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Parāśara Tantra an Ancient Text on Natural Sciences

R.N.Iyengar
Jain University, Bangalore
(Email: RN.Iyengar@jainuniversity.ac.in)

Extended Abstract

India, home for one of the most ancient surviving civilizations, naturally has a long tradition of science and technology. This covers such diverse fields as Astronomy, Architecture, Agriculture, Mathematics, Medicine, Metallurgy, and Music to name only a few. History of science and technology in India is a well-researched field. There are many publications covering the historical development of some of the above subjects in concept and in practice starting from the most ancient available literary source, namely, the Ṛgveda. Among these, perhaps Astronomy takes the lead in terms of the number of books and papers written. This is not surprising, since the number of ancient source books available on astronomy is very large.

Dikshit[1], the first person to write a History of Indian Astronomy, traces the subject in two distinct periods called pre-*siddhāntic* and *siddhāntic*. The word *siddhānta* in this context may roughly be translated as mathematical or computational astronomy. The content, outreach and limitations of *siddhāntic* astronomy are well known, with numerous texts starting roughly from the early centuries of the Common Era. A typical feature of the *siddhānta* texts is their postulation of a long period of time called *kalpa* in which planets are taken to execute integral number of revolutions. These texts contain long chapters on eclipse calculation along scientific lines discarding the legend of an extraneous dark planet *rāhu* causing solar and lunar eclipses. Samhitā texts written in the same period knew about comets and meteors by their generic name *ketu* and *ulkā* respectively, but comets were thought to be not amenable for computations.

For the pre-siddhāntic period of Indian astronomy we have only one published text namely, Lagadhā's *Vedānga Jyotisha*[2] (VJ). This text is solely devoted to the calendar and is silent about planets, eclipses and comets. However, several scholars have pointed out that a class of texts called *tantra* or *samhitā*, containing astronomical information, authored by Parāśara, Vrddha-Garga and others should have existed in the pre-siddhāntic period[3]. These were preserved through oral tradition over a period of time before someone recorded them in script form. Unfortunately copies of the texts of these authors are not available in their original form, except for quotations by later authors. Between Parāśara and Vrddha Garga, the former is more interesting since his statements are in prose. Vrddha Garga in verse follows Parāśāra closely with some important additional information. Al-beruni in the 11th century knew about the ancient Hindu astronomer

[1] S.B.Dikshit, *Bhāratīya Jyotisha Śāstra*, Govt. of India Press, Calcutta, 1969

[2] *Vedanga Jyotisha* (Ed. & Transl.) T.S.K. Sastry and K.V.Sarma, INSA, N.Delhi, 1984

[3] R.N.Iyengar, *Archaic Astronomy of Parāśara and Vrddha Garga*, IJHS, 43, 2008, pp.1-27.

Parāśara and his *samhitā*[4]. Varāha-mihira (6h Cent.) in his *Brhat-samhitā* (8.8-13) while describing the motion of Mercury attests Parāśara and *Parāśara-tantra* (*abbr.* PT) by name. Hence in the interest of tracing the history of Indian astronomy from Vedic times it becomes necessary to find out what was known to Parāśara several centuries before Varāha-mihira. Fortunately, there are reliable sources from which we can reconstruct the text of Parāśara. These are in the form of long quotations contained in the commentaries of Utpala (10th Cent.) and Bhāskara-yogi (13th Cent.) on the Brhat-samhitā (BS) and the encyclopedic text Adbhuta-sāgara (AS) started by Ballāla-sena but completed by his son Lakshmana-sena (11-12th Cent.).

The available published sources for compiling the statements attributed to Parāśara are;

i) Commentary of Utpala edited by K. C. Dvivedi (*Brhat Samhitā of Varāha Mihira* with Sanskrit commentary; Sampurnananda Sanskrit University, Varanasi. 1996)

ii) The Adbhuta-sāgara edited by Muralidhar Jha (*Adbhuta Sāgara of Ballāla Sena*, Sanskrit Text, Prabhakari & Co, Benares Cantt. 1905).

iii) Commentary of Bhāskara-yogi edited by K.V.Sarma (*Brhat Samhitā of Varāha Mihira* with the commentary *Utpala-parimala of Yogīśvara;* Rashtriya Sanskrit Sansthan, N.Delhi 2007).

