ASTR 288C Astronomy Research Techniques Fall 2019

(M 3:30 – 5:30 in ATL 0224)

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Office Hours: M 2:30 – 3:30 and by appointment

Course Description

Astronomy 288C is a two-credit, hands-on introduction to astrophysical research. We will explore some of the techniques used by astronomers to probe the secrets of the universe. You will have the opportunity to carry out some research on your own. The course works best if you are familiar with first-year mathematics and physics, have basic computer skills, and are familiar with basic astronomical concepts.

Course Philosophy

Observational research is conducted in similar ways across many fields of expertise. Astronomers acquire observations from which to extract physical properties of astronomical objects. This requires data analysis, including an assessment of uncertainties, and an interpretation of these results within a theoretical framework. Finally, these scientific results must be communicated in a concise and comprehensible manner to various audiences that include advisers, peers, and the public.

The objective of this course is to show students how astrophysical research is conducted. Astronomy embraces many kinds of instrumentation and areas of physics. For this course we must focus on one area. In accordance with my research background, I intend to concentrate on data obtained by the Hubble Space Telescope (HST), with special emphasis on the spectra of gaseous nebulae. The nature of modern research is almost always computationally intensive; we will work to ensure all students gain proficiency in the necessary computing languages and software tools.

TEXTS: There are NO required texts for this course. We will make use of web-based materials, such as the Space Telescope Science Institute (STScI) Handbooks. There will also be handouts in class.

Homework

Each class has a homework assignment that is related to the subject matter of that lecture/lab and explores the subject in more detail. It is due at 3:30pm on the Monday of the following week. You are expected to complete and submit the assignment even if you did not attend the class. It is your responsibility to make sure that your assignment is delivered.
Late assignments will be accepted, but the grade will be decreased by 50%. Your lowest homework grade will be dropped when calculating your final grade for the course.

Research Project

Astronomy is very much a collaborative science. Each student will work in a small group on an original research project, culminating in a written report and oral presentation. Projects are designed to enable students to apply and integrate the skills covered in the lectures, labs, and homework. This requires a significant part of the semester, and work should begin no later than November 4 th . Three class periods will be devoted to working intensively on the projects, with the instructor available for feedback. Drafts of the papers will be reviewed, and you will receive a written referee report prior to final submission. Your final paper and response to the referee are due the last class day (Dec 9). You will present an oral report of your project results at that time.

Academic Integrity

It is the responsibility of the students to be aware of, and comply with, all University policies, including those not explicitly mentioned in this syllabus. There is a zero tolerance policy with respect to incidents of academic dishonesty, including cheating, fabrication, facilitation, and plagiarism. See the University Code of Academic Integrity and other general rules here:

https://www.ugst.umd.edu/courserelatedpolicies.html

Calendar

Date		Lecture Topic	Lab Topic
Aug	26	Overview of Course	Computer Resources
Sep	9	Physics of Ionized Gases	HST Instrumentation
	16	Formation of Astronomical Spectra	MAST HST Data Archives
	23	Physics of Emission Lines	FITS data format
	30	Temperature Dependence of Spectra	Narrow Band HST Filters
Oct	7	Density Dependence of Spectra	IDL Language
	14	Chemical Abundances from Spectra	IDL Tools for HST Data
	21	H II regions & Planetary Nebulae	Python
	28	Nebular Modeling	Python Tools for HST Data
Nov	4	CLOUDY Nebular Models	Software Tools for Emission Lines
	11	Choosing a Research Project	
	18		Research Project
	25		Research Project
Dec	2		Research Project
	9	Presentation of Project	
Dec	11-16	*** NO FINAL EXAM ***	

Grading: Projects 50%, homework 40%, class participation 10%.