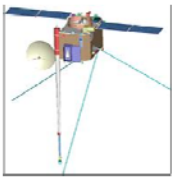
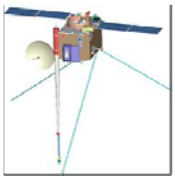


# Build your own STEREO model
# Lesson Plan



**Overview**

This lesson plan provides a complete and fun learning experience that revolves around the instrument S/WAVES on the STEREO spacecraft, its function, and contribution to space weather. See background knowledge for a list of concepts students should know before participating in this lesson.

Part of the lesson includes a demonstration using a STEREO model that needs to be constructed ahead of time. The model consists of a box with a radio —that will receive radio waves similar to the real spacecraft— wrapped up in a STEREO paper model. Materials and step-by-step instructions are available in the student section of this website.

Using the model as a demonstration tool is a very important aspect of this lesson. On the other hand, students would be able to have an overview of how the instrument works by watching the PowerPoint presentation. Just keep in mind that visual 3-dimensional models are extremely helpful in the understanding of concepts that are as abstract as radio wave emissions.

**Background Knowledge**

This lesson is most appropriate when students have a clear understanding of the following concepts:

Magnetism
- Earth's magnetic field

Electromagnetic Spectrum
- Frequency
- Wavelength
- Radio Waves- position on the spectrum

Electrons

Solar System
- Earth's dependence on the Sun
- Sun's effect on Earth

Having this variety of concepts involved in one lesson makes it great to relate big ideas learned in different units or even different grade levels. It also gives students a way to relate what they previously studied with the real world, adding meaningfulness to science class.

*A vocabulary list of definitions for these and many other concepts related with STEREO and the S/WAVES instrument is available in the student section of this website.

**Objectives**

The student will be able to:

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a) Relate previously learned science concepts to current real world science.
b) Recognize the importance of studying space weather.
c) Identify the components of the S/WAVES instrument and their function.

**Warm-up**

Use **worksheet 1** as a warm-up to prepare students for today's special lesson. This is a very simple warm-up that assesses students basic background knowledge of electromagnetic waves, the Sun, and their ability to relate the two. Ask volunteers to discuss their answers with the rest of the class. If you have posters, models of the solar system, or any other visual aids to motivate students in the discussion feel free to use them as well.

**Process**

Activity 1. Use the Power Point **presentation** to continue your discussion about the Sun, space weather, and the importance of STEREO. This presentation will enable students to realize why scientists believe is important to invest time, money, and other resources to study the Sun.

During the presentation -

***Use the radio STEREO model to show the position of the antennas. Turn the model on, so that students can see (hear) how the spacecraft receives radio waves. Just like a radio has the ability to track different radio stations by changing frequency, the S/WAVES instrument also tracks different solar radio waves, such as type II and type III radio bursts by using five radio receivers (see presentation for further details).***

Activity 2. Now that they have seen your model and understood the concepts behind the spacecraft's mission, they are ready to create their own three-dimensional model of STEREO. This is the **paper model** (available in the student section) provided by the Johns Hopkins University, Applied Physics Laboratory (APL), http://stereo.jhuapl.edu/

For this activity, divide the class in groups of four. There are two models per document, since the STEREO Mission has "twin observatories". Follow instructions on the document to cut and assemble the different parts.

The students can take their model home to share their experience with their parents or you may use a string to attached them all and hang them from wall to wall or each separately to hang it from the ceiling.

If there is any student interested in building their own *radio* STEREO model, please refer them to this web page to download the same set of instructions you used to construct the model.

**Closure**

In order to verify students understanding, hand out the **crossword puzzle** located in the student section of the website. This crossword puzzle is a fun way to verify a student's general knowledge of the science concepts behind this mission.

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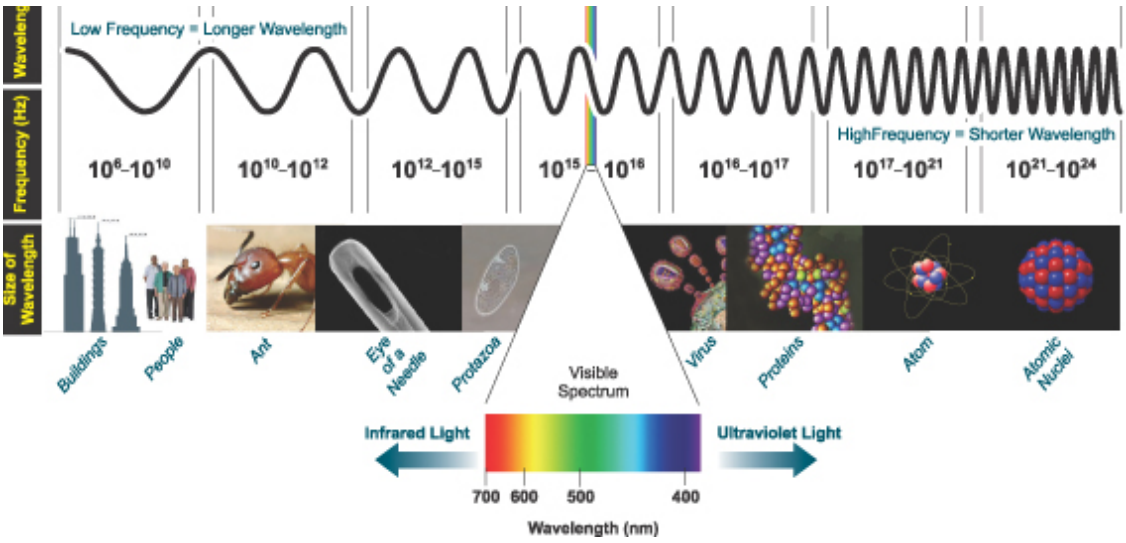
**Worksheet #1:**

## The Sun and Electromagnetic Waves

1. Use the diagram below to organize these electromagnetic waves (radio, x-ray, ultra-violet, infrared, visible) in order of frequency (from least to greatest).

_____ _____ _____ _____ _____




Credit: http://www.andor.com/printpage.asp?app=331

2. What is the difference between electromagnetic waves and other types of waves such as sound?

_____

_____

_____

3. Write a sentence that establish the relationship between the following terms:

Sun Earth Space Electromagnetic waves

_____

_____

_____

4. Mention at least two events in nature caused or influenced by the Sun.

a) _____

b) _____

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