

**PHYS 3313: Modern Physics**  
Spring 2018

**Instructor:** Dr. Ramon Lopez

**Office Number:** 008, Basement of Science Hall, lab in 010 SH

**Office Telephone Number:** 817-272-0386

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**Faculty Profile:** <https://mentis.uta.edu/explore/profile/ramon-lopez>

**Office Hours:** Monday/Wednesday 11:00-12:00 am or other times by appointment

**Section Information:** PHYS 3313, section 001

**Time and Place of Class Meetings:** Science Hall 330, Monday/Wednesday 1:00-2:20 pm

**Description of Course Content:** This course will provide an introduction to the following topics: Relativity; Elementary Quantum mechanics; Atoms, molecules, and solids; Radioactivity; nuclear physics, and elementary particles; Astrophysics and cosmology. Additional topics of interest not covered in the book (complex systems, space exploration, etc.) may be addressed at the end of the semester depending on time and student interest.

**Student Learning Outcomes:** As a result of taking this course, you will have a working knowledge at an introductory level of the topics above. You will be able to solve typical problems related to these topics. These include the ability calculate quantities such as the time dilation between two references frames, the quantity of a radioactive material left after a given time relative to the half-life, the approximate recessional velocity of a distant galaxy, and the energy of a photon of a given frequency. You will utilize your knowledge of Newtonian mechanics and electromagnetism in exploring 20<sup>th</sup> century physics topics and be able to explain aspects of how 20<sup>th</sup> century physics differs from the worldview of 19<sup>th</sup> century physics. You will be able to explain in your own words basic assumptions and findings of quantum theory, including probability associated with wave functions and Heisenberg's Uncertainty Principle. Your success in all of these learning outcomes will be measured by your ability to understand in-class concepts questions, apply the material in lecture and reading to solve homework problems, and to pass the exams in the course. Passing the course will indicate that you have reached the learning objectives

**Required Textbooks and Other Course Materials:** The book to be used is "Modern Physics for Scientists and Engineers" by Thornton and Rex (4<sup>th</sup> Edition). Students must buy a set of index cards.

**Descriptions of major assignments and examinations:** There will be 3 midterm exams and a comprehensive final exam. Students are allowed an index card with notes for each midterm exam, and 2 index cards for the final exam.

**Attendance:** In this course, attendance is not required but attendance is in general a critical indicator in student success. Moreover, class participation contributes to the grade. If you are unable to attend class on a given day, contact me to make arrangements for an alternative means to earn class participation points.

**Emergency Phone Numbers:** In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381

**Grading:** The course grade will be determined based on the total score in the semester with  $A > 90$ ,  $80 < B < 90$ ,  $70 < C < 80$ ,  $60 < D < 70$ ,  $F < 60$ , where the 100 points for the semester are allocated by:

Midterm Exams – 40%. Each midterm exam score will be on a 100 point scale. Your two top midterm exam scores will be averaged (your lowest midterm exam grade will be dropped), then multiplied by 0.4 to yield the midterm exam contribution to your grade.

Final exam – 30%. The final exam will be comprehensive, covering all of the material in the course, including material that is assigned after the third midterm exam. The score will be normalized to 100, then then multiplied by 0.3 to yield the final exam contribution to your grade.

Students are allowed 1 index card with notes for each midterm, and 2 index cards for the final.

Homework – 25%. Homework will be assigned regularly, with each problem assigned counting equally 1 point toward the total. The final tally for points will be divided by the number of points assigned. This will be multiplied by 110 to give your final homework score, which will be capped at a maximum of 100, then then multiplied by 0.25 to yield the homework contribution to your grade.

Homework will be assigned and submitted by email according to the following template:

**All homework must be in the form of a PDF file with the following naming convention –** lastname.firstname.HW#.pdf, where the HW# is the number of the assignment. The email with the homework must have the subject “PHYS3313 HW#”. Failure to follow this convention will mean that your homework will not be counted and you will get a 0 for that assignment since the script used to save the homework into the correct folder will not work unless you have named it correctly. The first homework assignment, HW1, is to submit answers to the following four questions:

1. What are your reasons for taking this course, and what do you hope to gain from doing so?
2. Which of the topics listed in the **Description of Course Content** do you find most interesting?
3. Have you have registered for the site where the on-line lectures will be posted?
4. Have you have bought a set of index cards and that you have marked a set of 5 with big number 1, 2, 3, 4, 5 for use in voting on concept questions in class and for questions to be turned in at the end of class?

These questions must each be answered by at least one complete sentence, which will be graded on the basis of grammatical correctness and spelling. **This assignment is due on Friday, 1/18 by 5:00 pm** and it is worth four homework points, one for each question. If you expect to get credit for #4, you need to bring your index cards with you on Monday 1/22.

Class Participation – 5%. Every class with include collaborative problem solving, concept questions to be answered in class, or both. Sometime during the semester, each student will need to come to the board to share a solution for a problem we are working on. You will all need to vote using the index cards that are part of HW1. Also, at the end of each class you must turn in an index card with one question about the material covered in class, from the reading, or on an on-line video, or something that you learned. I will keep track of all of these forms of participation and award you up to 5 points toward your final grade. If you are not doing what you should be doing, you will hear from me in class or by email. If not, you can assume that you are earning all 5 points.

