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OBITUARY

K. V. SARMA (1919-2005)*

Professor K. V. Sarma, an eminent scholar of Indian astronomy and mathematics, Sanskritist and manuscriptologist, passed away in Chennai on 14th January 2005, after a brief illness.

K. V. Sarma
(1919-2005)

Born at Chengannur in Kerala on 22nd December 1919, Prof Krishna Venkateswara Sarma had his school education in Attingal near Thiruvananthapuram. He completed his B.Sc. with physics as the major subject in 1940 from Maharaja's College of Science, Thiruvanathapuram. After this, his family tradition of Sanskrit scholarship influenced him to join the M.A. course in Sanskrit at Maharaja's College of Arts, Thiruvanathapuram which he completed in 1942 with a First rank from the Kerala University. In those days, Dr.V. A. Ramaswamy Sastri, Professor of Sanskrit at the Kerala University had a decisive influence on him . During 1943-51, Prof Sarma was the Supervising Pandit of the Manuscripts Section of the Kerala University Oriental Research Institute and Manuscripts Library. This position provided him with a golden opportunity for acquiring practical knowledge and training in the problems of reading and editing palm-leaf and paper manuscripts in different scripts, as well as initiation into textual criticism. During this period Prof Sarma prepared an analytical catalogue of nearly 50,000 manuscripts of this library, with the assistance of Pandits.

From 1951 till 1962, he was in the Department of Sanskrit, University of Madras, first as a Research Assistant and then as a Lecturer. In this period, he was associated with the project of the *New Catalogus Catalogorum of Sanskrit Works and Authors*, which was being directed by the internationally renowned scholar

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Prof V. Raghavan. It was also the time when his life-long pre-occupation with the Kerala school of Astronomy and Mathematics began. In those days, even well-meaning scholars had succumbed to the idea that Bhāskarācārya II's *Siddhānta Śiromaṇi* (c. 1150 AD) was the last great work in astronomy and mathematics in the Indian tradition, and that nothing much of consequence was achieved in India after this. This was despite the fact that many research articles by several scholars had been written on the pioneering work on mathematical analysis, especially the infinite series for pi, sine and cosine functions in the Kerala school of *Jyotiṣa,* from the fourteenth century onwards. It was probably due to the fact that very few texts of this school had been edited. Prof. K.V. Sarma's patient and persistent research succeeded in dispelling this notion to a great extent. He painstakingly collected/copied the Kerala manuscripts on astronomy, astrology and mathematics, and carefully edited and published many of them. Some of the early works in this genre were *Grahacāranibandhana* of Haridatta (1954), *Siddhāntadarpaṇ a* of *Gārgya-Kerala* Nīlakaṇṭha Somayājin (1955), *Venvāroha* of Mādhava of Saṅgamagrāma (1956), *Goladīpikā* (1957) and *Grahaṇāṣṭaka* (1959) of Parameśvara , *Candravākyas* of Vararuci (1962) and *Vākyakaraṇa* with the commentary *Laghuprakāśikā by* Sundararāja (1962) jointly with T.S.Kuppanna Sastri.

From 1962 to 1983, Prof. Sarma was with the 'Visvesvaranand Vishva Bandhu Institute of Sanskrit and Indological Studies' (formerly Visvesvaranand Vedic Research Institute), Panjab University, Hoshiarpur. He began his career there as a curator in the Research and Library Department and subsequently became the Director during 1975-80 , and continued as an Honorary Professor during 1981-83 except for a year (1980) when he was in Varanasi as the academic advisor to the well-known Indological Publishers, M/S Motilal Banarsidass. This was perhaps his most productive period, when more than 50 of his books, mostly on the Kerala School of Astronomy were published. These include *Dṛggaṇita* of Parameśvara (1963), *Golasāra* of Nīlakaṇṭha Somayājin (1970), A History of the Kerala School of Hindu Astronomy (1972), A Bibliography of Kerala and Kerala-based Astronomy and Astrology (1972), *Līlāvatī* of Bhāskarācārya with *Kriyākramakarī* of Śaṅkara and Nārāyaṇa (1975), *Tantrasaṅgraha* of Nīlakaṇṭha with the commentaries *Yuktidīpikā* and *Laghuvivṛtti* of Śaṅkara' (1977), *Jyotirmīmāṃsā* of Nīlakaṇṭha Somayājin (1977), and *Gaṇitayuktayaḥ,* Part I (1979). The last four are very important

