

PHY 361 - Introductory Modern Physics

Fall 2020

Instructor: Dr. Igor Shovkovy

Polytechnic campus | Tuesday & Thursday | 12:00 p.m. – 1:15 p.m. | AGBC 118

Course Description

This course covers selected topics of modern physics, including special relativity, introductory quantum theory with applications drawn from atomic, nuclear, and solid-state physics.

Credits: 3 credit hours

Prerequisites: PHY-131 (University Physics II: Electricity and Magnetism) or PHY-151 (Physics II), MAT 272 (Calculus with Analytic Geometry III) or MAT 267 (Calculus for Engineers III). Students will need to be able to apply algebra, trigonometry, and **calculus** to solve physics problems.

Instructor information

Name: [Dr. Igor A. Shovkovy](#)

Office Location: Wanner Hall 340F

Office Hours: 10:30 a.m. – 11:30 a.m. on **Mondays & Wednesdays**, and by appointment. To make an appointment, please contact the instructor via email at least 1 day in advance.

Email: Igor.Shovkovy@asu.edu

Phone Number: 480-727-1953

College Contact

This course is offered by the [College of Integrative Sciences and Arts](#) (CISA). For more information about the college, visit our website: cisa.asu.edu/. If you have questions or concerns about this course please speak with your instructor. If your instructor is unable to address your concerns, please send your inquiry to cisa@asu.edu.

Course Learning Outcomes

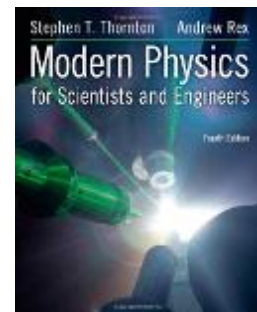
At the completion of this course, students will be able to:

1. Understand the key concepts of modern physics;
2. Use the main ideas of special relativity;
3. Explain the underlying ideas in particle and nuclear physics;
4. Understand and use modern physics terminology

Textbook(s)

Required Textbook:

Modern Physics for Scientists and Engineers (4th edition)
by S. T. Thornton and A. Rex
ISBN: 9781133103721



ASU Sync

This course is scheduled as an in-person (face-to-face) course. You will attend some class sessions in-person and be remote for other sessions to ensure we keep the room occupancy below 50%.

For the remote option, this course uses Sync. ASU Sync is a technology-enhanced approach designed to meet the dynamic needs of the class. During Sync classes, students learn remotely through live class lectures, discussions, study groups, and/or tutoring. You can find out more information about ASU Sync for students here: <https://provost.asu.edu/sync/students>.

To access live sessions of this class, [log into your ASU Zoom account](#), go to MyASU and click the Attend via Sync button next to this class on your schedule.

If you cannot physically be on campus due to travel restrictions or personal health concerns, you will be able to attend your classes via ASU Sync during the fall semester. If you will not be on-campus for the fall semester, you are expected to contact your professors to make accommodations.

Face Coverings

Everyone is required to wear a face cover while in ASU buildings and community spaces, regardless of distance. Face covers help prevent pre-symptomatic and asymptomatic individuals from inadvertently spreading COVID-19 to others. They are meant to protect others in case you are sick. Students will be required to wear a face cover in the classroom.

If you require accommodations due to a disability or health-related concern, please contact the Disability Resource Center.

Course Access

Your ASU courses can be accessed by both my.asu.edu and asu.instructure.com; bookmark both in the event that one site is down.

Student Success

To be successful:

- check the course daily
- read announcements
- read and respond to course email messages as needed
- complete assignments by the due dates specified
- communicate regularly with your instructor and peers
- create a study and/or assignment schedule to stay on track
- access [ASU Online Student Resources](#) or [CISA Academic Resources](#)

Grading

Your grade will be determined based on the following grading scheme:

A	90% – 100%	Excellent
B	78% – 89.9%	Good
C	66% – 77.9%	Average
D	54% – 65.9%	Passing
E	< 54 %	Failure
XE		Failure due to Academic Dishonesty

Percentage Distribution:

Homework assignments	35%
Mid-term Exam 1	20%
Mid-term Exam 2	20%
Final Exam	25%
Total	100%

Grading Procedure

Grades reflect your performance on assignments and adherence to deadlines. Grades on assignments will be usually available within 72 hours of the due date in the Gradebook.

