

U3A Port Fairy
Science...naturally!

Celestial Sights – Part Two

A Solar and Lunar Eclipse and an Occultation of Jupiter by the Moon

Ross Knudsen, 20 October 2020

INTRODUCTION

Having presented the Transit of Venus in Part One of Celestial Sights, the next part delves into events which feature our Moon - our closest neighbour. I have selected a Solar Eclipse, Lunar Eclipse and an Occultation which occasionally offer viewers on Earth more splendid wonders and attractions. If it were not for our Moon, these events would not occur.

A **solar eclipse** occurs when a portion of the Earth is engulfed in a shadow cast by the Moon which fully or partially blocks sunlight. This occurs when the Sun, Moon and Earth are aligned.

A **lunar eclipse** occurs when the Moon moves into the Earth's shadow. This can occur only when the Sun, Earth, and Moon are exactly or very closely aligned (in syzygy) with Earth between the other two, and only on the night of a full moon.

An **occultation** is an event that occurs when one object is hidden by another object that passes between it and the observer. The term is often used in astronomy but can also refer to any situation in which an object in the foreground blocks from view (occults) an object in the background.

THE MOON – A few facts

Diameter 3476 kms (3.7 Moons fit across the Earth)

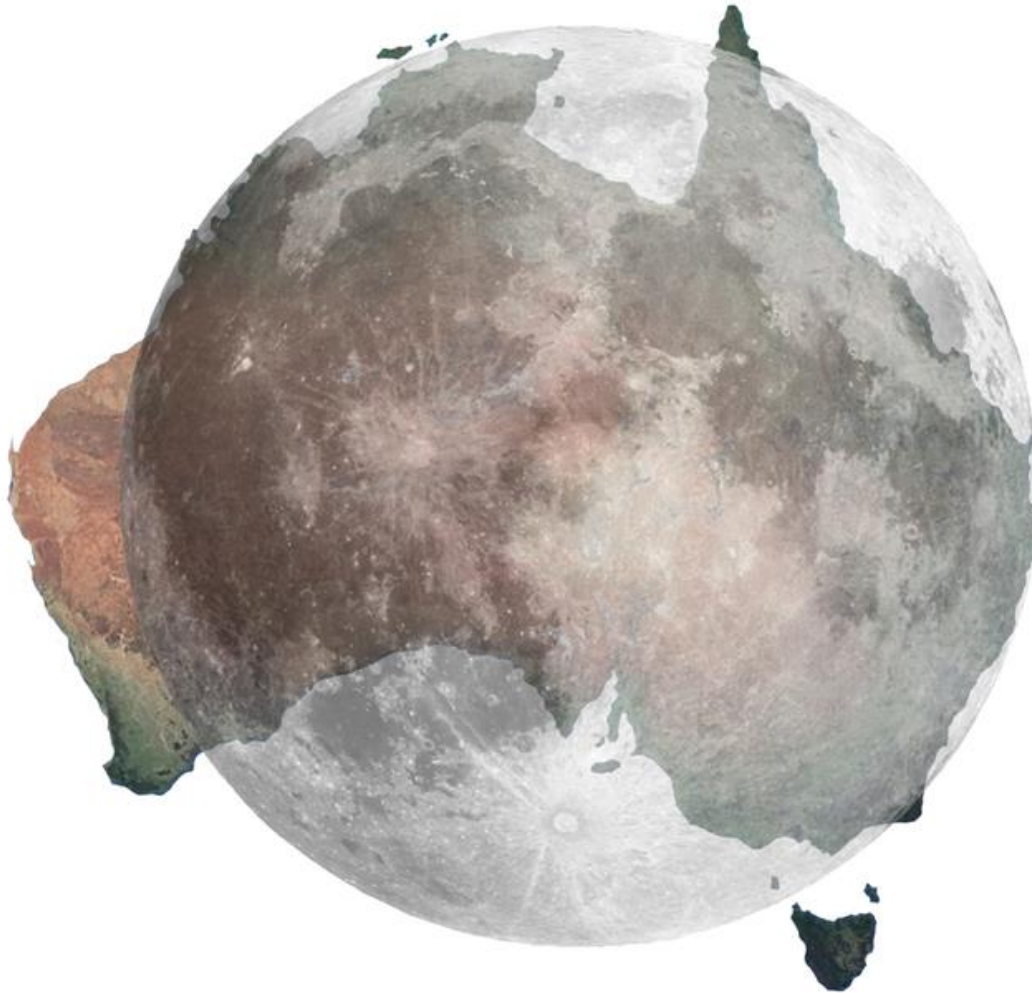
Orbital speed around Earth 1.022 kms per second or 3680 km/h

Average distance from Earth 384,400 kms

A day on the Moon is 655.72 hours long – not bad for working some overtime conditions

The average temperature on the Moon (at the equator and mid latitudes) varies from minus 183 degrees Celsius, at night, to 106 degrees Celsius during the day. Because the Moon has no significant atmosphere to block some of the Sun's rays or to help trap heat at night, its temperature varies greatly between day and night.

