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# How the Indians Discovered Solar Eclipses

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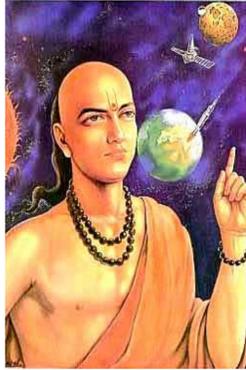
# How the Indians Discovered Solar Eclipses

Taylor Hojnowski, Alek Showalter | Western Oregon University



## Eclipses and the Rig Veda

Records show that in the Rig Veda (the oldest document in Indian culture) that eclipses were discovered around 1400 BC.



This is the Indian mathematician Aryabhata, who was credited with the discovery of solar eclipse in India.

## Aryabhata and Mathematics

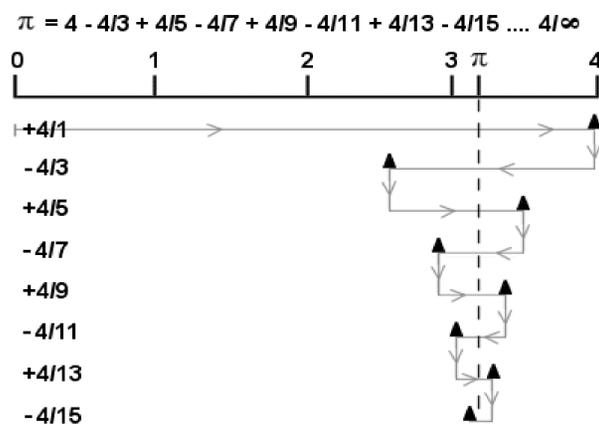
The Indian mathematician Aryabhata is credited with helping create trigonometry. One reason for this is that he found how to measure the area of a triangle. In his own words, "for a triangle, the result of a perpendicular with the half-side is the area".

Aryabhata is also credited with being the creator of "zero".

Possibly his biggest contribution to astrology is that he calculated that the sun is 400 times further away from the earth than the moon.

He started the conversation on the concept of *sine* in trigonometry. His works on topic have made *sine* into what it is today.

He also worked on approximating pi. He may have also have come to the realization that pi is irrational. The picture below gives an example of how pi was approximated.

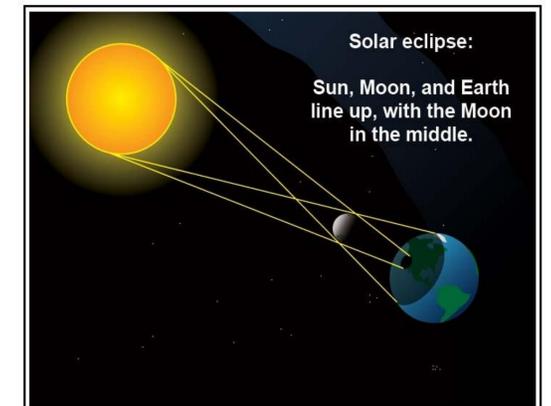


If this process were to be continued indefinitely, through all the odd number fractions to infinity, the approximation would hit  $\pi$  exactly

## How Aryabhata Discovered Eclipses

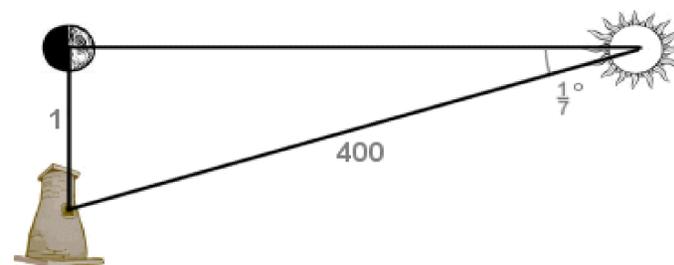
According to the Rig Veda, one of India's most sacred and historic texts, the solar eclipse was discovered by the Indian mathematician, Aryabhata. The text contained information on Aryabhata and on some of his processes of how he discovered the calculations for discovering solar eclipses.

- Aryabhata calculated that the sun is 400 times further away from the earth than the moon
- Aryabhata discovered that when the moon and sun and earth are in a straight line the angles of the sun's light will only reach the x and y axis of the earth and greater, instead of shining light on the surface
- Aryabhata states that moon and planets shine by reflected sunlight
- Aryabhata explains eclipses in terms of shadows cast by, and falling on earth
- Aryabhata also discovered lunar eclipses occur when the moon enters into the earth's shadow
- Aryabhata discusses at length the size and extent of the earth's shadow and then provides the computation and the size of the eclipsed part during an eclipse. Later Indian astronomers improved on the calculations, but Aryabhata's methods provided the core.
- Aryabhata's computational paradigm was so accurate that 18th-century scientist Guillaume Le Gentil, during a visit to Pondicherry, India, found the Indian computations of the duration of the lunar eclipse of 30 August 1765 to be short by 41 seconds, whereas his charts (by Tobias Mayer, 1752) were long by 68 seconds.
- Aryabhata applied plane trigonometry to spherical geometry by projecting points and lines on the surface of a sphere onto appropriate planes. This included prediction of solar and lunar eclipses and an explicit statement that the apparent westward motion of the stars is due to the spherical earth's rotation about its axis. Aryabhata also correctly ascribed the luminosity of the Moon and planets to reflected sunlight.



## Conclusion

- Eclipses were discovered by the Indian mathematician Aryabhata in 1400 BC
- Aryabhata is famous for finding other things as well, such as approximating Pi, creating "Zero", and started the work on the original Sine computation
- Aryabhata is credited as one of the main mathematicians to have come up with computations of eclipses



Indian trigonometry tables showed that an angle of  $1/7^\circ$  indicates triangle sides with a ratio of 400:1, meaning that the Sun is 400 times further away from the Earth than the Moon