Late or Missed Assignments

As a rule, late homework will **not** be accepted.

However, if an urgent situation arises and you are unable to submit the assignment on time, notify the instructor **BEFORE** an assignment is due.

Follow the appropriate University policies to request an [accommodation for religious practices](#), or to request accommodation for missed assignments [due to University-sanctioned activities](#) or [active military service](#).

Attendance Policy

Attendance is required either in person or remotely via Zoom. Students are responsible for all material presented in class, all homework, and for all changes to the schedule or plans announced in class.

If you cannot physically be on campus due to travel restrictions or personal health concerns, you will be able to attend your classes via Zoom. If you will not be on-campus for the whole semester, you are expected to contact your professors to make accommodations.

Requiring face coverings at ASU locations

Everyone will be required to wear a face cover while in ASU buildings. Face coverings will also be required in outdoor community spaces where social distancing isn't possible.

Course Outline

Detailed schedule: http://shovkovy.faculty.asu.edu/syllabus/2020/Fall/phy361_schedule.pdf

The exact schedule for lectures, quizzes and examinations will depend on how long it takes to cover the material. The following is a tentative schedule:

Date	Description
Aug. 20, 2020	First class
Oct. 8, 2020	1st midterm test
Oct. 13, 2020	Self-study day – No class
Nov. 19, 2020	2nd midterm test
Nov. 26-27, 2020	Thanksgiving holidays – No classes
Dec. 1, 2020	Last class
Dec. 3, 2020	Final Exam (12:00 p.m. - 1:15 p.m.) https://students.asu.edu/final-exam-

Assignment Details

Homework is truly one of the most important components in this course. This is because doing homework is the only way to truly learn the material and build a good intuition for physics. Solving physics problems effectively is a skill that students must develop. The only known way to achieve this is by practicing. The lectures will only cover the key concepts. The text will elaborate on these concepts and provide further explanation of their meaning and on how one uses them to solve problems. There is no way to do well in this course if you do not give the homework assignments the effort they require. (Allow about **4 hours per week** for reading and homework assignments.) Your homework assignment should be neatly and clearly written. The front page should list your name, the date and the homework assignment number. Each problem should be clearly labeled. The problem solutions should contain detailed explanations. Late homework will **not** be accepted.

Tests and exams. There will be *two midterm tests* on the dates shown below in the tentative schedule (the actual dates will be announced in class). The *final exam* at the end of the semester is a comprehensive exam. The use of the textbook and class notes will not be permitted during the tests and exams.

Electronic devices. The use of cell phones, iPads, laptops, and other similar devices is not permitted during lectures, tests and exams.

Communicating with your Instructor and Classmates

Netiquette

If you are engaging in online course interactions, use [netiquette](#): a social code that defines appropriate online behavior. Writing may be the only means of communication you have with classmates and instructors, so it is especially important to communicate as a scholarly, respectful, professional, and polite learner.

Classroom Community

In order to build a course climate that is comfortable for all, it is important that students (1) display respect for all members of the class – including the instructor and students; (2) pay attention to and participate in all interactive student partner/instructor sessions and activities; and (3) observe the rules of appropriate online behavior (also known as netiquette). This term is defined by the instructor and includes keeping course discussion posts and oral communication with other students (or the instructor) focused on the assigned topics. Students must maintain a cordial atmosphere and use tact in expressing differences of opinion; in addition, they must avoid racist, sexist, homophobic, or other negative language that may unnecessarily exclude course members. This is not an exhaustive list of behaviors; rather, it represents examples of the types of things that can have a dramatic impact on the course environment. Your final grade may be reduced each time you engage in the types of negative behaviors indicated above.

