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*Science...naturally!*

## Celestial Sights – Part One The Transit of Venus 2012

Ross Knudsen, 13 October 2020



**12.48pm - Venus's Transit across the Sun is well underway. The smaller, fainter dots are sunspots on the surface of the Sun. The Transit will take 6.5 hours on this occasion.**

### INTRODUCTION

The Earth and all its natural wonders are a source of amazement. If we look further than our clouds, there is another realm of amazement. Our sky and particularly our solar system present magnificent occurrences once-in-a-while. Tracking these events as they occur is quite easy – either through journals, magazines, the media, and social media. Our neighbouring planets are simply stunning to observe if you have the correct gear.

This presentation will highlight a few “recent” events I have recorded through the lens of my telescope. I shall present a few interesting facts, however, I will not delve too deep into scientific information. By taking in some of the photos, I hope you are inspired by the images.

The images in this presentation are through a Meade Refracting Telescope. I have placed my camera at the eyepiece for all the photos and I have a range of eyepieces, doublers, and filters for looking safely at our Sun. The photos are raw images and have not been photo-shopped for colour enhancement.

This phenomenon, as seen from Earth, has been happening for millennia, even billions of years. However, it has only been since the invention of the telescope that anyone has been able to observe it. Of course, before Kepler and Galileo, it was not even known to be happening. So in terms of observational astronomy, it is a relatively new phenomenon, the first known observation being in 1639. In fact, it has only happened 8 times and observed 7 times since the telescope was invented in 1609. Now we all know that the most recent transit, the last any of us will see in our lifetimes was on 6 June 2012. And 8 years before that, on 8th June 2004, was its paired transit.

## **The Transit of Venus – A Rare event indeed!**

Lieutenant James Cook departed England in August 1768 in command of the Barque *Endeavour*. He had been given two orders to fulfil on this expedition. One was to observe and record the Transit of Venus in June 1769 from Tahiti in the Pacific Ocean, and the other as we all know, to “discover” and investigate the *terra australis incognita*, the unknown “south land”.

Their mission was to reach Tahiti before June 1769, establish themselves among the islanders, and construct an astronomical observatory. Cook and his crew would observe Venus gliding across the face of the Sun, and by doing so measure the size of the solar system. Or so hoped England's Royal Academy, which sponsored the trip.

Cook and the ship's astronomer Charles Green both took recordings of the transit with hand drawings included.

The next opportunity to observe the transit of Venus would be in 1874. This trip was vital in gathering information and data for astronomers. If Cook and other observers failed in their attempts due to weather or other circumstances, every other astronomer would be dead before the next opportunity in 1874. Transits of Venus since 1874 have occurred in 1882, 2004, and 2012. It gives me the displeasure to inform you all, that neither you, your children, or your grandchildren will be alive for the next Transit predicted in 2117. I was indeed fortunate to have captured this event from Melbourne in 2012.

Like Cook in Tahiti in 1769, the good weather proved favourable in Ferntree Gully. This allowed us in 2012, to observe the entire Transit through cloudless skies.

## **Please enjoy this brief journey with some interesting facts:**

**Wednesday 6 June 2012**

**Transit began in Ferntree Gully at 8.16am and finished at 2.45pm**

**Telescope: Meade Refracting, F 1000mm, dia. 90mm, F/11**

**Fitted with a Type 2+ Daylight filter and viewed through a Plössl 32mm eyepiece**

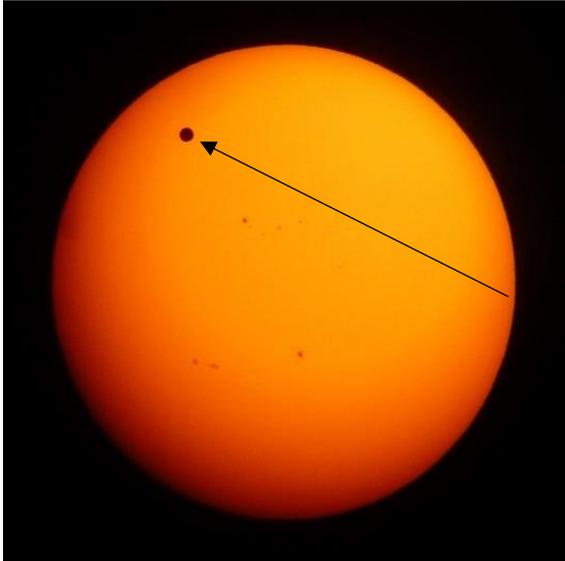
**Diameter of the Sun = 1,391,000 million kms**

