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PHYSICS 2053 – Spring 2021
Call # 3490
Modern Physics: Relativity and Quantum Phenomena

Instructor: Dr. J. Roche
rochej@ohio.edu, or ph: (740)592-3626,
I answer emails and phone calls promptly during regular business hours (M-F, 9-5).
Office hours: Wed and Th 1-3 pm (preferred, click here to book an appointment) or by appointment (send an email request).

Class:
Modality: Online - synchronous
Meeting time: M, W & F, 9:40 to 10:35 am.
Meeting space: using the video conferencing software Teams[1] (this link)
Class web site: Blackboard[2] (this link)

All information in this syllabus is subject to change. Changes will be announced in class and by email. You are responsible for keeping up to date with the changes.

I welcome your comments on the class organization. If something in this syllabus or your specific circumstances[3] make it difficult for you to participate or learn from this class, let me know. I will try my best to find a solution to make it easier for you to learn.

1 Learning outcomes

At the end of this class, you should:

- Know how to calculate kinematics for objects moving near the speed of light,
- Understand the basis of quantum theory and how to apply the uncertainty principle,
- Solve Schrödinger's equation in both one dimension and three dimensions,
- Understand the electron shell structure of simple atoms and their quantum numbers,
- Describe electrical conduction at the quantum level, and
- Know the basics of nuclear structure and nuclear quantum numbers, elementary particles, and cosmology.

2 Required Text and material

University Physics Volume 3 from OpenStax,
Print ISBN 1938168186, Digital ISBN 1947172220,
www.openstax.org/details/university-physics-volume-3

[1] For general information about using Teams follow this link.
[2] For general information about using Blackboard, follow this link.
[3] E.g.: internet connections, sharing spaces or devices, care responsibilities, work, etc...

This book is available for free online, in web view and PDF format! You can also purchase a print version, if you prefer, possibly via the campus bookstore or definitively from OpenStax on Amazon.com. You can use whichever formats you want. Web view is recommended -- the responsive design works seamlessly on any device. If you buy on Amazon, make sure you use the link on your book page on openstax.org so you get the official OpenStax print version. (Simple printouts sold by third parties on Amazon are not verifiable and not as high-quality.)
Note: The required book is free; it is less polished than other expensive books. I am ready and willing to recommend (and possibly lend) other books that you can use as a reference: ask me!

3 Attendance

Attendance during scheduled class times is recommended but it is not required and it will not be checked.

4 Preliminary Lecture Plan

Changes to this schedule will be announced in class. It is your responsibility to keep up with changes.

W 01-20	Introduction	
F 01-22	Chap 5: Relativity	
W 02-03	Computing tutorial	
M 02-10	Chap 6: Photons and Matter Waves	
F 02-19		Quiz 1 (chapters 5 and 6)
W 02-22	Chap 7: Quantum Mechanics	
W 03-03		No class: OU wellness day
W 03-08	Chap 8: Atomic Structure	
M 03-19	Chap 9: Condensed Matter Physics	
W 03-31		Quiz 2 (chapters 7, 8, and 9)
F 04-02	Chap 10: Nuclear Physics	
W 04-14	Chap 11: Particle Physics and Cosmology	
F 04-30, 1pm		Final Exam (comprehensive)

Most chapters will be studied over five class meetings. Typically I will prepare lecture-plans using the schedule below. Do read the book in parallel to us working our way through the material in class. You are expected to be familiar with all sections of the book but for the ones explicitly waived by your instructor.

Day 1 and 2	Material introduction
Day 3	Group work on important concepts of the chapter
Day 4	Problem practice
Day 5	Homework discussion and "Your best 10" discussion.

5 Evaluation

5.1 Homework

- For each chapter, there will be multiple problems to be solved. Typically, your solutions will be due on the first day of the next chapter in class. The solutions to the homework question will be posted on Blackboard usually one week after the due date. Therefore, student **solutions**

submitted more than a week after the deadline will not be graded and receive a zero. If you present a University-Valid Excuse[4], alternate arrangements will be made (e.g. a new homework set might be assigned). In case of doubt, talk to your instructor.

- Homework will focus on how to solve the problems. Therefore partial credit will be given to incomplete solutions but also to correct answers without adequate explanations. Show your math and use explanatory sentences. When appropriate, illustrate the physical situation with a sketch or diagram.
- Your solutions should be typed. You may use the software of your preference. If you do not know what to use or if you want to learn a software widely used in Physics, you could use Latex as implemented in the free software Overleaf (this link); I will gladly help you learn this word processing language. If you find typing equations too burdensome, write them on a piece of paper, take a picture of them and insert them in your document. You might also try to use this web site https://math.typeit.org (thanks Silas for the tip).
- I encourage you to work in a study group to solve homework but your solutions need to be individual. Every one upload their own solutions.

5.2 Exams and quizzes

- There will be one Final Exam (2h) and two Quizzes (1h) during the semester. The Final Exam will be comprehensive. Because of this semester's remote format, exams are open-book.
- The text of the exam and quizzes will be made available to you on Blackboard at the day and time indicated on the preliminary schedule. Your solutions need to be emailed back to me (Roche) promptly at the end of the examination period. I will be on stand by and you may contact me during the examination period with your questions.
- Submitting a good quality photo of your work will probably enough, a scan is best if possible. Unless you are very skilled, don't star typing your work. Use a well contrasting pen to write your answer. For multiple choices, indicate the question number and your chosen solution. You should not have to print the text of the exam.