On the Moon a person would weigh six times less than they do on Earth. This is because the Moon has one sixth the gravity of Earth.

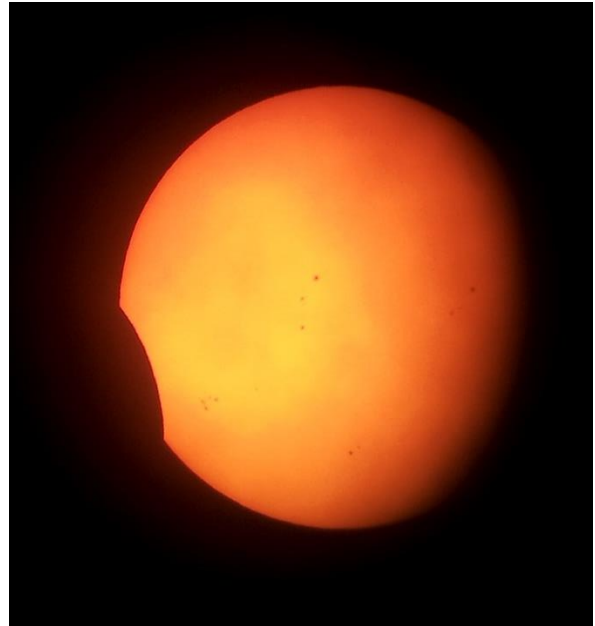


A superimposed Moon over Australia presents a realistic comparison of size.

Did you know?

- The Moon travels at 3680 km/h around the Earth
- The Earth with its Moon travels at 107,220 km/h around the Sun
- The Sun with its planets travels at 792,000 km/h through space around the Milky Way
- Even at that speed it takes our Sun about 225 million years to complete one orbit of the Milky Way
- Having completed 19 orbits around the Milky Way in the 4.5 billion years since the formation of the Sun, our significant Solar System is half-way through its predicted life span with only 19 more circuits to complete.
- The Milky Way travels at 2,160,00 km/h through space
- We are on a collision course with one of our nearest galaxies Andromeda Galaxy.
- They are expected to collide in 4.5 billion years-time.
- **So sit back, enjoy the ride, and let the galactic wind blow through your hair as we hurtle through space!**

SOLAR ECLIPSE (Partial)– 14 November 2012



Time 8.33am the Moon is passing towards the bottom left of the image. Time 8.57am and the partial eclipse is nearly over. The dark spots on the sun are sunspots – more visible on the righthand image.

SOLAR ECLIPSE (Partial)– 10 May 2013



Time 8.27am the Moon is encroaching and at time 8.48am it has progressed further over the Sun.

A short anecdote relating to this event and it is TRUE! – I had a hair appointment on this day and had been observing the eclipse from home in Ferntree Gully. I took the daylight filter off the

telescope and took it with me to the hairdressers to show the girls what the eclipse looked like. I stood outside the salon with one of the apprentice hairdressers and instructed her to look through the filter at the sun. I assured her it was okay to look at the sun through the filter. As she peered through the filter her comment to me was, and I quote – “Is this happening right now – wow that’s amazing!” I shook my head in disbelief. She realised what she had just said and was most embarrassed.

TOTAL LUNAR ECLIPSE - 4 April 2015



Time 10.54pm and the “blood red” Moon is deep in the Earth’s shadow. Time 11.08pm and the Moon is moving out of Earth’s shadow. The photos of this event were taken in Port Fairy.

OCCULTATION OF JUPITER BY THE MOON

Although many celestial objects/bodies are occulted by our Moon, most of the time these events go unnoticed by most of us. When a planet in our solar system is occulted by our Moon, the event is deemed important and astronomers dance with delight. Perhaps because this occurs “close to home”. Jupiter is a wonderful planet to keep track of and observe. It is as impressive as its neighbour Saturn. Jupiter’s moons are always in action and four of its brightest ones are interesting to observe. Jupiter has 79 known moons. Saturn has 82 known moons at this stage of human observation.

Imagine our tides on Earth if we had more than one Moon!

In February 2013 I was able to witness another heavenly event as our Moon passed between Earth and Jupiter.



18 February 2013 – 8.24pm - Jupiter and the Moon are approaching each other during the summer evening. A filter is not required for this image, so the sky appears with its blue colour.