**Make-up Exams:** If you are going to miss an exam, you must contact me beforehand. If you cannot do a make-up exam before the next class, when the exam is returned and reviewed, you will get a 0.

**Expectations for Out-of-Class Study:** This course will be taught as a partially “flipped” course. Part of the course lectures will be put online, and students will need to view those lectures prior to coming to class. Sometimes important information will be put there that you need to have prior to class. In-class time will include working on sample (or actual) homework problems, and those will need to be done prior to class. Participation in in-class problem solving will count toward the class participation grade. Expect to spend 6-12 hours per week outside of class, reading, viewing lectures, solving problems and studying. Check your email at least 2 times per day for messages related to reading, homework, or new lectures posted. Register this week at

<https://www.educreations.com/sr/FLJTLCA>

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/aao/fao/>).

**Disability Accommodations:** UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA)*, *The Americans with Disabilities Amendments Act (ADAAA)*, and *Section 504 of the Rehabilitation Act*. All instructors at UT Arlington are required by law to provide “reasonable accommodations” to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a **letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

**The Office for Students with Disabilities, (OSD)** [www.uta.edu/disability](http://www.uta.edu/disability) or calling 817-272-3364.

Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability).

**Counseling and Psychological Services, (CAPS)** [www.uta.edu/caps/](http://www.uta.edu/caps/) or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

**Non-Discrimination Policy:** *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit [uta.edu/eos](http://uta.edu/eos).*

**Title IX Policy:** The University of Texas at Arlington (“University”) is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit [www.uta.edu/titleIX](http://www.uta.edu/titleIX) or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or [jmhood@uta.edu](mailto:jmhood@uta.edu).*

**Academic Integrity:** Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington’s tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents’ Rule* 50101, §2.2, suspected violations of university’s standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student’s suspension or expulsion from the University. Additional information is available at <https://www.uta.edu/conduct/>.

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Campus Carry:** Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

**Student Feedback Survey:** At the end of each term, students enrolled in face-to-face and online classes categorized as “lecture,” “seminar,” or “laboratory” are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback via the SFS database is aggregated with that of other students enrolled in the course. Students’ anonymity will be protected to the extent that the law allows. UT Arlington’s

effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit <http://www.uta.edu/sfs>.

**Final Review Week:** for semester-long courses, a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is accessed via either stairwell to the right or left as exiting the classroom (depending on the circumstances whichever is safer). When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

You should also subscribe to the MavAlert system that will send information in case of an emergency to their cell phones or email accounts. Anyone can subscribe at <https://mavalert.uta.edu/> or <https://mavalert.uta.edu/register.php>

**Student Support Services:** UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include [tutoring](#), [major-based learning centers](#), developmental education, [advising and mentoring](#), personal counseling, and [federally funded programs](#). For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to [resources@uta.edu](mailto:resources@uta.edu), or view the information at <http://www.uta.edu/universitycollege/resources/index.php>.

**The IDEAS Center** (2<sup>nd</sup> Floor of Central Library) offers **free** tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email [IDEAS@uta.edu](mailto:IDEAS@uta.edu) or call (817) 272-6593.

### Course Schedule

As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. – Dr. Ramon E. Lopez

1/17	Chapter 1 – Physics at the start of the last century.
1/22	Chapter 2 – Special relativity Lorentz transformations
1/24	Chapter 2 – Special relativity momentum and energy
1/29	Chapter 3 – Spectra, quantization, blackbodies
1/31	Chapter 3 – Photons; Chapter 4 – Atomic models; <i>Census date</i>
2/5	Chapter 4 – Bohr model success and failure; Big Ideas for Exam 1
2/7	<b>Midterm Exam 1</b>
2/12	Review exam; Chapter 5 - Matter waves
2/14	Chapter 5 – Waves, particles, uncertainty, and probabilities
2/19	Chapter 6 – Schrodinger Equation and applications
2/21	Chapter 6 – Tunneling, Chapter 7 – Hydrogen atom
2/26	Chapter 7 – Quantum numbers, spin
2/28	Chapter 8 – Atomic structure
3/5	Chapter 8 – Total angular momentum; Big Ideas for Exam 2
3/7	<b>Midterm Exam 2</b>
3/12	Spring Break
3/14	Spring Break
3/19	Review exam; Chapter 10 – Bonds
3/21	Chapter 10 – Lasers, solids, superconductors
3/26	Chapter 11 – Band theory, semiconductors
3/28	Chapter 12 - Nucleus; <i>drop date 3/30</i>
4/2	Chapter 12 – Radioactive decay
4/4	Chapter 13 – Nuclear physics
4/9	Chapter 13 – Fusion and fission
4/11	Chapter 14 – Particles, conservation laws
4/16	Chapter 14 – Quarks, beyond the Standard Model; Big Ideas for Exam 3
4/18	<b>Midterm Exam 3</b>
4/23	Review exam; Chapter 13 – General Relativity
4/26	Chapter 16 – Cosmology
4/30	Complex systems, Space Exploration, +TBD
5/2	Big ideas for the Final Exam
5/7	<b>Final Exam 11:00-1:30</b>