

INTERNATIONAL YEAR OF ASTRONOMY 2009 GALILEO ACTIVITY

APERTURE EXPERIMENT

From *Galileo for Kids: His Life and Ideas* by Richard Panchyk (Chicago Review Press, 2005). There is extensive background information and many more activities in this book recommended by the National Science Teachers Association (NSTA).

Background

Galileo and Johannes Kepler were both fascinated with optics¹ and studied the properties of light and lenses. Galileo needed to understand how to use the powers of light and take advantage of the properties of the eye. Leonardo da Vinci and others had demonstrated the properties of an aperture, or small hole, in something called a *camera obscura*. A camera obscura is a dark chamber with a tiny hole in one side or wall. When the hole is placed in front of a brightly illuminated scene, the scene is projected through the hole onto the far side or wall of the camera obscura. Early astronomers used this camera obscura to project an image of a solar eclipse without looking directly at the sun.

This activity demonstrates how images are seen through an aperture. By understanding how optics work, you can better understand the nature of the light coming from the planets and stars all the way to the Earth.

Materials

- 2 pieces of thick, white paper
- scissors
- pin

Activity

Fold the paper in half and cut a tiny triangle (1/3 inch or less) in the center of the fold. When you open the paper, you will have a diamond-shaped aperture. Hold this diamond-shaped hole up to one eye and close the other eye. Observe how the closer you are to an object (a computer screen, for example), the less of it you will see in the diamond. What you do see will have the shape of a diamond. On the other hand, as you get farther away, you will see more and more of the object, until you are far enough away that the object is whole.

¹ a science that deals with the genesis and propagation of light, the changes that it undergoes and produces, and other phenomena closely associated with it (Merriam Webster Online Dictionary)

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Next, poke a pinhole in the second piece of paper. You cannot see much from a close distance, but you can look outside at night and see the moon through the tiny pinhole. Though the moon is larger in the sky than a pinhole, you can still see the entire moon through the tiny hole.

This aperture experiment demonstrates that each and every part of a luminous or brightly lit object or body transmits light rays in all directions. In this case, the light rays from the moon are being emitted in every direction, including into the tiny pinhole. Light can and will travel wherever there is an opening. Cameras, microscopes, and telescopes all collect and intensify light in order to make clear (and sometimes enlarged) images of objects. This simple principle of light rays coming through an aperture was refined by Renaissance scientists who figured out how to clarify and magnify the light once it entered the aperture.

Background and Extensions

- Check out “Telescopes from the Ground Up” site to explore the history of telescopes, from Galileo to NASA’s Great Observatories
<http://amazing-space.stsci.edu/resources/explorations/groundup/>

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