



# PHYSICS 3305: Introduction to Modern Physics

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## Instructor



### **Dr. Jodi Cooley**

Professor

Physics Department

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## About Your Instructor

Dr. Jodi Cooley is a Professor in the Department of Physics at SMU. She received a B.S. degree in Applied Mathematics and Physics from the University of Wisconsin in Milwaukee in 1997. She earned her Masters in 2000 and her Ph.D. in 2003 at the University of Wisconsin – Madison for

her research searching for neutrinos from diffuse astronomical sources with the AMANDA-II detector. Upon graduation she did postdoctoral studies at both MIT and Stanford University. Dr. Cooley has been teaching and conducting research at SMU since 2009. She has won numerous awards for her research, teaching and mentoring. In 2018 she was elected a fellow of the American Association for the Advancement of Science (AAAS) for her contributions to the search for dark matter scattering with nuclei, particularly using cryogenic technologies. In 2019 she was the recipient of the Klopsteg Memorial Lecture Award from the American Association of Physics Teachers (AAPT).

## RESEARCH INTERESTS

Dr. Cooley's current research interest is to improve our understanding of the universe by deciphering the nature of dark matter. The existence of dark matter was first postulated nearly 80 years ago. However, it wasn't until the last decade that the revolution in precision cosmology revealed conclusively that about a quarter of our universe consisted of dark matter. Dr. Cooley and her colleagues operate sophisticated cryogenic detectors. These detectors can distinguish between elusive dark matter particles and background particles that mimic dark matter interactions. She mentors both graduate and undergraduate student researchers in her LUMINA laboratory at SMU.

## PERSONAL

Dr. Cooley is a first generation college graduate who grew up in rural Wisconsin. When not trying to solve the puzzles of the cosmos, she enjoys jogging, cooking and spending time with her family.

## Class Logistics

Face Masks will be required during class regardless of your vaccination status.

Class Day/Time: TuTh 12:30 PM - 1:50 PM

Location: Fondren Science Building Room 158

## OFFICE HOURS

**Sign up in the Calendar on Canvas.**

Office hours in this course will be offered in person. You will be required to wear a mask in my office regardless of vaccination status.

Hours: TBD.

## RESPONSE TIME

Please note that my goal is to respond to student communications within 24 hours during **weekdays**. If for some reason I am unable to do so, I will follow up as soon as possible. I also

always try to let you know ahead of time if I will be unreachable.

## ASSIGNMENT FEEDBACK

My goal is to return graded assignments to you within 48 hours. If for some reason I am unable to do so, I will do my best to let you know in advance and will return your graded assignment to you as soon as possible.



## Course Description

For science and engineering majors. Covers special relativity, elements of quantum physics, structure of atoms, molecules and solids, nuclear physics, and elementary particles. Prerequisite: [PHYS 1304 \(https://catalog.smu.edu/preview\\_entity.php?catoid=33&ent\\_oid=3540#tt8135\)](https://catalog.smu.edu/preview_entity.php?catoid=33&ent_oid=3540#tt8135) or [PHYS 1308 \(https://catalog.smu.edu/preview\\_entity.php?catoid=33&ent\\_oid=3540#tt1466\)](https://catalog.smu.edu/preview_entity.php?catoid=33&ent_oid=3540#tt1466).



## Learning Outcomes

### COURSE LEVEL OUTCOMES (CLOs)

#### Course Objectives:

Upon completion of this course the students will be able to

1. Explain why relativity and quantum mechanics and are need to explain natural phenomena that are central to the modern world;
2. Apply their understanding of relativity and quantum mechanics to a range of problems that occur in areas as diverse as medicine, communication and computation;
3. Demonstrate the basic understanding of relativity, quantum mechanics and statistical mechanics required to pursue more advanced topics in each of these related areas.

The above objectives will be achieved through: participation in in-class discussion of lecture and reading materials; discussion with the lead instructor(s) of reading and lecture during regular office hours; successful completion of routine homework assignments; several in-class examinations.



