

PHYSICS 491 – Fall 2019

Atomic, Molecular, and Condensed Matter Physics

Monday, Wednesday, Friday, 1:50 -2:40pm, BPS 1420

Instructor: Norman Birge, 4224 BPS, 884-5653, birge@pa.msu.edu
Office hours: Monday & Tuesday, 3:00 – 4:00pm, or by appointment

Grader: Kasun Gamage, gamagek1@msu.edu

Course Information:

The homework sets will be handed out in class and posted on the D2L web site: <https://d2l.msu.edu/>. Your quiz, homework and exam scores will also be posted on D2L.

Clicker Questions:

I hope to create some i-clicker questions for the lectures. (They will not be graded.) Please remember to bring your i-clicker to each lecture.

Textbooks (required):

1. Charles Kittel, *Introduction to Solid State Physics*, 7th or 8th edition
2. Wolfgang Demtroder, *Atoms, Molecules and Photons*. This book is available free online from here: <https://link.springer.com/book/10.1007/978-3-642-10298-1>
3. Your favorite introductory quantum mechanics textbook, such as David J. Griffiths, *Introduction to Quantum Mechanics*

Homework and Exams

Homework will be assigned every week, and will be graded. There will be three midterm exams during the weeks of September 23, October 21, and November 18. The final exam will be on Wednesday, December 11 at 5:45pm in room 1420 BPS. Calculators are required for all exams.

Grading Scheme

The scores on the homework assignments, exams, and research paper will determine your Total Score. The Total Score is weighted as follows: 20%-Homework, 15% each Midterm, 10%-Paper, 25%-Final Exam. Grade assignments at the end of the term will be taken from the table below. (The grading scale may be shifted in your favor.)

Minimum %	Grade	Minimum %	Grade
90	4.0	66	2.0
84	3.5	60	1.5
78	3.0	50	1.0
72	2.5	< 50	0.0

(over)

Tier II Writing Requirement

Because this course partially fulfills the Tier II writing requirement for physics majors, there will be a 5-10 page research paper due near the end of the semester. Grades will be based on the following criteria, in order of decreasing importance:

1. Content: The most important aspect of the paper is that the physics explanations be correct. The paper must go beyond what we covered in lecture and homework, or what you learned in your previous Quantum Mechanics course. I will hand out a list of suggested paper topics late in the semester, but you are encouraged to choose your own topic with my approval.
2. Style, grammar and form: The paper should explain the physical concepts clearly, so that your peers could understand it. It should have proper grammar. Figures should be labeled clearly, and each figure should have a short figure caption explaining what is being shown in the figure. Every figure must be mentioned in the text. Please include citations in the paper where appropriate, and a bibliography at the end.

The rough draft of this paper is due on Monday, November 25, and the final draft is due on Friday, December 6, which is the last day of lecture. Turning in a rough draft on time is very important, because this is the only way you will get feedback from me before you write your final version. In the past, students who did not turn in a rough draft received significantly lower grades on their papers. The paper will count for 10% of your total grade.

Course Goals: This course gives an overview of atomic, molecular, and solid-state physics, with an emphasis on the latter. Topics to be covered include: review of atomic structure, chemical bonds and molecular orbitals, structure of crystalline solids, electronic and thermal properties of solids. (Depending on the wishes of the class, we may reduce the amount of time we spend on atomic and molecular physics to leave more time for advanced topic in solid state physics such as magnetism or superconductivity.) The goals of the course are to enhance your understanding of the matter that makes up most of the world you live in, and to help you appreciate how basic physical principles can be applied to complex systems that consist of huge numbers of atoms.

Expectations and Workload: As a Capstone course for physics majors, this course assumes that students are self-motivated and willing to spend the time necessary to understand difficult concepts. Be prepared to spend between 6 and 10 hours per week reading the book and doing the homework. Students are allowed to work together on homework, but beware of working in a group without pulling your weight. I strongly encourage each of you to start working on the homework alone, then come to office hours or get help from your peers when you get stuck. In any case, the work you hand in must be your own.

Spartan Code of Honor: Taking classes is not just about learning physics and getting good grades. Please read the Spartan Code of Honor and reflect on how it affects everything you do in your life. "As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do."