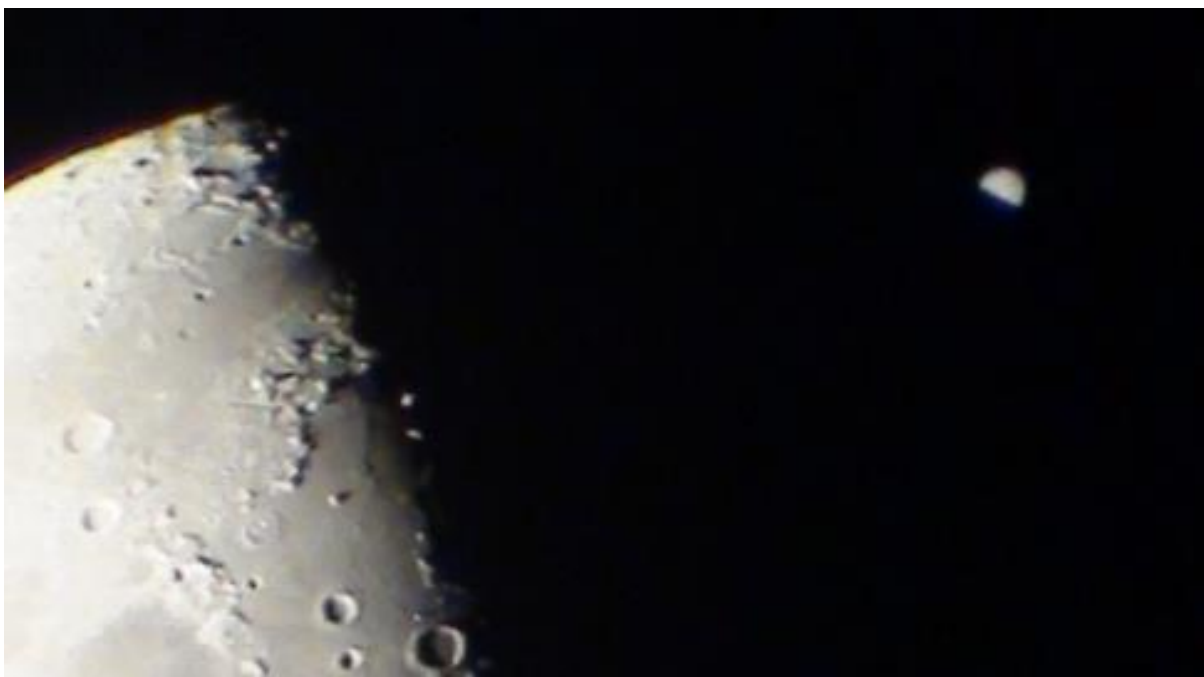
10.02pm – Jupiter with its cloud rings as it approaches the occultation. Apologies for the fuzziness. It is due to the Australian summer and its heat. The cloud rings are still definable.



11.22pm and Jupiter is getting close



11.32pm and the “occultation” has begun. The sphere of Jupiter is being cut-off by the limb of the Moon as it passes in front of our biggest planet.



11.32pm – This image is enlarged to show the sharp edge of the Moon in more detail during the beginning of the occultation. It took less than a minute to “block-out” Jupiter.

A LITTLE EXTRA TO CELESTIAL SIGHTS

I am a frequent observer of the Sun and I like to keep track on its sunspot activity. I believe that sunspots are a good indicator of weather-related occurrences on Earth.

Sunspots: One interesting aspect of the Sun is its sunspots. Sunspots are areas where the magnetic field is about 2,500 times stronger than Earth's, much higher than anywhere else on the Sun. Because of the strong magnetic field, the magnetic pressure increases while the surrounding atmospheric pressure decreases. This in turn lowers the temperature relative to its surroundings because the concentrated magnetic field inhibits the flow of hot, new gas from the Sun's interior to the surface.

Sunspots tend to occur in pairs that have magnetic fields pointing in opposite directions. A typical spot consists of a dark region called the umbra, surrounded by a lighter region known as the penumbra. The sunspots appear relatively dark because the surrounding surface of the Sun (the photosphere) is about 6,000 degrees C., while the umbra is about 4,000 degrees C. Sunspots are quite large as an average size is about the same size as the Earth.

