The article published below draws attention to the work of the Kerala school of astronomers, particularly Nilakanta (1500 AD) in modelling planetary motion. In the exchanges between authors and referee, it became clear that this school did not stop with copying their predecessors but attempted to wrestle with the problems of the old (geocentric) system. Whether their work constituted a clean break towards a true heliocentric system, as proposed by Srinivas and colleagues, appears to hinge upon some subtle points of interpretation of the original texts. For example, did the Kerala astronomers maintain the distinction between the mean and the centre of the epicycle of an interior planet, even though both move together in the sky? They could be at different distances, as a referee suggests. In any case, one cannot but note the vitality of this tradition of mathematics and astronomy which even studied infinite series some years later, while the rest of the country was going through an academic dark age.

— Editor

Modification of the earlier Indian planetary theory by the Kerala astronomers (c. 1500 AD) and the implied heliocentric picture of planetary motion

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We report on a significant contribution made by the Kerala School of Indian astronomers to planetary theory in the fifteenth century. Nilakantha Somasutvan, the renowned astronomer of the Kerala School, carried out a major revision of the older Indian planetary model for the interior planets, Mercury and Venus, in his treatise Tantrasangraha (1500 AD), and for the first time in the history of astronomy, he arrived at an accurate formulation of the equation of centre for these planets. He also described the implied geometrical picture of planetary motion, where the five planets – Mercury, Venus, Mars, Jupiter and Saturn – move in eccentric orbits around the Sun, which in turn goes around the Earth. The later astronomers of the Kerala School seem to have by and large adopted the planetary model developed by Nilakantha.

It is now widely recognized that the Kerala school of Indian astronomy[1], starting with Madhava of Sangamagrama in the fourteenth century, made important contributions to mathematical analysis much before this subject developed in Europe. The Kerala astronomers obtained the infinite series for π, sine and cosine functions and also developed fast convergent approximations to them[2]. Here we report that the Kerala school also made equally significant discoveries in astronomy, in particular, planetary theory.

We show that Nilakantha Somasutvan of Trkkantiyur (1444–1550 AD) carried out, in his treatise *Tantrasangraha* (1500 AD), a major revision of the earlier Indian planetary model for the interior planets Mercury and Venus. This led Nilakantha to a much better formulation of the equation of centre for these planets than was available either in the earlier Indian works or in the Islamic or European traditions of astronomy till the work of Kepler, which was to come more than a hundred years later.

We also note that Nilakantha in his later works, *Golasara*, *Siddhantadarpana* and more importantly the celebrated *Aryabhatiyabhashya*, explains that the computational scheme developed by him implies a geometrical picture of planetary motion, where the five planets Mercury, Venus, Mars, Jupiter and Saturn move in eccentric orbits around the mean Sun, which in turn goes around the Earth. Most of the Kerala astronomers who succeeded Nilakantha, such as Jyesthadeva, Acyuta Pisarati, Putumana Somayaji, etc. seem to have adopted this planetary model.

The conventional planetary model of Indian astronomy

In the Indian astronomical tradition, at least from the time of Aryabhata (499 AD), the procedure for calculating the geocentric longitudes of the five planets, Mercury, Venus, Mars, Jupiter and Saturn involves essentially the following steps[3]. First, the mean longitude (called the *madhyamagraha*) is calculated for the desired day by computing the number of mean civil days elapsed since the epoch (this number is called *ahargana*) and multiplying it by the mean daily motion of the planet. Then two corrections namely *manda samskara* and *sighra samskara* are applied to the mean planet to obtain the true longitude.

The *manda samskara* is equivalent to taking into account the eccentricity