HW4 is still being revised

Computational Physics 381c - Fall 2025

Overview: This course aims to provide a very broad survey of computational methods that are particularly relevant to modern physics research. We will aim to cover efficient algorithm design and performance analysis, traditional numerical recipes such as integration and matrix manipulation, and emerging methods in data analysis and machine learning. By the end of the class, we aim to feel comfortable approaching diverse, open-ended computational problems that arise during research, and to be ready to design new algorithms and share them with the broader research community.

Learning Outcomes: By the end of the course, students will be able to

1. Write appropriately-structured, reproducible, and well-documented code in Python.
2. Assess the memory and runtime complexity requirements of an algorithm.
3. Apply foundational algorithms from scientific computing, including variable-step integration, spectral methods, and matrix operations.
4. Identify physical scenarios requiring computational methods, and assess the computational resources required by different approaches.
5. Use best-practices from introductory statistical learning to analyze unique datasets arising from physics applications, including model selection, regularization, and feature engineering.

Instructor: William Gilpin. PMA 14.202. wgilpin@utexas.edu
TA: Carson McVay: carsonmcvay@utexas.edu
Course website: Website and GitHub repository
Anonymous Comment Form: Feel free to privately share questions, comments, concerns, or thoughts at any point in the course, through this webform.
Labs: We'll have optional technology labs after some lectures, so that students can get direct help from the course staff if needed. We will use the time to figure out technology issues like installing Python, using GitHub, etc. In other weeks, we will use the time to work in groups on the final project or homeworks.
Discussion & Questions: Please use Ed Discussions
Syllabus: If you are reading a PDF, you might not have the latest information. The course syllabus will be updated and modified online here. Depending on enrollment size, student feedback, and class poll results, the schedule and pacing may slow down during the term.
Textbooks and resources. Readings are linked with each lecture below. You shouldn't have to buy anything. If you are unable to locate a digital PDF of any books through the library, classmates, or other online sources, please let me know. By default, assignments and other information are available on the course website; however, some lecture slides, lecture recordings, and datasets have restrictions that require us to host them on UT Box
Background: Multivariate calculus, linear algebra, differential equations, and comfort with a programming language. We recommend PHY385K & 387K, or instructor consent. If you haven't used Python before, you will need to spend some extra time learning it to do the assignments and follow the lectures. We will primarily use Python in the class, although some readings use C++.

Course time & Location: *T Th 12:30 p.m.-2:00 p.m. in PMA 6.112***.**
Office hours: In class (when lectures end early), or by appointment with course staff.
Disability & Accommodation Statement. If you are a student with a disability, or think you may have a disability, and need accommodations please contact Disability and Access (D&A). You may refer to D&A's website for contact and more information. After registering with D&A, ask them to send an Accommodation Letter to william, so we can discuss your approved accommodations and how they apply to the class.
Attendance: I do not track attendance, but I hope you'll find the lectures interesting enough to attend. The homeworks and other materials should be self-contained. I do try to record lectures for convenience, but this is not guaranteed.
This course is taught in parallel with the advanced undergrad course 329, which covers different topics. Students can attend either/both/neither class's lectures and office hours, but please turn in assignments for your own class.
Raw Recordings: Raw (unedited) recordings of all lectures that William remembers to record will be on this box link. They will gradually be migrated to the YouTube links on the syllabus below.

Evaluation
Homeworks (40%): Homeworks are a completion grade only.The goal of these is to get programming experience and get a sense of how you might tackle a computational problem in the real world. You can use the Instructor Solutions from the course repository, ChatGPT, or student solutions to last year's homeworks. But you must turn in your own completed code and responses to free response questions. **Turn in your filled-out notebook by following the instructions here.**
Final Project (40%) & Presentations (10%): A final computational project. The primary deliverable is going to be polished, user-friendly Python code. This will primarily be graded on completeness, useability, code quality, and problem choice. You will have time to work on this in class at several points during the course, and there will be ~10-15 minute presentations per team during the final two weeks of the course.
Late policy: The final project (due date below) cannot be late without receiving an "Incomplete" that requires re-enrolling next year. We can't accept late homeworks without a UT-approved reason and corresponding document from the college, please also inform the TA.
Team Assignments: At the end of enrollment period, we will randomly assign students to ~10 groups, which will be listed in this document. You are welcome to change teams at any point, but the total number of groups must stay the same. There is no advantage to being on a larger and smaller team. Please negotiate any swaps among yourselves offline or on Ed Discussions, and indicate them as "comments" on the Google Doc. If special circumstances arise (e.g., the majority of your team members drop the class mid-semester), we may need to reassign or split teams to balance them.
Participation (10%): Submit a project proposal in the form of a repository template by the deadline on the syllabus.
Letter grades: Letter grade determined by the number points accrued, but sign (i.e. A+ vs A) will depend on the distribution of scores among all with the same letter grade.
Points conversion: Project: 100 points. Homeworks: 100 points total, 25 each. Participation: 25 points. Presentation: 25 points.