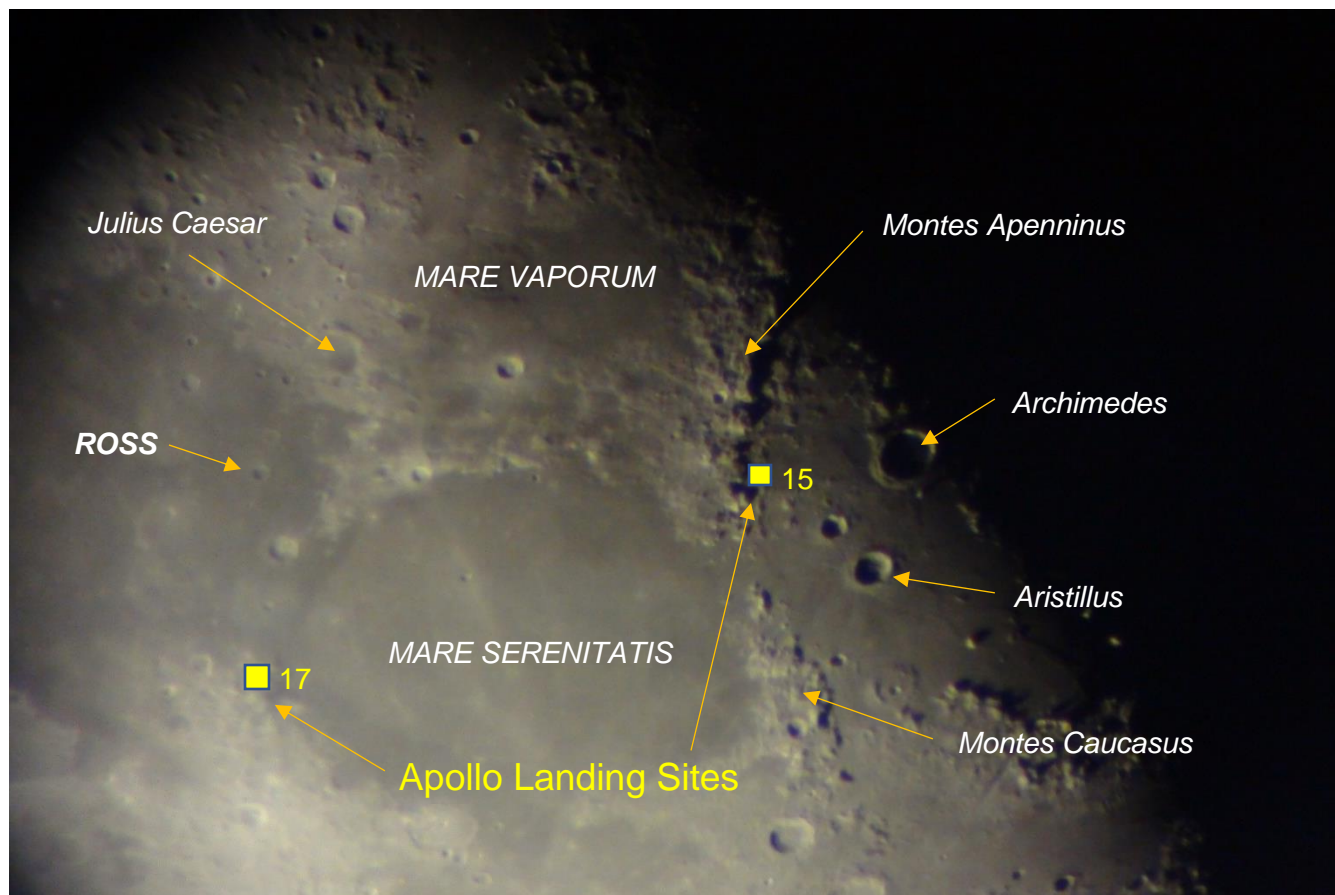


This image taken in Port Fairy at 2.53pm on 12 April 2015. It shows the well-defined sunspot and clearly evident is the *umbra* and the *penumbra*. This sunspot is much larger than the Earth. It takes 109 Earths to fit across the Sun.

AND LASTLY – OUR MOON

A couple of “happy snaps” of the Moon in different stages through my telescope.





The Moon zoomed in! Stunning features as observed from Earth.

Please note:

Many craters are named in honour of supreme and notable people. A few are named in the image above. Like Tim Doeg (a supreme and notable member of the community and Port Fairy U3A) who has a small water creature named after him (*Synamphisopus doegi*), there is a crater named Ross. A little piece of trivia to enlighten you all.

There is so much going on around us on Earth. If you look skyward during the evening and night through October and November 2020, you can see Jupiter and Saturn with the naked eye. They are almost directly up and are the brightest objects in that area of the sky. They are slowly moving westward and rise about 4 minutes earlier each day. Jupiter is the brighter of the two.

Venus is the bright planet in the early mornings.

Our planets follow the path of the sun (which is called the ecliptic) across the sky from east to west so they are relatively easy to see and follow.