

## Syllabus PHY4905

### PHY 4905 — Superconductivity— Fall 2020

**Class Hours:** MWF, Period 4 (10:40 - 11:30 am), Room: none (class will be taught remotely/synchronous). Class Number: 27205

**Instructor:** G. R. Stewart, Office NPB 2132, phone 392-9263, e-mail

[stewart@phys.ufl.edu](mailto:stewart@phys.ufl.edu), **Office Hours:** Via email, or by appointment in Zoom. Prof. Stewart is available for question and discussion via email 7 days/week. He is usually online 14 hours/day. **Technology needed:** a decent connectivity speed and a microphone on the home computer. A webcam is useful but not required. If you experience problems, contact Prof. Stewart's email or the UF Computing Help Desk at 352 392-4357 (HELP).

**Course Description:** 1.) hold lectures using Zoom sessions during the assigned class period, where the (short) Powerpoint lectures have been viewed as a homework assignment *before* class by the students. Discussion by the students during these sessions is a major component. 2.) besides requiring watching the lectures before class as part of the homework, set out starred (\*\*\*) questions in red in the powerpoint lectures where students do additional thinking/reading so that they can contribute to the discussion in a later Zoom class. Recommended literature will be assigned to help discussion at least once/week. 3.) a few experiments will be recorded and played back during special lectures.

The idea is that we meet on Zoom each class period (MWF at 10:40 am). On the first class meeting (Aug. 31, Monday) we will go over how the class works, and discuss the subject matter of Superconductivity. Starting Wednesday, Sept. 2, you will have completed your assignment for that day (which is to watch the short Powerpoint Lecture #1). During class, we will discuss the content of that Powerpoint lecture, clear up any questions, and supplement the material in the Lecture with other content pertaining to what was covered. And so on through the semester. Starting in Week 10, students will present prepared slides for a 15 minute lecture (share screen in the Zoom chat room) on a subject of their choice, agreed upon in advance by Prof. Stewart. Just like for a regular lecture, the presentation slides should be provided to Prof. Stewart a week ahead of time so that he can post them on the class Canvas page so that the other students can look at the slides and prepare questions/comments ahead of time.

**Education Objectives and Learning Outcomes:** By the end of the semester, students will have accumulated knowledge about a range of topics in superconductivity, including:

- Fundamental properties of superconductors such as  $\rho$ ,  $C/T$ , critical field and current, tunneling, energy gap, pairing mechanisms, . . .
- An understanding of the BCS theory of superconductivity
- An appreciation of which materials (elements, alloys, compounds) superconduct and an understanding of some of their differences.
- Dimensionality's effect on superconductivity
- "High"  $T_c$  superconductivity: cuprates, iron based, hydrides under high pressure

**Prerequisites:** This course requires that you have studied Newtonian mechanics in a previous calculus-based physics course such as PHY2048, as well as electricity and magnetism in PHY2049. In addition, Modern Physics, PHY3101 would be useful but is not absolutely required. Students must be at least co-registered in a vector calculus course (Calc 3).

**Course Schedule:** The class revolves around the schedule laid out in the 15 Modules on the Canvas web site for the class, see the Canvas website:

<https://ufl.instructure.com/courses/404047>

**Grading: Attendance: 20% (3 unexcused absences allowed, after that -2% for each miss; more than 13 absences=a grade of incomplete\*)** (Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.); **Participation in the discussions during the Zoom lectures and occasional homeworks: 20% (10% for the discussions/10% for the homeworks); Tests (1 midterm and 1 final, each 20%); Presentation on a subject during class, with the subject matter being agreed upon ahead of time between the student and Prof. Stewart: 20%. **Grades will be updated on Canvas weekly.****

**\*Some level of absences may be made up by extra work by the student, to be assigned by Prof. Stewart**

The final exam given on Friday, Dec. 18, at 7:30 - 9:30 am (date and time assigned by the registrar) online using Honorlock. The midterm (also using Honorlock) will be given Wednesday, Oct. 14, during the normal class period 10:40-11:30 am.

