

CORRESPONDENCE

THE LUNAR MODEL IN ANCIENT INDIAN ASTRONOMY

The basic premise of this paper is a new interpretation of the verse 46 in chapter 2 on “*Spaṣṭādhikāra*” (True longitudes), of the celebrated Indian astronomical work, *Sūryasiddhānta*. The author is totally wrong in interpreting this verse in *Sūryasiddhānta*, as giving the second correction to the Moon.

Verse 46 in Chapter 2 (*Spaṣṭādhikāra*) of *Sūryasiddhānta* says:

arkabāhuphalābhyastā grahabhuktirvibhājitā |

bhacakraikalikābhistu liptāḥ kāryā grahe arkavat ||

Rev. Ebenezer Burgess was perhaps the first to translate *Sūryasiddhānta* into English with detailed explanatory notes in 1858. The translation by Burgess reads:

Multiply the daily motion (*bhukti*) of the planet by the Sun’s result from the base sine (*bāhuphala*); and divide by the number of minutes in a circle ; the result in minutes, apply to the planet’s true place in the same direction as the equation was applied to the Sun.

There is nothing wrong with the translation. Here, *Sūryasiddhānta* is talking about the correction to the true longitude of any planet (not necessarily Moon) if we want to calculate it when the true Sun is on the meridian instead of the mean Sun. Yes, it pertains to the part of the ‘Equation of time’ due to the eccentricity of Sun’s orbit.

So, Correction = *Bāhuphala* of Sun (in minutes) x Daily motion of the planet / (Number of minutes in a circle).

If the *bāhuphala* of the Sun in minutes, that is, the equation of centre of the Sun is positive, true longitude of the Sun is more than mean longitude. That means, the Sun will cross the meridian a little later. In this duration, the planet’s longitude increases. The amount is decided by the rule of three: For an interval corresponding to 21600 minutes (that is, the whole day) the

increase in longitude of the planet is equal to its daily motion. What is the increase corresponding to the equation of centre of the Sun? That is what is given in the formula above which is the verse 46 itself in terms of an equation. Similarly, if the equation of centre of the Sun is negative, the true Sun would have crossed the meridian earlier, and the correction to the longitude of the planet is negative.

It is not just the “colonialists” who interpret it this way. Bhāskara II (b. 1114) says the same thing (as quoted in *Sūryasiddhānta* with a Sanskrit commentary by K.C. Dvivedi). The famous Indian astronomers, Parameśvara (1380-1460), Raṅganātha (early 17th cent.) and Kamalākara (early 17th cent.) also interpret the verse in the same way in their commentaries on *Sūryasiddhānta*. Anyway, it is not such a difficult verse, and the meaning is clear. Here it is clear that “*arkabāhuphala*” is the ‘equation of centre’ of the Sun. “*kāryā grahe arkavat*” means that the correction should be applied to the planet in the manner as it is done to the Sun (positive /negative when the eqn. of centre the Sun is positive/ negative).

There is no basis whatsoever to assert that “By ‘Sun-sine’ is meant the sine of the angle between the Sun and the Moon” or that “By Sun-like procedure is meant the multiplication of the Cosine of the angular separation between the Sun and the lunar apogee”, as the author does. ‘*Arkabāhuphala*’ is always “ $r \sin(\text{mandakendra of Sun})$ ” where r is the radius of Sun’s epicycle and *mandakendra* is the difference between mean planet and its apogee, (Sun, in this case) in all Indian works on astronomy. Similarly, ‘*arkavat*’ just means “as applied to the Sun” and has nothing to do with “Cos (mean Sun – Moon’s apogee)”.

To conclude, the relevant verse in *Sūryasiddhānta* taken up for reinterpretation by the author, deals with the correction to a planet’s longitude due to the equation of centre of the Sun, as explained by all the ancient commentators of the work, as also Rev. Burgess, and **not** the second correction to the Moon, as asserted by the author.

References

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