanics in one dimension .......... (Serway et al. Chapter 6)
7. Tunneling phenomena ........................................ (Serway et al. Chapter 7)

Test 2: Chapters 6-7

8. Quantum mechanics in three dimensions .... (Serway et al. Chapter 8)
9. Atomic structure ................................................ (Serway et al. Chapter 9)
10. Statistical mechanics ........................................ (Serway et al. Chapter 10)
11. TBD: Molecular structure .................................. (Serway et al. Chapter 11)

Final Exam: All the covered material

Course Structure:

Assigned readings: Readings from the textbook will be assigned and must be completed before lectures. The readings will be posted on Canvas (approximately one week in advance). You are required to read the material to familiarize yourselves with the topic. Try to identify the most important concepts by paying attention to the items highlighted in the textbook: figures, highlighted statements, equations. You are not required to work out examples or problems. These readings will help you understand better the lectures, and you will need this reading to answer one question at the beginning at the lectures.

Lectures: Before the lectures you must do the assigned reading. The lecture material will be presented both on slides and as worked examples at the blackboard; the slides will be posted on Canvas after the lecture.

The lecture will typically include two graded quizzes. They both count for the grade, and will be submitted using the Canvas app. The first quiz will be a short question on the assigned reading, and the second quiz will be based on the material covered in class. For the second quiz you are encouraged to team up with 1-2 of your colleagues.

Homework: Late homework will not be accepted. Homework will be posted on Canvas at least one week in advance and is due in Canvas, typically Tuesdays before class; the posting will specify the exact deadline. Homework will primarily consist in solving problems but may
include derivation of certain formula, or special problems. You are encouraged to form study groups but every student must present their homework independently.

**Special assignments:** Special assignments, such as problem-solving sessions in class, may be held instead of standard lectures which cover new material.

**Course grades:**

**In class quizzes:** You must be attending the class to take the quizzes. The in-class quizzes are also a measure of your participation in the class, therefore if you are present, you will receive partial credit even for an incorrect answer.

**Homework:** You must show how your thinking leads to your response (diagrams, equations, mathematical derivation, etc.) to get full credit. Your reasoning or rationale is the “meat” of the answer. It is your responsibility to clearly present the thinking that leads to the answer.

**Tests:** The two tests, 40 minutes long, will be given during class, at the end of the class. Make-up tests will not be administered. If you have an excused absence (with documentation) on the day of a test, the other test score will count twice.

**Midterm exam:** The midterm exam will be given during class and will take the whole duration of one lecture. Make-up midterm exams will not be administered. If you have an excused absence (with documentation) on the day of a midterm exam, your Final Exam score will be counted with the combined weight of the Midterm and the Final (i.e., 50% of the grade).

**Grading for exams and tests:** For open-ended questions on exams, you must show the derivation to get full credit, same as in the homework (see the homework section above). For multiple-choice questions, partial credit may be given if you show the derivation but pick the incorrect answer.

**Grading Scheme:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>In class quizzes</td>
<td>15%</td>
</tr>
<tr>
<td>Homework</td>
<td>15%</td>
</tr>
<tr>
<td>Tests</td>
<td>10% each</td>
</tr>
<tr>
<td>Midterm exam</td>
<td>20%</td>
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<tr>
<td>Final exam</td>
<td>30%</td>
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</tbody>
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**Attendance & Other Course Policies:**

You are expected to attend all classes. Only absences due to significant special circumstances **with documentation** are excused, such as death in the family or illness with doctors note. Whenever possible, please let me know in advance if you will miss a class and report it in the Self-Reporting Absence Application (https://sims.rutgers.edu/ssra/); this does not automatically excuse you but it can help. Unfortunately, we are unable to accommodate lateness or absences due to traffic.
Because issues do arise, students are permitted two lecture absences. This means that at the end of the semester I will drop four in-class quizzes (to account for technical difficulties as well) and one homework, no questions asked. If you have no absences, I will drop your lowest grade.

For religious holidays, please report your absence using the Self-Reporting Absence Application: https://sims.rutgers.edu/ssra/. Your absence will be excused and your daily grade (in-class quiz or homework) will be dropped.

If you are absent from a day of class, you should keep up with the course content by doing the assigned reading, reading the posted course slides, and doing the homework.

Student attendance is recorded via the in-class quizzes. Students with more than four absences without documentation will automatically receive a failing grade. If you think attendance may be a problem for you due to outside obligations, please meet with the instructor at the beginning of the semester or prior to your absences to discuss possible accommodations or solutions.

