



Lunar Eclipse, 8 October 2014: Information Pack

by Jared Henley

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The October 2014 lunar eclipse

On Wednesday, October 8, 2014, there will be a total lunar eclipse. Partial lunar eclipses are quite a common event but total lunar eclipses are a lot rarer. Observing a lunar eclipse can be an exciting and also educational event. This eclipse is particularly convenient for people in Eastern Australia, because it begins just after sunset.

Key Times (Eastern Daylight Saving Time)¹:

| Time | Event |
|----------|--|
| 7 pm | Approximate time of sunset |
| 7:16 pm | The Moon enters the Earth's penumbra. The moon becomes gradually darker, with a stronger shadow on one side. |
| 8:15 pm | The Moon enters the Earth's umbra. A growing "bite" will be taken out of the Moon. |
| 9:25 pm | Total eclipse begins. The Moon is now entirely within the Earth's umbra: the entire moon has been "bitten". |
| 10:24 pm | Total eclipse ends. A shrinking "bite" will be taken out of the Moon. |
| 11:34 pm | Total eclipse ends. The moon becomes gradually brighter, with a stronger shadow on one side. |
| 12:34 am | Eclipse ends. |

How to observe the eclipse

Observing is easy. Go outside after sunset and look for the Moon in the Eastern sky. Make sure you have a fairly clear view to the East. The Moon will just be rising at sunset. It should be visible above rooftops by about 8-8:30 pm.

For the impatient, the best time to start is at about 8:15 pm. For those with more ability to concentrate, heading outside at about 7:45 pm. Be prepared to wait for an hour or more.

How lunar eclipses occur

When the Sun shines on the Earth, the Earth casts a shadow. Sometimes the Moon passes into that shadow. The Moon makes no light of its own, it only reflects light from the sun, so when it is in the Earth's shadow it becomes dark.

During a total lunar eclipse, if you were standing on the Moon and looking back at Earth, you would see the Earth begin to cover the Sun. As more of the Sun was covered, the area around you would get darker and darker. When the entire Sun was covered, you would be in almost complete darkness.

¹NASA maintains a handy eclipse calculator at <http://eclipse.gsfc.nasa.gov/JLEX/JLEX-AU.html>. The exact coordinates of Moree are 148° 54' 26.8"E, 29° 04' 19.1"S, and our timezone is UTC+10 (10 E) in winter and UTC+11 (11 E) in summer.

Figure 1 shows how this all happens. The penumbra is where only a part of the Sun is covered by the Earth. The umbra is where the entire Moon is in Earth's shadow.

