

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 meeting times

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/3.13.1/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>.