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ABSTRACT

1. The Work of Kerala School of Astronomy and Mathematics - A Scientific Revolution Prior to European Renaissance by Prof. M. D. Sreenivas, CPS, Chennai

Though Kerala has had an ancient tradition of scholarship in Astronomy and Mathematics, it was Mādhava (c.1340-1425) of Saṅgamagrāma (near Ernakulam) who was the pioneer of a new school. Just a couple of Mādhava's works (dealing with the computation of lunar longitudes) are available. It is only from later works that we get to know of Mādhava's discoveries dealing with the infinite series for the π, sine and cosine functions and also various fast convergent approximations to them. Mādhava's disciple Parameśvara (c.1380-1460) is reputed to have made continuous and careful observations for a period of over fifty-five years; he developed the Diggaṇita system.

Nīlakaṇṭha Somasutvan (c.1444-1545), a disciple of Parameśvara's son Dāmodara, carried out an even more fundamental revision of the traditional planetary theory. In his work Tantrasaṅgraha (1500 CE) Nīlakaṇṭha presents a better formulation of the equation for the centre and the latitude of the interior planets (Mercury and Venus) than was available either in the earlier Indian works or in the Islamic or the Greco-European traditions of astronomy until the work of Kepler, which was to come more than a hundred years later. Nīlakaṇṭha is also the first savant in the history of astronomy to clearly deduce from his computational scheme and the observed planetary motion (and not from any speculative cosmological argument) that the interior planets (Mercury and Venus) go around the Sun and that the Earth is not circumscribed by their orbit.

The most detailed exposition of the work of the Kerala School (especially the contributions of Mādhava and Nīlakaṇṭha), along with detailed demonstrations (yukti), can be found in the seminal Malayalam text Yuktibhāṣā (c.1530) of Jyeṣṭadeva, a disciple of Dāmodara. Yuktibhāṣā has been hailed as the "First Textbook of Calculus". Many of the demonstrations in Yuktibhāṣā have also been presented (mostly in the form of Sanskrit verses) in a couple of commentaries by Śaṇkara Vāriyar (c.1500-1556), a disciple of Nīlakaṇṭha. The line of direct disciples of Mādhava continued up to Acyuta Piṣāraḍi (c.1550-1621), a disciple of Jyeṣṭadeva and the teacher of the great scholar devotee Nārāyaṇa Bhaṭṭaṭiri. By the time of Acyuta, most of Kerala had become a highly disturbed region − the scene of constant warfare between rival European powers, the Portuguese and the Dutch. However, the Kerala School managed to survive well into the nineteenth century, when Śaṅkaravarman the Raja of Kaḍattanāḍu wrote perhaps the last important work emanating from the School, Ṣaḍratnamālā, in 1819 CE.

Ever since the seminal work of Needham, who showed that until around the sixteenth century Chinese science and technology seem to have been more advanced than their counterparts in Europe, it has become fashionable for historians of science to wonder "Why did modern science not emerge in non-Western societies?" In the work of the Kerala School, we notice clear anticipations of some of the fundamental discoveries which are associated with the emergence of modern science, such as the mathematics of infinite series and the development of nongeocentric models of planetary motion. It seems therefore more appropriate to investigate "Why modern science ceased to flourish in India after the 16th Century?" It may also be worthwhile to speculate "What would have been the nature of modern science (and the
modern world) had sciences continued to flourish in non-Western societies?" In this way we could also gain some valuable insights regarding the sources and nature of creativity in geniuses such as Srīnivāsa Rāmānujan, Jagadish Chandra Bose and others in modern India.