Computational Physics Lab II
Winter 2025

Instructor
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Office: Weniger 485

Learning Assistants
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Course Credits
1

Class Meetings
Monday/Wednesday 2:00-3:20pm
Weniger 328

Office Hours
I would be happy to meet with you to chat about anything related to the course, from looking over your code to chatting about how your coursework is going overall. Office hours went largely unused in the fall, but many students made appointments to chat at a time that worked better. For that reason, there will be 1-on-1 meetings available by appointment, both in person and virtually. You are also welcome to drop by my office unannounced to chat if the door is open. For appointments:

- You can schedule a 30-minute meeting with me here: https://calendly.com/hamerski
- Email me for longer appointments if needed, or to ask any other questions.

Required and Recommended Courses

PH 213 and PH 365 are prerequisites. There are no corequisites.

If you are a physics major, this course is recommended but not required to be taken alongside PH 422 and PH 425 -- some activities may align with material from these courses.

Course Description

This is a project-driven laboratory experience in computational physics. We will learn common numerical, statistical, and mathematical methods used in physics, and apply them to several physical phenomena and data sets. We will primarily use the Python programming language in a Jupyter notebook interface. Topics to be covered will coordinate at times with PH 422 and PH 425. This course is the second in the sequence of computational physics lab courses, PH 365, 366, and 367.

Learning Goals

1. Build conceptual knowledge of algorithms and numerical methods commonly used in physics

2. Apply numerical methods to physics problems using computing tools in Python
3. Compare and analyze the precision, efficiency, and effectiveness of different computational approaches for solving physics problems
4. Create computational models of physics phenomena using intermediate data visualization tools
5. Apply statistics and modeling principles to data sets and use findings to draw insights about physics phenomena
6. Communally develop best practices for writing code, sharing it with peers, and using external resources

Course Activities

You are expected to bring laptops (if you have one) to each class meeting. We have extra laptops stored in the classroom for anyone who forgets or who does not own a laptop. We will primarily use Jupyter for coding activities, and instructions for accessing those can be found in the **Anaconda Setup** file on Canvas. We will also use our course Canvas page to organize course materials and submit in-class assignments.

During class, you will work collaboratively on computing assignments where you will learn how to program in Python and apply computing tools to physics problems. There will be whiteboards provided for planning purposes, and you can use them as a problem-solving tool. Because there is no work outside of class periods, the class activities are the primary mode of learning in this course. At the end of each class, there will be time for discussion to reflect on what was learned and the challenges encountered during the session. Active participation in these discussions is expected.

Course Calendar

Week	Date	Day	Class topic
1	Jan 6	1	Introduction Review of loops and the Euler method
	Jan 8	2	Review of functions Using the Euler method to solve initial value problems
2	Jan 13	3	Runge-Kutta algorithm and application with solve_ivp
	Jan 15	4	Taylor Series introduction
3	Jan 20	-	Holiday, no class
	Jan 22	5	Taylor series of electric potential
4	Jan 27	6	Reading data with pandas Plotting electric potential with heat maps
	Jan 29	7	Superposition of electric charges
5	Feb 3	8	Midterm mini-project
	Feb 5	9	Midterm mini-project
6	Feb 10	10	Metropolis algorithm and random variables
	Feb 12	11	Ising Model introduction and implementation
7	Feb 17	12	Ising Model completion and animation
	Feb 19	13	Analysis of probability in the Ising Model
8	Feb 24	14	Sampling data and computing probabilities

Week	Date	Day	Class topic
	Feb 26	15	Probability densities
9	Mar 3	16	Wave/particle duality
	Mar 5	17	Final project work time: beginning and development
10	Mar 10	18	Final project work time: completion and presentation preparation
	Mar 12	19	Final project presentations

Assessments and Grading Breakdown

Because this is a 1-credit course where all of the work takes place during class meetings, the graded components are based entirely on in-class activities.

Participation and in-class assignments (50%)

- Every day in class, you will work on a small assignment in the form of a Python notebook, which will be due on Canvas at the end of class. Completing these assignments and participating in class activities is expected, and through these items your ongoing engagement with different computing tools will be assessed, rather than a completed solution or final product.
- These assignments will be graded for attendance in class and demonstrated effort on the submitted file, not on completion or correctness.
- The 2 lowest scores will be dropped.

