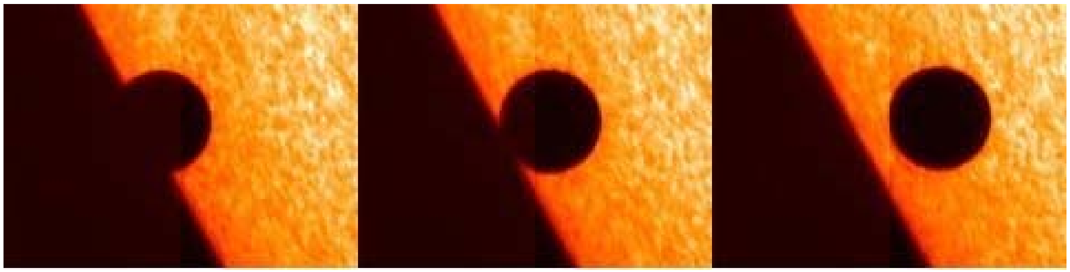
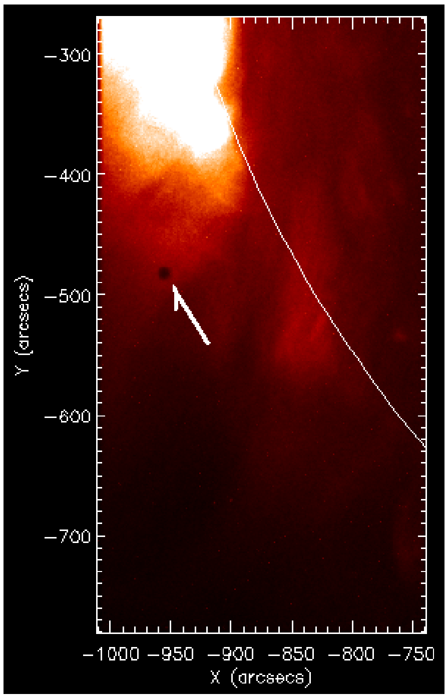
The Transit of Mercury





Every few times a century, the planet Mercury and Earth are lined up in such a way that Mercury passes across the disk of the sun as seen from Earth. The last time this happened was on November 8, 2006, and the next time this will happen will be on May 9, 2016. Since they were first observed in the 1600's, astronomers have studied them intently to learn more about Mercury, and to determine how far the sun is located from Earth. In recent times, astronomers no longer view these transits with much interest since the information that provide can be found by other more direct means. Still, when transits occur, astronomers turn their telescopes, now located in space, to watch the spectacle.

Top) Transit of Mercury obtained with Solar Optical Telescope (SOT) on the Hinode satellite on November 8, 2006. Left) Image obtained with the EUV Imaging Spectrometer (EIS). Solid curve indicates solar limb. The arrow shows the location of Mercury seen against the solar corona.

Problem 1: If the diameter of Mercury as viewed from Earth during the transit was 10 arcseconds, and the diameter of the sun at that time was 1900 arcseconds, what would be the diameter of the circle in the Hinode EIS image in centimeters that would represent the solar disk at this scale?

Problem 2: At the time of the transit, Mercury was about 55 million kilometers from the sun and about 92 million kilometers from Earth. How large, in arcseconds, would Mercury have appeared if it were at the distance of the Sun at this time?

Problem 3: How old will you be when the next Transit of Mercury happens?

Inquiry Problem: Why are transits of Mercury so rare?

Answer Key:

Problem 1: If the diameter of Mercury as viewed from Earth during the transit was 10 arcseconds, and the diameter of the sun at that time was 1900 arcseconds, what would be the diameter of the circle in the Hinode EIS image in centimeters that would represent the solar disk at this scale?

Answer: The tic marks on the lower image are 10 arcseconds apart. With a millimeter ruler, the separation is about 2 millimeters. The scale of the image is then 5 arcseconds/millimeter. If the solar diameter is 1900 arcseconds, its size on this page would be 1900 arcseconds / (5 arcseconds/mm) = 380 millimeters or 38 centimeters.

Problem 2: At the time of the transit, Mercury was about 55 million kilometers from the sun and about 92 million kilometers from Earth. How large, in arcseconds, would Mercury have appeared if it were at the distance of the Sun at this time?

Answer: The distance to the sun would be 55 + 92 = 147 million kilometers. At a distance of 92 million kilometers from Earth, mercury is 10 arcseconds in size, so at 147 million kilometers it would be 10 arcseconds x (92 million km /147 million km) = 6.2 arcseconds.

Problem 3: How old will you be when the next Transit of Mercury happens?

Answer: If you are 13 years old in 2007, you will be 13 + (2016 - 2007) = 13 + 9 = 22 years old, and will be graduating from college!!

Inquiry Problem: Why are transits of Mercury so rare?

Students may use GOOGLE to look up 'transit of Mercury' to find pages that discuss how transits occur.

They should deduce that the circumstances to not re-occur each year because Earth and mercury are on orbits that are tilted with respect to each other.