Community Forum

If your course uses a Canvas discussion topic called "Community Forum" for general questions and comments about the course check the syllabus, announcements, and existing posts to ensure it's not redundant prior to posting a question or comment. You are encouraged to respond to the questions of your classmates.

Email questions of a personal nature to your instructor. You can expect a response within 72 hours.

Chat

The Chat tool in Canvas allows students and teachers to interact in real time. Use Chat only for informal course-related conversations unless your instructor informs you otherwise. Chat is not ideal for questions about assignments; instructors are not required to monitor it and conversations may be buried or lost.

Email

ASU email is an [official means of communication](#) among students, faculty, and staff. Students are expected to read and act upon email in a timely fashion. Students bear the responsibility of missed messages and should check their ASU-assigned email regularly.

All instructor correspondence will be sent to your ASU email account.

Syllabus Disclaimer

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. Remember to check your ASU email and the course site often.

Course Time Commitment

Coursework includes all learning activities including reading, watching videos, studying, and completing assignments. Arizona Board of Regents (ABOR) requires 45 hours of coursework per credit for college-level courses, which translates to:

- 1 credit hour = 45 total hours
- 2 credit hours = 90 total hours

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- 3 credit hours = 135 total hours
- 4 credit hours = 180 total hours
- 5 credit hours = 225 total hours

ASU courses range in length from 6 weeks to 15 weeks. Below is a breakdown of the 135-hour required time commitment for a three-credit course divided among weeks for courses of various lengths.

Course Length	Time on Coursework per Week for a 3-credit course	Total Time Requirement for a 3-credit Course
6 weeks	22.5 hours	135 hours
7.5 weeks	18 hours	135 hours
8 weeks	17 hours	135 hours
15 weeks	9 hours	135 hours

Drop and Add Dates/Withdrawals

If you are unable to take this course for any reason, be aware that there is a limited timeline to [drop or add the course](#). Consult with your advisor and notify your instructor to add or drop this course. If you are considering a withdrawal, review the following ASU policies: [Withdrawal from Classes](#), [Withdrawing as a Financial Aid Recipient](#), [Medical/Compassionate Withdrawal](#), and a [Grade of Incomplete](#).

Grade Appeals

Students must first speak with the instructor of the class to discuss any disputed grades. If, after review, a resolution is not achieved students may proceed with the appeal process. Student grade appeals must be processed in the regular semester immediately following the issuance of the grade in dispute (by commencement for fall or spring), regardless whether the student is enrolled at the university. Complete details are available in the [CISA Grade Appeals policy](#).

Harassment Prohibited

ASU policy prohibits harassment on the basis of race, sex, gender identity, age, religion, national origin, disability, sexual orientation, Vietnam era veteran status, and other protected veteran status. Violations of this policy may result in disciplinary action, including termination of employees or expulsion of students. Students are encouraged to report harassment to instructors and the Dean of Students Office.

Student Conduct and Academic Integrity

ASU and the College of Integrative Sciences and Arts expects and requires its students to act with honesty, integrity, and respect. Required behavior standards are listed in the [Student Code of Conduct and Student Disciplinary Procedures](#), [Computer, Internet, and Electronic Communications policy](#), [ASU Student Academic Integrity Policy](#), and outlined by the [Office of Student Rights & Responsibilities](#). Anyone in violation of these policies is subject to sanctions. [Students are entitled to receive instruction free from interference](#) by other members of the class. An instructor may withdraw a student from the course when the student's behavior disrupts the educational process per [Instructor Withdrawal of a Student for Disruptive Classroom Behavior](#). The Office of Student Rights and Responsibilities accepts [incident reports](#) from students, faculty,

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staff, or other persons who believe that a student or a student organization may have violated the Student Code of Conduct.

Students must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement. Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions and records. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal. For more information, see provost.asu.edu/academicintegrity.

