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A rare, historically important, and hence astronomical interesting phenomenon this year is the transit of the sun by the planet Venus. While we are all busy with our earthly affairs, especially discussing the model of federalism our country should adopt, we should not ignore this heavenly event.

Also known to us as "Sukra Graha", the Venus is one of the eight planets (not nine as Pluto is no longer a planet) of the solar system. It is second from the sun as you travel outward, where our home planet Earth comes third followed by Mars, Jupiter, Saturn, Uranus and Neptune. Seen from the Earth, it is the brightest object in the sky, after the sun and the moon.

Transit

On Wednesday, June 6, Venus will cross the disk of the sun, an event we call a transit. A transit is similar to a solar eclipse, although since the Venus is a lot farther away than the moon, the eclipse will barely dim the light from the sun. It can just be seen as a small, dark blob moving over the disc of the sun.

While the whole passage is visible from Australia, only a part of the transit will be seen from sunrise in South Asia. The transit lasts around 6 hours, starting at 5 a.m. for the South Asian viewer.

Such transits are very rare due to the different tilts of the orbits of the Earth and Venus, occurring twice in eight years and will not happen again for another century. The last time the transit of Venus took place was eight years ago, and so more than a century will elapse before it occurs again in 2117 (A.D.) and then in 2125.

The Earth takes 365 days to orbit around the sun, while Venus only takes 225 Earth days to complete its cycle. Interestingly, Venus is a planet which gets closer to the Earth than any other planet.

As astronomers have to deal with large distances, the units they find convenient can seem strange to a general public used to centimetres and kilometres.

For astronomers, the distance between the Earth and the sun is set as 1 AU (Astronomical Unit) which is equivalent to about 150 million kilometres. In this weird unit of length, the distance of Venus from us is on average about 0.5 AU, equivalent to roughly travelling 1800 times between Kathmandu and New York. By observing the transit from differing locations, the distance to Venus was accurately measured during the voyages of Captain Cook in the 1700s.

In earlier centuries, measuring the distance between us and the sun or Venus was a fundamental, and quite difficult, astronomical problem. One of the most interesting discoveries from the transit of Venus was the estimation of this distance in the 18th century.

There is a very well-known law in astronomy, called Kepler's Law, which is similar to Newton's Three Laws of motion which we know from our high school science classes. Kepler's also has three laws, whose Third Law states that the cube of a planet's distance from the sun is proportional to the square of the time a planet takes to orbit the sun, which establishes the ratio of the distance of Earth-Venus to Venus-sun as 3 to 7. Armed with this, astronomers can use simple trigonometric calculations, called the parallax effect, to directly measure the distance from Venus to the sun, and also, therefore, reveal the size of the Earth's orbit.

But due to the fact that the sun dims at its edge, and because the Venus image has a diffused edge, popularly known as the 'Black Drop effect', the transit estimate will rather be poor. This effect is symmetric, which happens at the beginning and at the end of the transit. Distance computation is basically done in the same way that a finger held in front of your face will appear to jump from side to side as you open and close your eyes in turn.

If Venus is observed during a transit from widely separated locations, there will be a slight shift in the track across the sun as seen from the place. From there, one can use simple high school trigonometry to calculate the Earth-sun as well as the Earth-Venus distances. Such parallax measurements have now allowed astronomers to accurately measure the distance to thousands of nearby stars.

In terms of size and composition, Venus is taken as Earth's twin planet; you could fit approx. 1.6 Venus inside the Earth. Life-wise, Venus is totally different from our home planet, with incredibly high temperatures, a poisonous atmosphere and a dense crust which include the possibility of life in it. Nevertheless, the study of Venus is still important, as it gives insights into the formation history of our solar system and also the planetary system in general.

Due to the unimpressive climate, any possibility of human mission to Venus is extremely unappealing. However, there have been several unmanned-space missions to Venus, namely a series of Mariner probes launched by the USA in the last century, and also Pioneer, Venus and Magellan probes are among the few important missions to Venus so far.

A few ground-based telescopic studies, and all above-mentioned dedicated missions have altogether enriched the pool of knowledge about this planet. Today, we know a lot more about the atmosphere of Venus, magnetic fields that circle it, detailed view of its surface and geological activities like volcanoes. Some studies also claim that in the past, Venus might have had continents and oceans, and even possibly life.

And large, the European Space Agency (ESA)'s Venus Express is the most recent mission to Venus and is expected to answer lots of important lingering questions about the planet. It is hoped that this mission will answer important questions such as what causes the rapid atmospheric rotation in the Venus, what is the role of the greenhouse effect on global climate, are there water, and/or carbon dioxide, and why do some surface areas reflect radar, to name a few.

Study of the Venusian atmosphere would enhance our ability to understand the evolution of the atmosphere here on Earth.

How to watch

A small telescope or a pair of binoculars would be sufficient to view this transit. For safety and the sake of your sight, never look directly at the sun with your naked eyes. Use a solar filter in front of your binoculars or telescope to safely see the sun and the transit of Venus. One can even project the image formed by the binoculars on to paper to see the transit. For those who do not possess such equipment or if the weather goes bad, simply watch the live transit on the Internet.

Balmiki Vidyapatih, located on Exhibition Road in Kathmandu, organizes a public observation programme during such astronomical occasions. Moreover, the Central Department of Physics, Tribhuvan University, in Kirtipur and the Centre for Astrophysics research group of the BP Koilai Memorial Planetarium, Observatory and Science Museum has its own telescope located at Nagarjot. Remember, the National Academy of Science and Technology (NAST), Kathmandu is also a good place to visit if you are interested in discussing the topic with experts.

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