

# PHYS 642 Topological Phase of Matter

---- Fall 2022

## Instructor Information:

- Instructor:** Prof. Ruixing Zhang, Physics & MSE
- Office:** 203 South College
- Email:** [ruixing@utk.edu](mailto:ruixing@utk.edu) or, via the Canvas message system
- Class Location:** IAMM 310
- Class Time:** Tuesday and Thursday, 1:10 pm – 2:25 PM;
- Office Hours:** Tuesday 2:30 – 3:30 PM, @IAMM 310
- Communication:** The majority of classroom communication will be conducted via the Canvas for this class. To ensure prompt response from me, follow the email policy:
- Please put “**Course #**” (i.e. PHYS 642) in the subject line of all course related emails. This practice will help me identify course related emails and respond promptly.
  - You can expect up to a 24-hour delay in responding to emails; I will try to minimize such delays, but do not email me on the evening an assignment is due or before an exam expecting an immediate response.
  - Before emailing me with questions about the course, please ensure that the information is not already provided in the course syllabus or on Canvas.

## Course Description & Goals:

### Reference:

There is no standard textbook for this course. The following ones can serve as good references, while a lot of times, we will refer to some review or research articles as well.

[1] Topological Insulators and Topological Superconductors by B. Andrei Bernevig

[2] A short course on topological insulators by János K. Asbóth, László Oroszlány, András Pályi

[2] Topological Insulators by Shun-Qing Shen

**Course Overview:** This is a 3 credit-hour advanced graduate course on the topological phases of matter. This course will cover the following topics: Su-Schrieffer-Heeger model, Berry phase and Chern number, time-reversal-invariant topological insulators, topological

superconductors and Majorana physics. If time permits, I also plan to talk about a few advanced topics including toric code model, topological quantum chemistry, etc.

**Pre/corequisites:** Knowledge of graduate-level quantum mechanics and solid-state physics (especially electronic band theory) is **required**. Familiarity with group theory would be helpful, but not required. No prior knowledge of topology theory is needed.

## Grading & Evaluation:

**Homework Assignments (50%):** Problem sets and exercises will be assigned at regular intervals.

The assignments will be turned in during class on the indicated due date. If an assignment is turned in late, I will reduce the mark by 25% for each 24-hour period it is overdue (unless you have made prior arrangements to turn the material in at a later time).

**Final Project (50%):** There is no exam in this course. A final project will be assigned that includes both a term paper (30%) and an in-class presentation (20%). Detailed information about the final project will be announced later.

**Deadline for term paper: 12/06/2022.**

**Final presentation: 1:10 pm @12/06/2022, IAMM 310.**

**Make-up Policy:** If a known conflict exists you should contact me at least **two weeks** in advance to make alternate arrangements.

## Grading Scheme:

**Grades:** Your grade is calculated based on many elements of the course. See the table below for details on this.

Course Element	%
Homework	50%
Term Paper	30%
Final Presentation	20%
Total	100%

**Letter grade will be obtained using the conversion below:**

<b>%</b>	<b>Grade</b>
>90%	A
87% - 89%	A-
83% - 86%	B+
80% - 82%	B
77% - 79%	B-
73% - 76%	C+
70% - 72%	C
67% - 69%	C-
63% - 66%	D+
60% - 62%	D
57% - 59%	D-
<56%	F

**Other Information:**

**Class Rules:** Students need to follow the following guidelines and class room etiquette in order to ensure a positive and respectful learning environment for everyone:

- **Be respectful:** Act in a matured/polite manner and be respectful of the learning process (See the rules posted on Canvas).
- **Raise your hand:** If you have a question or comment during the class, please raise your hand.
- **Share the air:** If you have been dominating the discussion or participating disproportionately, let others participate. Alternatively, if you haven't said much, you are encouraged to participate more.
- Please use **respectful and (socially) inclusive language**.

**Group work policy:** I encourage students to work together and discuss the homework with each other. Such discussions are one of the most effective ways of assimilating the material. The

work you turn in must be written up by you and **NOT** be a copy of your peers' work or some other source such as solutions found on the Internet. **Any homework assignment that is a direct copy of another person's work without attribution will count as plagiarism and will be dealt with accordingly. Do not take advantage of the work of other people, and do not let anybody benefit from yours.**

**Your Feedback/Suggestions on the course:** You are encouraged to provide feedback on any aspect of the course all through the semester using any communication method you prefer. Your **grades will not be impacted by any feedback** you provide, they will be purely based on your coursework and lab work. However, your discretion in these matters is expected. You will also have an opportunity to give feedback at the end of the semester through the Course Evaluation System. Your feedback is critical in improving the course!

## Students with Disabilities:

If you need course adaptations or accommodations because of a documented disability, please contact the Student Disability Services (SDS). This will ensure that you are properly registered for the services provided by SDS. University Policy forbids me from making special accommodations without a letter from the Office of Student Disability Services.

## Disability Services Contact Information:

2227 Dunford Hall

Knoxville, TN 37996-4020

Phone: (865) 974-6087

Fax: (865) 974-9552

Email: [sds@utk.edu](mailto:sds@utk.edu)

Website: <https://sds.utk.edu/>

## Campus Syllabus

The campus syllabus provides additional important information, including academic integrity, UT alerts, wellness, etc. The campus syllabus can be found via

<https://utk.instructure.com/courses/55015/pages/ut-knoxville-campus-syllabus-%7C-2022-2023>

## COVID-19 Guidelines

### Masking

According to public health authorities, in areas where there is substantial or high COVID transmission, wearing masks in indoor spaces can help reduce transmission of the virus and keep communities healthy. Any individual can choose to wear a mask anywhere on campus, even when

it is not required. The university expects everyone to protect others from the spread of COVID-19 and strongly recommends wearing masks in academic and administrative spaces.

For the most current information on masks, please check the COVID-19 website at [utk.edu/coronavirus](https://utk.edu/coronavirus).

### **Vaccines**

The university recommends that all members of the campus community be vaccinated for their own protection, to prevent disruption to the semester, and to prevent the spread of COVID-19. Vaccination information and appointment signups are available at [tiny.utk.edu/vaccine](https://tiny.utk.edu/vaccine). The Student Health Center medical staff is available to students to answer questions or discuss concerns about vaccines, and the center provides vaccines free of charge for anyone 18 years or older who would like one.

### **Sickness or exposure**

If students think they are sick or have been exposed to COVID-19, they should contact the Student Health Center or their preferred health care provider. Students can also contact the university's COVID-19 support team for guidance by filling out the COVID-19 self-isolation form at [covidform.utk.edu](https://covidform.utk.edu). Students are advised not to attend class in-person if they have tested positive for COVID-19 and are in the isolation period, if they have COVID-19 symptoms and have not been cleared by a medical provider, or if they are an unvaccinated close contact in the quarantine period. The university recommends that students and employees stay home anytime they do not feel well. If you need to miss class for illness, please contact your instructor.

**You must not attend class if you have tested positive for COVID-19 and are in the isolation period, if you have COVID-19 symptoms and have not been cleared by a medical provider, or if you are an unvaccinated close contact in the quarantine period.**

**If you need to miss class for illness, contact me immediately via [ruixing@utk.edu](mailto:ruixing@utk.edu).**

### **DISCLAIMER**

The instructor reserves the right, when necessary, to alter the grading policy, change examination dates, and modify the syllabus and course content. Modifications will be announced in class. Students are responsible for announced changes.

**Good luck and have a great semester : )**