works of the Kerala school, bringing out its many facets. *Tantrasaṅgraha* (c.1500 AD) is a systematic treatise on almost all the important algorithms of Indian astronomy, with a major revision of the traditional Indian planetary model, and exact results & innovations in spherical astronomy. The *Yuktidīpikā* commentary on this work, as well as *Kriyākramakarī* contain detailed expositions on Mathematics including proofs. *Gaṇitayuktayaḥ* also contains many demonstrations and proofs. *Jyotirmīmāṃsā* is a unique work, expounding the epistemology of astronomy. Prof Sarma was awarded the D.Litt degree of Panjab University in 1977 for his monumental 2034-page thesis on 'Contributions to the Study of the Kerala School of Astronomy and Mathematics' which incorporated most of the above works, and some others too. It was also in this period that he brought out *Āryabhaṭīya* of Āryabhaṭa with English Translation (1976) in collaboration with K.S.Shukla, which is an important reference book for all scholars of Indian astronomy, and *Āryabhaṭīya* of Āryabhaṭa with the commentary of Sūryadeva Yajvan (1976).

From 1983 onwards, Prof Sarma was the honorary professor of Sanskrit at the Adyar Library Research Centre. In 1997, he founded the 'Sree Sarada Education Society Research Centre' towards fostering studies in Sanskrit, Ancient sciences of India and Indian Culture. He was its director, till he breathed his last. The Centre has some qualified scholars and has a collection of more than 12,000 books and issues of periodicals, a majority of them being donated by Prof Sarma himself. In this period, some of his important publications are, *Indian Astronomy: A Source Book* (1984) jointly with B.V.Subbarayappa, *Vedāṅga Jyotiṣa* with the translation of T.S.Kupanna Sastri (1985), and *Pañcasiddhāntikā* of Varāhamihira with the translation of T.S.Kuppanna Sastri' (1993), which are a gold mine of information on all aspects of Indian astronomy from Vedic period onwards. He had been working for a long time on editing the Malayalam and Sanskrit manuscripts of *Yuktibhāṣā* of *Jyeṣṭhadeva* (c. 1530 AD) and translating it. Fortunately, the work has been accomplished with detailed explanatory notes by K.Ramasubramanian, M.D.Srinivas and M.S.Sriram, just before he expired. *Yuktibhāṣā* is a unique work which is exclusively devoted to detailed proofs and demonstrations on most aspects of Indian mathematics and astronomy, including the celebrated infinite series expansions for pi, and sine and cosine functions. Though proofs and demonstrations of various results are to be found in the commentaries of some important Indian texts, *Yuktibhāṣā* is far

important texts of the Kerala school. The third volume on the Sanskrit version of the text has been published by the Indian Institute of Advanced Study, Shimla recently. When the far more important first two volumes are published, the three-volume work would be one of the most important contributions of Prof K.V.Sarma.

Apart from Indian astronomy and mathematics, he has worked on vedas, religion and philosophy, *dharmasāstras*, epics and *purāṇas*, and general literature in Sanskrit and Malayalam. He was also a noted manuscriptologist. One of his last works was 'Science Texts in Sanskrit in the Manuscripts Repositories of Kerala and Tamil Nadu' (2002), which has a list of 3473 texts related to science and technology. The breadth of his scholarship can be gauged from the fact that the 'Encyclopedia of Hinduism and Indic Religions' (South Carolina, USA) has140 articles by him! Similarly, the 'Encyclopedia of the History of Science, Technology and Medicine in North-Western Cultures' (Dordrecht/ Boston/London) has 38 articles and *Bhāratīya Śāstra Manjuṣā* (Trivandrum) has 20 articles by Prof. K.V. Sarma. He has also reviewed many books and articles by others. In all he has authored more than 100 books and 500 articles.