**Homework/Grading Scale:** Occasional written homeworks to supplement the lectures will be assigned during the semester. Unless otherwise announced homework will be due (electronically sent to [stewart@phys.ufl.edu](mailto:stewart@phys.ufl.edu)) each Monday by 10:40 am. Late homework is not allowed, as solutions will be posted ([eLearning](#) site, or Canvas) after the homework is turned in. You will get to drop your lowest homework score. If you miss a homework because of, e. g. illness or U of F mandated travel, that will count as your drop. *However*, in the event you are out of town for U of F mandated travel, you may email your homework by that Monday, 10:40 am.

The two Exams will be given using Honorlock, open notes but not open web. The anticipated letter grade scale is A: 85%; A-: 81%; B+: 77%; B: 70%; B-: 65%; C+: 60%; C: 50%; C-: 45%, D+: 40%; D: 35%; D-: 30%; E: <30%.

**Makeup:** For anyone missing the midterm due to an excused absence (illness with doctor's note, organized U of F activity requiring your presence elsewhere), the cumulative final test score will substitute for that grade. Only students with an officially excused absence may use this procedure. Students missing the cumulative final exam will receive an incomplete (which has the effect of getting an 'E' in the class).

**Course Evaluation:** Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://gatorevals.aa.ufl.edu/>. Evaluations are typically open during the last two or three weeks of the semester. 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 <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

**Textbook:** This is a very broad field and there is no single book – the basic course material is contained in the 25 (relatively short) Powerpoint lectures and in the discussion each class period in the Zoom room. However, additional reading will be offered throughout the semester to deepen the students' understanding of the concepts. Also, see below:

**Other books and resources:**

- E. A. Lynton, Superconductivity (available on the Internet Archive <https://archive.org/details/in.ernet.dli.2015.205980/page/n7/mode/2up> )
- Charles Kittel, Solid State Physics, Chapter 10 (37 good pages)
- Any introductory book on Superconductivity that you can find and is at a level comfortable for you, e. g. Fundamentals of Superconductivity Authors: **Kresin**, Vladimir Z., **Wolf**, Stuart (expensive)
- Short Intro to Superconductivity on the web: <https://pdfs.semanticscholar.org/a3b7/bcf0e6dae6de55aa24d30651fcc9249447f5.pdf>

**Outside Help Services:** The Teaching Center in Broward Hall (tel. 392-2010) offers a range of free services, including individual tutoring in physics. Teaching Center services are operating remotely this Fall. Their appointment tutoring services are available online at <https://teachingcenter.ufl.edu/tutoring/appointments>. A list of Physics tutors, for hire, is kept by the Physics Dept. undergrad advisors, see Profs. Biswas, Lee, Hershfield.

**Academic Support Services** are found at <https://ufonline.ufl.edu/resources/academic-support/>

**Student Support Services** are found at <https://archive.catalog.ufl.edu/ugrad/1112/support/info/student-services.html>

**Accommodations:** Students requesting accommodations (extra time on tests) must first register with the Disabilities Resources Program, located at 0001 Building 0020 (Reid Hall), phone 352-392-8565. The Disabilities Resources Program will provide documentation to the student, who must then deliver this documentation to the instructor when requesting accommodations.

**Academic Honesty:** All University of Florida students are required to abide by the University's Academic Honesty Guidelines and by the Honor Code, which reads as follows: *We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity. 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."* Cheating, plagiarism, or other

violations of the Academic Honesty Guidelines will not be tolerated and will be pursued through the University's adjudication procedures.

**Counseling and Wellness Center:** Contact information for the Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc/Default.aspx>, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

**Covid Statements:** The University mandated inclusion of statements for classes meeting FTF, which does not apply to this class. Second, the University mandated a privacy statement for classes which record their online meetings (“Virtual classes in which class meetings are recorded”), which our class does not do. However, this second statement would apply to anyone attending our Zoom class meetings: they should not record anyone else’s comments. “As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.”