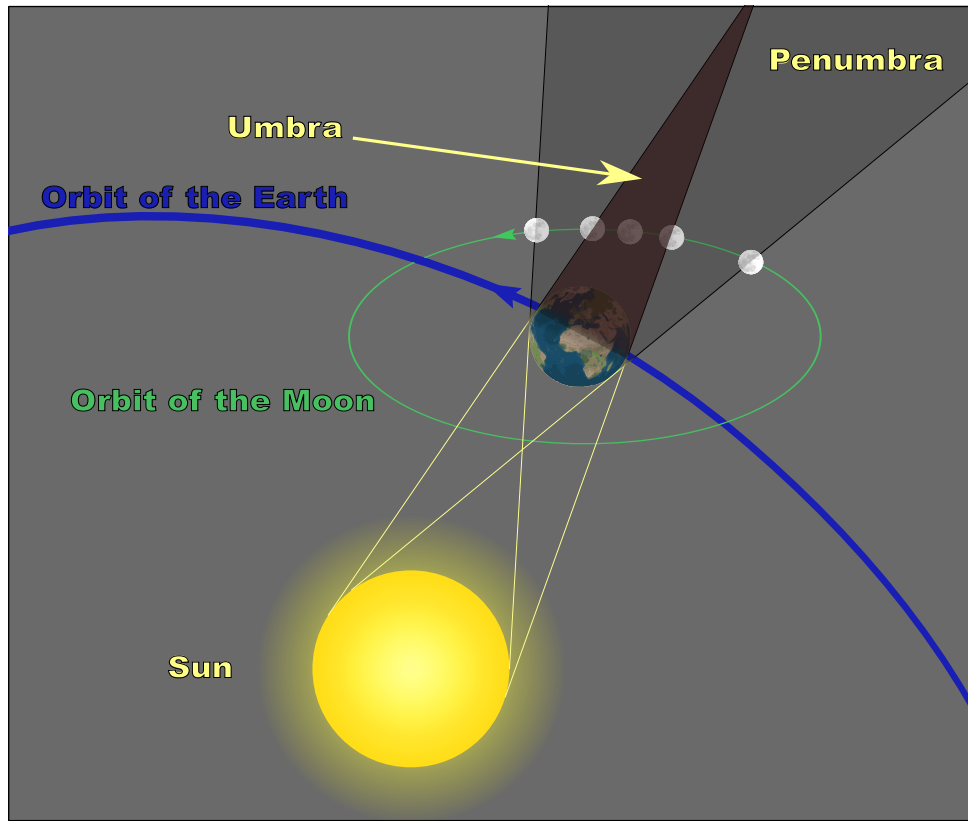


Figure 1: Geometry of an Eclipse

The Moon often appears red during an eclipse. This is because a lot of the light reaching it has to pass through the Earth's atmosphere first. The moon is coloured with all the sunsets and sunrises around the Earth!

When the Moon is full, it is on the opposite side of the Earth from the Sun. But the Moon might also be a bit above or below the Earth's shadow, and there will be no eclipse. If the Moon only passes through the penumbra, we get a penumbral eclipse. If a part, but not all, of the moon enters the umbra, we get a partial eclipse. If the entire moon enters the umbra, we get a total eclipse. Figure 2 shows these different types of eclipse.