## Grades

Your work and overall performance will be recorded on Canvas. Students can access their current weighted average at any time via [Grades. \(https://smuonline.instructure.com/courses/68169/gradebook\)](https://smuonline.instructure.com/courses/68169/gradebook)

## OVERVIEW

Activities	Percentage
Preparation and Participation Activities	10%
Presentation	10%
Homework	25%
Midterm Exams	10% each (30% total)
Cumulative Final Exam	25%
<b>TOTAL</b>	<b>100%</b>

### PREPARATION AND PARTICIPATION ACTIVITIES

Before each class you are expected to read relevant sections of the textbook and attempt the suggested problem from your textbook. Your work must be uploaded to Canvas prior to the start of class. During class you will be expected to participate in discussion, answer "flashcard" questions, and discuss ideas and responses with your classmates. As such, **you will be allowed 2 unexcused absences**. In addition to receiving a zero for the missed class period, you will lose 1 percentage point of your final grade for each additional unexcused absence. In class participation **make-up work for an excused absence must be completed within 24 hours** of the missed class.

### PRESENTATION

In the last class you will make a 10 minute presentation and lead a discussion on a unique topic chosen in consultation with the instructor.

### HOMEWORK

Post-class homework will be due most weeks. You will be expected to submit written solutions that are professional and follow the guidelines provided in class. Those solutions must be uploaded to Canvas prior 12:30 pm on the day they are due. **NO CREDIT WILL BE GIVEN FOR LATE HOMEWORK**. I encourage you to discuss your work with a study group and use office hours if you have difficulty.

### EXAMS

There will be three mid-term exams (Thursday, February 17; Tuesday, March 22; Thursday, April 14) and a final cumulative exam (Monday, May 9 from 11:30 am - 2:30 pm).

### GRADING SCALE

Range	Letter Grade

Range	Letter Grade	
94-100	A	Excellent Scholarship
94-90	A-	Excellent Scholarship
90-87	B+	Good Scholarship
87-84	B	Good Scholarship
82-80	B-	Good Scholarship
80-77	C+	Fair Scholarship
77-74	C	Fair Scholarship
74-70	C-	Fair Scholarship
70-67	D+	Poor Scholarship
67-64	D	Poor Scholarship
64-61	D-	Poor Scholarship
<60	F	Fail

## Materials

### REQUIRED

Modern Physics (4th Edition) by Kenneth S. Krane, ISBN: 978-1-119-49555-0.

## Technology

To be successful in this course, students should have basic keyboarding and computer skills, and be comfortable navigating the Internet.

### IMPORTANT

Your homework will need to be uploaded to Canvas in a specified format. I recommend the free [CamScanner app \(https://www.camscanner.com/\)](https://www.camscanner.com/) which produces adequate quality documents and has been a favorite of past students. However, you may use any method you would like to

digitize your work, so long as the final document is legible as determined by the Course Instructor.

## CANVAS

Please be sure that your device or devices meet the **technical requirements** for Canvas. [Technical requirements \(https://community.canvaslms.com/docs/DOC-2059\)](https://community.canvaslms.com/docs/DOC-2059) and [browser requirements \(https://community.canvaslms.com/docs/DOC-1284\)](https://community.canvaslms.com/docs/DOC-1284) for Canvas are located in the [Canvas Student Guide \(https://community.canvaslms.com/docs/DOC-4121#jive\\_content\\_id\\_Computer\\_Specifications\)](https://community.canvaslms.com/docs/DOC-4121#jive_content_id_Computer_Specifications). If you need Technical Support with Canvas, click the Help link on the left side [Global Navigation \(https://community.canvaslms.com/docs/DOC-1281\)](https://community.canvaslms.com/docs/DOC-1281). From there you can Search Canvas Guides, Chat with Support, or Submit a Request for assistance. You can also contact the SMU [IT Help Desk \(http://www.smu.edu/OIT/Help\)](http://www.smu.edu/OIT/Help) for assistance with Canvas.

