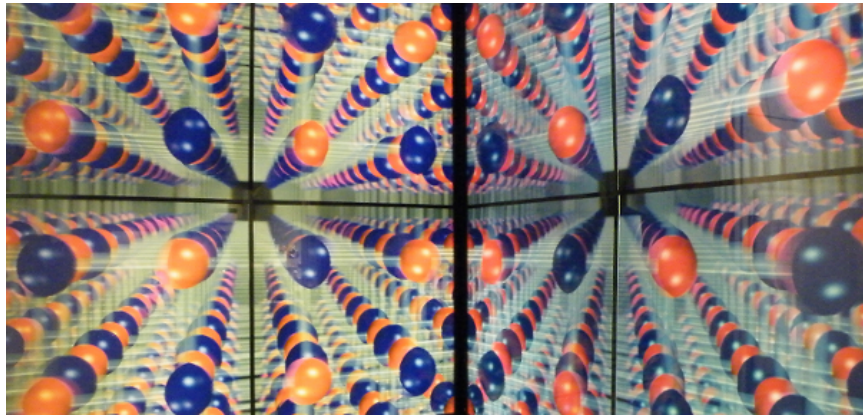


Phys 242 Syllabus Fall 2020

Solid State Physics
MWF 1:10- 2:00 PM



Modality, Meeting Pattern, Location

All students meet with the instructors **in-person** three times a week, **MWF 1:10-2:00 PM in Innovation E330**. After Thanksgiving break the course will meet remotely, via Teams, at the same times listed above.

Instructor Name, Contact Information, Office Hours

Madalina Furis

E225 Innovation Hall

Madalina.Furis@uvm.edu

Office Hours: TBA in the second update of the syllabus.

Technical support for students

Students, please read this technology check list to make sure you are ready for classes.
<https://www.uvm.edu/it/kb/student-technology-resources/>

Students should contact the Helpline (802-656-2604) for support with technical issues.

Pre-requisites or co-requisites

Phys 128 and a 200-level Math course

Course Description

This course is designed to provide senior Physics, Chemistry and Engineering majors with a mathematically rigorous approach to solid state physics basics. The instructor is

an expert in electronic properties of materials, interaction of light with matter, spectroscopy instrumentation and materials behavior in very high magnetic fields. Her approach will be to provide students with an in-depth physics perspective on very useful, applied topics that students can take with them in their future careers. Such topics include Crystalline Structure, Light Scattering by crystals, Lattice Vibrations, Band Theory of Electrons, Free Electron Gas, Magnetism and Exchange Interactions, Superconductivity, Optical Properties of Semiconductors, Excitons.

Course Learning Objectives

After completing this course, the student will be able to:

- Identify crystallographic structures from X-ray scattering experiments
- Describe different kinds of magnetic spin exchange interaction and magnetic ordering
- Find the phonon dispersion curves for 1D acoustic and optical modes
- Find the thermodynamic properties of Fermi electron gas
- Apply the tight binding and quasi-free electrons approximation to find the frequency dispersion (band structure) of electrons in solids
- Write equations of motion for “quasi-free” electrons in solids, in the presence of electric and magnetic fields.
- Extract lattice parameters from compressibility modulus measurement using chemical bonds models.

Outline

The students meet with the instructor three times a week in-person, until Nov 24th. After Thanksgiving the meeting will move online using the Microsoft Teams course group. Students are required to complete textbook reading assignments and post two questions related to the reading assignment before coming to class. Posting questions and answering other students' questions on time is part of the grade. In-class individual work will also constitute part of the grade. The class will observe a lecture-by lecture calendar available in Blackboard. Homework will be assigned weekly for credit. There are two mid-term exams and one cumulative final exam. The mid-terms are in-class exams, the final is an open-book, take-home exam that will be submitted online for grading.

Required Course Materials:

Fundamentals of Condensed Matter and Crystalline Physics, by D. L. Sidebottom 1st edition, Cambridge University Press.

Additional Readings: *The Oxford Solid State Basics* by Steven H Simon and *Solid State Physics* by Hook & Hall and many, many other materials posted in BB. (Yes, Kittel and Ashcroft and Mermin for the grads)

Blackboard, MS Teams, or other course sites:

All students must have access to **Blackboard** and a student account in **Piazza**. The latter is a free online discussion and homework forum that is integrated with Blackboard (and oh, so much better!). You can create an account by following the link under **SSP Forum** in **BB**. You must also have a scanning app on your phone or tablet. You will submit your homework electronically.

