

Week 1: Introduction to Electromagnetic waves

Objective: To introduce students to the fundamental concepts of electromagnetic waves, their properties, using engaging question of Search for Extraterrestrial Intelligence (SETI) and hands-on lab involving GNU Radio.

Duration: This learning plan is designed as a 3 days/week module.

STEPS TO FOLLOW

Day 1: Search for Extraterrestrial Intelligence

- Opening with the Big Question (15 minutes)
 - Philosophical perspectives on "Are we alone in the universe?"
 - Scale of the Universe and our place in it
 - The role of SETI in seeking the answer
- Introduction to SETI (20 minutes)
 - The core principles and objectives of SETI
 - An overview of the methods and technologies used in the search for extraterrestrial life
 - Highlighting some of the most promising SETI projects and discoveries to date
- Interactive Discussion: Imagining Extraterrestrial Life (15 minutes)
 - Inviting students to share their views on the possibility of extraterrestrial life
 - Discussing the implications of discovering extraterrestrial intelligence: what would it mean for humanity?
 - Encouraging students to think about what forms extraterrestrial life might take and how we might communicate with them
- Wrap-Up and Preview of Day 2 (10 minutes)

- Setting the stage for a deeper dive into the fascinating world of electromagnetic waves, which serve as the backbone of SETI's search methods

Homework/Assignment:

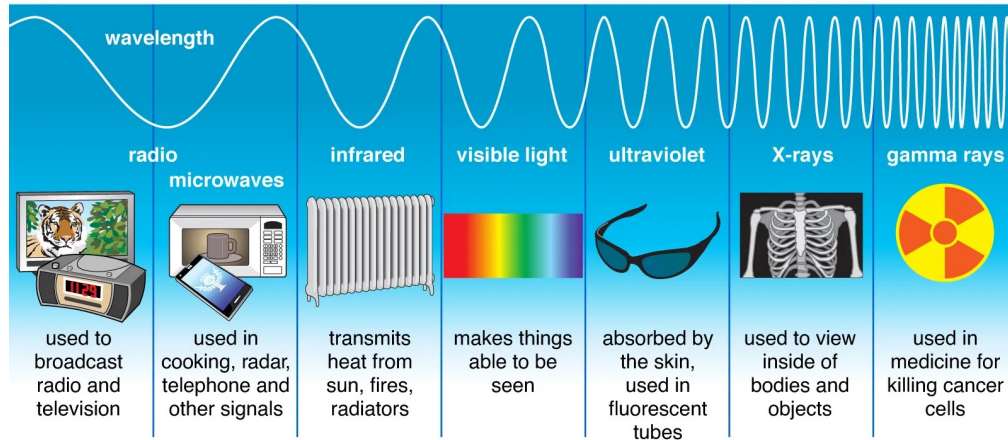
- Discussion Board (20 minutes)
 - Students post their reflections on the discussion board, responding to prompts about what excites them the most about SETI and its implications for our understanding of the universe.

This structure for Day 1 aims to give students an engaging and comprehensive introduction to SETI, laying the groundwork for the more technical components of radio science and GNU Radio that will be covered in the subsequent days. It's essential to stir their curiosity and engagement from day one, nurturing a sense of wonder and excitement about the possibilities that SETI research holds.

Day 2: The Electromagnetic Spectrum

Duration: 1 Hour

Types of Electromagnetic Radiation



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- Introduction (10 Minutes)
 - Connection to SETI (2 minutes)
 - Briefly recap Day 1 and emphasize the role of electromagnetic waves in the search for extraterrestrial intelligence.
- The Nature of Electromagnetic Waves (8 minutes)
 - What are Electromagnetic Waves? (Basic Definition)
 - Importance in Communication and Technology
- Main Content (40 Minutes)
- Characteristics of Electromagnetic Waves (20 minutes)
 - Wavelength and Frequency
 - Speed of Light in Vacuum
 - Amplitude and Polarization
- Spectrum of Electromagnetic Waves (10 minutes)
 - Brief overview of the spectrum (Radio Waves, Microwaves, Infrared, Visible Light, Ultraviolet, X-rays, Gamma Rays)
 - Focus on Radio Waves: Significance in SETI
- Generation and Detection of Electromagnetic Waves (10 minutes)
 - Generation: Antennas, Oscillators

- Detection: Radio Telescopes, Detectors
- Application in SETI (5 minutes)
 - Role in Communication with Potential Extraterrestrial Life
 - Recent on-going Research in SETI involving Electromagnetic Waves

Q&A and Assignment Introduction (5 Minutes)

- Questions and Clarifications (3 minutes)
- Introduction to Homework and Assignment for Day 2 (2 minutes)

Homework and Assignment for Day 2

Worksheet: Students will complete a worksheet with problems related to calculating wavelength, frequency, and speed of electromagnetic waves, providing them a hands-on experience of the topics covered.

Case Study: Students will research a real-world application of electromagnetic waves in the field of SETI and prepare a brief presentation or write-up explaining the case study.

This structure is designed to not only introduce the fundamentals of electromagnetic waves but also to consistently link back to SETI, thus helping to maintain engagement and emphasize the real-world applications of the concepts being taught. It involves both theoretical understanding and application-based learning, which should help to cater to a diverse range of learning styles.

Day 3: Introduction to GNU Radio & Waveform Generation

Duration: 1 Hour

- Overview of GNU Radio (5 mins)
 - What is SRD and GNU Radio?
 - Significance in Radio Astronomy and SETI
- Conceptual Foundation of Waveform Generation (5 mins)
 - Brief overview of waveforms
 - Importance in Signal Processing
- Main Content (40 Minutes)
- Hands-On Experiment 1: Basic Waveform Generation Using GNU Radio (20 mins): See attached GRC files where such demos are already created.
 - Tutorial on Setting up GNU Radio
 - Generating Basic Waveforms (Sine, Square, Triangle, etc.)
 - Visualizing Waveforms Using GNU Radio
- SETI-Inspired Experiment 1: Simulating Radio Signals from Extraterrestrial Intelligence (20 mins)
 - Introduction to the Concept
 - Generating Simulated Radio Signals representing possible Extraterrestrial Signals
 - Visualizing and Analyzing the Signals
- Conclusion & Assignment Introduction (10 Minutes)
- Discussion & Recap (5 mins)
- Recap of Day 3 Content
 - Open Discussion on SETI and Waveform Generation
 - Introduction to Homework and Assignment (5 mins)

Homework and Assignment for Day 3

Worksheet: Working with GNU Radio to generate different waveforms and analyzing them.

Project: Students will create their own simulated extraterrestrial signal using GNU Radio and document the process.