If you fail to meet the standards of academic integrity in any of the criteria listed on the university policy website, sanctions will be imposed by the instructor, college, and/or dean. Academic dishonesty includes, but is not limited to, cheating on an academic evaluation or assignment, plagiarizing, academic deceit (such as fabricating data or information), or falsifying academic records. Turning in an assignment (all or in part) that you completed for a previous class is considered self-plagiarism and falls under these guidelines. Any infractions of self-plagiarism are subject to the same penalties as copying someone else's work without proper citations. Students who have taken this class previously and would like to use the work from previous assignments should contact the instructor for permission to do so.

If you have any questions about your work and the academic integrity policy, please discuss your assignment or concerns with your instructor, teaching assistant, or your college Academic Integrity Officer in advance of submitting an assignment. Student resources on Sun Devil Integrity and strategies for completing your work with integrity and avoiding plagiarism are available here: [ASU Student Resources for Academic Integrity](#) or provost.asu.edu/academicintegrity for more information.

Title IX

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find [information](#) and resources at <https://sexualviolenceprevention.asu.edu/faqs>.

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available if you wish to discuss any concerns confidentially and privately. ASU online students may access 360 Life Services, <https://goto.asuonline.asu.edu/success/online-resources.html>.

Student Accessibility and Inclusive Learning Services (SAILS)

Qualified students with disabilities who will require disability accommodations in this class are encouraged to make their requests to the instructor at the beginning of the semester either during office

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hours or by appointment. Note: Prior to receiving disability accommodations, verification of eligibility from the Student Accessibility and Inclusive Learning Services is required. Disability information is confidential.

Student Accessibility and Inclusive Learning Services (eoss.asu.edu/drc)

Email: DRC@asu.edu

DRC Phone: 480-965-1234

DRC FAX: 480-965-0441

Statement on Inclusion

Arizona State University is deeply committed to positioning itself as one of the great new universities by seeking to build excellence, enhance access and have an impact on our community, state, nation and the world. To do that requires our faculty and staff to reflect the intellectual, ethnic and cultural diversity of our nation and world so that our students learn from the broadest perspectives, and we engage in the advancement of knowledge with the most inclusive understanding possible of the issues we are addressing through our scholarly activities. We recognize that race and gender historically have been markers of diversity in institutions of higher education. However, at ASU, we believe that diversity includes additional categories such as socioeconomic background, religion, sexual orientation, gender identity, age, disability, veteran status, nationality and intellectual perspective.

Mental Health

As a student, like anyone else, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These emotional health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. ASU Counseling Services provides counseling and crisis services for students who are experiencing a mental health concern. Any student may call or walk-in to any ASU counseling center for a same day or future appointment to discuss any personal concern. Here is the Web site: eoss.asu.edu/counseling. After office hours and 24/7 ASU's dedicated crisis line is available for crisis consultation by calling 480-921-1006.

Establishing a Safe Environment

Learning takes place best when a safe environment is established in the classroom. In accordance with SSM 104-02 of the Student Services Manual, students enrolled in this course have a responsibility to support an environment that nurtures individual and group differences and encourages engaged, honest discussions. The success of the course rests on your ability to create a safe environment where everyone feels comfortable to share and explore ideas. We must also be willing to take risks and ask critical questions. Doing so will effectively contribute to our own and others intellectual and personal growth and development. We welcome disagreements in the spirit of critical academic exchange, but please remember to be respectful of others' viewpoints, whether you agree with them or not.

All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students. If either office determines that the behavior poses or has posed a serious threat to personal safety or to the welfare of the campus, the student will not be permitted to return to campus or reside in any ASU residence hall until an appropriate threat assessment has been completed and, if necessary, conditions for return are imposed. ASU PD, the Office of the Dean

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of Students, and other appropriate offices will coordinate the assessment in light of the relevant circumstances.

Prohibition of Commercial Notetaking Services

In accordance with [ACD 304-06 Commercial Note Taking Services](#), written permission must be secured from the official instructor of the class in order to sell the instructor's oral communication in the form of notes. Notes must have the note taker's name as well as the instructor's name, the course number, and the date.

