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Blog

Lunar Eclipse Shadows

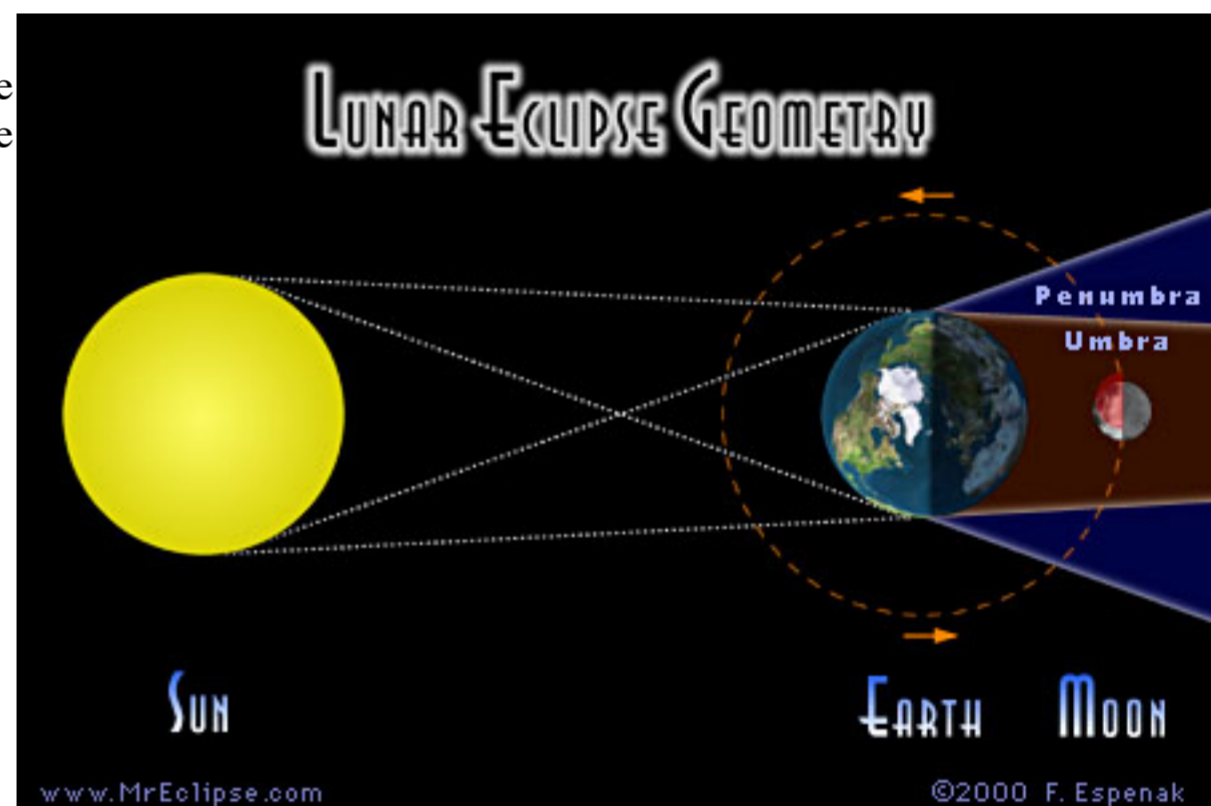
Posted by admin on March 17, 2014

Adapted from [Activity: Lunar Eclipse](#)



Because the sun has a significant apparent diameter (as opposed to stars, which appear as points of light), there are two types of shadows cast by the earth. This demonstration illustrates the two shadow regions through which the moon can pass--the umbra and the penumbra--during a lunar eclipse. A [schedule and details](#) of lunar eclipses are published by Fred Espenak of NASA GSFC.

The umbra is the smaller but darker inner shadow; from within it an observer would see no portion of the sun because the sun is fully blocked by the earth. The penumbra is the larger but fainter outer shadow; from within it an observer would see some portion (but not all) of the sun because the sun there is not fully blocked by the earth. A primer on lunar eclipses by Fred Espenak is at <http://www.mreclipse.com/Special/LEprimer.html>.



Moon phase demonstrations often use a singular light bulb. However, to highlight the penumbra requires a light source with significant diameter. For the sun you can use a single worklight bulb if it has a long filament. Here we simply turn on two separated worklights. If doing activity outside at night, car headlights work very well. For the moon, mount a plate on a stand (as shown) or have a student carry a paper plate or cake tray through the shadows to simulate the eclipse.

The shadow cast on the wall shows both the dark umbra and fainter penumbra. Because the light source is linear and horizontal, the shapes of the shadows are skewed to the vertical. Ideally our sun source should have a circle of lights to mimic the dimensions of the sun.

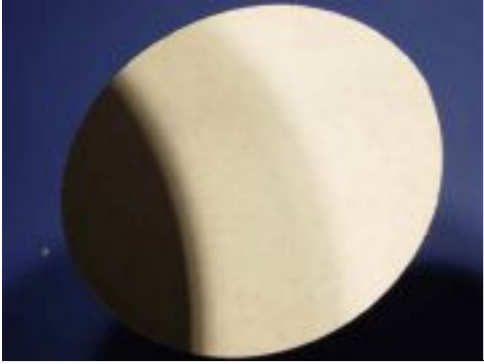
Before the orbiting moon reaches the cones of shadows behind the earth, the moon is fully illuminated.



Then it enters the penumbra, followed by the umbra. Obviously this system and its resultant shadows are not to scale. Sometimes the moon passes only through the penumbra and the eclipse is not discernible. When the darker umbra touches the moon, the lunar eclipse becomes readily apparent to observers on earth.

Notice the shadow on the background wall.





A close-up of the moon shows the two shadows clearly.

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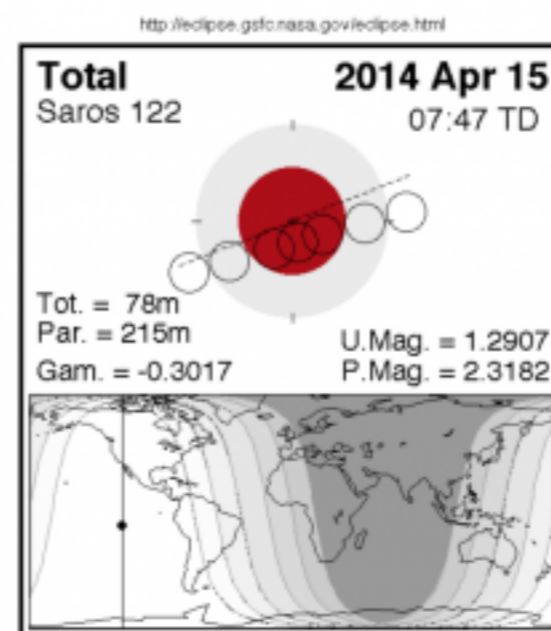
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April 15, 2014



Five Millennium Canon of Lunar Eclipses (Espenak & Meeus)
NASA TP-2009-214172



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