## TECHNICAL SUPPORT

If you run into any technical problems, there are a number of resources available to you. First, you can always check with me; in many cases, I can walk you through technical issues. Also, you can contact the [SMU IT Help Desk \(http://www.smu.edu/OIT/Help\)](http://www.smu.edu/OIT/Help) for assistance with Canvas and Zoom. Otherwise, here are additional useful resources:

- [Canvas \(https://community.canvaslms.com/docs/DOC-4121\)](https://community.canvaslms.com/docs/DOC-4121)
  - Click [Help \(http://help.instructure.com/\)](http://help.instructure.com/) on the [Global Navigation \(https://community.canvaslms.com/docs/DOC-4121#jive\\_content\\_id\\_Global\\_Navigation\)](https://community.canvaslms.com/docs/DOC-4121#jive_content_id_Global_Navigation) to search the Guides, [Chat \(https://cases.canvaslms.com/apex/liveagentchat\)](https://cases.canvaslms.com/apex/liveagentchat) or contact Instructure Support via email or phone
- Panopto
  - Search the [Panopto Support site \(https://support.panopto.com/s/\)](https://support.panopto.com/s/) (Links to an external site.) for forums and documentation, or contact the [SMU IT Help Desk \(https://www.smu.edu/oit/help\)](https://www.smu.edu/oit/help)
- Zoom
  - Search their [Knowledge Base \(https://support.zoom.us/hc/en-us\)](https://support.zoom.us/hc/en-us) or [Submit a Request \(https://support.zoom.us/hc/en-us/articles/201362003-Zoom-Technical-Support\)](https://support.zoom.us/hc/en-us/articles/201362003-Zoom-Technical-Support) (<https://support.zoom.us/hc/en-us/articles/201362003-Zoom-Technical-Support>)

## PRIVACY POLICIES

- [Canvas by Instructure \(https://www.canvaslms.com/policies/privacy\)](https://www.canvaslms.com/policies/privacy)
- [Kaltura Video App in Canvas \(https://corp.kaltura.com/privacy-policy#platform\)](https://corp.kaltura.com/privacy-policy#platform)
- [Panopto Privacy \(https://www.panopto.com/privacy/\)](https://www.panopto.com/privacy/)

- [Respondus LockDown Browser \(https://www.respondus.com/about/privacy.shtml\)](https://www.respondus.com/about/privacy.shtml)
- [SMU OIT Policies and Legislation \(https://www.smu.edu/OIT/Infosec/Policy\)](https://www.smu.edu/OIT/Infosec/Policy)
- [Zoom \(https://zoom.us/privacy\)](https://zoom.us/privacy)

## ACCESSIBILITY

- Canvas
  - [Accessibility within Canvas \(https://community.canvaslms.com/docs/DOC-2061\)](https://community.canvaslms.com/docs/DOC-2061)
  - [Voluntary Product Accessibility Template \(https://www.canvaslms.com/accessibility\)](https://www.canvaslms.com/accessibility)
- [Kaltura Video App in Canvas \(https://corp.kaltura.com/products/core-platform/video-accessibility\)](https://corp.kaltura.com/products/core-platform/video-accessibility)
- [Panopto \(https://support.panopto.com/s/article/Learn-About-Accessibility-Features\)](https://support.panopto.com/s/article/Learn-About-Accessibility-Features)  
(<http://www.respondus.com/products/accessibility-lockdown.shtml>)
- [Zoom \(https://zoom.us/accessibility\)](https://zoom.us/accessibility)

## Course Guidelines

### EXPECTATIONS

I expect from the students, sincere effort, honesty, punctuality and that their work follows the homework guidelines which can be found in the "first day" folder in the files section of the Canvas page for this course.

Absent questions or requests for assistance, instructors must assume that students understand the material being covered and are able to complete the assignments. It is primarily through your questions that the instructor learns where the students are struggling to understand and on which topics more time needs to be spent for the students' benefit.

### WORKLOAD

Students will be responsible for reading selected sections from their textbook, possibly watching a lecture video and attempting the class preparation problem or worksheet prior to each class period. In addition, a post-class homework assignment will typically be due each week. **No credit will be given for late homework.** Therefore, it is expected that students will spend between 12 and 15 hours per week on this course.

