

Module 4: Astronomy – The Solar System

Topic 7 Content: Eclipses Notes

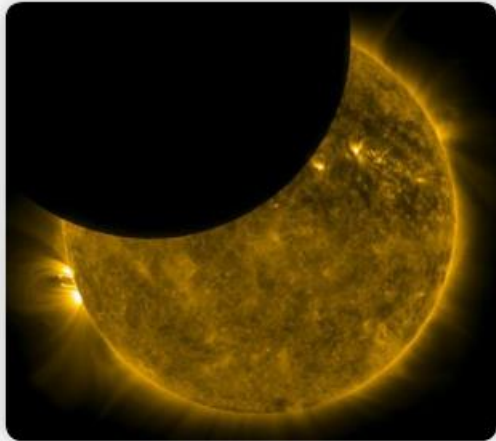
Eclipses

Eclipses

- Solar Eclipses
- Total and Partial Eclipses
- Lunar Eclipses
- How Often Do Eclipses Occur?

Eclipses

An eclipse occurs when an object moves in front of another. Click on each of the tabs to learn about the different types of eclipses and how they occur.



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Solar Eclipses

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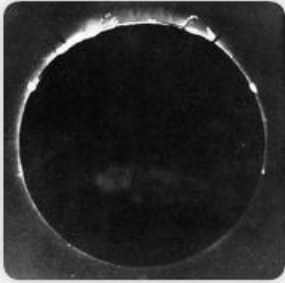
Total and Partial Eclipses

Lunar Eclipses

How Often Do Eclipses Occur?

Solar Eclipses

A solar eclipse occurs when the Moon passes directly between the Sun and the Earth and blocks the view of the Sun. This can only happen during a new moon phase. Although the Sun is bigger than the Moon, it is a lot farther from the Earth than the Moon. This makes the Sun and Moon appear to be the same size, and the Moon obscures the view of the Sun from Earth. When the Moon perfectly blocks the Sun's disk, all humans can see from Earth is the Sun's gaseous outer layer called the corona. This is a total solar eclipse. A partial eclipse occurs when the Moon covers a portion of the Sun's disk.



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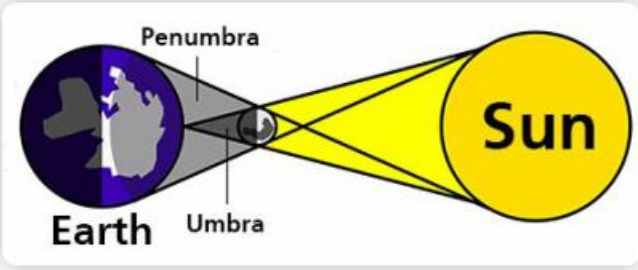
Total and Partial Eclipses

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Total and Partial Eclipses

The difference in total and partial eclipses can be explained by the cast of the Moon's shadow. The inner portion of the shadow that does not receive any direct sunlight is called the umbra. This is the area of total shadow and darkness. People located in the umbra experience a total solar eclipse. The outer portion of the shadow where some of the Sun's light reaches is the penumbra. People in the penumbra experience a partial eclipse. Usually an umbral shadow is never wider than 270 kilometers, so only a small portion of the Earth will see a total solar eclipse, whereas a partial solar eclipse is visible from a much larger portion.



The diagram illustrates the geometry of a solar eclipse. On the right, a large yellow circle represents the Sun. On the left, a smaller grey circle represents the Moon. Lines from the top and bottom edges of the Sun converge at the Moon, forming a cone of shadow that extends to the left. The inner, narrower part of this cone is labeled 'Umbra', and the outer, wider part is labeled 'Penumbra'. A blue and white globe representing Earth is positioned to the left of the Moon. The umbra is shown as a small, dark grey oval on the Earth's surface, while the penumbra is a much larger, light grey oval. Labels 'Earth', 'Umbra', and 'Penumbra' are placed near their respective parts in the diagram.

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Lunar Eclipses

A lunar eclipse occurs when the Moon passes through the Earth's shadow. This can only happen during the full moon phase when the Moon sits opposite of the Sun. The shadow of the Earth has umbral and penumbral portions just as the Moon's does. A total lunar eclipse happens when the entire Moon is in the Earth's umbra. Usually, this will last for approximately two hours. During a total lunar eclipse, the Moon is a reddish color because the sunlight that has passed near Earth has been refracted by Earth's atmosphere.

Image courtesy of NASA/Bill Ingalls



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How Often Do Eclipses Occur?



Solar and lunar eclipses do not occur every new and full moon because the Moon's orbit is tilted five degrees relative to the ecliptic plane. Usually the Moon passes north or south of the Sun as seen from Earth. Proper alignment is only possible when the Moon crosses the ecliptic, but even that cannot guarantee a solar eclipse. The plane of the Moon's orbit rotates slowly around Earth, and a solar eclipse only occurs when the intersection of the Moon's ecliptic is in a line with the Sun and the Earth.

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