**Diameter of Venus = 12,104 kms**

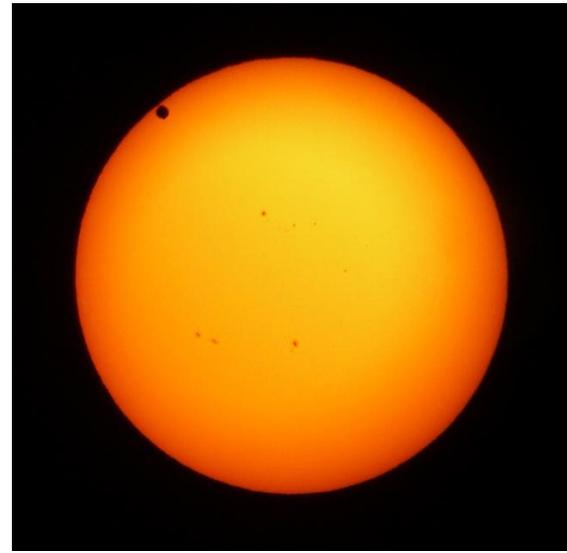
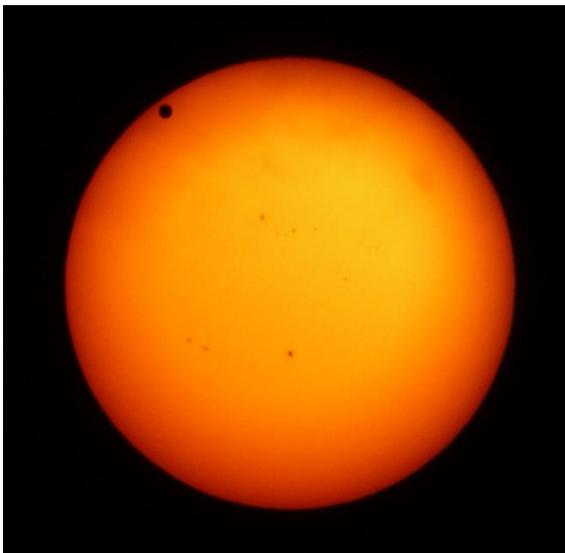
**Distance Earth to Sun = 150 million kms**

**Distance Earth to Venus = 40 million kms**

The following is a display, we on Earth were treated to by one of our nearest celestial neighbours.

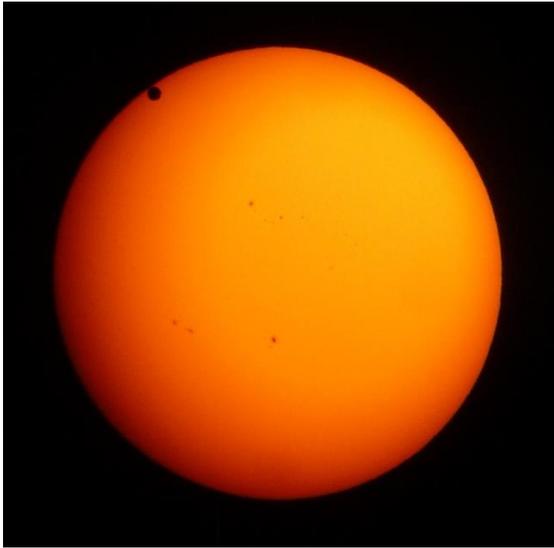


Time 1.18pm and 2.17pm – Venus is slowly moving towards the limb (the edge) of the Sun. The arrow indicates the approximate path across the sun.



2.19pm and 2.24pm – the Transit is coming to a end. Note how the sunspots have remained in place during this event.

