



Our Place in Space

Cosmic Ray Detector

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GRADE LEVEL(S): 3-5

SUBJECT AREA(S): science, radiation, muons, ultraviolet (UV), energy, work, light, atmosphere

ACTIVITY LENGTH: 1 Hour

DESCRIPTION: The students will be introduced to solar radiation with an activity centered on using a [cloud chamber](#) to visualize cosmic rays.

LEARNING GOAL(S):

- Students will discuss how energy from the sun is transmitted in a variety of forms that perform different amounts of work.
- Students will identify multiple pieces of evidence that demonstrate energy being transmitted from the sun.

NEXT GENERATION SCIENCE STANDARDS:

4-PS3-2

- Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents

COMMON CORE:

SCI.03.08 – Identify and trace the movement of objects in the sky

SCI.04.09 – Describe examples of energy transfer

SCI.05.04 – Describe the Earth's place in the solar system and the patterns of movement of objects within the solar system

SCI.05.05 – Identify natural objects outside the Earth

STUDENT BACKGROUND: Prior knowledge of sunlight - ROY G BIV

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EDUCATOR BACKGROUND: Basic understanding of the different types of energy from the sun. See:

- <http://solar.physics.montana.edu/YPOP/Spotlight/Tour/tour03.html>
- http://en.wikipedia.org/wiki/Electromagnetic_spectrum
- http://www.nasa.gov/mission_pages/sunearth/news/light-wavelengths.html#.VCJCo7tWrHI
- Basic background on how a cloud chamber works:
<http://www.scienceinschool.org/2010/issue14/cloud>

MATERIALS LIST:

- Wireless weather station - wind, temperature, humidity
- Ambient Weather TM-206 Solar Power Meter
- 2 gallon Fish tank
- Dry ice
- Aluminum tray
- Work lamp
- Felt
- Duct tape
- 99% Isopropyl alcohol

VOCABULARY:

- Visual light
- Ultraviolet
- Infrared
- Microwave
- X-ray
- Gamma radiation
- Atmosphere
- Muons
- Cloud chamber
- Dry ice
- Mist

PREP:

1. Create the cloud chamber - directions available 'How to build a cloud chamber.pdf'.
2. 10 minutes before the lesson, add 1-2 Tbsp of isopropyl alcohol to the felt in the tank. Rock the tank back and forth to spread the liquid.
3. Quickly flip the tank upside down and duct tape to the aluminum tray (also flipped upside down).
4. Once the tank is sealed to the tray, place the tray over the dry ice. The metal needs to be touching the dry ice block. Allow the tank to cool during the PowerPoint presentation.

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LESSON DETAILS: COSMIC RAYS ARE ALL AROUND US

MATERIALS:

- 2 gallon Fish tank
- Dry ice
- Aluminum tray
- Work lamp
- Felt
- Duct tape
- 99% Isopropyl alcohol

GUIDING QUESTIONS:

- What do we know about our Sun?
- What types of 'rays' can we see or feel?

ACTIVITY PLAN:

- Start with a discussion of the seen and unseen 'cosmic rays' from the Sun and all stars
- Show the PowerPoint presentation - 'Get to know our Sun'
- Notes for each slide are included in the presentation file.
- Additionally, UV beads and Nature Print Paper may be useful tools for elementary students to begin demonstrating the work done by invisible energy from the sun.
- Demonstrate the existence of 'unseen' muons from the Sun with the cloud chamber
- Using a projector, angle the light beam so that the students can see the mist layer. Ask the students to relax their eyes and stare into the mist. Our peripheral vision is best at noticing changes so it easier to view the muon trails that way (instead of scanning the mist with the central vision).
- After the tank has been on the dry ice for about an hour the temperature differential is usually lost and the mist layer is more difficult to see. The tray can be removed, warmed, and then reused if there is enough dry ice left.
- Follow up with a writing assignment or discussion that asks students to explain how their perception of the Sun's energy has changed and/or why they believe understanding these particles is important.

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