Grade disputes must be brought to the instructor within 2 weeks of receiving the grade. For example, a grade complaint about Test 1 will not be considered at the end of the semester.

**Rutgers Academic Integrity Policy:** As an academic community dedicated to the creation, dissemination, and application of knowledge, Rutgers University is committed to fostering an intellectual and ethical environment based on the principles of academic integrity. Academic integrity is essential to the success of the University’s educational and research missions, and violations of academic integrity constitute serious offenses against the entire academic community. The entire Academic Integrity Policy: https://academicintegrity.rutgers.edu/sites/default/files/pdfs/current.pdf

**Accommodation and Support Statement**

Rutgers University-Newark (RU-N) is committed to the creation of an inclusive and safe learning environment for all students and the University as a whole. RU-N has identified the following resources to further its mission of access and support:

**For Individuals Experiencing Disability:** The Office of Disability Services (ODS) works with students with medical, physical, and/or mental conditions who encounter disabling barriers to determine reasonable and appropriate accommodations for access. Students who have completed the process with ODS and have approved accommodations are provided a Letter of Accommodation (LOA) specific to each course. To initiate accommodations for their course students must both provide the LOA and have a conversation with the course instructor about the accommodations. This should occur as early in the semester as possible. More information can be found at the RU-N ODS website (ods.newark.rutgers.edu). Contact ODS at (973) 353-5375 or via email at ods@newark.rutgers.edu.

**For Individuals who are Pregnant:** The Office of Title IX and ADA Compliance is available to assist with any concerns or potential accommodations related to pregnancy. Students may contact the Office of Title IX and ADA Compliance at (973) 353-5063 or via email at TitleIX@newark.rutgers.edu.
For Short-term Absence Verification: The Office of the Dean of Students can help with absences related to religious observance, emergency or unavoidable conflict (illness, personal or family emergency, etc.). Students should refer to University Policy 10.2.7 for information about expectations and responsibilities. The Office of the Dean of Students can be contacted by calling (973) 353-5063 or emailing deanofstudents@newark.rutgers.edu.

For Individuals with temporary conditions/injuries: The Office of the Dean of Students can assist students who are experiencing a temporary condition or injury (broken or sprained limbs, concussions, recovery from surgery, etc.). Students experiencing a temporary condition or injury should submit a request using the following link: https://temporaryconditions.rutgers.edu.

For Gender or Sex-Based Discrimination or Harassment: The Office of Title IX and ADA Compliance can assist students who are experiencing any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking. Students can report an incident to the Office of Title IX and ADA Compliance by calling (973) 353-1906 or emailing TitleIX@newark.rutgers.edu. Incidents may also be reported by using the following link: tinyurl.com/RUNReportingForm. For more information, students should refer to the University’s Title IX Policy and Grievance Procedures located at https://uec.rutgers.edu/wp-content/uploads/60-1-33-current-1.pdf

For support related to Interpersonal Violence: The Office for Violence Prevention and Victim Assistance (VPVA) can provide any student with confidential support. VPVA is a confidential resource and does not have a reporting obligation to Title IX. Students can contact the office by calling (973) 353-1918 or emailing run.vpva@rutgers.edu. VPVA also maintains a confidential text-based helpline available to students; students can text (973) 339-0734 for support. Students do not need to be a victim/survivor of violence to receive assistance; any student can receive services, information, and support.

For Crisis and Concerns: The Campus Awareness Response and Education (CARE) Team works with students in crisis to develop a plan of support plan and address personal situations that might impact their academic performance. Connect with the CARE Team by using the following link: tinyurl.com/RUNCARE or emailing careteam@rutgers.edu.

For Psychological Support (Stress, Mood, Family Issues, Substance Use concerns and other personal challenges): The Rutgers University-Newark Counseling Center provides individual therapy and support groups for students dealing with psychological issues. To schedule an appointment, email counseling@newark.rutgers.edu or call (973) 353-5805.

Additional support is available to any RU-N student through Uwill services:
- Umatch: Teletherapy with flexible scheduling, starting with a free account.
- Uhelp: Crisis support at 833-646-1526 (available 24/7/365).
- Urise: Wellness-based video collection with a free account.

Access Uwill@RUN at https://my.rutgers.edu using your netid. Services are confidential and free.

For emergencies, call 911 or Rutgers University Police Department at (973) 353-5111.