In the pre-independence era, there were several scholars who dug deep into the primary sources on Indian mathematics and astronomy, brought to light many classic works of great ancient astronomers and mathematicians like Āryabhaṭa, Bhāskara-I, Brahmagupta, Mahāvīra and Bhāskara-II, and laid the foundations of historical research in the field. However, in the post-independence period, there have not been many such scholars of comparable eminence. Prof. K.V.Sarma and Prof. K.S.Shukla of Lucknow University were two great exceptions. Prof.Sarma was a towering figure, who single-handedly brought to light very many important Kerala works on astronomy and mathematics in Sanskrit, providing the English translation also in some cases. This was possible because of his mastery over English, Malayalam and Sanskrit. For this task, he had to first obtain the manuscripts, of course. His son, Sri.A.V.K.Murthy informs me that when he was serving in Madras University and later in the Vishveshvaranand Vishvabandhu Institute at Hoshiarpur, he used to devote all his time during vacations touring the Kerala countryside to procure manuscripts, after tracing them. Some of the manuscripts were to be found in the various manuscript repositories, but several of them were in private collections. In some cases, the owners had to be persuaded and cajoled to part with the manuscripts,

even temporarily. It is worth mentioning that all such searches were not successful. In an article on Prof.Sarma in the Malayalam daily *Mathrubhūmī* a few months back, there is a poignant account of one search. He was searching desperately for a manuscript of *'Golavāda'* by Mādhava of Saṅgamagrāma. After travelling for several days and talking with many people, it was felt that a manuscript of this could be available in the private collection of a branch of the royal family of Cochin, near Ernakulam. After reaching there, he came to know that it would be located in a box in the premises of a temple in the royal household. When the box was broken open (as the key for the lock was not available), he found only a pile of dust in it, apart from a few rusted nails. All the manuscripts in the box had been devoured by white termites! Fortunately, he was successful in many other cases, and all this hard work was rewarding. It was because of his solid work that the Kerala school is talked about so much in recent times, and the entire perspective on Indian astronomy and mathematics has changed considerably because of his contributions. In recent times, there is no work in any other branch of ancient Indian sciences, comparable to his work in the field of astronomy and mathematics. His edited texts need to be studied thoroughly.

Prof. Sarma has been the recepient of several honours and awards, the most important being the 'President's Certificate of Honour' (Government of India, 1992) which is perhaps the highest honour in India for Sanskrit scholarship. Some of the other awards were 'Maharani Sethu Parvati Bai Prize' for Sanskrit research (1992), '*Vidyabhushanam*' (Kerala Sanskrit Academy, 1992), *'Paṭṭathānam' (Bhaṭṭasthānam)* from the Zamorin of Calicut, Kerala (1993), 'Outstanding people of the 20th century' for contribution to Education, Sanskrit and Manuscriptology, International Biographical Centre (Cambridge, England 1998), *'Swadeśī Āryabaṭīya Puraṣkāram'* Swadeshi Science Movement, Kerala, Trivandrum (1999), '2000 Millenium Medal of Honour', American Biographical Institute, USA (1998), and the honorary degree *'Vācaspati'*, Kendriya Sanskrit Vidyapeetha, Tirupati (2003).

Prof. Sarma was self-motivated to a large extent. The eminent Sanskritist Acharya Vishwabandhu influenced him considerably during his career in Hoshiarpur by his own deep scholarship, as well as by providing him with all facilities and constantly encouraging him. In his earlier days at Madras, his collaborator Prof. Kuppana Sastri had also a decisive influence, thanks to his (Sastri's) scholarship in Sanskrit, as well as his in-depth knowledge of astronomy

and mathematics. The Indian National Science Academy recognised Prof Sarma's talents by publishing some of his works, as well as through research grants for several of his projects.