**Did you know?** Venus' day is longer than its year. (Keep reading - further details follow)



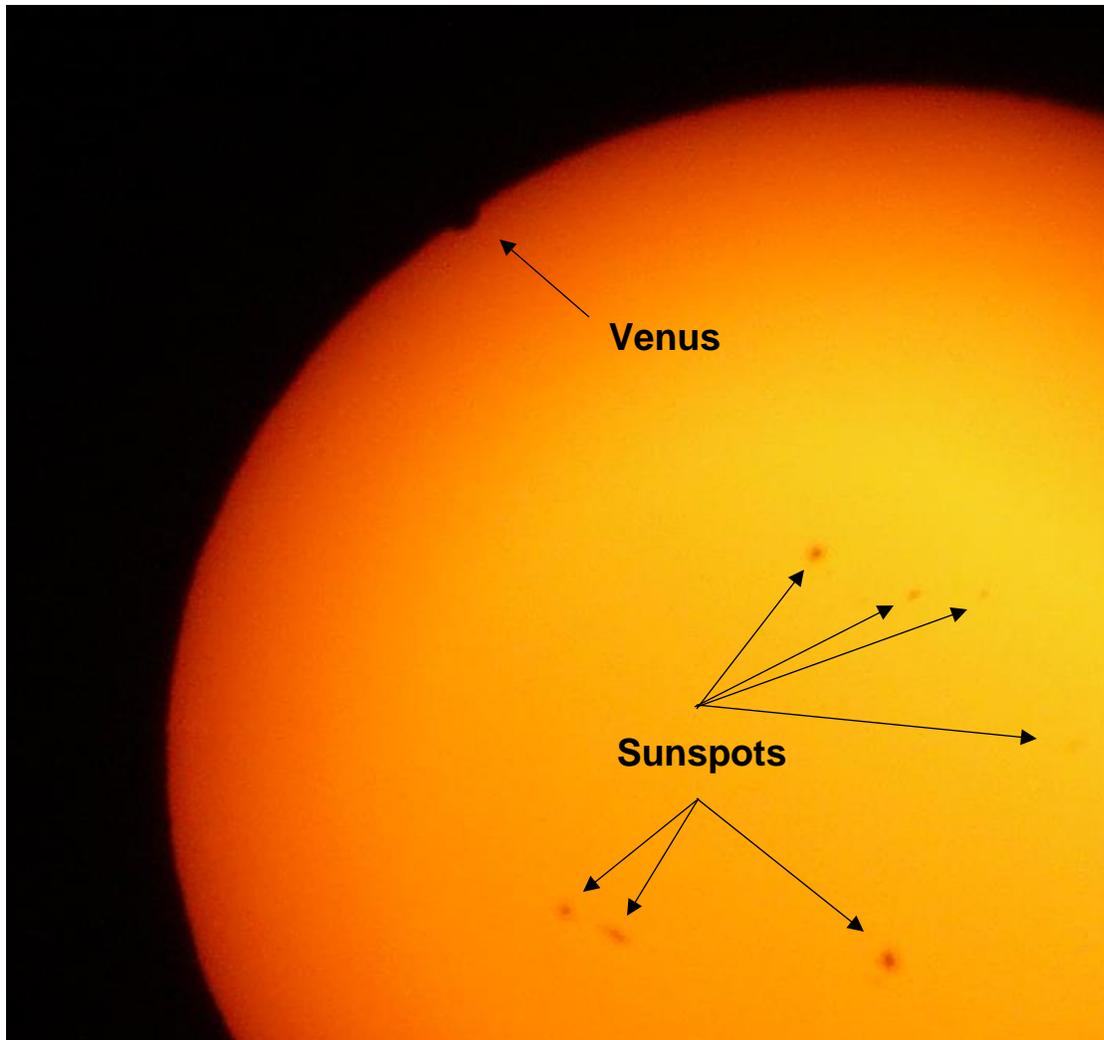
**2.26pm and 2.32pm – Venus has reached the limb of the Sun**

**Please note:** The background in these photographs is black because the attached filter is blocking the blue light. If man were able to view the Sun in real light, this is how it would appear. Unfortunately, our eyes are too sensitive to the harsh rays of the Sun to view without a filter.

The winter Transit made “seeing” the event clearer. Had it occurred during our summer, heat waves in our atmosphere would have made images a little blurry.



