

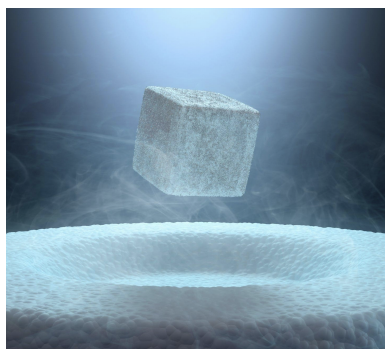
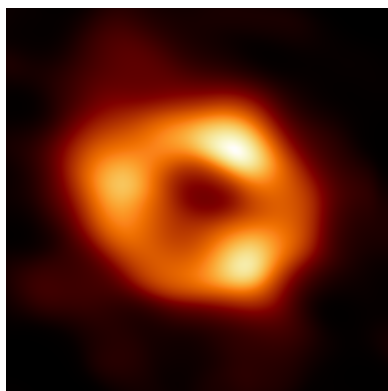
**Physics 106: Gravitation to levitation: physics of supernova to
superconductor
Room: 103, Summer Course**

Professor: Prof. Savan Kharel (he/him)
Email: skharel@uchicago.edu

Office: KPTC 310, 9:00 A.M- 3:00 PM

Textbook: No class like this can be captured in one textbook.
Here are some references, but no need to purchase any of it:

- **The Character of Physical Law**
 - Author: Richard Feynman
 - Publisher: The MIT Press; Reprint edition
- **Physics for Future Presidents: The Science Behind the Headlines**
 - Author: Richard Muller
 - Publisher: Norton
 - ISBN: 978-0939337112
- **On the Origin of Time: Stephen Hawking's Final Theory**
 - ISBN: 978-1911709084
- **The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory**
 - Author: Brian Greene
 - Publisher: W. W. Norton & Company
 - ISBN: 978-0393338102
- **Dreams of the Final Theory: The Scientist's Search for the Ultimate Laws of Nature**
 - Author: Steven Weinberg
 - Publisher: Pantheon Books
- **Articles from Diverse Scientific Journals**
 - Sources: Physics Today, Science, Nature, etc.
 - Description: These journals feature articles on new discoveries, theoretical advances, and reviews in physics.
- **Professor's Notes**
 - Description: Notes compiled by a professor, encompassing lecture content.
- **OpenStax Physics**



- Link: <https://openstax.org/details/books/physics>
- Description: A freely accessible, comprehensive introductory textbook that covers fundamental physics concepts, suitable for both high school and early college students.

Office Hours: TBD

Class Information

Course Description

This course provides an introductory exploration of the fundamental forces and their diverse applications. It covers essential topics such as gravity, electromagnetism, light, particle physics, and quantum mechanics. The curriculum highlights the universality of physical laws and demonstrates how these principles illuminate a broad spectrum of phenomena, from black holes and biology to superconductors and supernovae. The focus is on developing a robust conceptual understanding of physics and connecting these concepts to contemporary research. Students will engage with pedagogically appropriate scientific papers, enhancing their learning experience. The teaching approach is inclusive and interactive, designed to accommodate and benefit all students.

What is the Character of Physical Law?

Some physicists peer through telescope to see the largest scale of the universe. Some use particle accelerators to detect the smallest particles such as quarks and gluons. Some physicists are interested in developing quantum computers while others are interested in understanding the quantum nature of black holes. Physics can enrich the life you live. In this course, we will study topics that will give you a glimpse of the extraordinary world of physics. I envy you; I was once in your shoes. How thrilling and exciting to embark in the journey to study the laws of the universe!!!

Workload

The class meets five times a week. We will integrate lectures and use interactive tools that promotes classroom engagement. The class period will provide opportunities for students to learn from one another as well as the instructor. I expect students to read the assigned materials before the class. I also expect to show you some interesting demonstrations and videos. Assigned material could either come from chapters in the textbook or other materials. There will be a reading reflection

that is due before every class. Moreover, there will be written homework assignment that is due. Afternoon session will be devoted to problem solving, labs, activities, and just thinking about the universe.

Learning Outcome

At the end of the class, you should be able to:

- understand how laws of physics applies to phenomena in the world.
- apply basic mathematical tools to physics problems and use approximations and estimations to simply complex problems.
- transfer knowledge of physics to other disciplines like biology, chemistry, and other dimensions of human life.
- identify connections between the discipline of physics and human society.
- **understand and abide by the principle of academic integrity in the context of a physics course.**

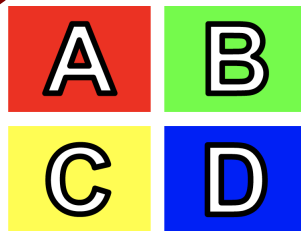
Technology

Canvas

Please make sure you are checking your canvas regularly. All announcements will be made there and I will also be uploading course materials and assignments.