Midterm mini-project (20%)

- During week 5, we will spend the 2 class periods working on a mini-project. This is a more open-ended, longer in-class assignment. Collaboration is welcome during these mini-projects, but you will be expected to submit your own work.

Final project (30%)

- During weeks 9 and 10, we will spend the final 3 class periods working on a group-based final project and presentation. This will involve collaborating with peers, synthesizing different computational modeling techniques that you learned throughout the term, and presenting the project in a written report and an oral presentation.
- The written report will be worth 20%, and the oral presentation will be worth 10%.

Grading Scale

Numerical Score x/100	Grade
$93 \leq x$	A
$90 \leq x < 93$	A-
$87 \leq x < 90$	B+
$83 \leq x < 87$	B
$80 \leq x < 83$	B-

Numerical Score x/100	Grade
77 ≤ x < 80	C+
73 ≤ x < 77	C
70 ≤ x < 73	C-
67 ≤ x < 70	D+
63 ≤ x < 67	D
60 ≤ x < 63	D-
x < 60	F

Late Policy

There are lots of reasons why you might not be able to attend class or complete your assignments on time in a given week. If needed, the instructor can work with you to amend some of the expectations or partially modify the schedule to enable you to engage with the course effectively. Please reach out to the instructor to chat individually.

All deadlines will be posted clearly on Canvas. Moderately late work will be accepted with a grading penalty, but after a certain deadline, work will be considered completely missed and receive no credit at all. Here is a more detailed breakdown of the policy.

- **Participation and in-class assignments**
  - On time: Present in class for the full period and assignment submitted by the deadline (4pm on that day of class)
  - Late: Missing less than 20 minutes of class and assignment submitted within 48 hours after the deadline (20% penalty)
  - Missed: Missing 20 minutes or more of class, or assignment not submitted within 48 hours (no credit)
- **Midterm mini-project**
  - On time: Handed in on Canvas by the deadline
  - Late: Handed in on Canvas within 4 days after the deadline (20% penalty)
  - Missed: Not handed in within 4 days (no credit)
- **Final project**
  - Note, the oral presentation must be given by the entire group during the designated class period, and missing this will mean no credit for the oral presentation.
  - On time: Written report handed in on Canvas by the deadline
  - Late: Written report handed in on Canvas within 4 days after the deadline (20% penalty on written report)
  - Missed: Written report not handed in within 4 days (no credit for written report)

Accommodations and Disability

There are many physical, mental, and social expectations imposed on you to participate in this course. These include being physically present in class, communicating in a group setting, managing time and pacing, retaining spoken and written information, planning and executing open-ended problem solutions, asking for

help, using a screen for an extended period, and more. It's understandable that you might need permanent or temporary accommodations to help you engage fully.

If you have any concerns about disability or accommodations, you can reach out to me and/or go through Disability Access Services (DAS) to receive formal approval for accommodations. Small accommodations can be made easily and quickly, but for longer term concerns or more complicated accommodations, please reach out to me and/or go through DAS as soon as you can to ensure I can provide the proper support.

Official statement: Accommodations for students with disabilities are determined and approved by DAS. If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at https://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Generative AI Policy

You are allowed to use generative AI (gen-AI) tools (e.g. ChatGPT, Dall-e, etc.) in this class. With that said, you are responsible for the information you submit based on an AI query (for instance, that it does not contain misinformation or unethical content). Your use of gen-AI tools must be properly documented and cited in order to stay within university policies academic integrity and student conduct. As a class, we will have opportunities to discuss and agree on what proper documentation can mean. Remember, gen-AI is not likely to generate a response that would be seen as quality work, and should be modified and improved. Anytime you use gen-AI in your work, you must:

Describe how you used it, for example:

- Getting a different perspective on a new concept to help you understand it better
- Brainstorming how to convert an idea into code
- Taking code or an explanation from a gen-AI output, and making it your own through significant changes
- Using explanations and/or code directly with minimal editing

You also must provide an attribution:

- What prompt(s) did you use to get a helpful output?
- If exploring a concept brainstorming, how did the generative AI output change your perspective?
- If using code/explanations directly, what parts did you alter, and why?

