ASTRON 98: Introduction to Python For Astronomers (Spring 2026)

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Time & Location: Mondays & Wednesdays, 11:00-12:00 PM
131 Campbell Hall

Office Hours: TBD (Posted by Week 2)

Course Number: 98 — GRP 003

Course Code: TBD

Units: 2 units, P/NP

Course Description

This course offers an introduction to the Python programming language with an emphasis on **data analysis** and **scientific research in astronomy and physics**. Python is one of the most common programming languages used by modern astronomers, and this class focuses on preparing undergraduate intended/declared astronomy students for **upper-division laboratory courses and research**. However, students from all backgrounds are welcome to apply.

Key topics include the command line, VS Code, scripting, version control with Git, documentation, Jupyter Notebooks, and common Python packages/libraries. We'll also cover advanced topics such as curve-fitting, processing FITS files, querying databases, animation, and object-oriented programming.

The Python DeCal is designed for students with little or no prior programming experience. However, learning the technical material covered in this course—especially for beginners—requires **dedication, patience, and regular practice**. Many students find this workload more demanding than other lower-division DeCals at UC Berkeley. If you have already taken advanced computer science or data science courses at Berkeley or elsewhere, this class may not be the best fit for you. But if you are excited to explore how coding can be applied to astronomical research, we still encourage you to apply.

Everyone's "learning to code" journey will be different. Some concepts may click quickly, while others take time. **Your effort on homework and the Final Project will directly shape what you gain from the Python DeCal.** We strongly recommend attending all lectures and discussions, but attendance is not strictly required since each lecture is recorded and posted to our class YouTube Channel. To get the most out of this course, complete homeworks to the best of your ability (with little to no help from AI tools), attend office hours regularly, and put meaningful effort into your Final Project. If you need help, please reach out. We have a large team, so we can give as many students as possible one-on-one support.

Learning Objectives

Students will be introduced to **fundamental programming concepts** with the goal of building proficiency in developing software for **upper-division astronomy laboratory work** and **scientific research** using Python. In addition to completing weekly homework and lecture check assignments, students will demonstrate their understanding of **version control, scripting, packages/libraries** (i.e., NumPy, Matplotlib, Pandas, SciPy, Astropy), and **software structure and flow** by designing and creating a **Final Project** of their choice.

This project will culminate in an **open-source GitHub repository** containing the Final Project and a **Final Presentation** during the last week of instruction. The presentation will give students practice in **scientific communication**, a skill required for upper-division astronomy coursework and jobs in academia.

Course Materials & Resources

Students are expected to **bring and use their own computers** for the duration of this course. If you are unable to obtain a laptop, please consider utilizing the Student Technology Equity Program (STEP) which offers **semester-long computer rentals**. If the STEP program is not a suitable option, **reach out to the Python DeCal course staff** and we can help arrange alternative accommodations.

Required Readings

There are **no required readings** outside of material provided during lecture, discussion, and the guides. However, we recommend two **optional textbooks** written by former Python DeCal instructors:

- **Python for Astronomers: An Introduction to Scientific Computing**
  - Written by previous facilitators (Imad Pasha and Christopher Agostino), last updated in 2019.
  - GitHub Link
- **Astronomical Python: An Introduction to Modern Scientific Programming**
  - Official textbook by Imad Pasha, published in May 2024.
  - IOPscience Link

For additional reference on the packages/libraries we use throughout the semester, you may find these **optional documentation links** helpful:

- **NumPy**
- **Matplotlib**
- **Pandas**
- **SciPy**
- **Astropy**

bCourses

All course-related content will be available on our **bCourses** site, unless otherwise noted:

- **Lecture materials, homeworks, demos, rubrics, and guides** $\longrightarrow$ posted under the **Files** section
- **Important updates and reminders** $\longrightarrow$ posted under the **Announcements** section
- **Syllabus** $\longrightarrow$ posted under the **Syllabus** section
- **Office hours** $\longrightarrow$ posted under the **Home** section
- **Grades** $\longrightarrow$ posted under the **Grades** section

Gradescope

All assignments for the Python DeCal will be submitted via **Gradescope** with the exception of Lecture Checks which will be submitted via Google Forums. This includes homework, Google Form submissions, and all assignments related to the **Final Project**.