ABCD card

I will use ABCD cards to get feedback on conceptual question during class. It is your responsibility to bring it with you to every class. If you lose it print it from the canvas site.



Whiteboard

For in class group work, I will be providing whiteboard soon. Please stay tuned.



Assessments

Class Participation (5%) and reading reflection (5%)

- During class, we will review physical principles, discuss conceptual and quantitative physics problems, and address questions from your reading reflections. Every week, you will have an opportunity to write your reading reflections, watch youtube video, and/or read an academic paper. This will be posted on canvas.
- **You are not allowed to use phones and computers during the classroom.** Studies show that multitasking during class time is detrimental for your learning and class performance. These studies furthermore show that multitasking distractions in class also disrupt your classmates learning. Therefore, out of consideration for everyone, as well as to maximize your own learning, cell phones, laptops may NOT be used in class, and should be put away in your bag. If there are special circumstances that absolutely require the use of these items in class, please speak to me ahead of time. **Using phones and computers room without prior notification to me would hurt your participation grade.**
- You are expected to attend class lectures. Attendance will be taken periodically. If you miss these attendance, it will hurt your grades.

Group Presentations (30%)

We will have two group presentations

Homework Assignments and exam (30%)

Developing problem solving skill is the central objectives of this course. There will be a variety of problems in the homework ranging from conceptual problems to longer quantitative problems. I

strongly encourage you to think about the problems and attempt it yourself before working with others. Of course, I invite you to work with others and seek assistance from me and the teaching assistants. You will be required to upload a pdf scan of your work to Canvas. **I will NOT accept late homework unless there is a documented excuse.** Homework will be due on Monday 11:00 PM of each week.

There will be a mid-term exam!

Application of Physics to Community and the world (10%)

In this project, you will get a chance to showcase your interest and connect it with physics. The project could range from a video project to a written essay. More details will be provided!

Laboratories (20%)

This course includes a laboratory component that is designed and taught by the Department of Physics laboratory staff.

Extra Credit Assignment (Reflections of Physics and Physics Blog)

An extra credit problem will be assigned. It is voluntary. (see canvas)

Diversity, Equity, and Inclusive Policies

Academic Integrity: Please hand in work that is your own and cite or give credit when you use somebody else's work. Review the university of Chicago policies for academic integrity. Suspected violations of academic integrity will be reported to the Dean of Students. **Assignments with "any" plagiarized elements will receive a zero.** There will be an assignment in canvas about academic integrity in the classroom in the context of Physics for future president course!

Student Disability Services: Please contact SDS (disabilities@uchicago.edu) to set up accommodations for this course. All information will remain confidential.

Inclusive Learning Environment: This class will be an inclusive community, learning from the many perspectives that come from having differing backgrounds and beliefs. As a community, we aim to be respectful to all. I will conduct a class where we reject all forms of prejudice and discrimination, including but not limited to those based on age, color, disability, gender, gender identity, gender expression, national origin, political affiliation, race, religion, sexual orientation, and veteran status. Students are expected to commit to creating an environment that facilitates inquiry and self-expressions, while also demonstrating diligence in understanding how others' viewpoints may be different from their own. I will do the same and try to bring the best out of all of you

Multilingual Students: If English is not your first language, please do not hesitate to contact me. I will try my best to accommodate you.

Personal Pronouns: If you prefer to be called a different name than what is on the class roster, please let me know. Feel free to correct me on your personal pronouns.

Very Tentative Class Schedule and Reading *

Date	Class	Activity
June 16	Forces Basics	Introduction to Experimental Physics
June 17	Forces Fundamentals	Problem Solving/Pres. Prep
June 18	Energy Fundamentals	Problem Solving/Pres. Prep
June 19	Holiday	No Class
June 20	Electricity and Magnetism: Fundamentals	Pendulums and the Scientific Method
June 23	Group Presentation	Cratering
June 24	Gravity and Blackhole (Hawking Radiation?)	Problem Solving/ Presentation Prep
June 25	Guest Lecture: Roy Zhao (Cosmology)	Problem Solving/Pres. Prep
June 26	Field Trip (Tentativae)	
June 27	Neutrino, Dark Matter, and Baryogenesis	Solar Absorption Spectrum I: Diffraction
June 28	Waves	Problem Solving/Pres. Prep
July 1	Presentation: Neutrinos?	Solar Absorption Spectrum II: Fraunhofer L
July 2	De Broglie Wavelength	Problem Solving/Superconductors
July 3	Group Presentation	

Table 1: Tentative Class Schedule

*These are tentative dates. I will inform you of many inevitable changes throughout the semester. If there is a change in exam date, I will announce it at least a week ahead of time.