Gen-AI is not inherently bad or scary, in the same way that a calculator does not have to be bad or scary for math. Gen-AI tools can be an excellent starting point and a place to begin inquiry or access help during the computing process. However, please be aware that gen-AI is not a replacement for human thinking and learning. Robots lack empathy and nuance. You will still be expected to engage reflectively and earnestly with this tool. We will have opportunities to do this collectively.

Prioritize Your Health

You are encouraged to seek treatment when you feel sick. Please do your best to take care of yourself, both physically and mentally. There are campus resources to support you physical and mental health:

- Student Health Services: https://studenthealth.oregonstate.edu/
- Counseling and Psychological Services (CAPS): https://counseling.oregonstate.edu/

Basic Needs

Success at OSU means knowing and using your resources. One helpful resource is the community of staff available at the Basic Needs Center (BNC) for support (https://studentlife.oregonstate.edu/bnc). Students can drop in during open hours and talk with a BNC student leader for resources, ideas and strategies connected to basic needs challenges.

The BNC is often known for its food pantry, but there are other resources connected to groceries and affording food often available and staff who can help you work through housing stressors. Undergraduate students, living in Oregon are especially encouraged to explore SNAP (up to $194 in grocery money each month for eligible students, as of Winter 2025) as a resource. Domestic undergraduate students living in Oregon are more likely than not to be eligible for SNAP and BNC staff are skilled with helping students navigate this process.

- SNAP FAQs for OSU students: https://studentlife.oregonstate.edu/bnc/food-security/snap-food-stamps/frequently-asked-questions-about-snap

Children in Class

Many students, staff, and faculty at OSU are parents. At times, I expect children to be present in academia some form.

Exclusively breastfeeding babies are welcome in class as often as is necessary to support the breastfeeding relationship. Students should not have to choose between feeding their baby and continuing their education. You and your nursing baby are welcome in class.

For older children and babies, minor illnesses and unforeseen disruptions in childcare often put parents in the position of having to choose between missing class to stay home with a child and leaving them with someone you or your child does not feel comfortable with. While this is not meant to be a long-term childcare solution, occasionally bringing a child to class in order to cover gaps in care is perfectly acceptable.

I ask everyone in class to please help me create a welcoming environment that is respectful of all students, including those with parenting responsibilities.

When you need to bring your baby or child to class, please sit close to the door so that if your little one needs special attention and is disrupting learning for other students, you can easily step outside until their need has been met.

I hope that you will feel comfortable disclosing your student-parent status to me. This is the first step in me being able to accommodate any special needs that arise. I am happy to problem solve with you in a way that makes you feel supported as you strive for school-parenting balance.

Registration and Enrollment

All students are subject to the registration and refund deadlines as stated in the Academic Calendar: https://registrar.oregonstate.edu/osu-academic-calendar

Code of Conduct

Students are expected to comply with the University code of conduct: https://beav.es/codeofconduct.

The Code of Student Conduct prohibits Academic Misconduct and defines it as: Any action that misrepresents a student or group's work, knowledge, or achievement, provides a potential or actual inequitable advantage, or compromises the integrity of the educational process.

If you're not sure whether an action constitutes academic misconduct, please ask, or consult more details here: https://studentlife.oregonstate.edu/studentconduct/faculty-info

Your Rights as a Student

Copied from these sources:

- OSU Discrimination and Discriminatory Harassment Guidelines: https://eoa.oregonstate.edu/discrimination-and-discriminatory-harassment
- Associated Students of Oregon State University (ASOSU): https://asosu.oregonstate.edu/advocacy/rights

The university prohibits unlawful discrimination on the basis of age, race, color, religion, sex, sexual orientation, gender identity or expression, national origin, citizenship, marital or family status, pregnancy, disability, genetic information, protected veteran status / service in the uniformed service, or any other status protected by law or OSU policy.

Oregon State University students have the right to...