After the first homework, all homework submissions must be GitHub repositories uploaded to **Gradescope.**

EdStem

EdStem is our main **Q&A platform** where students can ask questions and receive timely answers from course staff and peers. We highly recommend using **EdStem over email**, as it enables collaborative learning and quicker response times.

If you need to contact a staff member directly, please include [**PYTHON DECAL**] or [**ASTRON 98**] in the subject line of your email so it can be identified quickly. For **logistical or urgent matters**, contact the Head Instructor **Katie Mora** at katherinemora@berkeley.edu.

YouTube Channel

For supplemental review and asynchronous learning, the Python DeCal records and posts all course videos to our YouTube channel. While these videos are a helpful resource, we **highly recommend attending all classes in person** to benefit the most from this course.

If you can only participate asynchronously, we **strongly recommend attending office hours** outside of class to stay on track to get personalized support.

Office Hours

Course staff **office hours** provide a dedicated space for students to ask questions, collaborate with peers outside of regular class times, and get **one-on-one support**. We strongly encourage attending **office hours weekly** and taking the opportunity to connect with staff members. If you are struggling to come up with an idea for your **Final Project** or implementing your idea, **office hours** are a great place to get help.

Even if you don't have course-related questions, our interns and instructors are more than happy to offer guidance on **selecting or declaring a major, finding research opportunities, applying to graduate school**, or **exploring summer programs** on and off campus.

The **finalized office hours schedule** will be posted to **bCourses** by the end of Week 2. Additional office hours will be held during the **first two weeks** of the course to help students install the software needed for the semester.

Grading Breakdown

Participation	20%
Homework	40%
Final Project	40%

To pass the Python DeCal, you must earn a grade of 70% or above *and* submit an attempt for all assignments related to the Final Project.

Participation (20% of your grade)

Class meets **twice a week**, with most weeks following this structure:

- **Monday** $\longrightarrow$ Lecture to introduce new material (more formal, led by instructors/interns with demos)
- **Wednesday** $\longrightarrow$ Discussion to apply lecture material through hands-on practice (more collaborative, with staff assisting as students work through guided problems)

A **laptop is required** for all lectures and discussions. If you do not bring a computer, you will not be able to follow along easily or participate fully. Laptops should only be brought out **after warm-up activities**, which must be completed **on paper** to avoid the temptation of asking Google or ChatGPT directly for answers.

Lecture Checks

Instead of tracking in-person attendance, we will track your engagement with class material. Lecture check assignments will make up the most significant portion of your participation grade.

- Students will complete a 5-10 minute **lecture check** google forum each day of class. These open at the end of each lecture and close at midnight the day after lecture.
- Students have until **the end of the semester** to submit late lecture checks for a deduction in points.
- Only **70%** completion of lecture check assignments (for example, **19 out of 27** assignments) is required for full credit.
- These assignments help demonstrate engagement, especially for asynchronous attendance, and reinforce lecture concepts.
- Each lecture check requires a code that can be found in the corresponding lecture's slides, which are posted on bCourses. The code is not required for submitting the form, but students will not receive full credit if the code entered is incorrect.
- Lecture checks will be linked at the end of each lecture, as well as posted on bCourses as an assignment.

In order to complete these assignments you will need to either attend class, read the lecture slides, or watch a recording of the lecture/discussion on our YouTube channel. While asynchronous attendance is available, we **highly recommend attending in person**. Due to technical or human error, some recordings may go missing. While we do have a catalog stretching back to Spring 2021, older recordings may not match the content from this semester.

Additional Participation

Throughout the semester we will request that you fill out **Google Forms** in a timely manner. You will receive participation credit for these assignments.

Homework (40% of your grade)

Starting in **Week 2**, homework will be assigned **weekly on Mondays** and will be due the **following Wednesday at 11:59 PM** on **Gradescope**. After the first homework, **all submissions must be GitHub repositories** uploaded to Gradescope. Homeworks will reinforce lecture material, include questions similar to those in discussion, and introduce additional topics for you to explore on your own.

