

Making stars disappear and reappear

In class you explained how eclipses occur based on changes in the position of the Moon relative to the Sun and a person on Earth. In a solar eclipse the Moon passes between the Sun and a place on Earth from which someone can see the eclipse. This is just one example of when one celestial object appears to cross in front of another in space from the perspective of an observer on Earth. Any time such a crossing happens, it is called a *transit*. What are some other objects in space that might appear to cross in front of other objects from time to time if you observed them from Earth over long periods? Write your ideas below.

Once, to impress his foes, a Portuguese leader and astronomer said he was going to perform a magic trick and make a star appear from behind the Moon. That star is called Aldebaran, one of the brightest stars we can see from Earth (besides our Sun). It is the eye of the Taurus the bull constellation in ancient Greek astronomy, and it is part of the outstretched arm of the Biboonkeonini constellation, the Wintermaker, in the Ojibwe star culture. People on Earth have recorded the light from Aldebaran disappearing behind one side of the Moon and then reappearing on the other side of the Moon a short while later. Claudius Ptolemy, a Greek mathematician, astronomer, geographer, and astrologer, wrote of four instances where the Moon blocked stars from the view of people where he lived, around 150 CE. Other recorded examples of Aldebaran disappearing include March 4, 640 CE in Japan, and as recently as September 3, 2018 in North America.



The view from Spain of the Moon and Aldebaran, February 5, 2017. Credit: Stellarium.

Scientists call this phenomenon, when a celestial object passes between an observer and a smaller celestial object, blocking all its light, an *occultation*. These occultations occur nightly for different stars, planets, and moons and are visible from nearly anywhere on the nighttime side of Earth. Occultations can be seen with your eye but are easier to see with a small telescope. Moons, asteroids, and planets can all block other celestial objects from a person's view. Since these objects move around the sky in very predictable patterns, future occultations can be predicted.

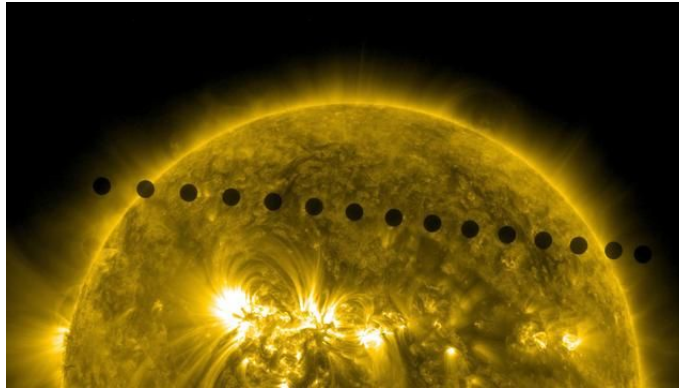


Time lapse pictures of the Moon blocking the light from Aldebaran on December 23, 2015

Using what you have figured out about lunar phases and eclipses, describe what is happening with the Moon that can help explain what causes a star, like Aldebaran, to disappear from view for part of the night for someone looking at the sky from the nighttime side of Earth. Use words and pictures in your explanation.

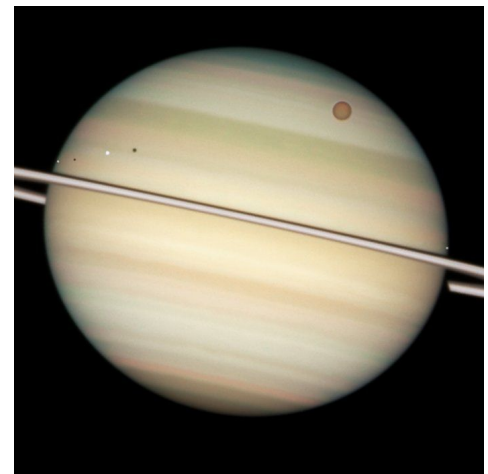
The Moon isn't the only object in the sky that can block light from the Sun or other stars. Sometimes nearby planets do this too. These transits can happen in many different ways. One example is when a planet passes between Earth and the Sun. The planet is "transiting" the Sun.

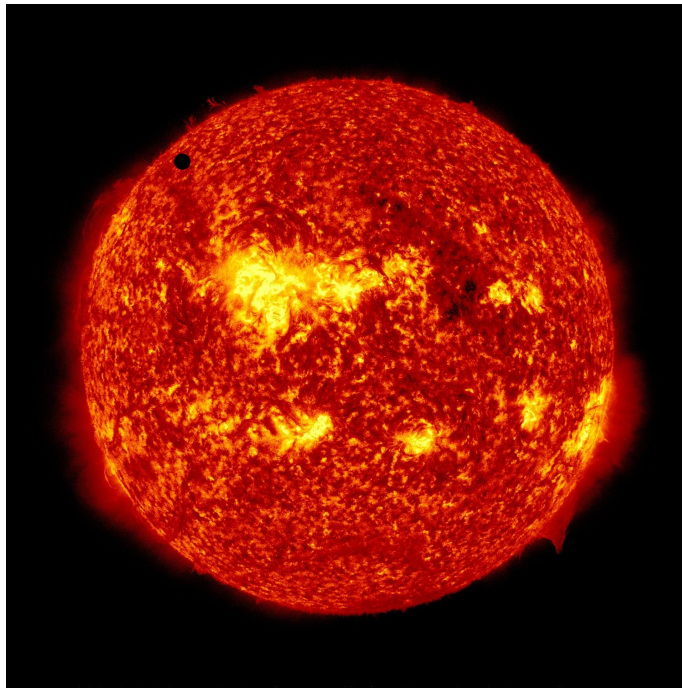
On Earth, there are some times when we can see Mercury and Venus pass in front of the Sun. Taking photographs of the Sun as it happens helps us detect this because it is hard to notice any visible dimming of sunlight with an unaided eye. Here is one photo of Venus transiting the Sun in 2012.



This is a time-lapse photo taken using a different type of camera (so the color looks different). The camera took 15 separate photos, spaced several minutes apart. The final photo is a merged image of all 15 and shows the movement of Venus over time.

Another example of a transit is when a planet's moon(s) pass in front of the planet, such as several of Saturn's moons transiting the planet as seen by the Hubble Space Telescope in the image here.





Venus is bigger than the Moon but smaller than Earth. So why does it appear so small? Why does it block so little of the Sun's light? Using what you have figured out about lunar phases and eclipses, explain what you think could be going on to cause us to see this pattern? Use words and pictures in your explanation.

Sources

- <https://skyandtelescope.org/astronomy-blogs/make-way-wintermaker11122014bk/>
- <https://astrosociety.org/news-publications/mercury-online/mercury-online.html/article/2019/05/08/the-occultation-of-aldebaran-in-1347>
- <http://www.nightskyhunter.com/Moon%20-%20Pleiades%20Occultation%20Dec%2021st%2007.html>
- <https://www.virtualtelescope.eu/2017/01/31/5-feb-2017-aldebaran-occultation-by-the-moon/>
- <https://occultations.org/>
- <https://www.star-facts.com/aldebaran/>