Astro 32 -
Galactic and Extragalactic Astrophysics/Spring 2016

The class meets Monday and Wednesday 10:30-11:45am (Block E+)
in **574 Boston Ave, room 401**

Instructor:
Professor Anna Sajina
email: Anna.Sajina@tufts.edu
Office: 574 Boston Ave (CLIC) 312F
Office Hours: Monday/Wednesday 1-2pm,
or send me an email for an appointment

Textbook:

"An introduction to Modern Astrophysics" 2nd edition, by Caroll & Ostlie

Note: if you took Astro31 already, or plan to in the future, we use the same textbook, except Astro31 covers the "stellar" chapters, while Astro32 covers the "galactic" chapters.

Grading:

Homework assignments: 30%
Project: 20%
Midterm Exam: 20%
Final Exam: 30%

A = 90-100%
B = 80-89.99%
C = 70-79.99%
D = 60-69.99%
F= <60%

The homework and homework solutions will all be posted on the course site on Trunk.

All assignments are due at the beginning of class on the due date, or you can email me a scan of your assignment. **You get 10% off for every day you're late.**

Extensions, only for legitimate reasons, need to be requested in advance and the maximum extension is one week, after which I'll post the assignment solutions on Trunk. There is no excuse for missing the project deadline.

If you need special accommodations (e.g. extended exam time) then you need to give me a letter to that effect from the ARC early in the semester. I will discuss the arrangements with you separately.

Computing:

There are a number of homework questions as well as the term projects that will involve the use of computers. The default software we will be using is **python**, although for basic plotting type problems you are welcome to use whatever you are most comfortable with.

Python comes pre-installed with most recent computers (all Macs and other Unix-based systems, but also many Windows-based systems), so chances are you already have it on your machine. Instructions on how to check if you do, or to download it if you don't can be found here:
https://wiki.python.org/moin/BeginnersGuide/Download

If you do not have a personal computer/laptop that you can use for this class, come talk to me and I will give you temporary access to one of the astronomy desktops in 574 Boston Ave.

An introduction to the basics of python will be given in a special session sometime in the second week of classes (date TBD during the first lecture). There are also multiple online resources that you will find helpful. Here is a good place to start:
https://www.python.org/about/gettingstarted/

How to succeed in Astro32:

This class is aimed at students majoring in the physical sciences, especially of course astrophysics majors. The goal is for you to learn both some of the theoretical grounding of modern astrophysics, but also to learn some of the tools professional astronomers use including data analysis, coding, collaboration on projects. Success will depend on coming to class, doing all assigned work in a timely fashion (including reading the book), and most of all SEEK HELP WHEN YOU NEED IT!

Project:

The main goal for this project is understanding one of the key aspects of extracting scientific information from astronomical data. Our understanding of the Universe is often drawn from large surveys that nowadays deal with millions of objects at once, leading to statistical studies rather than examining individual objects. Your project allows you to do just that:

Computing the local galaxies luminosity function: Using the SDSS catalog (data release 7 or DR7), compute the R-band luminosity function of galaxies. I will provide you separately with instructions on how to obtain and handle these data.

For the projects, you can work in groups of 2 (maximum 3) people, but need to provide me with individual project reports. Sometime in the second half of the semester, we'll set up extra office hours when everybody should come talk to me about their projects, so that I can make sure you are on the right track.

The final project reports (10-15 pages including figures) should be submitted at the beginning of class April 27th.

Exams:

There will be 2 exams: A midterm on **March 7** and a Final Exam (**May 9, 3:30-5:30**). The exams will focus on conceptual understanding and will be closed book, in-class. The final exam will be cumulative.

Class schedule:

Preliminaries (briefly parts of Chapters 3, 8, 9, 10, 12,13, 15, 16)

January 25: Lecture 1: Introduction to the class, basic astronomy concepts

January 27: Lecture 2: Stellar properties, opacity, blackbody radiation

February 1: Lecture 3: Stellar evolution

HW #1 due February 3

The Milky Way (Chapter 24)

February 3: Lecture 4: Morphology of the Milky Way, part 1

February 8: Lecture 5: Morphology of the Milky Way, part 2

HW #2 due February 10

February 10: Lecture 6: Rotation curve and dark matter halo

February 15: Presidents' Day — *No classes*

February 17: Lecture 7: Interstellar medium

February 18: (Monday schedule) Lecture 8: Galactic center, *Chapter review*

HW #3 due February 22

The nature of galaxies (Chapter 25)

February 22: Lecture 9: The different types of galaxies.

February 24: Lecture 10: Measuring galaxies

February 29: Lecture 11: Orbits of stars

HW #4 due March 2

March 2: Lecture 12: Supermassive black holes, *Chapter review*

March 7: **Midterm**

Galactic Evolution & Structure of the Universe (Chapter 26 & 27)

March 9: Lecture 13: Redshifts, distances, and Hubble's law

March 14: Lecture 14: The role of mergers and interactions

March 16: Lecture 15: Formation of galaxies, part 1

March 21: Spring break — *No classes*

March 23: Spring break — *No classes*

HW #5 due March 28

March 28: Lecture 16: Formation of galaxies, part 2

March 30: Lecture 17: High redshift galaxies

April 4: Lecture 18: Large scale structure of the Universe, *Chapter review*

HW #6 due April 6

Active Galaxies (Chapter 28)

April 6: Lecture 19: Types of active galaxies; synchrotron radiation

April 11: Lecture 20: Active galaxies, part II

April 13: Lecture 21: Active galaxies, part III, *Chapter review*

April 18: Patriots' Day - *No class*

HW #7 due April 20

Observational Cosmology (Chapter 29)

April 20: Lecture 22: Cosmology formalism

April 25: Lecture 23: The Cosmic Microwave Background

April 27: Lecture 24: Other observational tests of cosmology **Project reports due!**

May 2: Lecture 25: *Course review*

HW #8 due May 2