### ASSESSMENT

All problems on exams and post-class homework in this course will be assigned points using "Dr. Cooley's Rubric for Problems" as appropriate. The preparation worksheet or problem will be assigned points using "Dr. Cooley's Rubric for Class Preparation"

Dr. Cooley's Rubric for Problems						
Criteria	Absent	Beginning	Developing	Developing	Accomplished	Mastered

Key Concepts: The student clearly identifies the key concepts in the outline of the solution to the problem.	0	1	2	3	4	5
Application: Student has outlined key steps and showed adequate details of calculations or thought process required to obtain a correct result. The calculations and details lead to and pertain to a correct solution and do not contain mistakes or extraneous details. The student has obtained the correct numerical result, with correct significant figures and units.	0	1	2	3	4	5

**Dr. Cooley's In Class Activity Rubric**

<b>Criteria</b>	<b>Absent</b>	<b>Beginning</b>	<b>Developing</b>	<b>Developing</b>	<b>Accomplished</b>	<b>Mastered</b>
Students have identified the key concepts in the outline of the solution to their problems. The team has outlined key steps and showed adequate detail of their calculations or through	0	1	2	3	4	5



processes required to obtain a correct result. In the case that the students had difficulties, an adequate explanation of their difficulties was described.						
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A course grade of Incomplete (I) will be given only in the case of extraordinary circumstances that prevent the student from finishing the semester. Students must have completed at least 50% of the course with a passing grade to be eligible for an Incomplete grade.

## COMMUNICATION PATTERNS

Direct communications with the instructor should be made in the manner indicated by the instructor. General questions and questions that are relevant to multiple students, that is, questions that are not specific to an individual and involve that individual's private information, should be posted on the course wall.



## Student Services

The following services and resources are available to SMU students:

- **[Student Academic Success Programs: \(https://www.smu.edu/Provost/ProvostOffice/SAES/StudentSupport/SASP\)](https://www.smu.edu/Provost/ProvostOffice/SAES/StudentSupport/SASP)** Students needing assistance with writing assignments for SMU courses may schedule an appointment with the Writing Center through Canvas. Students who would like support for subject-specific tutoring or success strategies should contact SASP, Loyd All Sports Center, Suite 202; 214-768-3648; <https://www.smu.edu/sasp> (<https://www.smu.edu/sasp>).
- **[Caring Community Connection \(CCC\) program \(http://www.smu.edu/deanofstudentsccc\)](http://www.smu.edu/deanofstudentsccc)** is a resource for anyone in the SMU community to refer students of concern to the Office of the Dean of Students. The online referral form can be found at [smu.edu/deanofstudentsccc](http://www.smu.edu/deanofstudentsccc) (<http://www.smu.edu/deanofstudentsccc>). After a referral form is submitted, students will be contacted to discuss the concern, strategize options, and be connected to appropriate resources. Anyone who is unclear about what steps to take if they have concerns about students should either consult the **[CCC Reference \(https://www.smu.edu/-/media/Site/StudentAffairs/StudentLife/PDF/Brochure\\_CCC\\_Details\\_Concerned\\_about\\_an\\_SMU\\_Student.pdf?la=en\)](https://www.smu.edu/-/media/Site/StudentAffairs/StudentLife/PDF/Brochure_CCC_Details_Concerned_about_an_SMU_Student.pdf?la=en)** **[Guide \(https://www.smu.edu/-/media/Site/StudentAffairs/StudentLife/PDF/Brochure\\_CCC\\_Details\\_Concerned\\_about\\_an\\_SMU\\_Student.pdf?la=en\)](https://www.smu.edu/-/media/Site/StudentAffairs/StudentLife/PDF/Brochure_CCC_Details_Concerned_about_an_SMU_Student.pdf?la=en)** or contact the

Office of the Dean of Students at 214-768-4564.