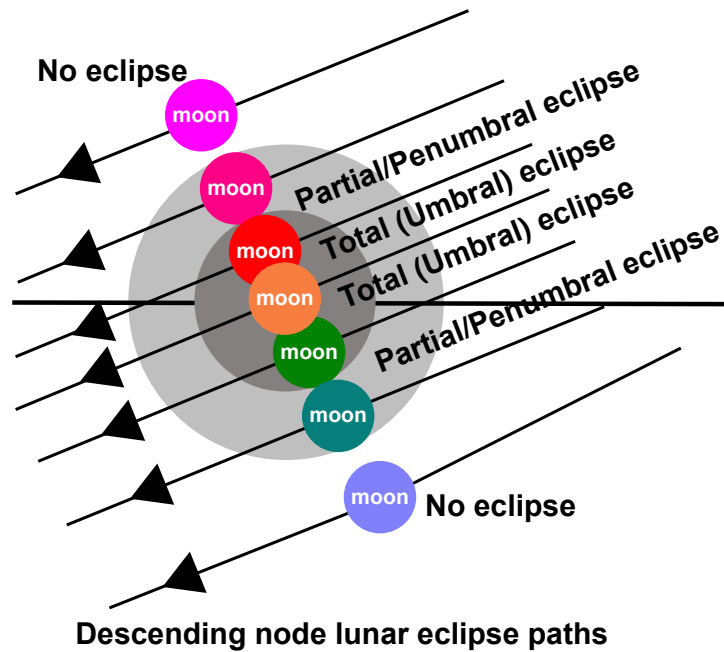


Figure 2: Eclipse Types

More cool facts

- ◆ The Moon travels through the Earth's shadow at about one kilometre per second. That's 3600 kilometres per hour! At that speed, you could travel from Moree to Narrabri in 1 minute and 40 seconds, or Moree to Inverell in 2 minutes 20 seconds.
- ◆ The Moon's orbit is not exactly circular. When it is further from the Earth, it travels a little slower. However, the size of the umbra nearly the same whether the Moon is at its nearest or farthest points from Earth, so eclipses last longer when the Moon is at its farthest.
 - The farthest point in the orbit of a planet, moon, etc. is called the apogee. For the Moon, this is about 405,500 km.
 - The nearest point is called the perigee. For the Moon, this is about 355,600 km.
- ◆ The Moon's orbit around the Earth is tilted 5 degrees compared to Earth's orbit around the Sun. The places where the Moon's orbit crosses the plane of the Earth's orbit are called lunar nodes, or orbital nodes of the Moon. Eclipses can only occur at or near these lunar nodes.
- ◆ When three bodies in the solar system (such as the Sun, Moon or the planets) all line up, it is called a syzygy.

Make a model eclipse

Materials:

- ◆ A room with windows that can be darkened.
- ◆ A large ball, such as a basketball.
- ◆ A smaller ball, such as a softball or tennis ball.

Procedure:

1. Turn out the lights and darken all but one of the windows. Our goal is to have light entering the room from only one direction, through a window size of about 2 m². The window represents the Sun.
2. Hold up the larger ball about 1-2 m away from a wall opposite the open window. Our goal is to have a fuzzy shadow of the ball on the wall. The larger ball represents the Earth.
3. Pass the smaller ball between the larger ball and the wall. The smaller ball represents the Moon. Notice how it passes through the penumbra, and then the umbra.

Questions and Answers

What is a lunar eclipse? A lunar eclipse is when the Moon is blocked from view by the Earth's shadow. The Moon doesn't make any light, it just reflects light from the sun, so it can't be seen when it is in the shadow.

Why is it called a lunar eclipse? Lunar is a word that refers to the Moon. An eclipse is when an astronomical object is temporarily blocked out by some other astronomical object.

Are there other eclipses? Yes, there are. Here on Earth, we experience solar eclipses (when the Sun is blocked by the Moon), and lunar eclipses (when the Moon is blocked by the Earth). On other planets, they have different eclipses, but they don't mean much to us because there's nobody there to watch them.

Is an eclipse a sign of something? Ancient people often had myths about eclipses. Often they believed that the Moon was being swallowed by an animal. In reality, an eclipse is a normal astronomical event.

What causes a lunar eclipse? A lunar eclipse happens when the Sun, Earth, and Moon are all aligned, with the Earth in the middle. The Moon travels into the Earth's shadow, so it becomes darker.

How often do lunar eclipses happen? Lunar eclipses happen about twice a year. There can be as many as five lunar eclipses in one year. Total lunar eclipses are less common than partial lunar eclipses.

Lunar eclipses only ever happen on the night of the full Moon, because that is when the Earth is directly between the Sun and the Moon.

Why don't lunar eclipses happen at every full Moon? The Moon's orbit around the Earth is a bit tilted compared to the Earth's orbit around the Sun. At the time of the full Moon, the Moon might be a bit above or below the earth's shadow, so there won't be an eclipse that month.

How do we know that there will be a lunar eclipse? People have been observing and even predicting lunar eclipses for a long time. People observed cycles in the times between eclipses, and used that to predict when the next one would be.

These days, we also have very precise information about the orbits of the Earth and the Moon, so computers are able to show exactly what the eclipse will look like before it happens.

Is it safe to watch a lunar eclipse? Yes, it's quite safe to watch a lunar eclipse. The solar eclipses are dangerous because you'll be looking at the Sun, but watching a lunar eclipse is no more dangerous than watching the Moon at any other time.

Can everyone in the world see a lunar eclipse? In a solar eclipse, the Moon's shadow is a very small spot on the Earth. If you want to see a solar eclipse, you have to be somewhere that the shadow is going to fall.

Lunar eclipses can be seen by anyone who can see the moon at the time of the eclipse. This means that only half of the world can see a lunar eclipse at any one time: the half that is having night.

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