#education #physics #philosophy #syllabus

Title:
Relativity and Futurism

Purpose:
To present visions of humanity's distant future in terms of the most fundamental scientific principles that we know of and teach the basics of special relativity in the process.

Length:
7 weeks

Topics:

- Fundamental principles vs. science fiction:
  - Locality
  - Causality
  - Relativity
- Interstellar travel and SETI:
  - Different rockets and their limitations
  - Alternative forms of propulsion and interstellar journeys
  - Interstellar communication and SETI
- Energy and sustainability:
  - Energy efficiency and availability
  - Megastructures
  - Entropy and the end of time

Outline:

- Week 1:
  - Day 1:
    - Locality, Causality, and Relativity as concepts and why we believe them.
    - Special relativity as an implication of these laws under certain conditions.

- Day 2:
  - Physics as the study/enumeration of what is possible and what is impossible.
- Day 3:
  - General relativity as a broader implication of these laws.
  - Fundamental laws of physics versus science fiction.
    - 3-5 minute student presentations.
- Week 2:
  - Day 1:
    - Representation of reference frames.
  - Day 2:
    - Time dilation and length contraction in the context of interstellar journeys.
  - Day 3:
    - Simultaneity and “paradoxes”.
- Week 3:
  - Day 1:
    - Present day rockets and the rocket equation
    - Is this a rocket? activity
  - Day 2:
    - Alternative rocket fuels
    - Limitations of rockets as a category of propulsion
  - Day 3:
    - Alternative forms of propulsion and near light interstellar journeys
- Week 4:
  - Day 1:
    - Introduction to SETI and its subfields
    - "Grabby Aliens"
  - Day 2:
    - Interstellar communication theory and the myth of a galactic civilization
    - Class discussion on the assumptions of Classical vs. Dysonian SETI
  - Day 3:
    - Op-eds on SETI

        - 3-5 minute presentation
- Week 5:
    - Day 1:
        - Relativistic energy and momentum - analogies to relativistic time and space
    - Day 2:
        - Particle collisions and radiations
    - Day 3:
        - Binding energy and mass
- Week 6:
    - Day 1:
        - Analyzing the energy efficiency of various energy generation methods and considering how much fuel for such methods are available
    - Day 2:
        - Exploring the concept of megastructures for the purpose of energy collection, energy storage, habitation, and communication.
        - Talk about the concept of limiting factors in long term growth
    - Day 3:
        - Introduce a new fundamental law of physics: entropy and consider its implications.
        - Limiting factors in the growth of human society
            - 3-5 minute presentation
- Week 7:
    - Day 1:
        - Discussion on futurism in terms of the problems that face humanity today and how visions of the future affect how those with the privilege to do so may steer towards or away from that future.
    - Day 2:
        - Internal class discussion on the student’s particular visions of the future.
        - Intro to final project presentation
    - Day 3:
        - Short discussion on the relationship between technology and progress.

- Visions of the distant future, 1, 10, 100, 1000 years from now
    - 15-20 minute student presentation