Preliminaries

Table of contents

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 pa
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!
/Users/tabel/pyEnvs/k3dEnv/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.