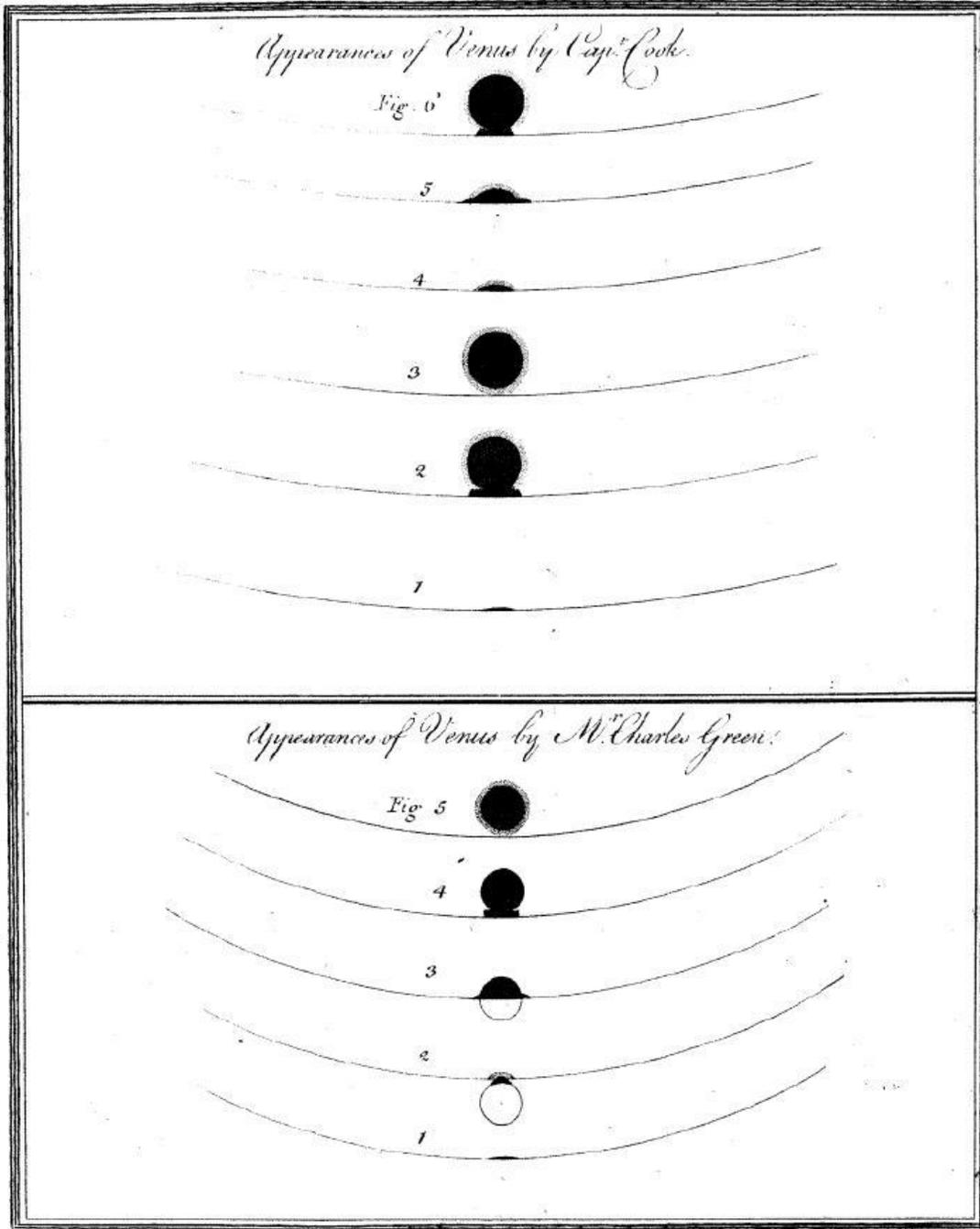
**Sue Knudsen observing the Transit of Venus**



**2.40pm – Venus is exiting the limb of the Sun and is about to say farewell as it has almost completed its Transit. There is about one-third of the planet visible. In five minutes time Venus will disappear from view. It will be another 105.5 years before she makes a return Transit across our Sun.**

**Venus –** Orbits the Sun every 224.7 days and a Venusian day lasts 243 days long. The planet has an average surface temperature of 460°C. It is a terrestrial planet with an atmosphere that contains 96.5% carbon dioxide and 3.5% nitrogen, and is covered with an opaque layer of clouds of sulphuric acid. The surface of Venus is covered mainly with smooth volcanic plains and its highest peak is 11 kilometres in elevation. Craters range from 3 to 280 kilometres wide.