1. ...express differing opinions and dissent on campus.
2. ...associate and assemble to collectively express, promote and defend common interests.
3. ...exercise the practice of religion free from discrimination.
4. ...academic advising that is accurate and can be relied upon for progress towards graduation.
5. ...have their voice heard in all university policymaking decisions that impact students.
6. ...a campus free of discrimination and harassment based on one's race, color, gender identity or expression, religion, age, national origin, disability, marital status, parental status, sex, sexual orientation, genetic information or veteran status.
7. ...complete a course of study should the university discontinue a course of study.
8. ...due process in all university disciplinary processes.
9. ...an equal opportunity to learn and to participate and benefit from the academic community.
10. ...meet with and engage with course instructors and professors during their office hours.
11. ...the protection of student educational records and confidential information.
12. ...be graded in accordance with the course syllabus and the quality of their work.

If you feel any member or party of the university is violating your rights as a student, please contact ASOSU at 541-737-9200 or asosu.advocacy@oregonstate.edu

Reach Out for Help

University students encounter setbacks from time to time. If you encounter difficulties and need assistance, it's important to reach out. Consider discussing the situation with an instructor or academic advisor. Learn about resources that assist with wellness and academic success at https://counseling.oregonstate.edu/reach-out-success.

If you are in immediate crisis, please contact the Crisis Text Line by texting OREGON to 741-741 or call the National Suicide Prevention Lifeline by dialing 988 (available 24 hours a day / 7 days a week).

Other crisis lines:

OSU CAPS: Campus counseling office a crisis line which can also be used to schedule a visit

- Dial 541-737-2131
- Scheduling available Monday through Friday, 10am to 4pm
- Help is available after-hours: Press 1
- https://counseling.oregonstate.edu/main/accessing-our-services

National Sexual Assault Hotline: Routes to a local sexual assault service provider, who can provide confidential support and connect you to resources in your area

- Available 24 hours a day / 7 days a week
- Dial 800-656-4673
- Chat online: https://hotline.rainn.org/online

Love is Respect: Information, support, and advocacy to young people who have questions or concerns about their dating relationships

- Available 24 hours a day / 7 days a week
- Dial 866-331-9474
- Text LOVEIS to 22522
- https://www.loveisrespect.org/

The Trevor Project: For lesbian, gay, bisexual, transgender and questioning (LGBTQ) young people

- Available 24 hours a day / 7 days a week
- Dial 866-488-7386
- Text START to 678-678
- https://www.thetrevorproject.org/get-help/

Trans Lifeline: A trans-led organization that offers direct service, material support, advocacy, and education

- Peer support hotline available 10am to 6pm Pacific, Monday through Friday
- Dial 877-565-8860
- https://translifeline.org/hotline/

Veterans Crisis Line: Confidential help for veterans and their families

- Available 24 hours a day / 7 days a week

- Dial 988 and Press 1
- Text 838-255
- https://www.veteranscrisisline.net/

Friends for Survival: National support for survivors grieving the suicide death of a loved one

- Phones answered 7 days a week
- Dial 916-392-0664
- https://friendsforsurvival.org/

Sexual Misconduct and Mandatory Reporting

A confidential campus resource for survivors of sexual assault is the Center for Advocacy, Prevention & Education (CAPE), which cultivates a survivor-centered, trauma-informed culture of consent. They aim to create lasting social change and eliminate gender-based violence through shared goals of comprehensive sexual health education, action-oriented prevention and compassionate survivor support.

- Dial 541-737-2030 for safe, confidential support and resources
- CAPE: https://cape.oregonstate.edu/

As your instructor, I cannot be a completely confidential resource. Most OSU employees (including faculty and instructors and GTAs) are mandated by the university to report any knowledge of sexual misconduct involving anyone affiliated with OSU or occurring on OSU property or at an OSU event. This means informing OSU's office of Equal Opportunity and Access (EOA) of what happened. At this point, EOA will review the report and reach out to you via your university email to invite you in to discuss your concerns and refer you to CAPS and CAPE. You can choose whether or not you would like to engage with EOA, or any other resources provided.