5.3 Bonus points

- When in class, you should be prepared to actively participate. Students may volunteer to present answers to problems discussed in class. If a student presents a solution three or more times during the term, their lowest homework set score will be replaced by 100%.
- Furthermore, for each chapter, we will use 3 active learning techniques (worksheet: day 3, problem: day 4, best 10: day 5). Email your work for each of these days within 24h of the class meeting for at least 75% of the time and your lowest homework set score will be replaced by 100%. If you do not attend the class meeting, you are still welcome to email your work to Roche.
- For both of these bonus point opportunities (in-class presentation and after-the-fact email), points will be given for good-faith attempts, not for the correctness of the answers.

5.4 Grading

The grading breakdown will be as follow:

Homework	40 %
Quizzes (15% each)	30 %
Final exam	30 %

[4] For a definition of University Valid Excuse, look for the Academic Policies pages in the University Class catalog. On this linked page, search for "Class Attendance Policy".

Final grades will be assigned according to the following breakpoints: A-/B+: 90%, B-/C+: 80%, C-/D+: 70%, and D-/F: 60%. I reserve the option to adjust the breakpoints down, but will not raise them.

6 Academic Misconduct

Academic misconduct is a Code A violation of the Ohio University Code of Student Conduct (this link). If you are found to be involved in academic misconduct regarding this course, you will receive F on the pertinent work, possibly for the entire course, and possibly also a referral to the Director of Community Standards. Procedures for judicial actions will be invoked as described in the Student and Faculty Handbooks.

7 Disability accommodation

If you feel you need an accommodation based on the impact of a disability, contact me privately to discuss your specific needs, and provide written documentation from Student Accessibility Services. If you are not yet registered as a student with a disability, please contact Student Accessibility Services at 740-593-2620 or visit their website (this link).

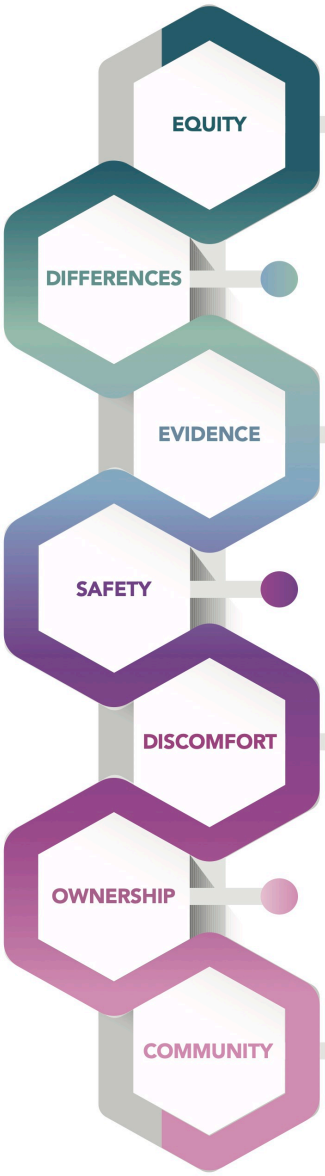
8 The value of inclusion and equity

Physics and Astronomy are best done in an inclusive and equitable environment. The students, staff, and faculty of the Department of Physics and Astronomy are committed to professional interactions, with respect and consideration of the rich and diverse backgrounds of all its members. We expect each member[5] of our Department to encourage and support a culture of equality and inclusion of all social identities in all activities in which we participate, and to uphold all Ohio University diversity policies. For more information about our culture of inclusion and how to report issues and concerns, consult the Inclusion and Equity website of the Physics and Astronomy Department (this link).

I hope that everyone will feel comfortable participating in this class. I invite you to help me create an inclusive experience for example by following the Guidelines for discussion in remote environments exposed on the next page.

[5] including any student taking any class in our department

Guidelines for Conduct During Remote Discussions



Share air time equitably.

Know yourself, balance your listening and talking, even when we're discussing remotely, asynchronously or anonymously.

Value differences.

Remember that your perspective is not the only one, and that we all face different challenges.

Argue using evidence.

Back what you have to say with data.

Make sure everyone feels safe.

Safe is not the same as comfortable. Ensure that there are ways to report problematic behavior.

Discomfort is okay.

Identify your learning edge and push it. We can still find ways to learn and support each other online.

Own your impact.

Your intentions may not be the same as your impact. Positivity and respect are critical when we don't have in-person cues.

Create a sense of community.

Acknowledge others and do not isolate anyone.

This poster represents the understanding and work of many. More details, free lesson plans, and community sign up can be found at:

STEPUPphysics.org

NSF

STEP UP
PHYSICS TOGETHER

MCQ on the syllabus

1) To get bonus points, you need to upload your work onto Blackboard before submitting your homework.
   a) TRUE
   b) FALSE

2) You are expected to know all topics discussed in the book even if they are not discussed in class but for the section that the professor explicitly excuses from reading.
   a) TRUE
   b) FALSE

3) You should wait until the end of class to ask a question so you don't slow down the students who understood what was discussed.
   a) TRUE
   b) FALSE

4) The final exam will test students' knowledge of all topics studied in class.
   a) TRUE
   b) FALSE

5) Homework solutions submitted up to one week after the due date will be graded but will get a late-penalty.
   a) TRUE
   b) FALSE

6) Attendance is mandatory: unless you have a doctor's note, you need to show up.
   a) TRUE
   b) FALSE

7) This class will be taught on a flipped instruction model: you don't need to read the book.
   a) TRUE
   b) FALSE

8) Roche's preferred office hours are Wednesday and Thursday 1-3 pm. If you have class or work at that time then you need to skip them to see Roche.
   a) TRUE
   b) FALSE

9) Your instructor is ready and willing to recommend (and possibly lend) other books than the free book required for this class.
   a) TRUE
   b) FALSE

10) You can only submit your best-ten list for bonus points if you came to class.
   a) TRUE
   b) FALSE