

Workshop Overview

Radio Astronomy Workshop Pravega 2022

Summary

1. Description: *Build a radio telescope!* A 2-day experience of Radio Astronomy filled with discussions and hands-on activities. Assemble a radio telescope and learn the fundamentals of instrumentation, observational Astrophysics and RF electronics.
2. Topics: Fundamentals of Multi-Messenger Astronomy, Sources of Radio, Processes in the universe producing radio waves, Instrumentation basics and observational techniques.
3. Grade/Level: Intermediate-Advanced (Ideal for 11th/12th std students as well as undergraduates)
4. Objective: To provide a complete overview of theory, instrumentation and computational aspects of Radio astronomy and introduce them to the process of building a telescope.

Reading Rainbow Tip: Think about how you will INSPIRE your students and consider what you want them to take away from today's lesson plan.

5. Time Allotment: 4-5 hours on Day 1, 4-5 hours on Day 2. (Total workshop duration estimated to be 8-10 hours).

Radio Astronomy Workshop
**BUILD A
RADIO
TELESCOPE!**
3rd and 4th September



Overview

Learning Outcomes

- a. Concise Introduction to Radio Astrophysics
- b. Mathematical Rigor as seen in actual astrophysical research problems
- c. Concise Introduction to Coding in Python
- d. Hand-On Experience in Instrumentation Projects
- e. Get trained in troubleshooting and debugging Skills

Modules and Topics Covered

Day 1:

1. *Theoretical Background of Radio Astronomy*: Basic Laws(Rayleigh-Jeans; Stefan-Boltzmann; Wien), Radiative Transfer Equation - Optical Depth, Fourier Transforms and Fourier Optics(Double Slit Experiment - fringes are a result of Fourier Transform of the source), Polarization, Power Spectrum, Deconvolution
2. *Instrumentation Background of Radio Astronomy*: Telescopes - Angular Resolution; Field of View; Mounts, Aperture Synthesis, Signal-to-Noise Ratio, Antenna - Types; Temperature, Sampling Theorem, Nyquist Rate
3. *Introduction to Electronics and Coding*: Amplifiers(IC741), FET Amplifiers, Oscillators, Analog-to-Digital Convertors, Digital-to-Analog Converters, MUX, DeMUX, Microcontrollers, Arduino, Arduino IDE
4. *Exhibition of Different Antennae*

Day 2: Hands-On Activities

1. *Instrumentation Assembly* Interferometric Radio Receiver
2. *Observation Session*: Visualization of Data (or Sample Data)
3. *Computation Session*: Calculations of the necessary quantities using Python with data taken from the telescope.
4. *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. (Optional)
- 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 a group before the workshop starts, in order to receive information and reading material in prior.

