

PHYS 324
Modern Physics
Fall 2020

Instructor: Dr. Can Ataca
E-mail: ataca@umbc.edu (expect a response in 48 hours, excluding breaks and weekends)
Office: PHYS 315 (Working online)
Office hours: Fridays 13:00-14:00 or by appt

Prerequisite: PHYS 224 (Vibration and Waves)

Lecture Hours: Monday, Wednesday, Friday 11:00-11:50 AM

Online Meeting details: WebeX Meeting

Meeting link:

<https://umbc.webex.com/umbc/j.php?MTID=mc65bb88f53ac7238289aa7697bec5b57>

Meeting number: 120 712 1858

Password: phys324

Host key: 604530

Textbook: J. R. Taylor, C. D. Zafiratos, M. A. Dubson, *Modern Physics for Scientists and Engineers*, ISBN: 978-1-938787-75-1
(Recommended) J. S. Townsend, *Quantum Physics-A Fundamental Approach to Modern Physics*, ISBN: 978-1-891389-62-7
(Recommended) D. J. Griffiths, *Introduction to Quantum Mechanics*, ISBN: 978-1107179868

Course Objectives: This course will introduce the basic concepts, theory and applications of modern physics, with the emphasis on relativistic and quantum physics. We will talk about special relativity, basic quantum mechanics, solid state and nuclear physics. We will discuss the key experiments and develop a fundamental understanding of the principles and laws of the different branches of physics. Some math will be involved, but the emphasis in the homework will be not on solving the standard quantitative problems but rather on learning the important physical concepts and the development of scientific reasoning skills.

At the end of this course, you should:

1. Understand the ideas and consequences of the special theory of relativity.
2. Understand the importance of quantum mechanics to explain nanoscale phenomena with important historical steps of its development.

3. Understand how electrons behave in different environments at nanoscale.
4. Have a better understanding of how different branches of physics are related with each other.
5. Broaden and deepen your physical scientific reasoning and problem-solving skills.

Grading:

Your final grade will be determined by:

Final Exam:	20%
Quizzes:	10 x 4%
Term Project:	20%
Homework:	10 x 2%

Your letter grade will depend on the total score. If your total grade is:

≥ 85 , your letter grade will be	“A”
$85 > X \geq 70$, then	“B”
$70 > X \geq 60$, then	“C”
$60 > X \geq 50$, then	“D”
$50 > X$, then	“F”

Please focus on learning the material rather than the grades.

Final Exam: The date of the final exam is determined by the university and it will be on December 11th, 2020 (10:30 AM-12:30 PM). The exam will include all the course material covered up to the day of the exam, if not informed otherwise. Final exam will be closed book. At least one question of the exam will be similar to the ones assigned in homework. You may have one page of **YOUR OWN** handwritten notes to any exams (no photocopies or print-outs are allowed).

Homework: Your preliminary homework for every class is to read the corresponding chapter/sections of the book. Homework assignments will be available on the Blackboard page every Friday and are due at the beginning of the class the following Friday, unless you are told otherwise. You are encouraged to study in groups and discuss the material and homework questions among yourselves. However, the homework solution should be your own work, not a group product. No late assignments will be accepted. I plan to assign weekly (~a total of 13) homeworks each having up to 3 questions. The top 10 highest graded homeworks will be counted towards your grading. This is meant to allow for things that come up unexpectedly.

Quizzes: There will be weekly quizzes (~a total of 11). Quizzes will be closed book/notes. They might take place any time during the class and related closely with the homework assignments. They will not be longer than 15 minutes. They will be

related to the topics covered in that chapter of the book. The top 10 highest graded quizzes will be counted towards your grading. This is meant to allow for things that come up unexpectedly.

Term Projects: Every student will choose a subject to work on. No two students can choose the same subject, so please discuss your subject with me before starting to work on it. You will write a detailed report on your chosen subject (8-page manuscript in two columns at most) and present your subject within a class-hour. You will also prepare 2 questions homework set for your subject. The deadline for the term project is the last week of November and the first week of December, respectively.

Term project topics: Molecules, Solids- Theory, Solids-Applications, The structure of Atomic Nuclei, Radioactivity and Nuclear Reactions, Elementary Particles.

Course Material: All of the course material including recorded lectures and slides, homeworks and quizzes will be uploaded to Blackboard page of the course. Your duty is to check Blackboard regularly.

Topics to be covered:

Courses	Chapter	Subject
1-5	1	The Space and Time Relativity
6-9	2	Relativistic Mechanics
10-13	3	Quantum Mechanics-Atoms
14-15	4	Quantization of Light
16-17	5	Quantization of Atomic Energy Levels
18-20	6	Matter Waves
21-24	7	The Schrodinger Equation in One Dimension
25-28	8	The Three-Dimensional Schrodinger Equation
29-30	9	Electron Spin Theory
31-33	10	Multi-electron Atoms; the Pauli Principle and Periodic Table
34-36	11	Atomic Transitions and Radiation
37-39	12-14	An introduction to Solid State Physics

40-42	16-18	An introduction to Nuclear Physics
-------	-------	------------------------------------

Student Responsibilities:

- Students are responsible for checking their academic e-mails and the Blackboard page of the course daily for getting updates about the course, grades, homeworks and class notes.

- If you need to take a make-up exam, please provide a university-approved excuse (such as a nurse/doctor signed document).

- In order to be successful in this course, you should attend all classes by having read the background material. Please be attentive and take notes during lectures. You are welcome to ask questions to clarify any point that is not clear, either during class or during my office hours. Please complete all homework on time and prepare for the exams.

