

Physics 3 – Relativity and Quantum Physics

Phys 325

Fall 2020

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Office Hours: Tuesday 1:00 - 4:00 pm and by appointment.
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Office Hours: By appointment, Zoom Meeting ID: 203 928 2775

Class Location and Hours: Monday & Wednesday, 10:30-11:20 am, Cardwell Hall 144/145,
Friday, 10:30 - 11:20 am, Cardwell Hall 143.

Lab Orientations: Thursday, Morning Session: 9:30-11:30 am,
Afternoon Session: 2:30 - 4:20 pm, Cardwell Hall 311.

Labs: In groups of 2-3, two hours per week after lab orientation and the following week,
Cardwell Hall 311/312.

Mid-term Exams: Mondays, 10:30-11:20 am, Cardwell Hall 144/145,

Final Exam: Wednesday Dec 9th, 11:50 am - 1:40 pm, Online.

Description: This class represents an introduction into Modern Physics. During this course you will learn basics of fundamental physics of the 20th century, which include elements of theory of relativity and quantum mechanics. With the speed of light being constant in all reference frames, and particle locations described by probabilities, many physics results are very non-intuitive and profound. You will learn basics of atomic physics using the hydrogen atom as an example, basics of quantum theory of light, as well as some aspects of solid-state physics and quantum statistics. You will explore some pivotal experiments in the laboratory and learn how to evaluate results quantitatively using error analysis. You will also learn basics on how to use computers for solving physics problems.

Textbooks: Raymond A. Serway, Clement J. Moses, and Curt A. Moyer, *Modern Physics*, 3rd edition, publisher: Brooks/Cole Cengage Learning.
John R. Taylor, *An Introduction to Error Analysis*, 2nd edition, publisher: University Science Books (paperback).

You are expected to read the relevant material in the textbook before lecture. Please stay ahead of lectures in your reading.

E-mail: I will communicate with you by email frequently. Please check your university email account regularly. If you typically use another account (such as physics, google, etc.), set up forwarding from your university account to that other account.

Web-site: The electronics documents: lecture material, problem assignments and solutions, laboratory schedule, rules and write-ups, practice exams will be posted at K-State Canvas.

Homework: Should be submitted online and will be due Tuesdays midnight (one minute before 12:01 am Wed). Late homework will be accepted with a penalty of 10% per day in score. You are welcome to *meet online and work in groups, discuss and help* each other with the homework, but you *may not copy* the solutions of others. For the full credit you must do the work yourself, and write your solutions *detailed and clear*, with logical step-by-step explanation how you worked out the problem.

Exams: Mid-terms will be in-class, closed book, and the final will be online. Calculators are allowed. The spreadsheet with relevant constants and equations will be provided.

Laboratories: Lab books will be provided to students at no charge. Please do not purchase your own elsewhere. The format for the reports and for performing the experiments will be discussed during the laboratory orientations on Thursdays. You can enroll into one of the two laboratory orientation sessions: morning or afternoon. The experiments will be performed in groups of two-three students.

Grading: Your grade will be determined by:

- Homework assignments (25%) with 5% bonus
- Attendance (5%) and In-Class work (5% bonus)
- Laboratory reports and assignments (20%)
- Mid-term exams (30%)
- Comprehensive Final Exam (20%)

Classroom Work: Lecture will be held in a room with computers. Please do not use computers for checking emails, reading the news, and any other activities unless so directed by your instructor. We will be using the **Top Hat** (www.tophat.com) classroom response system in class. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message. You can visit the Top Hat Overview: <https://success.tophat.com/s/article/Student-Top-Hat-Overview-and-Getting-Started-Guide> within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system. An email invitation will be sent to you by email, but if don't receive this email, you can register by simply visiting our course website: <https://app.tophat.com/e/471756/> Our course join code is 471756.

Top Hat may require a paid subscription, and a full breakdown of all subscription options available can be found here: www.tophat.com/pricing. The Top Hat Support Team can be contacted using the application support button, via e-mail support@tophat.com, or by phone: 1-888-663-5491.

Computer Work: We will go over basics on how to use computers to make plots needed for your lab reports, and to solve physics problems. We will focus on Python programming language. I recommend that you install "Anaconda" on your laptop. Anaconda is a full Python environment with all the tools you will need (and more!). Anaconda is available for free download from <https://www.anaconda.com/products/individual>.

Download the version appropriate for your computer system and follow the instructions to install it.

