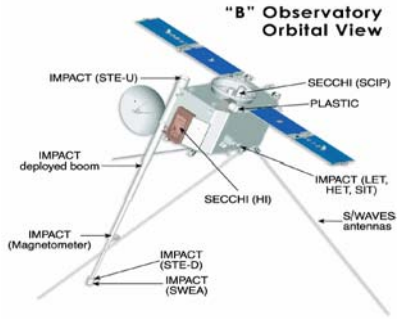
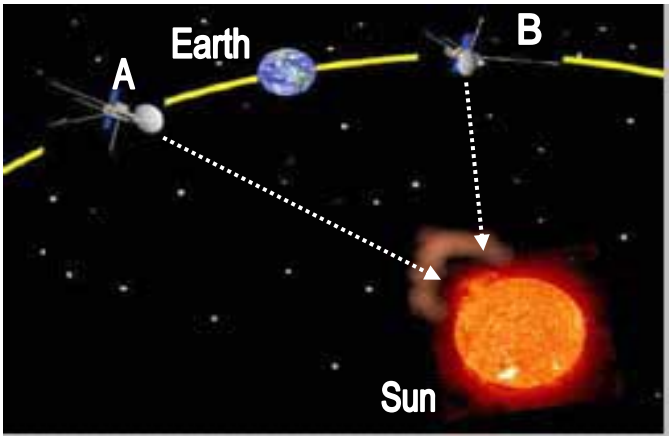
The STEREO Mission
Space Academy Student Activity

STEREO is an acronym for **S**olar **TE**rrestrial **RE**lations **O**bservatory, and is the third mission in NASA's Solar Terrestrial Probes Program. STEREO is a 2-year mission employing two nearly identical space-based observatories to provide the first-ever, three-dimensional, or 3-D, **stereoscopic** images of the Sun to study the nature of coronal mass ejections or CMEs. These powerful solar eruptions are a major source of the magnetic disruptions on Earth and a key component of space weather, which can greatly affect satellite operations, communications, power systems, the lives of humans in space, and even global climate over the long term.

The twin observatories will fly as mirror images of each other to obtain unique "stereo" views of the Sun's activities. They must be placed into a rather challenging orbit where they're offset from one another. One observatory will be placed ahead of Earth in its orbit and the other behind. Simultaneously from their two different points of view, the observatories will be aimed at the Sun and will collect data. Just as the slight offset between your eyes provides you with depth perception, this placement will allow the STEREO observatories to obtain 3-D images and particle measurements of the Sun. Data collected by the twin observatories can include photographs that can be paired as a stereogram and viewed as a 3-D image with an instrument called a stereoscope.

Views of the nearly identical spacecraft (**"A" Observatory** and **"B" Observatory**) are shown below with an artist's depiction of where they will be placed relative to Earth, with the Sun shown in the foreground.





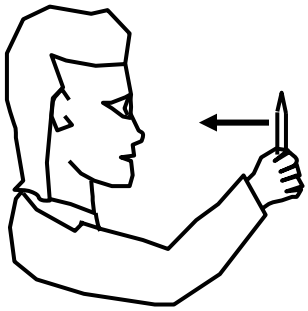
For more information about the STEREO mission, visit http://stereo.jhuapl.edu or http://stereo.gsfc.nasa.gov/.

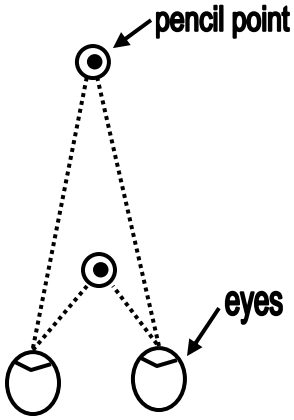
Seeing in 3-D

It is natural for two-eyed creatures, such as we humans, to perceive the world with images formed in our brain that give us a sense of depth, or three-dimensional ("3-D") space. This sense is possible because we view the world from two different points of view--our two eyes. Because our eyes are separated across the bridge of our nose by about 6 centimeters (approximately 2.4 inches), each eye "sees" a slightly different view of the scene in front of us. These two different views are transmitted to our brain. The brain "fuses" the two images together to give us a sense of a 3-D world. If you close one eye, it is difficult to get that sense.

Try This

Hold a pencil at arms length in front of your face as shown to the right. Slowly move the pencil toward your face. You will easily sense that the pencil is getting closer.





With the help of the diagram to the left, imagine viewing this action looking down on top of your head. The view seen by each eye is represented with dotted lines. Note that when the pencil is closest to your face, the angle between the dotted lines appears to be greater than the angle between the dotted lines when the pencil is further away. This angle is called the **parallax angle**, and our brains make a judgment about how far something is from our pair of eyes based on this angle. The closer the object, the larger the parallax angle. The further an object, the smaller the parallax angle.

Now try this. As you move the pencil back and forth, alternately blink your eyes. You should notice that the pencil "appears" to jump back-and-forth. The closer the pencil, the bigger the jump. The "apparent jumping" will not happen as you move the pencil back-and-forth with only one eye (either eye) constantly open. One eye cannot help your brain to perceive depth "3-D." You need two good eyes, separated by some distance, in order to perceive depth.

Technology, in the form of stereograms and stereoscopes, can mimic what our eyes do naturally: create 3-D images. In the following activities you will make a stereogram and a stereoscope for viewing it.