Schedule

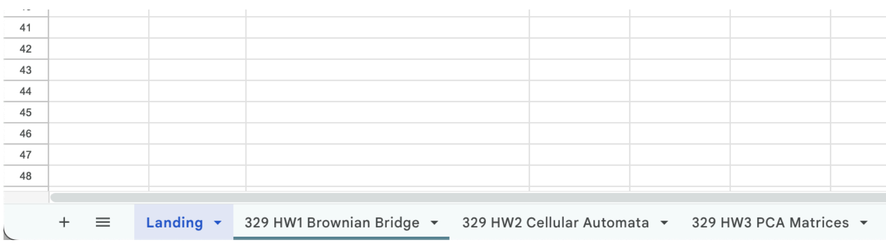
The full detailed schedule, along with suggested reading and due dates, can be found at this web page:

[Computational Physics Course Schedule]

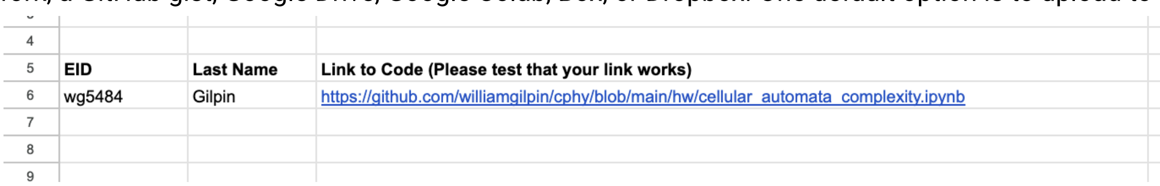
How to turn in homework

To turn in homework assignments, you must submit a link to a *completed* ipynb file. You will need to download the homework file from the course, modify and run the code, save your changes, and then submit the edited file. To submit the file, navigate to the [assignments spreadsheet located here.]

1. Go to the bottom of the spreadsheet and find the appropriate assignment and section.

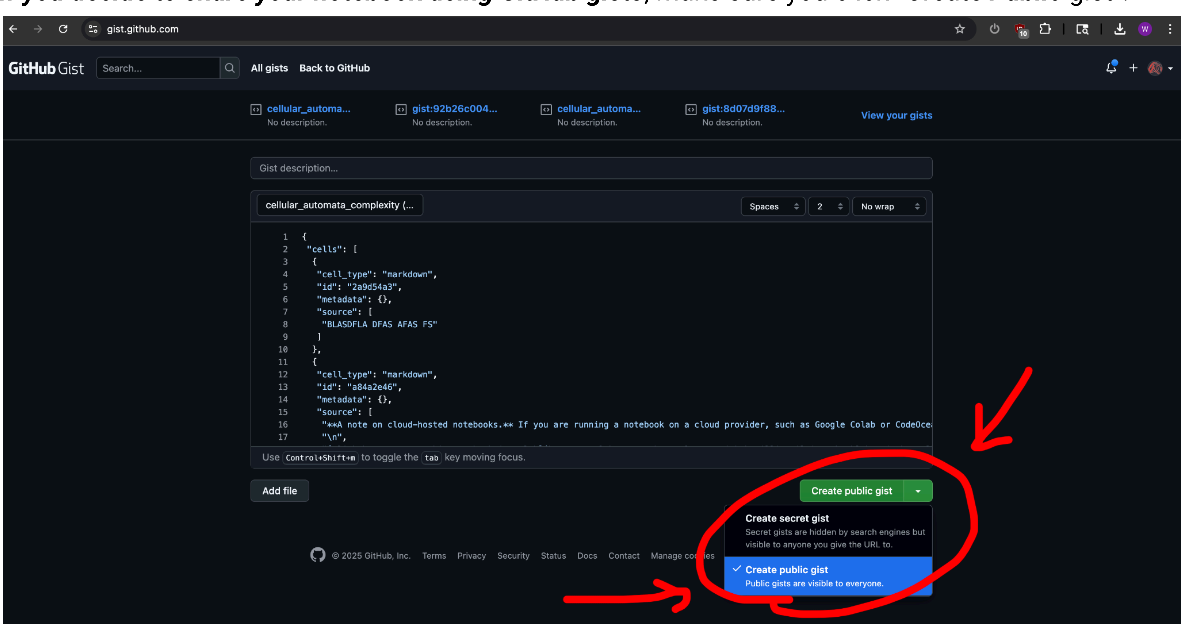


2. In the resulting table, enter your EID, name, and provide a link to your assignment notebook on GitHub, a GitHub fork, a GitHub gist, Google Drive, Google Colab, Box, or Dropbox. One default option is to upload to [Github gists]