After Thanksgiving the classes will switch to synchronous remote instruction using the Microsoft Teams platform. You should already see that you were added to a Phys 242 group. All office hours will be scheduled and take place via Teams.

Attendance Policy and Classroom Environment Expectations:

You are expected to attend all lectures in -person. All in-class whiteboard work will be credited in lieu of attendance. You will take pictures of this work and upload in BB/Piazza. Posting questions and answering other students' questions on time is part of the grade. In-class individual work will constitute part of the grade. The class will observe a lecture-by lecture calendar available in Blackboard. Homework will be assigned weekly for credit. There are two mid-term exams and one cumulative final exam. The mid-terms are in-class exams, the final is an open -book, take- home exam that will be submitted online for grading.

“The [Green and Gold Promise](#) clearly articulates the expectations that UVM has for students, faculty, and staff to remain compliant with all COVID-19 recommendations from the federal CDC, the State of Vermont, and the City of Burlington. This include following all rules regarding facial coverings and social distancing when attending class. If you do not follow these guidelines, I will ask you to leave the class. If you forget

your mask, you cannot enter the class and should go back and retrieve your mask. The [Code of Student Conduct](#) outlines policies related to violations of the Green and Gold Promise. Sanctions for violations include fines, educational sanctions, parent notification, probation, and suspension.”

Attendance and illness/isolation/quarantine:

Some of you may need to isolate during the semester. In that case, the lecture will be streamed live and also recorded on Teams. **Advance notification is required, since lectures are not streamed by default for in-person classes.**

Grading Criteria/Policies:

Undergraduate students:

- Homework 25%
- In-class work: 10%
- Follow -up reading questions: 5%
- Posting correct answers to reading questions: 5%
- Midterm Exams: 30%
- Final Exam: 25%

Grading scale: A-range > 85% B-range: 70% - 84% C-range: 55% - 69% D-range: 40% - 54% F: < 40%

Graduate Students:

- Homework 20 %
- In-class work: 10%
- Additional design, open-ended, context rich problem assignment 15%
- Follow -up reading questions: 5%
- Posting correct answers to reading questions: 5%
- Midterm Exams: 20%
- Final Exam: 25% Includes additional grad -level problems

Grading scale: A-range > 85% B-range: 70% - 84% C-range: 55% - 69% F: < 55%

Assessments (Graded Work):

- Written homework assignments will be due two days after the relevant chapter is discussed in class. (see calendar). The assignments will be scanned and uploaded electronically using the homework link in BB.
- In-class work will be photographed or scanned using a smart phone or tablet and uploaded into Piazza by midnight on the day the class took place
- Reading questions will be submitted in Piazza by

- The mid-terms will be closed book exams, taking place during class time (see calendar). They will consist of problems similar to homework. The final will be a take-home open book exam that will be also uploaded electronically no later than xxx. (Fall exam matrix is not available yet!)
- **Graduate students will be assigned context-rich open-ended problems with increased level of difficulty and mathematical sophistication. Most of these problems will involve reports of physical observation and experimental data.**

Recording Class Sessions:

“Our class sessions may/will be audiovisually recorded for students in the class to refer back to, and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live.”

Research and Citation Help

For help selecting research topics, finding information, citing sources, and more, ask a librarian. Although we're working remotely, we're eager to help. You may ask questions by phone, e-mail, chat, or text, or make an appointment for an individual consultation with a librarian.

Howe Library: <https://library.uvm.edu/askhowe>

Dana Medical Library: <https://dana.uvm.edu/help/ask>

Silver Special Collections Library: <https://specialcollections.uvm.edu/help/ask>

Course Evaluation:

All students are expected to complete an evaluation of the course at its conclusion. The evaluations will be anonymous and confidential, and the information gained, including constructive criticisms, will be used to improve the course.

COVID 19 Policy section

<http://catalogue.uvm.edu/>

The University of Vermont reserves the right to make changes in the course offerings, mode of delivery, degree requirements, charges, regulations, and procedures contained herein as educational, financial, and health, safety, and welfare considerations require, or as necessary to be compliant with governmental, accreditation, or public health directives.

Green and Gold Promise:

The [Green and Gold Promise](#) clearly articulates the expectations that UVM has for students, faculty, and staff to remain compliant with all COVID-19 recommendations from the federal CDC, the State of Vermont, and the City of Burlington.

