

## STARDOME OBSERVATORY & PLANETARIUM FACTS, RESOURCES AND ACTIVITIES ON...

# ECLIPSES & TRANSITS

Credit: NASA

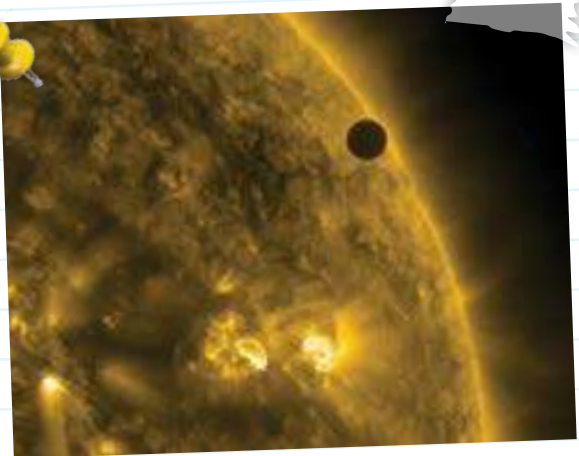
This resource and exercise discusses solar observations.

Three major astronomical objects can pass between Earth and the Sun - the planets Mercury and Venus and our Moon. As Mercury and Venus orbit the Sun, occasionally one passes directly between the Earth and Sun. This is referred to as a transit. When observing a transit, one of the planets appears as a small shadow passing over the solar disk.

In the case of a Moon transit, this can be either a partial, full or annular eclipse. These are unique transits, because not only does the Moon block out part of the Sun as in a regular transit, also it casts a shadow on the Earth. A total solar eclipse is only visible from the centre of the Moon's shadow called the umbra (Latin for "shadow"). In the umbra the Moon covers up the entire solar disk. The Sun is usually so bright that we cannot see its outer atmosphere, the corona. When a total solar eclipse occurs, we can see streams of solar flares coming from the Sun. Also, since the Moon is covering the solar disk, the sky becomes dark as night for a short period.

During a partial eclipse, a 'bite' appears to have been taken out of the solar disk. This happens when the Earth, Moon, and Sun are not quite in a straight line. The partial shadow of the Moon is referred to as the penumbra. An annular eclipse is when all three are in a straight line just like in a total solar eclipse, but with one difference. Since the Moon doesn't orbit the Earth in a perfect circle, when the Moon is further away from the Earth, it appears slightly smaller. Usually, you wouldn't notice the difference, but if the Moon is at its furthest point from the Earth when it passes between the Earth and Sun, it doesn't cover the entire solar disk. This is when you see the Sun appear as a ring around the Moon. A lunar eclipse happens when the Moon passes behind Earth's shadow. Visit our [teacher resource on lunar eclipses](#) for more information.

There is another type of transit, but it's not a planet or moon going across our Sun, it's a planet transiting across another star. When astronomers detect light from a distant star dim at regular intervals, they might have discovered a planet transiting that star. Astronomers have discovered over 3,000 exoplanets orbiting other stars, most of which have been found by using this transit method.



Credit: NASA

**Remember:**  
You should never look  
directly at the Sun.

### Check out these other resources...

<https://www.nasa.gov/content/eclipses-and-transits-overview>

[https://en.wikipedia.org/wiki/Transit\\_of\\_Venus](https://en.wikipedia.org/wiki/Transit_of_Venus)

<http://www.skyandtelescope.com/astronomy-news/observing-news/how-to-look-at-the-sun/>

Observing a lunar eclipse helped astronomers discover the shape of the Earth.

If an exoplanet doesn't orbit its star in an exactly straight line with Earth's line of sight, you won't be able to see a transit. How many other millions of planets must be out there that we don't know about because they don't line up directly with our point of view?

The transit of Venus helped astronomers figure out the distance between the Earth and the Sun.

