CosmicFacts

Lethbridge Astronomy Society

Astronomy Series

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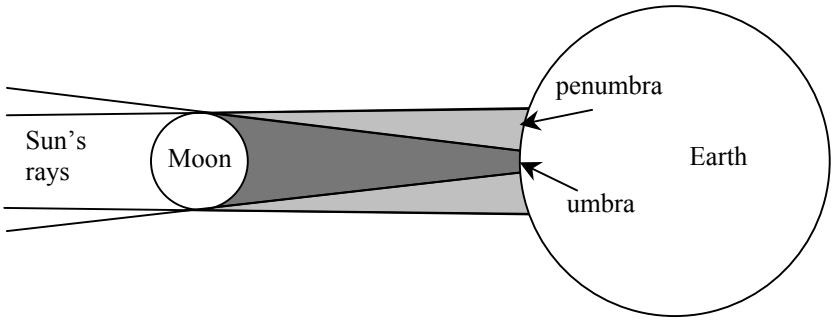
Eclipses of the Sun

The Moon goes through its phases, from new to full and back to new again, every 29½ days as it goes around Earth. At new Moon, it is "between" Earth and the Sun, and we cannot see the Moon at all, because its sunlit side is now pointing towards the Sun, and away from Earth. So why don't we have a solar eclipse every 29½ days?

Unfortunately for eclipse watchers, the plane of the Moon's orbit does not lie in the same plane as Earth's orbit around the Sun. If the two planes were exactly aligned, there would be a solar eclipse every month. But because the Moon's orbit is tilted about 5½ degrees from Earth's orbit, most of the time the Moon appears to pass "above" (north) or "below" (south) of the Sun, as it passes the point of new Moon.



However, the alignment of these two planes does shift throughout the year, and twice each year the Moon really is directly between Earth and the Sun. At such times, the Moon's shadow will touch Earth, and there will be a solar eclipse.

Although the Sun's diameter is about 400 times larger than the Moon's, it is also about 400 times further away on average. That is why the Sun and the Moon appear to be about the same size in the sky. But the Moon's orbit is elliptical, not circular. At its nearest, the Moon is about 355,000 kilometres from Earth, while at its furthest, it is about 405,000 kilometres. To complicate matters even more, the Moon may be at its nearest, or furthest, at any point in its monthly phase. But, when it is near its minimum distance, at new Moon, and during one of the two yearly eclipse seasons, the Moon appears to be slightly larger than the Sun, and the eclipse will be **total**. The Moon's shadow will be a dark spot on Earth's surface, never more than about 250 kilometres wide. It sweeps across the daylight side of Earth, from west to east, at a rate of about 1 kilometre per second. A person standing under this narrow path of totality will at first see a dark "bite" taken out of the Sun's edge. As the Moon moves in its orbit, it takes about an hour for it to completely cover the Sun. At that moment, the **partial eclipse** becomes total. The Earth-facing side of the Moon is a perfectly black disk, surrounded by the pearly white glow of the Sun's outer atmosphere, or **corona**. The stars come out, and day becomes night for a few minutes. Then, the first bit of the Sun peeks out from behind the Moon, and the total part of the eclipse is over. In another hour, the Moon has moved on, and all of the Sun is visible again.

To an observer outside the track of totality, the entire eclipse will be partial and the Moon will never completely cover the Sun.

There are at least two solar eclipses somewhere on Earth every year, and each one creates a partial eclipse over a large part of Earth. Partial eclipses are really quite common. From Lethbridge, within about a 10-year period, there have been or will be partial solar eclipses on July 22, 1990; July 11, 1991; January 4, 1992; May 21, 1993; May 10, 1994; July 31, 2000; December 25, 2000; December 14, 2001; June 10, 2002. But total solar eclipses over a particular point on Earth are quite rare. If you would like to see one, you must be preapared to travel to where it will be total. Either that, or wait a long time. The next one visible in Lethbridge will not be until August 22, 2044.

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