

Physics 653/753-2E

Solid State Physics I

Fall, 2006

TTH 2:00 - 3:15 pm

Rm. 304 Campbell Hall

Textbook: Condensed Matter Physics (Corrected edition)
by Michael Marder, Wiley-Interscience (2000)

Instructor: Harrison

Office: 308 CH

Hours: 2:30 - 3:30 pm MWF

e-mail: jgharrison@uab.edu

Course Website: <http://homework.phy.uab.edu/~harrison/phys753>

Grading: Exam I (15%)

Exam II (20%)

Homework (25%)

Project (15%)

Final Exam (25%)

Thu., Dec. 14, 1:30 - 4:00 pm

TOPICS: Electronic Structure, Schrodinger Equation and Symmetry, Nearly-Free and Tightly-Bound Electrons, Energy-Band Structures, Cohesion of Solids, Phonons, Electron Transport, Microscopic Theories of Conduction, Electron-Phonon Coupling, Superconductivity

Grading Scale: 100 - 90 A, 89 - 80 B, 79 - 70 C, < 70 F

Course Objectives: The objectives of the course are to provide the graduate student with knowledge of - and certain problem-solving skills in - the area of solid state physics beyond the undergraduate / introductory level. To a certain extent, this course can be regarded as a follow-on applications course in quantum mechanics since most of what we will be discussing uses concepts and methods of quantum theory. So it is assumed the student has had a course in quantum mechanics at least at the undergraduate level. The topics are foundational, intended to provide the basis for more advanced study. This course involves a special-project component designed to give the student more exposure to "real-world" systems by the use of simulation / computation. In addition, the student is encouraged to employ some of the free software packages listed in the Project Assignment section to numerically solve and visualize some of the problems discussed in the text.

Syllabus: The syllabus is tentative. You are responsible for any changes announced during the lecture period, such as changes in exam dates or chapters to be included.

Week	Tue	Thu	Assignment	CH	Due
Aug.20	1.1 – 1.3; 2.1 – 2.2	2.2, 2.5; 6.1 – 6.3	4*, 5*	1	Aug. 29
27	6.3 – 6.5; 7.1 – 7.2	7.2 – 7.3; 8.1 – 8.2	1*, 3*, 6, 7	2	Sep. 7
Sep. 3	8.2 – 8.4	8.4; 9.1 – 9.2	2*, 3*, 4*, 8	6	
10	9.2 – 9.3	10.1 – 10.3	1*, 3*, 5 (let $\hbar = 1$)	7	Sep.12
17	10.3; 11.1 – 11.3	11.3 – 11.5	1*, 3*, 5*, 6	8	Sep.19
24	11.6 – 11.7	Exam 1 (1,2,6 - 9)	1*, 2*, 3, 4*, 5	9	
Oct. 1	13.1 – 13.2	13.2 – 13.3			
8	13.3 – 13.5	13.5; 16.1 – 16.4			
15	16.4 – 16.5	18.1 – 18.3			
22	18.3 – 18.4	18.4 – 18.5			
29	27.1	27.1 – 27.2			
Nov. 5	27.2	Exam 2 (Ch. 10-11,13, 16,18)			
12	27.2	27.2			
19	27.3	NO CLASS			
26	27.3	27.3			
Dec. 3	Project Reports	NO CLASS			
10	NO CLASS	Final Exam			

Project Assignment

Goal: To apply packaged computational tools for solving problems in condensed matter physics. Numerous open-source packages are employed in current research. Most can be downloaded for use on Windows and/or Linux machines. These include PWScf (www.pwscf.org), LmtART (www.physics.ucdavis.edu/~mindlab) and Abinit (www.abinit.org). Access is also available to commercial, licensed software (Crystal-03 and Vasp) is available on the Alabama Research and Education Network (AREN).

Assignment: You will be provided a list of ideas for possible problems that you can solve numerically. You will work as a group and the group must come to a consensus as to which problem to solve. A title, abstract and brief outline of your project must be submitted by 5pm, Oct. 6.