

Preliminaries

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1 Course Overview

1.1 Learning Goals

- Have a good understanding of what to expect from this course
- Learn about the grading policy, assignments and final project scope

1.2 Modern Astrophysics

This course is directed at first/second year graduate students interested in astrophysics research. We cover a few of the important physical processes necessary to understand astronomical objects and observations. The course will use python notebooks throughout helping with experiential learning and give the student resources to explore the code/formulas and algorithms behind the plots and animations.

1.3 Course Notes and Schedule

1.3.1 Texts and resources

- A useful free textbook for a number of theoretical concepts by Nick Kaiser: *Elements of Astrophysics*: [Link to PDF](#)
- Binney and Tremaine (2008) is a key reference for Galactic Dynamics.
- Fundamentals of Astrophysical Fluid Dynamics by Kato and Fukue (2020) is recent and has a large scope with interesting discussion of fluids and radiation physics.
- If you have access through Stanford libraries I'll also add some .pdf files to the files section in the course Canvas site.

1.3.2 Syllabus: Calendar, Reading, and Problem Sets

In short: 4 lectures on gravity, 4 on fluids, 4 on radiation,
4 on special topics and 4 with student presentations = 20 weeks

Rough Calendar [will change]				Reading	Problem Set
Tu	1	Jan 7	Intro/Overview/Gravity	K:285-300	Workflow+
Th	2	Jan 9	Gravity 3 ways Stellar dynamics		K: 26.7.1 p295 + 1-2 p
Tu	3	Jan 14	Cosmology + Zeldovich approx.	K:303+5,337+3,385+3	Bertschinger Dust Solu
Th	4	Jan 16	Hydrodynamics I)	K:246-247,251-253	
Tu	5	Jan 21	Hydrodynamics II)		
Th	6	Jan 23	Sound Waves, Shocks & Sedov Taylor	K:258,22.2,23.2	K:20.10.3 + Bertsch. g
Tu	7	Jan 28	Radiation	K:61-69	
Th	8	Jan 30	Radiation Transport	K:81-89	K:6.12.1-4 +
Tu	9	Feb 4	Radiative Processes I)		
Th	10	Feb 6	Radiative Processes II)		
Tu	11	Feb 11	Radiative Processes III)		K:14.9.2-3 +
Th	12	Feb 13	AT I) Spectra of Galaxies	Notes	
Tu	13	Feb 18	AT II) HII regions	Notes	
Th	14	Feb 20	AT III) Press Schechter theory	Notes	reproduce Mo & White 98
Tu	15	Feb 25	AT IV) Summary Statistics	Notes	
Th	16	Feb 27	AT V) Plasmas/Acceleration	Notes	
Tu	17	Mar 4	Presentations I		
Th	18	Mar 6	Presentations II		
Tu	19	Mar 11	Presentations III		
Th	20	Mar 13	Presentations IV		

1.3.3 Grading

- 40% Final project and presentation
 - 60% Problem set (worst dropped)
-

Testing our python code setup:

```
import sys
sys.path.append('../code')
from astro_utils import hello_astrophysics

hello_astrophysics()
import sys
print(sys.executable)
```

Hello astrophysics!
/opt/hostedtoolcache/Python/3.12.8/x64/bin/python3

Binney, James, and Scott Tremaine. 2008. *Second Edition*. Princeton: Princeton University Press. <https://doi.org/doi:10.1515/9781400828722>.

Kato, Shoji, and Jun Fukue. 2020. *Fundamentals of Astrophysical Fluid Dynamics; Hydrodynamics, Magnetohydrodynamics, and Radiation Hydrodynamics*. <https://doi.org/10.1007/978-981-15-4174-2>.