ISYA
INTERNATIONAL SCHOOL FOR YOUNG ASTRONOMERS

UNIVERSIDAD YACHAY TECH

PYTHON FOR ASTROPHYSICS

Lecture 4

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2025

Lecture 4 goals:

1. Look into some Astropy functions

2. Open FITS files of astronomical images

3. Open TNG simulation files with the YT package

What do you need for the practicals?

- A PC/laptop with any OS.
- Internet access.
- A Google/gmail account.
- A GitHub account (desirable, not strictly needed).

Astropy

Astropy is a toolkit for Astronomical Computing (helpful in observational and theoretical work).

Astropy is an **open-source project** that provides a comprehensive collection of tools designed to make astronomical research and data analysis more **efficient, accurate, and reproducible.**

https://www.astropy.org/

Astropy was created to standardise and centralise these efforts, offering a robust and well-tested framework for astronomical computing.

Astropy functionality

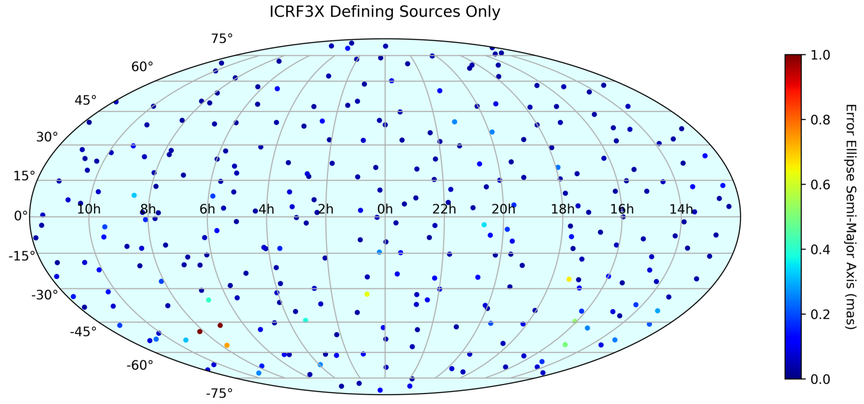
Some of its modules provide functionality for:

- Units and Physical Constants

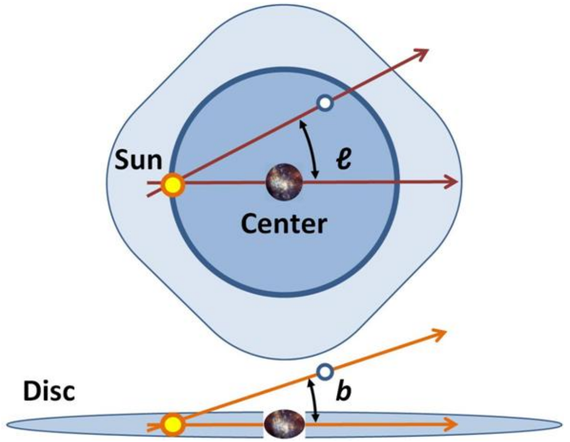
- Celestial Coordinates and Times

- Data Handling (e.g. **FITS format** readers)

- Visualisation tools



International Celestial Reference Frame.
https://en.wikipedia.org/wiki/International_Celestial_Reference_System_and_its_realizations



Galactic Reference Frame.
https://en.wikipedia.org/wiki/Galactic_coordinate_system

FITS data format

Flexible Image Transport System (FITS) format

This is the preferred data format used in **observational** astronomy.

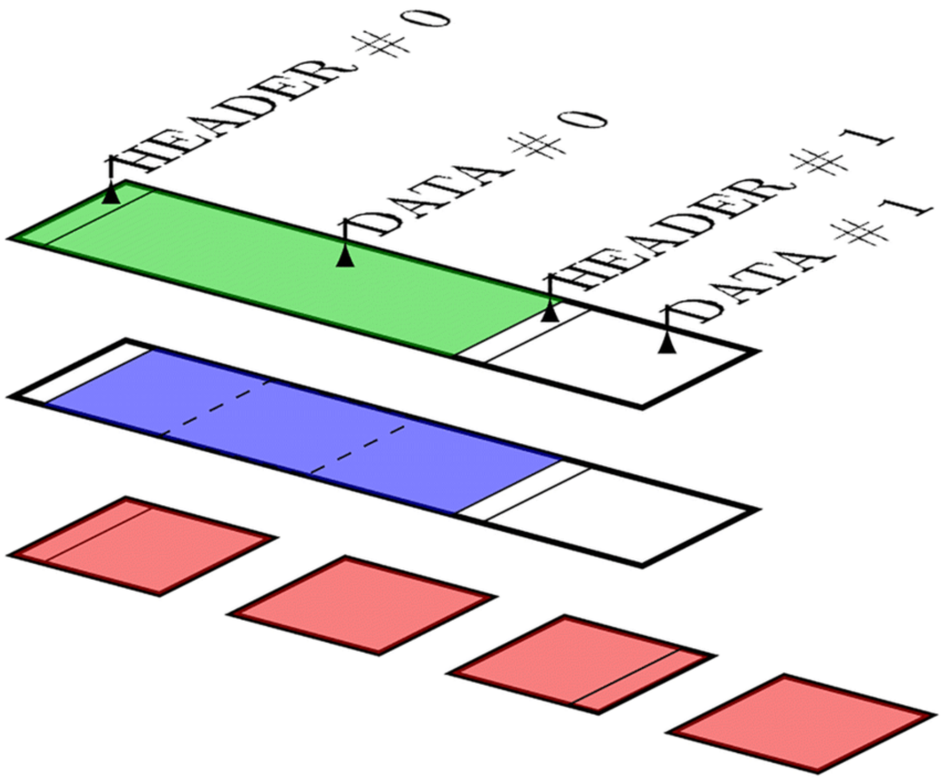
Theorists should learn to use and handle FITS files too.

It is mainly used as a standard format to share astronomical images.

But it can also contain tables or cubes, e.g. position-position-velocity diagrams

It has a header with metadata related to the image.

Header Data Units (HDU)



https://fits.gsfc.nasa.gov/fits_documentation.html

Tutorial Time

1. Please log into your gmail accounts:

2. Open this lecture on GitHub:

https://github.com/Astronomia-Ecuador/ISYA2025/blob/main/Python_for_Astrophysics/01_programming_essentials.ipynb

3. Click on the "**Open in Colab**" icon and you are ready to code!