

Physics 19: Introduction to Theoretical Physics

Fall 2019

Course Expectations

Wednesday, September 4, 2019

This document contains important information about the course. Please be sure to read the information below in its entirety before our first class.

Who Belongs in this Course?

If you like math and have done well in high-school or college math classes and if you think you also really like physics and might want to pursue undergraduate study in the subject in college, or if you are interested in learning some foundational physics for use in other areas of study, then this course is for you and you belong here. The other prerequisites are

- creativity,
- enthusiasm,
- curiosity,
- a sense of wonder,
- a high degree of comfort with abstraction,
- the courage to ask questions,
- a willingness to make lots of mistakes and learn from them,
- an interest in participating in class discussions and activities,
- and an ability to share and cooperate with others.

There is no one correct attitude or demographic profile to be a physicist. There are amazing physicists of all identities, genders, ethnicities, nationalities, religions, and backgrounds who have made major contributions to the field and who have had an exciting intellectual adventure along the way.

Feeling Unwelcome or Causing Others to Feel Unwelcome

- If at any point during the course you feel unwelcome because of who you are or what you look like, please let me know. I will take your concerns seriously.
- If you harbor any stereotypical assumptions about what a physicist looks or acts like, please check those preconceptions at the door.
- Prejudicial or condescending comments, arrogant or aggressive conduct, intimidating or egotistical attitudes, inappropriate questions or jokes about identities or appearances, and other unwelcoming behavior are harmful to the learning environment and the overwhelmingly cooperative spirit of physics and will therefore not be tolerated.
- It is up to *all of us* to improve the culture of science, so please be on the lookout for such behavior, even if it is not directed at you, and please don't let it go unchallenged if you are in a position to say or do something about it.

Class Sessions

- You should plan to attend every class session. Attendance will be worth 5% of your overall grade for the course. There will be an attendance sheet near the door for you to sign at the beginning of each class.
- There will be 10 to 30 pages of lecture notes posted to the course website shortly after each class session. Most of this reading will be a review of material that we've covered in class, but there will sometimes be additional material included. You will be expected to keep up with this reading.
- The course is not intended to make anyone feel lost. If something in class doesn't seem to make sense, please raise your hand right away and ask for clarification. Don't be afraid to be persistent. Everyone will benefit—yourself, other students who likely have the same questions, and the instructor who's trying to explain things in the clearest way possible.
- Questions that you may think are naïve or simple are actually the best kinds of questions. Never avoid asking a question because you think it makes you seem like you don't know what you're doing. It takes courage to ask questions like these, but I guarantee you that it's worth asking them anyway.
- When is the right time to raise your hand? Any time!
- Don't worry about asking too many questions in class. Just always remember to raise your hand first. If time is running short, I'll specifically let you know that you should hold onto your questions until after class.

Homework

- The only way to learn and understand the concepts and techniques covered in this course is to attempt to solve every part of every homework problem as completely as possible, whether you are taking the course for a letter grade or pass/fail.
- If you get stuck and can't figure something out, please come to our office hours and we will help you!
- If you would like to find a study group, please email me.
- Whether or not you work with a study group, you should always save the actual writing process until you're by yourself. You should write or type up your solutions on your own in your own words.
- Always list your collaborators clearly at the top of every homework set.
- Read the entire question carefully before proceeding—including any hints provided—and then, after solving a problem, read the entire question again and make sure that every part was answered.
- If you get stuck and don't know what to do in a given problem, or if you feel like you're just guessing at the right approach, try breaking down the problem into the smallest steps possible and carrying out each step explicitly.
- In writing up your solutions, be sure to show your steps and explain your logic. This practice will not only make it easier for us to grade your homework, but will also help you understand what you're doing, whether it all makes sense, and what you may benefit from learning more about. Filling in these details is a useful way to identify why particular steps might not be working correctly, as well as uncover mistakes and hidden assumptions in your reasoning.
- Label all quantities with appropriate symbols, solve the problem symbolically/algebraically, and only plug in numbers at the very end.

- Remember that minus signs don't necessarily mean negative. In general, they just mean "opposite."
- At the end of every problem, check limiting cases as appropriate, meaning that you should first ask yourself conceptually (without looking at your answer) what should happen when particular variables are taken to extreme values, and then you can check that your actual formula replicates those intuitive expectations.
- Always plug in numbers at the end when numbers are given or requested, and calculate a simple, final number, using scientific notation $(\text{number}) \times 10^{(\text{power})}$ as needed for numbers bigger than 1000 or smaller than 0.01, where the quantity (number) should be between 1 and 10. For example, you should write 3.23×10^5 instead of 323 000 and you should write 5.3×10^{-4} instead of 0.00053.
- Use dimensional analysis, meaning that when you plug in numbers at the end, you should keep all your units with the appropriate quantities and ensure that your final answer has the correct units. Remember that units go *inside* symbolic variables, meaning that one should write things like $m = 5.2 \text{ kg}$, not $m \text{ kg}$ with the kg units outside the symbol m .
- Feel free to use any equations, formulas, numerical quantities, or physical constants from class or from the lecture notes, especially anything that has an equation number. This includes physical constants provided in class or in the lecture notes. Be sure to cite where you get any numbers or formulas from.
- If you are asked to solve a problem as a Fermi problem, then you shouldn't look up any quantities, but should use your own intuitive estimates. The idea is that underestimates of some quantities will be compensated by overestimates of other quantities, and your final answer should be correct to within a power of ten, known as an order of magnitude.
- If you aren't explicitly asked to solve a problem as a Fermi problem, then you can look up quantities that you need online, provided that you carefully cite your sources.
- How much work do we need to see in your solutions? We need to be able to understand your logic without great effort. Calculating software is allowed as long as we are able to understand conceptually, clearly, and unambiguously what your logical arguments are. When in doubt, attach a copy of your source code.
- Answers must be fully simplified in order for you to receive full credit.
- Homework must be neat, orderly, and legible, with final answers boxed.
- Give yourself adequate space and don't try to cram everything into a small space or onto a single page.
- Handwritten solutions are fine as long as they're clear and legible. Typing is recommended, especially using LaTeX, which is a document-formatting system that's widely used in the scientific community. Please see the "Using LaTeX" page on the course website for more information about LaTeX.