

The University of Western Ontario  
Department of Physics and Astronomy

**Condensed Matter Physics**  
**Physics 9812a**  
Fall 2011

**Lectures**

Monday and Wednesday 10:00 am - 11:30 am, P&A room 233  
First meeting: September 14, 2011, 10am.

**Course Instructors**

Dr. Lyudmila Goncharova (Part one)  
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Department of Physics and Astronomy  
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**Web-site:** You will find details on the course outline, course announcements, posted lecture notes and homework assignments on this web-site.

<http://www.physics.uwo.ca/~lgonchar/courses/p9812/index.shtml>

We can be reached in the office, especially after class, or during office hours (TBA). We can also be reached during the week through e-mail for simple questions, or to make an appointment. I will try to reply to e-mails as soon as can.

**Prerequisites:** Quantum Mechanics. An undergraduate-level courses in Solid State Physics, Materials Science are desirable but not required.

**Recommended books:** (These books will be on a 2-hour reserve in the library.)

M.P. Marder, *Condensed Matter Physics* (2000).

M.A. Omar, *Elementary Solid State Physics: Principles and Applications* (1993)

Ch. Kittel, *Introduction to Solid State Physics* (any edition, the newest ones are not necessarily the best).

Ashcroft and Mermin, *Solid State Physics* (1976).

**Assignments and Grades**

Course requirements will include 2 homework assignments (each of them contributes 15% of the grade). Since people usually "learn by doing," the homeworks are an extremely important part of the course experience. A little discussion among your classmates and looking through books is permitted and even encouraged, but the write-up must be your own work.

9/12/2011

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There will be a midterm exam (30% of the grade, late October), a final exam (40% of the grade). Assignments and their deadlines will be posted on the web site.

Assignments must be turned in at the requested day before 6pm. Penalty points may be applied, if you are late more than one time.

The Department of Physics and Astronomy may, in rare cases, adjust the final course marks in order to conform to Departmental policy.

## Course Material

### Part I

1. Crystal Lattices; The Reciprocal Lattice; Experimental Determination of Crystal Structure
2. Complex Structures (surfaces, nanostructures, liquids, liquid crystals, polymers and quasicrystals)
3. Lattice vibrations; Neutron Scattering
4. Electron Theory in Metals; Band Theory
5. Transport Phenomena in Solids (Metals, Semiconductors, Devices)  
Additional advanced topics to be covered:
  - Scanning and Transmission Electron Microscopy
  - Nanofabrication methods: lithography, focused ion beam milling

### Part II (will include but would not be limited to):

6. Optical Properties of Solids
7. Ferroelectricity and Structural Phase Transitions
8. Magnetism and Superconductivity

### Other General Reference Books and Materials:

1. O'Reilly, *Quantum Theory of Solids*, (2002) - a nice shorter, lighter, paperback
2. Kaxiras, *Atomic and Electronic Structure of Solids*, (2003).
3. Zangwill Andrew, *Physics at Surfaces*, (1996).
4. Taylor P.L., *A Quantum Approach to the Solids State*, (1970)
5. Burns G., *Solid State Physics*, (1985). – older book, but good pedagogical clarity

### Advance and Specialized Reference Books:

1. Taylor and Heinonen, *A Quantum Approach to Condensed Matter Physics* (2002).
2. Callaway, *Quantum Theory of the Solid State* (2nd Edit., 1974).
3. Ibach and Lüth, *Solid State Theory* (1991).
4. Philips, *Advanced Solid State Physics* (2003).
5. Kohanoff, *Electronic Structure Calculations for Solids and Molecules* (2006).

### Plagiarism:

Scholastic offences are taken seriously and you are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

<http://www.uwo.ca/univsec/handbook/appeals/scholoff.pdf>

Students must write their assignments on their own. Students must acknowledge cited text by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar).

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A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Record's Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found here:

[https://studentservices.uwo.ca/secure/medical\\_document.pdf](https://studentservices.uwo.ca/secure/medical_document.pdf)

**Accessibility Statement**

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.