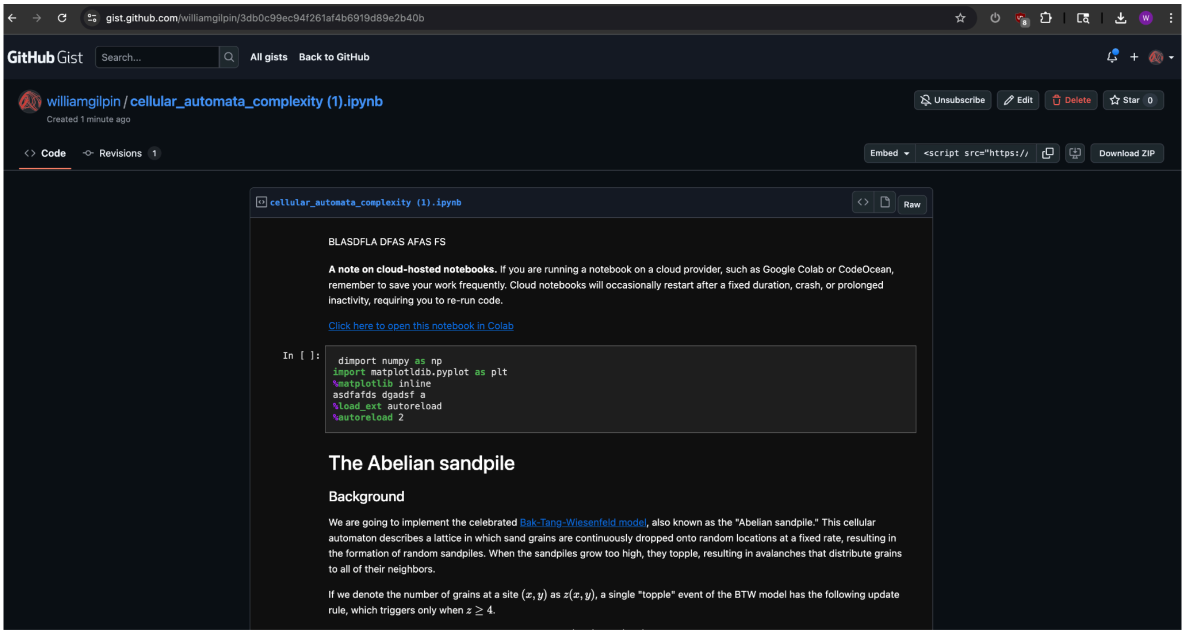


4			
5	**EID**	**Last Name**	**Link to Code (Please test that your link works)**
6	wg5484	Gilpin	https://github.com/williamgilpin/cphy/blob/main/hw/cellular_automata_complexity.ipynb
7			
8			
9			

3.
    a. ***If you decide to share your notebook using GitHub gists***, make sure you click “Create ***Public*** gist”:



b. After uploading and clicking “Create public gist,” make sure that the gist renders as an `.ipynb` file (you should be able to read and view the file after uploading):



4. **Important:** Regardless of your sharing method, please make sure that you have enabled sharing permissions on your link. Try opening your link in a private browsing tab/Incognito to check it.
5. If there’s something that you’d like to flag for us to review, please leave a comment. For example, if you find a typo, error, have an alternate implementation or generalization of my approach, if you use Julia, or you find a bug or issue in the assignment that I should fix. In the case of the latter, feel free to submit an issue or pull request to the course GitHub if you prefer.

Resources

A curated list of resources and additional reading relevant to this book [may be found at this link.]

Final Project

Please see the [detailed instructions, suggestions, and rubric here.]

Catalogue Description

The following text represents the description of PHY381C found in the UT course catalogue
Dynamical and statical descriptions and solutions of many-body, nonlinear physical systems by computation. Theory of computation and applications to various branches of physics. Three lecture hours a week for one semester. Prerequisite: Graduate standing; and Physics 385K and 387K, or consent of instructor.

William’s Zoom Link: Password Q810

William Gilpin is inviting you to a scheduled Zoom meeting.

Topic: William Gilpin's Personal Meeting Room

Join Zoom Meeting
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Meeting ID: 764 271 7220
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Dial by your location
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+1 669 444 9171 US
+1 669 900 6833 US (San Jose)
+1 719 359 4580 US
+1 312 626 6799 US (Chicago)
+1 386 347 5053 US
+1 564 217 2000 US
+1 646 931 3860 US
+1 929 205 6099 US (New York)
+1 301 715 8592 US (Washington DC)
+1 309 205 3325 US
Meeting ID: 764 271 7220
Find your local number: https://utexas.zoom.us/u/adRQzABrKj

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7642717220@zoomcrc.com

Join by H.323
162.255.37.11 (US West)
162.255.36.11 (US East)
115.114.131.7 (India Mumbai)
115.114.115.7 (India Hyderabad)
213.19.144.110 (Amsterdam Netherlands)
213.244.140.110 (Germany)
103.122.166.55 (Australia Sydney)
103.122.167.55 (Australia Melbourne)
149.137.40.110 (Singapore)
64.211.144.160 (Brazil)
149.137.68.253 (Mexico)
69.174.57.160 (Canada Toronto)
65.39.152.160 (Canada Vancouver)
207.226.132.110 (Japan Tokyo)
149.137.24.110 (Japan Osaka)

Meeting ID: 764 271 7220