Student Safety:

In response to the COVID-19 pandemic, it is understood that some students who are enrolled in classes that have an in-person component may have or develop COVID-19 related health concerns coming to campus to attend those classes this semester. No student shall be compelled to attend class or attend an assessment if they have COVID-19 related health concerns. However, for students enrolled in courses having a physical presence component who anticipate not being able to attend the in-person class sessions due to COVID-19 related health concerns, it is advisable to provide notice to the course instructor at the beginning of the term so that alternate arrangements can be made. Students enrolled in courses with an in-person component who develop COVID-19 related health concerns during the semester should immediately contact the course instructor to discuss alternative instructional arrangements.

Technology: Access, Requirements, Resources, Support:

To help ensure that UMBC students are equipped for academic success, the Division of Information Technology (DoIT) provides a wealth of resources and support, including tips for getting online and minimum specifications to consider when purchasing a computer (doit.umbc.edu/students). UMBC does require all students to be technologically self-sufficient, which entails having a reliable personal computer (preferably a laptop with webcam) and Internet access. Since UMBC requires all students to have a computer and Internet access, financial aid may be used to meet this requirement. To learn more, students should contact their financial aid counselor at financialaid.umbc.edu/contact.

COVID-19: Safety Expectations and Guidelines:

Students enrolled in this course are expected to adhere to all UMBC policies, rules, and regulations, including COVID-19 emergency health and safety rules, policies, guidelines, and signage enacted for the UMBC community. For students attending in-person classes, signage, policies, rules, and/or guidelines may include but are not limited to specific requirements for face coverings, physical distancing, and sanitization, in addition to efforts to reduce density efforts that involve reductions in seating and room capacity. Please be aware that UMBC's COVID-19 emergency health and safety rules, regulations, policies, guidelines, and/or signage are subject to change as our public health crisis evolves. Any violation will be subject to disciplinary action and may include but not limited to immediate dismissal from the classroom, removal from the classroom and/or campus, a requirement to work remotely, and/or sanctions and conditions enumerated in the UMBC Code of Student Conduct that may entail suspension or expulsion from UMBC.

Academic integrity in the Online Instruction Environment:

Academic integrity is an important value at UMBC. By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. These principles and policies apply in both face-to-face and online classes. Resources for students about academic integrity at UMBC are available at <https://academicconduct.umbc.edu/resources-for-students/>.

Resources to Help you Succeed in Online Courses:

Many students need additional support to succeed in online courses. Click on the following links for helpful resources:

UMBC's Academic Success Center (ASC) provides a range of resources to support students as they progress toward degree completion. They will continue to offer all of their services online.

The ASC has created a specialized set of **Online Learning Resources**, including videos and guides to help students succeed while learning online.

In addition, check out the following resources:

- **Academic Success Center Resources** include: Online tutoring and writing support, supplemental instruction/peer-assisted study sessions (SI PASS),

placement testing, FYI academic alerts, success courses, academic advocacy, academic policy and academic success meetings.

- **Tutoring and Writing Center Appointments** will be online; students can make appointments using this [link](#).
- **SI PASS** Supplemental Instruction (SI)/ *Peer Assisted Study Sessions* (PASS). The SI PASS program targets traditionally difficult academic courses, providing regularly scheduled, out-of-class review sessions, happening in Blackboard Collaborate inside your existing Blackboard course.
- **Academic Advocates:** Advocates work one-on-one with students who need support navigating academic and institutional challenges, no matter how complex the concerns (i.e., personal, academic, or financial).
- **Academic Success Meetings** - Schedule a one-to-one virtual meeting with an Academic Success Center Professional who can help you with time management, study skills, and accessing campus resources.

If you have a question, please contact the ASC at academicsuccess@umbc.edu

Accessibility and Disability Accommodations, Guidance and Resources:

Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADA AAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that would create equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at sds.umbc.edu for registration information and office procedures.

SDS email: disAbility@umbc.edu, SDS phone: (410) 455-2459

If you will be using SDS approved accommodations in this class, please contact me (instructor) to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.

Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination:

UMBC's **Policy on Sexual Misconduct, Sexual Harassment and Gender Discrimination** and Federal Title IX law prohibit discrimination and harassment on the basis of sex in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based

harassment or retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources:

Mikhel A. Kushner, Title IX Coordinator (she/her/hers)
410-455-1250 (direct line), kushner@umbc.edu

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in or thinking about making a report, please see the **Online Reporting Form**. Please note that, while University options to respond may be limited, there is an anonymous reporting option via the online form and every effort will be made to address concerns reported anonymously.

Notice that Faculty are Responsible Employees with Mandatory Reporting Obligations:

All faculty members are considered *Responsible Employees*, per **UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination**. Faculty are therefore required to report possible violations of the **Policy** to the Title IX Coordinator, even if a student discloses something they experienced before attending UMBC.

While faculty members want you to be able to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report Sexual Misconduct to the Title IX Coordinator so that the University can inform students of their **rights, resources and support**.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of **Confidential Resources** available to support you:

- The **Counseling Center**: 410-455-2472 / After-Hours 410-455-3230
- **University Health Services**: 410-455-2542
- Pastoral Counseling via **Interfaith Center**: 410-455-3657; interfaith@umbc.edu

Other Resources:

- **Women's Center** (for students of all genders): 410-455-2714; womenscenter@umbc.edu.
- **Shady Grove Student Resources, Maryland Resources, National Resources**.

Child Abuse and Neglect:

Please note that Maryland law and **UMBC policy** require that I report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police.