Tentative Schedule for Fall 2020 semester

Week		Lecture (MWF)	Laboratory Orientation (Lab: U + assigned time)	Homework / Lab Homework
1	Aug 17-21	Relativity, Kinematics	Oscilloscope	
2	Aug 24-28	Relativity, Minkowski Spacetime & Paradoxes		HW#1(25pts-Ch1) Due W 12:00 am
3	Aug 31 -Sep 4	Relativity, Dynamics	Speed of Light	Lab Report #1 Due M 12:00am HW#2(25pts-Ch1) Due W 12:00 am
4	Sep 7-11	Error Analysis		HW#3(25pts-Ch2) Due W 12:00 am
5	Sep 14-18	Exam 1 (Ch 1-2) Quantization of Light	Planck Constant	Lab Report #2 Due W 12:00am
6	Sep 21-25	Atoms, Energy Levels		LabHW(25 pts) Due M 12:00am HW#4(25pts-Ch3) Due W 12:00 am
7	Sep28-Oct2	Matter Waves	<i>e/m</i> Bainbridge	Lab Report #3 Due M 12:00am HW#5(25pts-Ch4) Due W 12:00 am
8	Oct 5-9	Schrodinger Equation in 1 dimension		HW#6(25pts-Ch5) Due W 12:00 am
9	Oct 12-16	Exam 2 (Ch 3-5 + Error Analysis) Particle in a box	Frank-Hertz Experiment	Lab Report #4 Due W 12:00am
10	Oct 19-23	Tunneling		HW# 7(25pts-Ch6) Due W 12:00 am
11	Oct26-30	Schrodinger Equation in 3 dimensions	Single-Photon Interference	Lab Report #5 Due M 12:00am HW#8(25pts-Ch7) Due W 12:00 am
12	Nov 2-6	Zeeman Effect, Electron Spin		HW#9 (25pts-Ch8) Due W 12:00 am
13	Nov 9-13	Multi-electron Atoms		HW#10 (25pts-Ch9) Due W 12:00 am
14	Nov 16-20	Exam 3 (Ch 6-9) EPR Paradox		Lab Report #6 Due W 12:00am
15	Nov 23-27	== Thanksgiving Holidays ==		
16	Nov 30- Dec 4	Quantum Computing, Review		
17	Dec 7-11	Final Exam (Ch 1-9)		

Face Coverings: To protect the health and safety of the K-State community, students, faculty, staff and visitors must wear face coverings over their mouths and noses while on K-State campuses in all hallways, public spaces, classrooms and other common areas of campus buildings, and when in offices or other work spaces or outdoor settings when 6-foot social distancing cannot be maintained. In addition, all students, faculty, and staff are required to take the [COVID-19 and Face Mask Safety training](#). Employees who need reasonable accommodations and assistance related to required face coverings may contact the ADA coordinator at charlott@k-state.edu, and students needing accommodations may contact the Student Access Center at accesscenter@k-state.edu.

In classrooms, faculty have the right to deny a student entry into the room if the student is not wearing a face covering. Students not wearing a face covering will be reminded to do so and offered a clean face covering, if one is available. If the student does not comply, the faculty member will ask the student to leave the space, and if available, join the class remotely. As a last resort, campus police will be called. The faculty members will complete the [Code of Conduct form](#) and the Office of Student Life will look further into the issue and take the non-compliance with the request to leave into consideration of further accountability measures.

At no point should the professor or other students put themselves into an unsafe situation while attempting to enforce the face-covering policy. Manhattan campus police: 785-532-6412

Academic Honesty: Kansas State University has an Honor and Integrity System based on personal integrity, which is presumed to be sufficient assurance that, in academic matters, one's work is performed honestly and without unauthorized assistance. Undergraduate and graduate students, by registration, acknowledge the jurisdiction of the Honor and Integrity System. The policies and procedures of the Honor and Integrity System apply to all full and part-time students enrolled in undergraduate and graduate courses on-campus, off-campus, and via distance learning. The Honor and Integrity System website can be reached via the following URL: www.k-state.edu/honor. A component vital to the Honor and Integrity System is the inclusion of the Honor Pledge, which applies to all assignments, examinations, or other course work undertaken by students. The Honor Pledge is implied, whether or not it is stated: "*On my honor, as a student, I have neither given nor received unauthorized aid on this academic work.*" A grade of XF can result from a breach of academic honesty. The F indicates failure in the course; the X indicates the reason is an Honor Pledge violation.

Disabilities: Students with disabilities who need classroom accommodations, access to technology, or information about emergency building/campus evacuation processes should contact the Student Access Center and/or their instructor. Services are available to students with a wide range of disabilities including, but not limited to, physical disabilities, medical conditions, learning disabilities, attention deficit disorder, depression, and anxiety. If you are a student enrolled in campus/online courses through the Manhattan or Olathe campuses, contact the Student Access Center at accesscenter@k-state.edu, 785-532-6441; for K-State Polytechnic campus, contact Academic and Student Services at polytechnicadvising@ksu.edu or call 785-826-2974.

Classroom Conduct: All student activities in the University, including this course, are governed by the [Student Judicial Conduct Code](#) as outlined in the Student Governing Association [By Laws](#), Article V, Section 3, number 2. Students who engage in behavior that disrupts the learning environment may be asked to leave the class.

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