Prof. Sarma was a workaholic who put in nearly 15 hours of work everyday. He was very enthusiastic about new projects even in his later years. The author recollects an occasion nearly two years ago, when Prof Sarma at the age of 84, came up with a scheme of editing 10 manuscripts in Sanskrit, when the Rashtriya Sanskrit Sansthan was looking for scholars to take up edition of unpublished manuscripts. He was an unassuming and simple person. He had a genial personality and was always available for consultations, to anybody with even a mild interest in any aspect of Indian sciences, culture and literature. He would enthusiastically provide valuable references and concrete suggestions to serious scholars. As far as recognitions and awards are concerned, he cared only for recognition from the scholarly world, and was keen that his work should be carried forward by younger scholars. The impressive achievements of Prof Sarma, would not have been possible, but for the selfless cooperation of his loving and affectionate wife Smt. Sarada, who took care of all his material needs and had no demands of her own.

Prof. Sarma is survived by his wife, a son and a daughter. Vide also List of Publications below:

List of Publications on Astronomy, Mathematics and Other Sciences of Prof. K.V. Sarma*

A. BOOKS

1. *Rāśigolasphuṭanīti* of Acyuta, crt. ed. with intro. and trans. Madras: Adyar Library and Research Centre, 1953. pp. 30.
2. *Veṭikkampavidhi* (Malayalam), a manual on fire-works by Nīlakaṇṭha of Tirumaṅgalam, crt. ed. with com. and historical intro., Madras: University of Madras, 1953. pp. 58.
3. *Grahacāranibandhana,* a *Parahita-gaṇita* manual by Haridatta, crt. ed. with intro. and app., Madras: Kuppuswami Sastri Research Institute, 1954. pp. xii + 34.
4. *Grahacāranibandhana-Saṅgraha*, Anon. Madras: Kuppuswami Sastri Research Institute, 1954. pp. 6.
5. *Siddhāntadarpaṇa* of Gārgya-Kerala Nīlakaṇṭha Somayājin, crt. ed. with intro., trans. and two appendices, being *Siddhāntadarpaṇa-siddha-paryayādayaḥ* and *Siddhāntadarpaṇastha-paryaya-bhūdināni*, Madras: Adyar Library and Research Centre, 1955, pp. 42.

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6. *Veṇvāroha* of Mādhava of Saṅgamagrāma, with the Malayalam com. of Acyuta, crt. ed. with intro. and appendices, Truppunithura: Sanskrit College, 1956. pp. 24, 30.

7. *Śīlam rājñaḥ śriye-tyādi-Candravākya-s* of Mādhava of Saṅgamagrāma. crt. ed. with notes, Trippunithura: Sanskrit College, 1956, pp. 6.

8. *Dṛg-veṇvāroha-kriyā*, Anon., crt. ed., Trippunithura: Sanskrit College, 1956. pp. 2.

9. *Golad īpikā* of Parameśvara, with auto-commentary, crt. ed. with intro. and trans., Madras: Adyar Library and Research Centre, 1957. pp. 126.

10. *Grahaṇāṣṭaka* of Parameśvara, crit. ed. with intro. and Trans., Madras: Kuppuswami Sastri Research Institute, 1959. pp. 14.

11. *Candravākyas* of Vararuci, crt. ed., Madras: Kuppuswami Sastri Research Institute, 1962. pp. 10.

12. *Kujādi-pañcagraha-mahāvākyāni*, crt. ed., Madras: Kuppuswami Sastri Research Institute, 1962. pp. 115.

13. *Vākyakaraṇa*, with the com. *Laghuprakāśikā* by Sundararāja, crt. ed. with intro. and appendices (Jointly with T.S. Kuppanna Sastri), Madras: Kuppuswami Sastri Research Institute, 1962. pp. 6, xxxii + 302.

14. *Dṛggaṇita* of Parameśvara, crit. ed. with intro, Hoshiarpur: Vishveshvaranand Institute, 1963. pp. xviii + 32.

15. *Grahaṇamaṇḍana* of Parameśvara, crit. ed. with intro. and trans, Hoshiarpur: Vishveshvaranand Institute, 1965. pp. xviii + 44.

16. *Grahaṇa-nyāyadīpikā* of Parameśvara, crit. ed. with intro. and trans, Hoshiarpur: Vishveshvaranand Institute, 1966. pp. xx + 41.

17. *Golasāra* of Nīlakaṇṭha Somayājin, crt. ed. with intro. and trans, Hoshiarpur: Vishveshvaranand Institute, 1970. pp. xxvi + 28.