Important Notes

- There is **no penalty for late submissions within a two-week grace period** of the original due date. If additional time is needed beyond the grace period, contact a member of the Python DeCal staff or email the Head Instructor **Brianna Peck** at bpeck114@berkeley.edu.
- Homeworks are graded on **effort and accuracy**. You will earn most points as long as you show **clear thought** and honest attempts, even if your answers are not fully correct.
- While independent exploration is encouraged, **any submission of AI-generated code will receive an automatic zero**. You may use Google or AI-tools to ask questions, but avoid directly copying and pasting code from AI tools. Remember, **humans are grading your homework**, so please submit **human-written code**.
- **Collaboration is allowed**, but all work submitted must be on **your own**.

While AI has become a powerful tool in recent years, please **avoid over-reliance** on it for homework. AI can give you answers easily, but **working through problems yourself is what builds skills** needed for upper-division labs and research/industry. **Misuse of AI-generated content will be treated as a violation of academic integrity** and reported. With great power comes great responsibility.

Final Project (40% of your grade)

Instead of a traditional final exam, the **Final Project** is your chance to apply the skills you've gained throughout the semester in a **creative, research-relevant** and **data-driven** way. Most projects in the Python DeCal fall into one of three categories: **data analysis, simulations/animations**, or **video game creation**. However, we still encourage you to think outside of these boundaries while exploring any topic of interest in **astronomy or physics** using Python.

You may work **individually or in pairs (maximum two students**, no exceptions). Completion of the **project, updated GitHub repository, check-ins, Google Forms, final report**, and **presentation** is **mandatory to pass this course**.

Check-ins and Deadlines

- Throughout the semester, you will complete short **check-in assignments** to update the Python DeCal staff on your project's status.
- The **Final Project, Report, and Presentation** are all due **before the first class of the last week of instruction**. This applies to all students, even if you present on the second day.
- **All students must present in person**, no exceptions.

More details about the Final Project will be released later in the semester.

Regrading

Due to the Python DeCal extension policy on homework assignments, **we will not be accepting regrades this semester.** If you believe your work was inaccurately graded (not just graded a bit harshly), you can ask a Python DeCal instructor to re-grade it. Keep in mind that the instructors reserve the right to re-grade the entirety of the assignment and you may potentially end up with a lower grade than you initially received.

Academic Misconduct

As with all classes, cheating, plagiarism, and other forms of academic dishonesty will not be tolerated. First violations will result in a zero on the assignment, and any subsequent violations may result in administrative action in accordance with the UC Berkeley Astronomy Department Policy on Academic Misconduct.

Other Resources

Here is a list of other resources that may benefit you while at UC Berkeley:

- Basic Needs Center: Provides support with food, stable housing, hygiene, transportation, healthcare, mental wellness, financial sustainability, sleep, and emergency dependent services.
- Counseling and Psychological Services/University Health Services(CAPS/UHS): Provides confidential, brief counseling and crisis intervention to students with personal, academic and career stress.
- Path to Care Center: Provides affirming, empowering, and confidential support for survivors and those who have experienced gendered violence, including sexual harassment, dating and intimate partner violence, sexual assault, stalking, and sexual exploitation.
- Undergraduate Astronomy Society: An organization of astrophysics majors dedicated to creating a strong sense of community among undergraduates in the Astronomy Department at UC Berkeley.

Schedule

Below is a schedule of class meetings along with a curriculum; the schedule is subject to change based on the needs of our students, and the dates are not set yet.

Week	List of Lectures/Discussions
1	• No Class (MLK Jr. Day) • No Class
2	• Introductions + Syllabus + Installations • VS Code + Data Types + Variables + Command Line/Terminal
3	• Lecture: GitHub • Discussion: GitHub
4	• Lecture: Functions + Conditionals + Loops • Discussion: Functions + Conditionals + Loops
5	• No Administration • Lecture: Lists + Dictionaries
6	• Lecture: Lists + Dictionaries • Introduce Final Projects + Review Session + Debugging
7	• Jupyter Notebooks + Lecture: NumPy Arrays • Discussion: NumPy Arrays
8	• Lecture: Matplotlib • Discussion: Matplotlib
9	• Lecture: Pandas • Discussion: Pandas
10	• Lecture: SciPy • Discussion: SciPy
11	• Spring Break • Spring Break
12	• Lecture: AstroPy • Discussion: AstroPy
13	• Final Project Proposal Feedback + Review Session • Review Sessions + Documentation
14	• Animation • Object-Oriented Programming
15	• Final Project Presentations! • Final Project Presentations!