- [my.SMU \(https://my.smu.edu/\)](https://my.smu.edu/)
  - Online portal for SMU students that allows you to view personal information, emergency contact information, register for AARO (if applicable), view class schedule, enroll in classes, add/drop/swap classes, view grades and view financial aid packages.
- [SMU Bookstore \(http://smu.bncollege.com/webapp/wcs/stores/servlet/BNCBHomePage?storeId=17551&catalogId=10001&langId=-1\)](http://smu.bncollege.com/webapp/wcs/stores/servlet/BNCBHomePage?storeId=17551&catalogId=10001&langId=-1)
  - Information on textbooks, events, buyback, promotions and more.
- [SMU Bursar \(http://www.smu.edu/EnrollmentServices/Bursar\)](http://www.smu.edu/EnrollmentServices/Bursar)
  - Information on student finances, bill pay and more.
- [SMU Counseling Services \(http://www.smu.edu/StudentAffairs/HealthCenter/Counseling\)](http://www.smu.edu/StudentAffairs/HealthCenter/Counseling)
  - College can be a stressful time. There are many transitions and major life events occurring while you are a college student. If you or a friend is going through a difficult time and needs someone to talk to please seek out the resources provided by the counseling center, located in the Health Center and their phone number is (214) 768-2211. For 24 hour help contact (214) 768-2860.
- [SMU Dedman Recreation Center \(http://www.smu.edu/StudentAffairs/RecSports\)](http://www.smu.edu/StudentAffairs/RecSports)
  - Regular exercise is one of the best things you can do for your mental and physical well-being.
- [SMU Libraries \(https://www.smu.edu/Libraries\)](https://www.smu.edu/Libraries)
  - SMU Libraries has reference librarians happy to help with your research needs. Contact a librarian at <http://askalibrarian.smu.edu/> (<http://askalibrarian.smu.edu/>) or call (214) 768-2326.
- [SMU OIT \(https://www.smu.edu/OIT\)](https://www.smu.edu/OIT)
  - OIT provides computing, information processing, and communications resources to satisfy the needs of faculty, students, and staff, and offers comprehensive support services to help them use technology effectively and creatively.
- [SMU Student Affairs \(http://www.smu.edu/studentaffairs\)](http://www.smu.edu/studentaffairs)
  - SMU Student Affairs is a network of [departments, programs and services \(https://www.smu.edu/StudentAffairs/VPSA/Departments\)](https://www.smu.edu/StudentAffairs/VPSA/Departments) focused on supporting students' out-of-classroom experiences and co-curricular learning.



## Policies

### ACADEMIC INTEGRITY

According to university policy, **cheating or plagiarism** of any kind is strictly prohibited and subject to disciplinary action. Please take the time to read the [SMU Honor Code \(http://www.smu.edu/StudentAffairs/StudentLife/StudentHandbook/HonorCode\)](http://www.smu.edu/StudentAffairs/StudentLife/StudentHandbook/HonorCode).

## POLICY for MISSING TESTS and QUIZZES

Students who miss a test because of illness or other compelling circumstances as determined by the instructor may make arrangements to make up the test. No student has the right to request a make-up test for other reasons, aside for absences for scheduled, officially sanctioned University extracurricular events. Requests for make-up tests will be dealt with on a case-by-case basis. Students who miss a quiz because of illness or other compelling circumstances will have that quiz excused at the discretion of the instructor.

## DISABILITY ACCOMMODATIONS

Students who need academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit <http://www.smu.edu/Provost/SASP/DASS> (<http://www.smu.edu/Provost/SASP/DASS>) to begin the process. Once they are registered and approved, students then submit a DASS Accommodation Letter through the electronic portal, *DASS Link*, and then communicate directly with each of their instructors to make appropriate arrangements. Please note that accommodations are not retroactive, but rather require advance notice in order to implement.

## SEXUAL HARASSMENT

All forms of sexual harassment, including sexual assault, dating violence, domestic violence and stalking, are violations of SMU's Title IX Sexual Harassment Policy and may also violate Texas law. Students who wish to file a complaint or to receive more information about the grievance process may contact Samantha Thomas, SMU's Title IX Coordinator, at [accessequity@smu.edu](mailto:accessequity@smu.edu) (<mailto:accessequity@smu.edu>) or 214-768-3601. Please note that faculty and staff are mandatory reporters. If students notify faculty or staff of sexual harassment, they must report it to the Title IX Coordinator. For more information about sexual harassment, including resources available to assist students, please visit [www.smu.edu/sexualmisconduct](http://www.smu.edu/sexualmisconduct) (<http://www.smu.edu/sexualmisconduct>).

