Why Was the Transit of Venus Important to Science?

It told us our distance from the Sun to gain the first realistic estimates of the size of the Solar System.

The tiny black disc of Venus edges across the Sun….
The movement of a little black dot may seem insignificant, but it is one of the rarest sights in astronomy, an event known as a transit of Venus.

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. The last transit of Venus was 2012 and was the last Venus transit of the 21st century.
It will next occur in 2117.

By 1619, German astronomer Johannes Kepler had figured out the relative distances of all the planets from the Sun*. For example, if the Earth's distance from the Sun is **one astronomical unit** (**AU**), then Venus's distance from the Sun is.72 AU, and so on. However, no one knew the *value* of AU, so the absolute distances between the celestial spheres were not known.

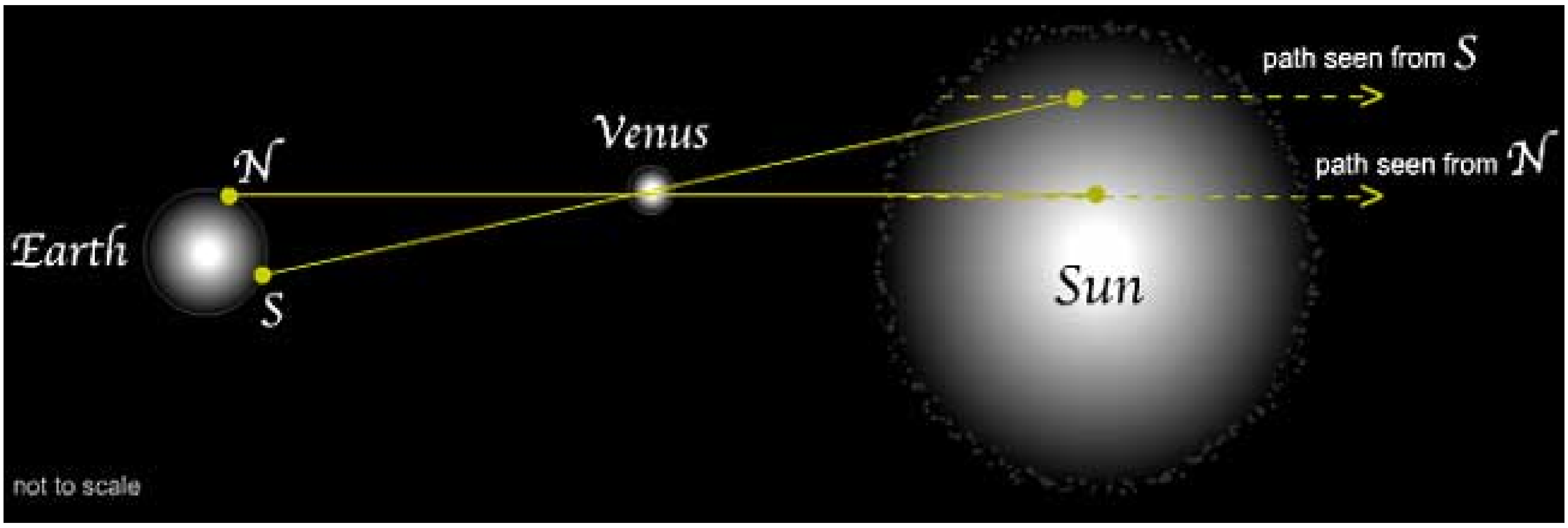
In 1716, English astronomer Edmond Halley proposed a method for calculating our distance from the Sun—the astronomical unit—using the Transit of Venus.

The underlying principle behind Halley's method is something called parallax, the shift in position that comes from viewing an object from two different points. Hence Cook's measurement from Tahiti.

The square of the orbital period of a planet is proportional to the cube of the semi-major axis of its orbit" That's Kepler's third law. In other words, if you square the 'year' of each planet, and divide it by the cube of its distance to the Sun, you get the same number, for all planets.

What is parallax? Try this.

Imagine two different people, one on each pole of the Earth, viewing the transit of Venus. The person on the North pole sees Venus following one path across the Sun. The person on the South pole sees Venus follow a slightly higher path, one that's shifted a little to the north.



Because we see the Sun as a circle, these two different paths will have different lengths. Halley proposed that an easy way to measure the difference between the lengths of these two paths would be to time the transits, using the four phases of the transit—the first, second, third, and fourth contacts—as indicators.

With the two different paths known, the distance between the Earth and the Sun can be pretty easily calculated using trigonometry and Kepler's third law of planetary motion.*

Transits are still of interest to scientists today, because they can be used to find planets outside our solar system, also known as extrasolar planets, or exoplanets. Extrasolar planets are too distant and too dim to be viewed directly, but when one passes in front of (that is, transits) its parent star, it blocks a little bit of the star's light. The transit of Venus provides great practice for these scientists, allowing them to track the optical changes that take place during a transit.

https://www.exploratorium.edu/venus