ASTR 211: Observational Astronomy Lab
Section 01 — Spring 2021

General Information

Instructor: Mason V. Tea
Email: mtea@wesleyan.edu
Office hours: Mondays, 8:00pm – 10:00pm (or by appt)
Meeting time: Wednesdays, 9:00pm – 10:30pm

Class webpage: mvtea.github.io/astr211
Zoom office: https://wesleyan.zoom.us/j/94575105980
Zoom classroom: https://wesleyan.zoom.us/j/92281449183

Course Description

This is the lab portion of Observational Astronomy. While you'll be learning the fundamentals of the field in lecture, these sessions will be dedicated to some practical skills, namely programming and telescope operation. Most sessions will include a tutorial on a topic in Python programming, followed by some exercises. As weather and COVID cases permit, a few will involve training and observing with some of VVO's telescopes.

Course Objectives

Over the course of the semester, we'll learn how to...

- Access, navigate, and manipulate files with the Unix network environment.
- Write programs in Python to read, manipulate, plot and view astronomical data.
- Effectively utilize Python tools and libraries for scientific computing.
- Operate the new 24" PlaneWave telescope at VVO.
- Collect, analyze and interpret real astronomical data.

Time and/or interest permitting, we may explore...

- Typesetting academic writing using LaTeX.
- Storing, updating, and publishing files with Git and GitHub.
- Querying astronomical databases using SQL and Python.
- Creating and deploying your own personal website.

Format

We will meet once a week, usually to work through Python-related material, but sometimes to observe in some fashion. During the Python meetings, we'll start with a "tutorial" and go over material that is likely to help you with the coding problems on upcoming homework. After the tutorial, if time allows, you'll go through some exercises on your own to solidify your understanding. Having a full-blown lecture at 9pm isn't ideal, so I'll try to keep things informal — feel free to chime in whenever you have a question or (constructive) comments.

As for the observing sessions, details are currently TBD. COVID obviously makes gathering in groups difficult, so for any in-person sessions, Prof. Moran and myself will have to devise a way to mind COVID capacities & social distancing while getting the work done. Because this will be tricky in a tiny telescope dome, it is likely that you'll all be trained to use the remote-access features of the new 24" PlaneWave telescope (with me in the dome making sure nothing breaks).

Class Attendance and Participation

Some of you may be well-versed in Python already, while others may be new to programming. For those of you in the latter category, I strongly suggest that you attend every session, as the material each week will trend strongly with what shows up on that week's problem set. As for the rest of you, I still suggest you attend as much as possible, for the same reason! However, if you've skimmed the session plan and/or the homework and determined that you don't need a refresher, just let me know that you won't be there that day via email.

Textbooks

While there are no required textbooks, below are some supplementary materials that may be helpful somewhere down the line:

- Python for Astronomers
- Think Python
- Python Data Science Handbook
- Python Graph Gallery
- Intro to UNIX
- SDSS SQL Tutorial
- Intro to Git & GitHub
- Markdown Guide

Software

We'll be using a few different pieces of Python software over the course of the semester, most of which can be installed in one go with Anaconda. Anaconda is a data science package that includes the latest version of Python (3.9), Python libraries for scientific computing (`numpy`, `matplotlib`, `pandas`, etc) and the interactive scripting software Jupyter notebook, all of which we will be using.

For folks on Macs, I suggest the text editor Atom in conjunction with the command line (which we'll learn to use in class). As for PCs, I'm not well-acquainted with Python programming on that operating system, but my colleagues who are strongly recommend the Spyder IDE.

Instructions on how to install all this software can be found either in your email or on the course's Moodle page.

Schedule of Topics

Below is a schedule of meetings and topics, subject to change at the whim of the instructor.

Date	Topics	Materials	Relevant HW
February 17	Intro to Unix How to use Python tools Python basics Strings, lists & arrays (`numpy`)	Intro to Unix Tutorials 1.1, 1.2 Lab 1	HW 2
February 24	Conditionals Loops Functions Basic plotting (`matplotlib`)	Tutorials 2.1, 2.2, 2.3 Lab 2	
March 3	Reading & writing data (`pandas`) Plotting data (`matplotlib`)	Tutorials 3.1, 3.2 Lab 3	HW 3, 4
Week of Mar. 10	*Observing Week #1: Binocular Tour*	Lab 4	
March 17	Fitting data	Tutorials 5.1, 5.2 Lab 5	HW 5
March 23/24	**SPRING "BREAK" — NO LAB**		
March 31	Higher-dimensional arrays & images Working with FITS files Image processing & calibration	Tutorials 6.1, 6.2, 6.3 Lab 6	HW 6, 7
Week of Apr. 7	*Observing Week #2: 24" Training*	PlaneWave manual	
April 14	SQL basics Accessing databases (`astroquery`)	Intro to SQL Tutorial 7.1 Lab 7	HW 8
April 21	**THESIS DEADLINE WEEK — NO LAB**		
Week of Apr. 28	*Observing Week #3: Collecting 24" Data*	Data collection sheet PlaneWave manual	
May 5	Advanced topics	Tutorial 8.1 Lab 8	HW 10
May 12	Typesetting with LaTeX GitHub repos and sites		Final project