Workshop Overview

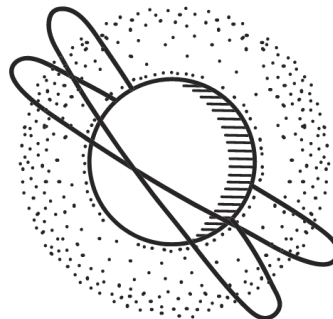# Observational Astrophysics Workshop

Pravega 2022

27th and 28th August

Summary

1. Description: *Play with Astronomical Data!* Join this hands-on workshop and get a complete guide to the basics of Observational Astrophysics! You will learn to process data, categorize Astronomical objects, and learn important software skills required in data-driven applications.
2. Topics: Fundamentals of Multi-Messenger Astronomy, Observation basics, Studying Distant Stars, Measuring Cosmic Distances, Using the EM Spectrum to observe the Universe, Observational tools and techniques, Python basics, Visualizing FITS images, and more!
3. Grade/Level: Intermediate-Advanced (Ideal for 11th/12th std students to senior undergraduates and above)

Data Driven Applications in Astrophysics

OBSERVE.
ANALYZE.
INFER.

27th and 28th August
Observational Astronomy workshop

Overview

Learning Outcomes

    a. Concise Introduction to all the important concepts in Observational Astronomy
    b. Mathematical Rigor as seen in actual astrophysical research problems
    c. Concise Introduction to Coding in Python
    d. Hands-On experience in handling data and performing analysis techniques
    e. Get trained in accessing datasets, exploratory analysis, regression, curve-fitting and visualization.

Modules and Topics Covered

Day 1:

1. *Theoretical Background of Astronomy:* Coordinate system, Magnitude system, Stellar Evolution, Multi-Wavelength Astronomy, Ground-based instruments, Space-based instruments, Luminosity and Distance, Standard Candles
2. *Instrumentation Background of Astronomy:* Telescopes - Angular Resolution; Field of View; Mounts, Aperture Synthesis, Signal-to-Noise Ratio
3. *Data and Computation in Astronomy:* The role of Data and Big Data, How Data is stored, FITS files and Astronomical catalogs, The role of Python and Open source Libraries, The role of ML in Astronomical Applications.
4. *Introduction to Python, a really quick crash course:* Functions and conditionals, Strings and Lists, Dictionaries, Introduction to Pandas
5. *Photometry:* the measurement of the brightness of stars and other celestial objects (nebulae, galaxies, planets, etc.). Such measurements can yield large amounts of information on the objects' structure, temperature, distance, age, and more.
6. *Analysis of sample dataset* - Hands-on Activity!

Day 2:

1. *Visualizing Data:* Analyzing Astronomical images using DS9
2. *Variable Stars:* Analyzing the properties of Cepheid variable stars, a photometry project
3. *Spectroscopy:* probing the temperature of stars and studying chemical signatures

4. *Astrometry:* the science of positional astronomy, which measures the location of a celestial object and its movement within the plane of the sky + short hands-on activity
5. *Certificate Distribution*

Materials & Resources

Materials and pre-workshop reading resources will be provided by Naxxatra to all participants. We will also provide observational data for the participants to analyze.

Participants only have to bring the following:

a. Laptop with any basic coding environment set up.
b. Note taking tools.

Assessment

Students who show a keen interest in the project and engage actively during the workshop will be selected for interviews with Naxxatra Sciences under the *Research and Teaching Fellowship Program.* There will also be quizzes and printed handouts for the participants during the workshop to help them follow along with the material. All participants are to join the communication channel or group before the workshop starts, in order to receive information and reading materials in advance.