- EOA: https://eoa.oregonstate.edu/
- Reporting Obligations and Processes: https://eoa.oregonstate.edu/employee-reporting-responsibilities

You can still ask me to help direct you to resources without requiring me to report to EOA, as long as you share minimal details or simply ask for resources directly. For example, you can ask me:

- "I'm worried about something that happened involving me/a friend, and I'm not sure where to ask for help."
- "I'm in a crisis. I can't share details, but I'm not sure where I can turn to right now."
- "Can you walk me through the campus resources for survivors of sexual assault?"

With that said, you are still allowed to disclose to me that sexual assault or some other form of misconduct happened, just know that I cannot offer professional help, and I will be required to report the incident. If you wish to discuss an incident with me, I will never ask detailed or invasive questions, and I will keep everything you tell me private and confidential outside of my obligation to report to EOA.

I am also a mandatory reporter of child abuse and neglect. More information here: https://hr.oregonstate.edu/mandatory-reporting-child-abuse-neglect

Active Shooter Response

If we hear gunshots or become aware of an active shooter nearby, we will follow the Run, Hide, Fight protocol.

Evaluate: Try to remain calm, and quickly decide how to protect your own life

- Try to warn others to run away (get out/evacuate)
- Once you are safe, have one person call 541-737-7000 and 911 and provide:
  - “This is (name), (give your location) and we have an active shooter at (building on OSU campus) gun shots fired”
  - If you are able to see the shooter, give a description of the shooter's sex, race, clothing, type of weapon(s), location last seen, direction of travel, and any other identifying details, if known
  - If you have observed any victims, provide the location seen and a description

Run: Get out of the area

- The main escape route from Weniger 328 is the stairwell directly across the hallway
- If that southwest stairwell is not usable:
  - There are three other stairwells in the other three corners of Weniger
  - Windows on the third floor or lower can also be used to exit the building
- Leave belongings behind
- Run in a zig-zag
- Keep your hands visible
- Do not attempt to move wounded people, but if you feel there is time to stop and stop someone’s bleeding, do it quickly and escape

Hide: If you cannot run away, find a place to hide where the active shooter is less likely to find you

- The default hiding place is Weniger 328
  - The two hallway doors are windowless and remain locked from the inside at all times
  - The two interior doors lead to offices 332A and 332B, which also remain locked from hallway access
- Do not pull the fire alarm. An alarm can cause hiding people to evacuate the building and put them in potential danger
- Move away from the doors
- Do not trap yourself or restrict your options for movement
- If the active shooter is nearby:
  - Silence all devices and footsteps
  - Hide behind large items, such as desks
  - Remain quiet
  - Do not open the door or make noise until you are sure it is safe

Take Action: If you cannot run or hide, remain calm

- After dialing 911, leave the line open and allow the dispatcher to listen
- Only when your life is in danger, try to harm the active shooter:
  - Throw items and improvise weapons

    - Get a group of people together to fight against the shooter
    - Act as aggressively as possible against the shooter
    - Attempt to disarm or knock out the shooter
- Do not occupy cell phone bandwidth with calls or messages to anyone not involved in the emergency

Further resources:

- https://emergency.oregonstate.edu/emergency-management/emergency-procedures/active-shooter
- https://app.hazadapt.com/hazards/active-shooter

Syllabus Writing Resources

Some syllabus language was borrowed and adapted from many of the resources listed throughout the syllabus, as well as these resources:

- OSU DAS Faculty Guidelines: https://ds.oregonstate.edu/facultyguidelines
- Kate Birdsall's Generative AI policy and #iteachmsu: https://iteach.msu.edu/iteachmsu/groups/ai-education/stories/2766/challenge_id/391/level_id/1
- Melissa Cheyney's policy on children in class and The Young Mommy Life blog: http://www.theyoungmommylife.com/2013/01/25/student-parents-syllabus/
- OSU Basic Needs Statement: https://studentlife.oregonstate.edu/bnc/about-bnc/osu-basic-needs-statement
- Oregon Crisis Lines: https://www.oregon.gov/oha/ph/preventionwellness/safeliving/suicideprevention/pages/crisislines.aspx