## PREGNANT AND PARENTING STUDENTS

Under Title IX, students who are pregnant or parenting may request academic adjustments by contacting Elsie Johnson ([elsiej@smu.edu](mailto:elsiej@smu.edu)) in the Office of the Dean of Students, or by calling 214-768-4564. Students seeking assistance must schedule an appointment with their professors as early as possible, present a letter from the Office of the Dean of Students, and make appropriate arrangements. Please note that academic adjustments are not retroactive and, when feasible, require advance notice to implement.

## RELIGIOUSLY OBSERVANT STUDENTS

Religiously observant students wishing to be absent on holidays that require missing class should

notify their professors in writing at the beginning of the semester and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. [Click here for a list of holidays. \(https://www.smu.edu/StudentAffairs/ChaplainandReligiousLife/ReligiousHolidays\)](https://www.smu.edu/StudentAffairs/ChaplainandReligiousLife/ReligiousHolidays)

### COVID-19 ATTENDANCE STATEMENT

Students who test positive for COVID-19 and need to isolate, or who are notified of potential exposure, must follow [SMU's Contact Tracing Protocol \(https://www.smu.edu/Coronavirus/Contact-Tracing\)](https://www.smu.edu/Coronavirus/Contact-Tracing) . (<https://www.smu.edu/Coronavirus/Contact-Tracing>) To ensure academic continuity and avoid any course penalties, students should follow the same procedures described by their instructors as they would for any other medical-related absence in order to be provided with appropriate modifications to assignments, deadlines, and exams.

### EXCUSED ABSENCES for UNIVERSITY EXTRACURRICULAR ACTIVITIES

Students participating in an officially sanctioned, scheduled university extracurricular activity should be given the opportunity to make up class assignments or other graded assignments that were missed as a result of their participation. It is the responsibility of the student to make arrangements for make-up work with the instructor prior to any missed scheduled examinations or other missed assignments. (See [2020-2021 SMU Undergraduate Catalog \(https://catalog.smu.edu/content.php?catoid=51&navoid=4645&hl=%22excused+absences%22&returnto=search\)](https://catalog.smu.edu/content.php?catoid=51&navoid=4645&hl=%22excused+absences%22&returnto=search) under "Enrollment and Academic Records/Excused Absences.")

### FINAL EXAMS

Final course examinations shall be given in all courses where appropriate, and some form of final assessment is essential. Final exams and assessments must be administered as specified in the official examination schedule. Exams cannot be administered or due during the last week of classes or during the Reading Period. Syllabi must state clearly the form of the final exam or assessment, and the due date and time must match the official SMU exam schedule. Final exams are not required to be provided online.

### MASK REQUIREMENTS

Masks are required in this course. This masking requirement is subject to change during the semester, and any changes will be announced in class, posted clearly in Canvas, and updated in the syllabus.

Mask wearing in this class is included as one of the expectations of maintaining professionalism within a culture of respect, such that a failure to follow the classroom requirements would negatively impact the overall professionalism/participation grade for up to 10% of the final course grade.

## CAMPUS CARRY

In accordance with Texas Senate Bill 11, also known as the 'campus carry' law, and following consultation with entire University community, SMU chooses to remain a weapons-free campus. Specifically, SMU prohibits possession of weapons (either openly or in a concealed manner) on campus. For more information, please see: [http://www.smu.edu/BusinessFinance/Police/Weapons\\_Policy](http://www.smu.edu/BusinessFinance/Police/Weapons_Policy) ([http://www.smu.edu/BusinessFinance/Police/Weapons\\_Policy](http://www.smu.edu/BusinessFinance/Police/Weapons_Policy)) .  
([http://www.smu.edu/BusinessFinance/Police/Weapons\\_Policy](http://www.smu.edu/BusinessFinance/Police/Weapons_Policy))