AST 3722: Observational Techniques

Spring 2022

Instructor:	Prof. Jamie Tayar	Time:	T/Th 16:05–16:55, W 17:10-22:10
Email:	jtayar@ufl.edu	Place:	Rm 7, Bryant Space Science Center,
			Campus Teaching Observatory,
		Office Hours:	TBD, BRT 320
TA:	Francisco Mendez	Office Hours:	TBD
Email:	fmendez@ufl.edu		

Timing / Structure:

Currently, the plan is for this course to be taught mainly in person. Should COVID or some other situation encourage a change, we will use Zoom and other online tools.

On observing and lab nights, you will be expected to spend 5 hours in lab or at the observatory (17:10-22:10). Observing is weather-dependent! While the lab classes are officially Wednesday, if the weather is consistently bad on Wednesdays, you may have the opportunity to observe on other nights.

Course Pages:

1. https://ufl.instructure.com/courses/476587

Communication:

Communication will be via Canvas, Email and possibly Zoom or Slack.

Office Hours:

Office hours will be available in person, or over Zoom. You may also email if you require assistance or need to meet at a time not during the usual office hours. Please include the course number in your email subject line.

Materials: Access to a computer will be essential for this course. You will also need a notebook for taking notes during labs (any notebook type is fine). Having a phone or tablet, and a flash drive, in addition to a laptop may also be helpful. If any of this is an issue, please talk to the instructor or TA.

Main References:

No textbook is required for this class. For additional information, you are welcome to consult any outside references including:

- Andrew J. Norton, "Observing the Universe",
  https://www.google.com/books/edition/Observing_the_Universe/_wFLSJJdDvwC

- Bevington & Robinson, "Data Reduction and Error Analysis for the Physical Sciences",
  http://hosting.astro.cornell.edu/academics/courses/astro3310/Books/Bevington_opt.pdf

- Stuart Littlefair, "PHY241: Observational Astronomy"
  http://slittlefair.staff.shef.ac.uk/teaching/phy241/

- Matt Craig and Lauren Chambers, *CCD Data Reduction Guide*,
  https://mwcraig.github.io/ccd-as-book/00-00-Preface.html

Objectives: You will learn to:

- Operate an optical telescope and CCD system

- Plan an observing run

- Process ("reduce") CCD data using python

- Perform astronomical photometric measurements

Course Outline:

Learning goals of the course:

1. Use python for astronomy

2. Plan an observation

3. Execute an observation

4. Reduce an imaging observation

5. Perform a photometric measurement

6. Understand a telescope

Ancillary goals:

1. Meet your peers in the astronomy track (network)

2. Write an observing proposal

3. Practice communication

Grading Policy:

- Class Assignments and participation, homework (40%)

- Labs and Observing Projects (60%)

Requests for extensions must be submitted by email to the instructor. In the past we've been able to be reasonable about such things, but I reserve the right to take up to 10% off for each undiscussed full day late if it becomes a problem.

As long as you turn in a reasonable attempt for each lab, your lowest lab score will be dropped.

More information on grades and grading policies is here: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx and here
   https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

Letter grades are:

Letter	Minimum	Letter	Minimum	Letter	Minimum%
		A	93	A-	90
B+	87	B	84	B-	80
C+	77	C	74	C-	70
D+	67	D	64	D-	60

I reserve the right to curve the class such that your scores improve if the final score distribution is lower than I expect. This can only help your grades; I will not apply a curve to reduce your score below the raw score.

Attendance

Attendance is required for both the lectures and the labs. Part of your grade for the semester is based upon class participation during the lectures, and the lectures cover material that will be important for the labs and observing projects. In general, making up a lab will require prior permission or an emergency situation. If you feel that you have a situation that may allow for a make-up, contact the professor immediately via email. If you are absent without being excused you will receive a zero for the lab.

Excused absences are consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Course Communication Policy:

- We will use Canvas and email for announcements and other digital communication, so you are expected to regularly check Canvas.

- Regular attendance is essential and expected.

Students Requiring Accommodations

Formally, students with disabilities requesting accommodations should first register with the UF Disability Resource Center (352.392.8565) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodations. Students with disabilities should follow this procedure as early as possible in the semester. You may also come talk to the instructor about accommodations that will help you achieve the learning objectives in this course.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

COVID policies

We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

- Approved face coverings are expected at all times during class and within buildings. Following and enforcing these policies and requirements are all of our responsibility. Failure to do so will lead to a report to the Office of Student Conduct and Conflict Resolution.

