

PHZ7427-16F9(17982) - Solid State 2

Spring 2021

Lectures

Lectures will take place every Monday, Wednesday, and Friday from January 11 through April 21 **except** January 18 (Holiday) and January 25 (conference). Classes will be held 7th period (1:55–2:45 p.m.) on zoom.

Instructor

Xiaoguang Zhang
Office: NPB 2332
email: xgz@ufl.edu
tel: 352.392.6971

Office Hours: Mon 1 p.m.–1:55 p.m.

Course Overview

PHZ 7427 is a continuation of PHZ 6426 (Solid State I).

Main Text:

Ashcroft and Mermin "Solid State Physics", Brooks/Cole, Cengage Learning, 1976

Supplementary Texts:

- Charles Kittel "Introduction to Solid State Physics", 7th Edition, John Wiley, 1996
- Charles Kittel "Quantum Theory of Solids", 2nd Edition, John Wiley, 1987.
- Joseph Callaway "Quantum Theory of the Solid State", 2nd Edition, Academic Press, 1991. (The "Student Edition" is a simpler, lower level version, but is also an interesting read if you want to quickly know what solid state physics is about)
- P. M. Chaikin and T. C. Lubensky "Principles of Condensed Matter Physics", Cambridge University Press, 1995.
- J. M. Ziman "Electrons and Phonons", Oxford University Press, 1960.
- R. H. Silsbee and J. Dräger "Simulations for Solid State Physics", Cambridge University Press, 1997.

Prerequisites

Graduate-level quantum mechanics and statistical mechanics (and to a lesser extent electromagnetism), and Solid State I.

Homework

There will be a homework set approximately every two weeks. The homework is your best opportunity to learn the material in depth. If at all possible, do the homework entirely on your own. Only if you are hopelessly stuck is it alright to seek help from the instructor or other students. Any help must be explicitly acknowledged at the end of the corresponding problem. In that case you will not be penalized for having received help.

Topics to cover (subject to change)

- Diamagnetism and paramagnetism. *AM Ch. 31.*
- Electron-electron interaction and magnetic structure. *AM Ch. 32.*
- Magnetic ordering. *AM Ch. 33.*
- Electron-phonon interaction. *Notes.*
- Superfluidity. *Notes.*
- Superconductivity: conventional superconductors. Phonon mechanism of Cooper pairing. Landau-Ginzburg equations. Electrodynamics of superconductors. Elements of the BCS theory. *AM Ch. 34+Notes.*
- Unconventional superconductivity. Kohn-Luttinger effect. p- and d-wave pairing. HTC cuprates and pnictides. *Notes.*
- Fermi liquid theory. *Notes.*
- Spin-orbit interaction in solids. Fundamentals of spintronics. *Notes.*
- Topological phases

- Quantum effects in transport. Weak localization. Aharonov-Bohm effect. Universal conductance fluctuations. Anderson localization. Altshuler-Aronov effect. Kondo effect. Coulomb blockade. Transport in ballistic devices. Landauer formula. Integer Quantum Hall Effect. *Notes.*

Attendance Policy, Class Expectations, and Make-Up Policy

Students are expected to attend every class.

Grades and grade points

The final grade will be based on:

Homework 80%

Research paper 20%

Research paper is due on April 19.

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

[UF Graduate Catalog](#)

[Grades and Grading Policies](#)

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the [Disability Resource Center](#). It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Click here for guidance on how to give feedback in a professional and respectful manner. Students will be notified when the evaluation period opens, and can complete evaluations through the email

they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via ufl.bluera.com/ufl/. [Summaries of course evaluation results are available to students here.](#)

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” [The Honor Code](#) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see the [Notification to Students of FERPA Rights](#).

Campus Resources:

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or police.ufl.edu.

Academic Resources

[E-learning technical support](#), 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.

[Career Resource Center](#), Reitz Union, 392-1601. Career assistance and counseling.

[Library Support](#), Various ways to receive assistance with respect to using the libraries or finding resources.

[Teaching Center](#), Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

[Writing Studio](#), 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

[Student Complaints Campus](#)

[On-Line Students Complaints](#)

Course Summary:

Date	Details	
Mon Jan 25, 2021	Assignment Homework 1	due by 11:59pm
Wed Apr 21, 2021	Assignment Presentation	due by 11:59pm
Fri Apr 30, 2021	Calendar Event University of Florida GatorEvals – Spring 2020 Assignment Homework 2 Assignment Homework 3 Assignment Homework 4 Assignment Homework 5	11:59pm

Course Status

January 2021

Calendar						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
27 December 2020 27 Previous month	28 December 2020 28 Previous month	29 December 2020 29 Previous month	30 December 2020 30 Previous month	31 December 2020 31 Previous month	1 January 2021 1	2 January 2021 2
3 January 2021 3	4 January 2021 4	5 January 2021 5	6 January 2021 6	7 January 2021 7	8 January 2021 8	9 January 2021 9
10 January 2021 10	11 January 2021 11	12 January 2021 12 Today	13 January 2021 13	14 January 2021 14	15 January 2021 15	16 January 2021 16
17 January 2021 17	18 January 2021 18	19 January 2021 19	20 January 2021 20	21 January 2021 21	22 January 2021 22	23 January 2021 23
24 January 2021 24	25 January 2021 25 Click to view event details	26 January 2021 26	27 January 2021 27	28 January 2021 28	29 January 2021 29	30 January 2021 30
31 January 2021 31	1 February 2021 1 Next month	2 February 2021 2 Next month	3 February 2021 3 Next month	4 February 2021 4 Next month	5 February 2021 5 Next month	6 February 2021 6 Next month

Assignments are weighted by group:

Group	Weight
Assignments	80%
Research Paper	20%
Total	100%