**DISCUSSION POINTS**



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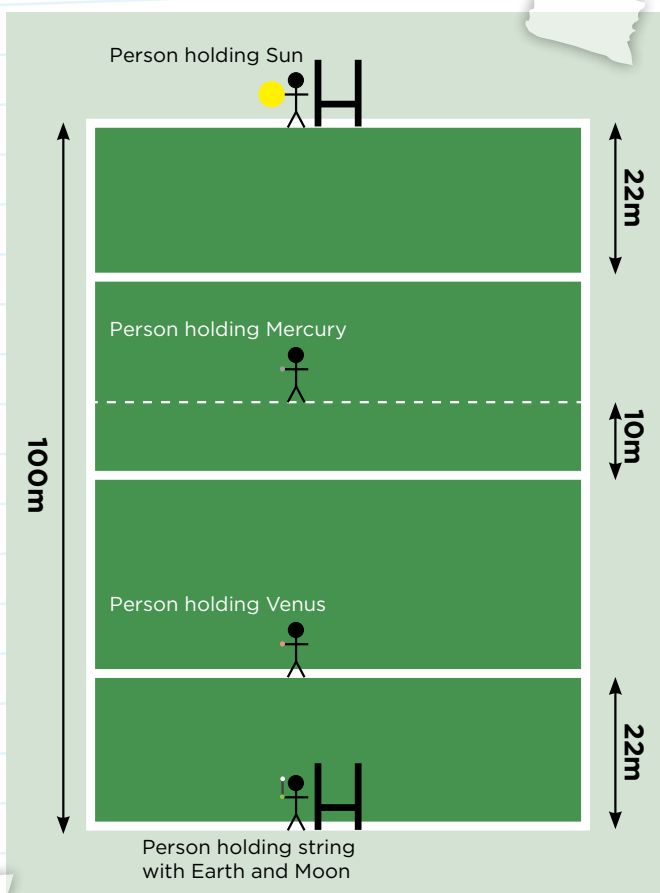
## STARDOME OBSERVATORY & PLANETARIUM

# CREATING ECLIPSES AND TRANSITS

Create a scale model of the Solar System, and see how perfectly planets need to line up for a transit.

### You'll need:

- ⇒ Tape measure
- ⇒ Pens
- ⇒ putty/dough/blue tack/clay
- ⇒ One sheet of cardboard large enough for a metre diameter circle
- ⇒ Rugby pitch or 100 metres of space (If outdoor space is not as big as a rugby pitch, divide all numbers by no more than half, otherwise the models will be too small to work with.)
- ⇒ Paper
- ⇒ String



### Instructions...

**Step 1** On the cardboard draw a circle with a one metre diameter. This represents the solar disk in our model Solar System.

**Step 2** In groups, ask the students to measure and cut 275mm of string. This represents the distance between the Earth and the Moon.

**Step 3** Have each group mould a 10mm diameter ball for the Moon with the putty/dough/blue tack/clay. Then ask them create a Venus model that is slightly smaller than their Earth, and a Mercury model that is slightly larger than their Moon.

**Step 4** Have each group stick their Earth and Moon models onto either end of the string.

**Step 5** If your school has a rugby field, the distance between the goal lines should be 100m. If you place the Sun just past one goal line, and the students are lined up behind the other goal line, this will approximate the distance for our scale AU (astronomical unit = distance between the Earth and the Sun).

**Step 6** Ask each student to hold the Earth by the ridge of their nose, close one eye, and hold the Moon out in front of them with the string taught. See if they can create a total solar eclipse by covering the solar disk with their model Moon.

**Step 7** Now have a member of each group run to the closest 22m line from their Earth model with the model of Venus. Have that student walk across the field, and try and see if the students by the Earth can see Venus transit across the solar disk.

**Step 8** Have another student take their model of Mercury out past the half way line, to the next 10m line. Have that student cross the field and see if the students by Earth and Venus can see a Mercury transit (Mercury being the closest planet to the Sun, and having no moons, will never get to see a transit). Have the students move between the

Earth and Venus to see how Mercury's transit appears different at the different planets.



Take a photo of your activity and send it to us. We'd love to see it! [education@stardome.org.nz](mailto:education@stardome.org.nz)