- If you are experiencing COVID-19 symptoms (Click here for guidance from the CDC on symptoms of coronavirus), please use the UF Health screening system and follow the instructions on whether you are able to attend class. Click here for UF Health guidance on what to do if you have been exposed to or are experiencing Covid-19 symptoms.

- Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. Find more information in the university attendance policies.

Online Teaching Policy

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate orally in class are agreeing to have their voices recorded. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Class Demeanor (in person)

Students are expected to arrive to class on time and behave in a manner that is respectful to the instructor and to fellow students. Please avoid the use of cell phones and limit activities that can be distracting to other students. Opinions held by other students should be respected in discussion, and conversations that do not contribute to the discussion should be held at minimum, if at all.

Materials and Supplies Fees

There are no additional fees for this course.

University Honesty Policy

UF students are bound by The Honor Pledge which states, '*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Student Honor Code. On all work submitted for credit by Students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."*' The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TA in this class.

During this course, you will be working together in groups. It is fine to discuss ideas and even look at each other's code. However, when I ask for written thoughts, analysis, etc. I expect those to be entirely your own words, with sources properly cited.

Counseling and Wellness Center

Contact information for the Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Lab Report and Project Due Dates (subject to change) Submit via Canvas by 5:00 pm

1. Intro to the Campus Teaching Observatory (CTO): Jan. 20th

2. Observing Plan: Jan 27th

3. CCD Characterization : Feb. 3rd

4. CCD Reduction : Feb. 3rd

5. CCD Observing: Feb. 17th

6. Color Images: Mar. 3rd

7. Optics Lab: Mar. 31st

8. Observing Proposal: Apr. 7th

9. Cluster CMDs: Apr. 21st

Preliminary Schedule for Class & Lab Topics (subject to change)

- Week 1 (Jan 10): Coordinates and Time // Introduction to Observing
  Lab: Introduction to CTO // Python: Installation

- Week 2 (Jan 17): Introduction to Python // CCDs
  Lab: Introduction to CTO // Python: Intro to Python

- Week 3 (Jan 24): CCD Reduction // CCD characterization
  Lab: CCD Observing // Python: Observation Planning I

- Week 4 (Jan 31): Statistics and Error Analysis
  Lab: CCD Observing // Python: Observation Planning I

- Week 5 (Feb 7): Atmospheres
  Lab: CCD Observing // Python: RGB Images

- Week 6 (Feb 14): Magnitudes and Colors
  Lab: Color Images

- Week 8 (Feb 21): Stellar Evolution whirlwind
  Lab: Color Images

- Week 8 (Feb 28): Astronomical Optics
  Lab: Color Images

- Week 9 (March 7) : Working Day
  Lab: Photometry

- (Mar 14): Spring Break

- Week 10 (Mar 21): Color Image discussion
  Lab: Photometry

- Week 11 (Mar 28): The Eye
  Lab: Photometry

- Week 12 (Apr 4): Spectroscopy
  Lab: Photometry

- Week 13 (Apr 11): Research, careers, observing proposals
  Lab: Time Domain Observing

- Week 14 (Apr 18): Telescopes and Detectors
  Lab: Time Domain Observing

- Week 15 (Apr 25): Cluster CMDs
  Lab: Time Domain Observing

- Week 16 (May 2): Finals Week
  Lab: None

General topics covered

- Python for astronomy: astropy, jupyter

- Basics of Observational Astronomy: Coordinates and Time, Planning Observations, Atmospheric Effects, Sky Brightness

- Acquiring Astronomical Data: Basic Techniques, Calibration Images, Filters, Exposure times, Dithering

- Optics and Telescopes: Geometric Optics, Lens Equation, Telescope Designs, Practical Telescope Considerations

- Detectors: Types of Detectors, Fundamentals of Charge Coupled Devices, Read Noise, Dark Current, Exposure Times

- Photometry: Magnitude Systems, Photometric Calibration, Impacts of Atmosphere Spectroscopy: Science Applications, Dispersive Elements, Spectrograph Designs

- Data Analysis: Statistics and Error Analysis

- Photometry and Data Analysis: Tools in Python, astropy

- Presenting Astronomical Results: Color Images, Presentation Skills, Literature Searches

- Special Topics: TBD