Physics 880.06 **Condensed Matter Physics I** Prof. Nandini Trivedi
Handout 1 http://w3.physics.ohio-state.edu/∼trivedi 2026 Phys Res Bldg
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Lecture schedule: 10:30-11:18 am on Mondays, Wednesdays and Fridays in SO 0241

Physics 880.06: *Condensed Matter Physics* I is the first of a three-quarter sequence of graduate-level courses whose aim is to teach the central ideas of the physics of matter in the condensed state (both solids and liquids).

Who should take this course?: If you want to do research in condensed matter physics– either theory or experiment, you will make extensive use of ideas developed in this course. Even if you choose another area for research, some of the concepts and techniques that you will encounter in this course are sufficiently general and important to be worth understanding. [See *Handout 2*].

Course structure: I will start by motivating each topic through experiments, then develop the theoretical framework, and finally through hands-on simulations in class help you get a deeper understanding of these topics. You will not be required to write detailed computer programs but instead you will run Java applets to simulate experiments that will help you develop intuition for the topics in the course.

What is condensed matter physics?: The subject brings to bear tools of twentieth century science – quantum mechanics and statistical mechanics– to understand the physical properties of matter, in all its rich variety, in terms of its microscopic constituents.

The central question we will address is **"How do many degrees of freedom – many particles for example – organise themselves? What are the types of organisations or phases that they form? What new properties emerge in these phases?** Little at the atomic scale prepares us for at this rich variety (*e.g.*, the existence and properties of metals, semiconductors, insulators, magnets, superconductors,...). While particle physics and string theory aim to explore the physics of the very small and astrophysics and cosmology the physics of the very large, condensed matter physics is the fundamental physics of the emergence of complexity from constituents or laws that at the elementary level are simple.

Condensed matter physics is a subject of fundamental importance. It has led to the development of new concepts and techniques. It is also tremendously empowering, as it provides the scientific handles that are allowing us to manipulate and control, to an unprecedented extent, the matter that we encounter in our lives.

Textbooks: I have assigned *Solid State Physics* by N. A. Ashcroft and N. D. Mermin and the companion book *Solid State Simulations* by R. H. Silsbee and J. Draeger as the textbooks. In addition, my own lecture notes will be available on the web.

Handout 3 contains list of books that will be on reserve in the Physics-Astronomy Library.

Homeworks: A set of homework questions, will be handed out each week on Wednesdays. Your solutions are to be turned in the following wednesday in class. Go to course website to obtain the *Homework*. You can also reach a useful page, *Course News*, on which I shall post various matters pertaining to the course (*e.g.*, times and locations of office hours and make-up lectures, any typographic errors in homeworks).

Class participation: I encourage you to ask questions in class: not only does this provide me with feedback that will help me to judge whether I'm explaining things clearly, but often you will also be clarifying points for others. Typically, the lectures will be used to introduce and develop the theoretical concepts, and for homework and simulations you will work through examples chosen to illuminate these ideas.

Office Hours: I will have office hours on Tuesdays at 1:30 pm. In my experience, informal discussions in small groups can be extraordinarily rewarding, and I urge you to come to these sessions.

Seminars and Colloquia: Finally, we are fortunate to have a large number of high-calibre seminar and colloquium series here on Campus, and you should try to attend at least some of them regularly. Especially while you are in the process of making the crucial decision of what research field to enter it is very important to hear something about a broad range of fields. You can find out about most relevant seminars and colloquia from the weekly Physics Department calendar. Additionally, I will try to remember to announce interesting seminars, *etc*. You may wish to make a note of the following regular events:

Condensed Matter Physics Theory	M	4018 PRB	11:30 a.m.
Physics Colloquium	T	Smith Seminar room	4:00 p.m.
Biophysics	W	Smith Seminar room	3:00 p.m.
Cold Atoms	W	4018 PRB	11:30 a.m.
Condensed Matter Physics Experiment	Th	Smith Seminar room	11:30 a.m.
NT group meeting: focus cold atoms	F	2015 PRB	12:00 noon