18. *A History of the Kerala school of Hindu astronomy*., Hoshiarpur : Vishveshvaranand Institute, 1972. pp. xiv + 205.

19. *A Bibliography of Kerala and Kerala-based astronomy and astrology*., Hoshiarpur: Vishveshvaranand Institute, 1972. pp. xii + 116.

20. *Candrasphuṭāpti* of Mādhava of Saṅgamagrāma, crt. ed. with intro. and trans., Hoshiarpur: Vishveshvaranand Institute, 1973. pp. 66.

21. *Sphuṭanirṇaya-tantra* of Acyuta, with auto-commentary, crt. ed. with intro. and ten appendices., Hoshiarpur: Vishveshvaranand Institute, 1974. pp. xxvi, 76.

22. *Chāyāṣṭaka* of Acyuta Piśārāṭi, (app. to *Sphuṭanirṇaya-Tantra*), Hoshiarpur: Vishveshvaranand Institute, 1974. p. 1.

23. *Līlāvatī* of Bhāskarācārya with *Kriyākramakarī* of Śaṅkara and Nārāyaṇa, being an elaborate exposition of the rationale of Hindu mathematics, crt. ed. with intro. and five appendices, Hoshiarpur: Vishveshvaranand Institute, 1975. pp. xxx + 496.

24. *Āryabaṭīya* of Āryabhaṭa, crt. ed. with intro., trans., notes, comments and indexes, in collaboration with Kripa Shankar Shukla, New Delhi: Indian National Science Academy, 1976. pp. lxxvii + 219.

25. *Āryabaṭīya* of Āryabhaṭa, with the commentary of Sūryadeva Yajvan, crt. ed. with detailed introduction and three appendices, New Delhi: Indian National Science Academy, 1976. pp. lii + 200.

26. *Candrasphuṭāpti* of Mādhava of Saṅgamagrāma, crt. ed. with intro., trans. and two appendices, Hoshiarpur: Vishveshvaranand Institute, 1976. pp. xxviii + 54.

27. *Rāśigolasphuṭanīti* of Acyuta, crt. ed. with intro. and trans. and appendices, Hoshiarpur: Vishveshvaranand Institute, 1977. pp. 41.

28. *Tantrasaṅgraha* of Nīlakaṇṭha with the commentaries *Yuktidīpikā* and *Laghuvivṛti* of Śaṅkara, crit. ed. with detailed intro. and three appendices, Hoshiarpur: Vishveshvaranand Institute, 1977. pp. lxxx, 370.

29. *Jyotirmīmāṃsā* of Nīlakaṇṭha Somayājin, crt. ed. with intro. and appen-dices, Hoshiarpur: Vishveshvaranand Institute, 1977. pp. li + 90.

30. *Āryabhaṭīya and allied literature* : *A select bibliography*. New Delhi: Indian National Science Academy, 1977. pp. 21.

31. *Contributions to the Study of the Kerala School of Astronomy and Mathematics*, (D. Litt. Thesis), Chandigarh: Panjab University, 1977. pp. xv + 203.

32. *Gaṇitayuktayaḥ*, Part. I, Hoshiarpur: Vishveshvaranand Institute, 1979. pp. xxvii + 124.

33. *Indian Astrononomy: A source-book*, jointly with B.V. Subbarayappa, Bombay: Nehru Centre, 1984. pp. xliii + 338.

34. *Vedāṅga-jyotiṣa* with translation of T.S. Kuppanna Sastri, crt. ed. with intro. and indices. New Delhi: Indian National Science Academy, 1985. pp. 74.

35. *History of Astronomy in India: A Survey of Source Materials*, New Delhi: Indian National Science Academy, 1986, pp. 24.

36. *Observational Astronomy in India*, Calicut: Department of Sanskrit, University of Calicut, 1990. pp. 8 + 57.

37. *Nāzhikamaṇiyuṭe Yukti*: Principle of the pendulum tower-clock in medieval India, ed. with intro. *Prācīnakairaḷi* 25 (1991), Trivandrum: Oriental Research Institute, Kerala University. pp. 22.