Course Evaluation

Students are expected to complete the course evaluation. The feedback provides valuable information to the instructor and the college and is used to improve student learning. Students are notified when the online evaluation form is available. The results are always anonymous and cannot be reviewed by the instructor/department until after final grades have been posted.

Trigger Warning

Please note that some course content may be deemed offensive by some students, although it is not my intention to offend anyone. In addition, some materials that we link with online might also be considered offensive, troubling, or difficult to review in terms of language or graphics. I attempt to provide warnings when introducing this kind of material; yet if I forget to do so, or if something else (in my materials or posts from fellow students) seems offensive, please contact me at igor.shovkovy@asu.edu, or the faculty head, Dr. Kelly P. Steele (email: Kelly.Steele@asu.edu).

Academic Affairs Manual

For a complete guide to Arizona State University course policies, please refer to the [Academic Affairs Manual \(ACD\)](#).

SCHEDULE of Lectures, Exams, and Homework assignments**PHY 361 - Introductory Modern Physics**

Fall 2020

Instructor: Igor Shovkovy

Tue, Thu

12:00 p.m. – 1:15 p.m.

AGBC 118 (Poly)

#	Date	Description	Reading material	Homework	Weekday
1	20-Aug-20	Introduction; Foundations of special relativity	1 & 2.1-2.3		Thu
2	25-Aug-20	Lorentz transformation	2.4		Tue
3	27-Aug-20	Dilation & contraction	2.5 & 2.7	HW #1	Thu
4	1-Sep-20	Paradoxes, Doppler effect	2.8-2.10		Tue
5	3-Sep-20	Velocity addition; Momentum & Energy	2.6 & 2.11-2.12		Thu
6	8-Sep-20	Mass in relativity; Kinematics	2.12-2.14	HW #2	Tue
7	10-Sep-20	Quantization effects; Blackbody radiation	3.1-3.5		Thu
8	15-Sep-20	Photoelectric effect; X-ray production	3.6-3.7		Tue
9	17-Sep-20	Compton scattering; Pair production	3.8-3.9	HW #3	Thu
10	22-Sep-20	Rutherford & Bohr models of atom	4.1-4.5		Tue
11	24-Sep-20	X-Ray spectra; Frank-Hertz experiment	4.6-4.7	HW #4	Thu
12	29-Sep-20	De Broglie waves; Davisson-Germer expermt.	5.1-5.2		Tue
13	1-Oct-20	Wave packets; Classical uncertainty principle	5.3-5.4		Thu
14	6-Oct-20	Quantum uncertainty principle; Particle in Box	5.5-5.8	HW #5	Tue
	8-Oct-20	1st midterm test (lectures 1-13)			Thu
	13-Oct-20	Self-study day – No class			Tue
15	15-Oct-20	Schroedinger equation	6.1		Thu
16	20-Oct-20	Particle trapped in a square-well potential	6.3-6.5	HW #6	Tue
17	22-Oct-20	Expectation values & operators; S.H.O.	6.2 & 6.6		Thu
18	27-Oct-20	Reflection and transmission	6.7		Tue
19	29-Oct-20	Schroedinger equation for hydrogen atom	7.1-7.2	HW #7	Thu
20	3-Nov-20	Hydrogen wave functions; spin	7.3-7.5		Tue
21	5-Nov-20	Energy levels, Selection rules; Periodic table	7.6 & 8.1	HW #8	Thu
22	10-Nov-20	Properties of nuclei	12.1-12.5		Tue
23	12-Nov-20	Radioactivity; Nuclear models	12.6-12.7	HW #9	Thu
24	17-Nov-20	Introduction to Standard Model	14.1-14.3		Tue
	19-Nov-20	2nd midterm test (lectures 14-24)			Thu
25	24-Nov-20	Particle interactions; Conservation laws	14.4	HW #10	Tue
	26-Nov-20	Thanksgiving Holiday – No class			Thu
26	1-Dec-20	Quark model; Families of matter	14.5-14.6		Tue
	3-Dec-20	Final Exam (12:00 p.m. - 1:15 p.m.)	https://students.asu.edu/final-exam-sched		Thu