*Philos. Trans. Vol. LXI. Tab. XIV. p. 410.*



**Drawings of the Transit of Venus in 1769 by James Cook and Charles Green.**

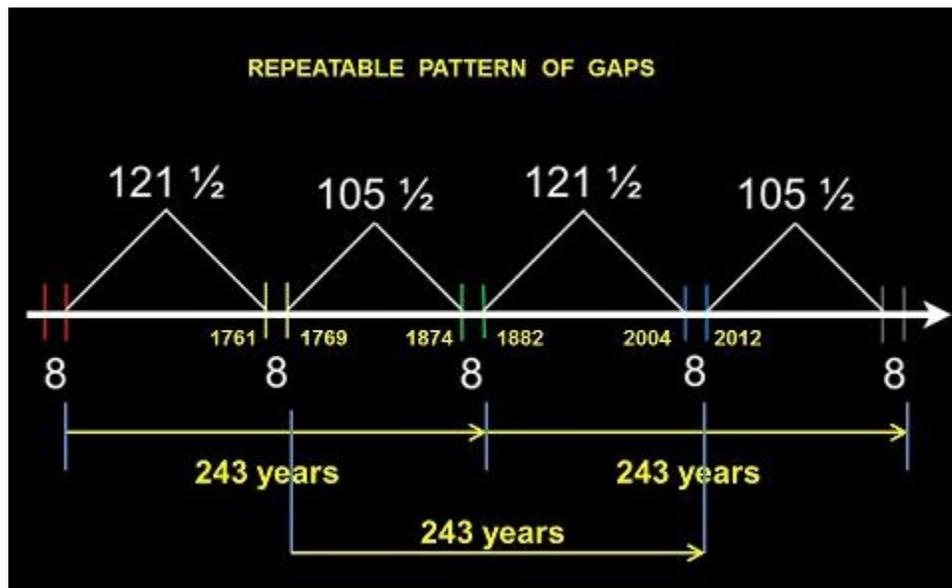
Cook and Green observed the "black drop effect." When Venus is near the limb of the sun--the critical moment for transit timing--the black of space beyond the Sun's limb seems to reach in and touch the planet. You can recreate the black drop effect with your thumb and index finger: Hold the two in front of one eye and narrow the distance between them. Just before they touch, a shadowy bridge will spring across the gap. This is simply the result of how two fuzzy bright-to-dark gradients add together. The black drop effect, like the fuzziness of Venus' atmosphere, made it hard to say just when the transit began or ended.

The "dusky shade round the body of the Planet" was a problem. Intense sunlight filtering through Venus' atmosphere fuzzed the edge of the disk and decreased the precision with which Cook could time the transit. For this reason, his measurements disagreed with those of ship's astronomer Charles Green, who observed the transit beside Cook, by as much as 42 seconds.

This was a problem for observers elsewhere, too, not only Cook in Tahiti. In fact, when all was said and done, observations of Venus' 1769 transit from 76 points around the globe, including Cook's, were not precise enough to set the scale of the solar system. Astronomers did not manage that until the 19th century when they used photography to record the next pair of transits.

I, like Cook, astronomers, and others, were able to observe the Transit of Venus during one of its rare transits as seen from Earth. Unfortunately, I am yet to discover another land on this planet that is unknown to European civilisation. Well – the English civilisation. This notion is highly unlikely!

**The last word:**



Transits of Venus are among the rarest of predictable astronomical phenomena. They occur in a pattern that generally repeats every 243 years, with pairs of transits eight years apart separated by long gaps of 121.5 years and 105.5 years.

**How will astronomers and travellers view the next transit in 2117?**

**Food for thought.**

**Part Two of Celestial Sights focuses on (pardon the pun) a Solar and Lunar Eclipse and an Occultation of Jupiter by the Moon.**