38. *Pañcasiddhāntikā* of Varāhamihira, crt. ed. with trans. of T.S.K. Sastri, and detailed intro. and appendices, Madras: PPST Centre, 1993. pp. xxx, 382.

39. *Science Texts in Sanskrit in the Manuscripts Repositories of Kerala and Tamilnadu*, New Delhi: Rashtriya Sanskrit Sansthan, 2002. pp. 240.

40. *Sadratnamālā* of Śaṅkaravarman, crt. ed. with intro., trans. and indexes, *IJHS* 36, 3-4 (Sept-Dec 2001), Supplement. pp. 1-58.

41. *Grahaparīkṣākrama* of Nīlakaṇṭha Somayājin with Malayalam commentary, crit. ed. (Press copy ready).

42. *Bṛhatsaṃhitā* of Varāhamihira with the com. *Utpalaparimala* of Bhāskara-Yogi, son of Kumāra, crit. ed. with intro. and appendices, (A forthcoming publication of Rashtriya Sanskrit Sansthan, New Delhi).

43. *Sadratnamālā* of Śaṅkaravarman, ed. with the com. in Malayalam by the author himself. (A forthcoming publication of Sastra Sāhitya Parisad, Cochin, Kerala).

44. *Contribution of Kerala to Scientific and Technical literature in Sanskrit* (To be published).

45. *Surgery in Ancient India* (with special reference to the *Suśrutasamhitā*) (Press copy ready).

46. *The Atharvan roots of Āyurveda* (Press copy ready).

B. Research Papers

ABBREVIATIONS

AIOC: *All-India Oriental Conference*. Poona: Bhandarkar Oriental Research Institute; ***ALB***: *Adyar Library Bulletin*, Madras: Adyar Library and Research Centre; ***IJHS*** : *Indian Journal of History of Science*, New Delhi: Indian National Science Academy; ***JOR*** : *Journal of Oriental Research*, Madras: The Kuppuswami Sastri Research Institute; ***MW*** : *Mathrubhumi Weekly* (Malayalam), Kozhikode (Kerala); ***VIJ*** : *Vishveshvaranand Indological Journal*, Hoshiarpur: V.V.B. Institue of Sanskrit and Indological Studies, Panjab University; ***Vis. Sam.***: *Vishva Samskrtam* (Skt.), Hoshiarpur: V.V. Research Institute, Sadhu Ashram; ***VJ***: *Vishva Jyoti* (Hindi), Hoshiarpur: V.V. Research Institute, Sadhu Ashram.

1. Horticulture in ancient India, Guest lecture given in the college of Arts, Trivandrum, 1942.

2. Medicine in the *Atharvaveda*, Presented in the AIOC 12 (1943-44), Varanasi.

3. Nīlakaṇṭha, author of *Mātaṅgalīlā* : His date and works, AIOC 17 (1953), Ahamedabad, Sum., p. 194.

4. Anpattiraṇ ṭu kollatte tapassu (Mal.): A penance for 55 years of Parameśvara, the Kerala astronomer, *MW* 10-10-1954.

5. Parahitagaṇ itattinte mūlagrantham (Mal.): The basic text of the Parahita system of astronomy, *MW* 10-10-1954.

6. Putumana Comātiriyuṭe avijñāta-kṛtikaḷ (Mal.): Hitherto unknown works of Putumana Somayāji, *MW* 29-1-1956.

7. Putumana Comātiriyuṭe kālam (Mal.): Date of Putumana Somayāji, *MW* 5.2.1956.

8. Saṅgamagrāma-Mādhavan (Mal.): Mādhava of Saṅgamagrāma, *MW* 4.11.1956.

9. Oru Jyotiṣa-granthavari (Mal.): A genealogical document of Kerala astronomers, *MW* 19-5-1957.

10. Date of Mādhava, a little-known Indian astronomer (c. 1350-1410), *Quarterly Jl. of the Mythic Society*, Bangalore, 49.iii (Oct. 1958), pp. 183-86.