The [Code of Student Conduct](#) outlines policies related to violations of the Green and Gold Promise. Sanctions for violations include fines, educational sanctions, parent notification, probation, and suspension.

Intellectual Property Statement/Prohibition on Sharing Academic Materials:

Students are prohibited from publicly sharing or selling academic materials that they did not author (for example: class syllabus, outlines or class presentations authored by the professor, practice questions, text from the textbook or other copyrighted class materials, etc.); and students are prohibited from sharing assessments (for example homework or a take-home examination). Violations will be handled under UVM's Intellectual Property policy and Code of Academic Integrity.

Tips for Success (optional):

Course-specific study/preparation tips

Here are a few resources for students on remote/online learning:

- Checklist for success in <https://learn.uvm.edu/about/support-for-students/checklist-online-credit-courses/>
- Academic support for online courses:
<https://www.uvm.edu/academicsuccess/online-learning-student-resources-remote-instruction>

- 30-minute webinar on online learning success (Mar 2020):
https://www.youtube.com/watch?v=Xp_MYsqQyvE

Helpful resources other than the professor (e.g. [Undergraduate/Graduate Writing Center](#), [Supplemental Instruction](#), [Learning Co-op tutors](#), supplemental course materials)

Student Learning Accommodations:

In keeping with University policy, any student with a documented disability interested in utilizing ADA accommodations should contact Student Accessibility Services (SAS), the office of Disability Services on campus for students. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly recommended to discuss with their faculty the accommodations they plan to use in each course. Faculty who receive Letters of Accommodation with [Disability Related Flexible accommodations](#) will need to fill out the Disability Related Flexibility Agreement. Any questions from faculty or students on the agreement should be directed to the SAS specialist who is indicated on the letter.

Contact SAS:

A170 Living/Learning Center;

802-656-7753

access@uvm.edu

www.uvm.edu/access

Important UVM Policies

Religious Holidays:

Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the second full week of classes. You will be permitted to make up work within a mutually agreed-upon time. <https://www.uvm.edu/registrar/religious-holidays>

Academic Integrity:

The policy addresses plagiarism, fabrication, collusion, and cheating.

<https://www.uvm.edu/policies/student/acadintegrity.pdf>

Grade Appeals:

If you would like to contest a grade, please follow the procedures outlined in this policy:

<https://www.uvm.edu/policies/student/gradeappeals.pdf>

Grading:

For information on grading and GPA calculation, go to

<https://www.uvm.edu/registrar/grades>

Code of Student Conduct:

<http://www.uvm.edu/policies/student/studentcode.pdf>

FERPA Rights Disclosure:

The purpose of this policy is to communicate the rights of students regarding access to, and privacy of their student educational records as provided for in the Family Educational Rights and Privacy Act (FERPA) of 1974.

<http://catalogue.uvm.edu/undergraduate/academicinfo/ferparightsdisclosure/>

Promoting Health & Safety:

The University of Vermont's number one priority is to support a healthy and safe community:

Center for Health and Wellbeing:

<https://www.uvm.edu/health>

Counseling & Psychiatry Services (CAPS)

Phone: (802) 656-3340

C.A.R.E. If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (802-656-3380). If you would like to remain anonymous, you can report your concerns

online by visiting the Dean of Students website at <https://www.uvm.edu/studentaffairs>

Final Exam Policy:

The University final exam policy outlines expectations during final exams and explains timing and process of examination period. <https://www.uvm.edu/registrar/final-exams>

Alcohol and Cannabis Statement:

The Division of Student Affairs has offered the following statement on alcohol and cannabis use **that faculty may choose to include, or modify for inclusion**, in their syllabus or Blackboard site:

Statement on Alcohol and Cannabis in the Academic Environment

As a faculty member, I want you to get the most you can out of this course. You play a crucial role in your education and in your readiness to learn and fully engage with the course material. It is important to note that alcohol and cannabis have no place in an academic environment. They can seriously impair your ability to learn and retain information not only in the moment you may be using, but up to 48 hours or more afterwards. In addition, alcohol and cannabis can:

- Cause issues with attention, memory and concentration
- Negatively impact the quality of how information is processed and ultimately stored
- Affect sleep patterns, which interferes with long-term memory formation

It is my expectation that you will do everything you can to optimize your learning and to fully participate in this course.