11. Parameśvararācāryaruṭe *Dṛggaṭitam* (Mal.): Parameśvara's *Dṛggaṭita*, *MW* 28-8-1960.

12. Gleanings from Bhāskara's Bhāṣya on the *Āryabhaṭīya*, AIOC 21 (1961) Srinagar, Sum., p. 203.

13. *Tantraratna* and *Candravākya*s : Two astronomical works of Sāluva Gopendra Tippa Bhūpāla, AIOC 21 (1961), Srinagar, Sum., pp. 204-05.

14. The *Devālayacandrikā*: A hitherto unknown work of Nārāyaṇa, author of *Tantrasamuccaya*, *ALB* 25 (1961) pp. 582-86.

15. Metallurgy in ancient India, paper presented in the Sanskrit Association, Madras, 1963.

16. *Laghubhāskarīya-vyākhyā* : An early specimen of Malayalam prose, presented in the AIOC 24 (1968), Varanasi.

17. Contribution of Kerala to Indian astronomy, paper presented in the International Sanskrit Conference (1972), New Delhi.

18. *Śibikāvakravaṃ Śalakṣaṇam* : A method to grow crooked bamboos for palanquin beams, in *Professor M. Hiriyanna Birth Centenary Commemoration Volume*, ed. V. Raghavan and M. Marulasiddiah, Mysore: University of Mysore, 1972, pp. 161-66.

19. Direct lines of astronomical tradition in Kerala, *Prof. Charudeva Shastri Felicitation Volume*, Delhi: Prof. Charudeva Shastri Felicitation Committee, 1973, pp. 601-04.

20. Kerala literature on Jyotiṣa, *Journal of the Ganganatha Jha Kendriya Sanskrita Vidyapeetha*, Allahabad, 29 (1973) : *Ganganatha Jha Centenary Volume*, pp. 405-23.

21. The *Kriyākramakarī* - An extensive commentary on the *Līlāvatī* of Bhāskara II and its joint authorship, AIOC 27 (1974), Kurukshetra, Sum., p. 331.

22. Scientific thought in Ancient India: Synopsis of a series of nine talks, AIR, Jullundur, November, 1975.

23. Grahaparīkṣākrama of Nīlakaṇṭha Somayāji on the computation of the planets by observation, AIOC 28 (1976), Dharwar, Sum., p. 260.

24. Nīlakaṇṭha Somayāji's *Jyotirmīmāṃsā* - A unique Kerala work on astronomical rationale. Paper presented in the Seminar on the Contribution of Kerala to Sanskrit literature, Trivandrum, 1977, 8 pp.

25. Sanskrit literature on mathematics and astronomy, *Proceedings of the U.G.C. Seminar on scientific literature in Sanskrit*, Trivandrum: Kerala University, 1977.

26. A survey of studies in technical sciences and fine arts: Some suggestions of their development: Sectional Presidential Address to the 29th AIOC, Proc. of the AIOC 29 (1978), Poona, pp. 147-71.

27. Corrections in Indian astronomy : Principles and methods in medieval Kerala. *Jl. of the Bharati Research Centre*, Indore. (1978) pp. 127-33; *Jl. of the Jagannath Univ.*, Puri. 1, pp. 127-33.

28. Evolution of the physical sciences in ancient and medieval India, Panjab University, Chandigarh, 1978, 25 pp.

29. Indian astronomy during medieval times : Need for assessment. Key paper at the workshop on Astronomy, Bharatiya Vidya Bhavan, Bombay, 24 March 1979, 19 pp.

30. Jyotiśśāstra and modern man, *Gita Jnana Yajna Souvenir*, Tirupati: Chinmaya Mission, 1979, pp. 17-19.

31. Sawai Jai Singh and his contribution to Indian astronomy, being the Foreword to *Mānamandira Observatory of Kāśi* by Bapudeva Shastri, ed. Shakti Dhar Sharma, Kurali (Panjab): Martand Bhavan, 1982, pp. ix-xxiv.

32. Indian astronomy in Vedic age, in Vivekananda Kendra Patrika. Feb 1983. pp. 98-108.

33. Some highlights in astronomy and mathematics in ancient and medieval India, Sanskrit and World Culture, SCHR.OR., Berlin, 18 (1986), pp. 595-605; Vivekananda Kendra Patrika, Madras, Aug 1983, pp. 1-8.

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