The book of Adbhuta-sāgara has three sections, classified into celestial *(divya*), atmospheric *(antariksha)* and terrestrial *(bhauma)* anomalies *(utpāta)*. Among the authors quoted by Ballāla-Sena, the prose text of Parāśāra attracts our attention. A comparison of these quotations with the commentaries of Utpala and Bhaskara-yogi clearly brings out that the unique prose text PT of Parāśara was widely known in India till at least 14th century through authentic palm leaf manuscripts. The available quotations of Parāśara preserve reference to *nakshatra* as the background for observing the sky. The seasons are indicated conspicuously in terms of *nakshatra* divisions without invoking the twelve zodiacal signs or *rāśi* of *siddhāntic* astronomers. Another remarkable feature of PT is its list of twenty-six comets with year numbers. It also has long chapters on occultation of stars, astro-geography, earthquakes and rainfall. Thus PT is a treatise on natural sciences as cultivated in ancient India long before Varāha-mihira wrote his more famous Brhat-samhitā.

Texts on medicine and agriculture besides astronomy and astrology are attributed to Parāśara. Hence it is natural to wonder about the identity of our author. As is typical of ancient Indian authors, the identity of Parāśara who composed or stated the *samhitā* or *tantra* standing in his name is not known. It is likely there were several persons belonging to different generations identified by the same family name. Hence the PT text need not be taken to be by a single author belonging to a particular period. It follows; any statement about the date of astronomer Parāśara should be taken as the traceable initial period of the oral tradition of *Parāśara-tantra,* likely to be same as that of its author, but certainly not of the text fixed in script. Nevertheless, in delineating the historical development of Hindu astronomy the importance of the initial date of PT tradition is too precious to be ignored. The earliest person to investigate the date

[4] E.C.Sachau*, Alberuni's India*, (English Transl.) London, 1910

of Parāśara was William Jones suggesting 1180 BCE as the likely date[5].

Utpala and Sena quote Parāśara stating the six seasons in terms of the position of sun in the different nakshatra segments. Four and half nakshatra length makes a season. This is same as the measure of a season in the Vedānga-jyotisha. The winter season *śiśira-r.tu* started with sun and moon at the beginning of star division *śravishthā* also known as *dhanishthā.* Summer started when sun was at the middle of *āśleshā.* Parāśara describes the solar zodiac in terms of the six Indian seasons, each of two months duration. He upholds the equal division of the 27 nakshatra, similar to that of VJ of Lagadha. This is the *nakshatra* system of astronomy, using stars along the ecliptic as background for sky observations. Since the winter season started at the first point of star *dhanishthā* (β-delphini) this is same as the year beginning of VJ, which is a well discussed topic. From the time of Varaha-mihira which may be taken as 530 CE when the winter solstice was at the first quarter of star *uttarāshādha* (σ-Sagittari) to the stated era of PT, the precession amounts to one and three-fourth nakshatra length, equal to $23^0 20'$. As per this value not only VJ but also Parāśara's season statement has to be assigned to 1150-1370 BCE.

Ancient Indian tradition has left chronological signatures through such shifts in season markers either directly or figuratively. The above remote dating for the start of the tradition of PT brings up the question of its connection to the Vedānga Jyotisha and the still older Vedas. The former is a calendar with no statements about planets, eclipses and comets. In contrast PT is silent on the calendar but has several interesting things to say about planets, eclipses and comets. The relation of PT to the older Vedic texts is yet to be investigated systematically. At present a relative chronology between PT and the Maitrāyanī Āranyaka Upanishad (MAU) can be established. There is a hymn in MAU indicating that the winter solstice started at the middle of the *śravishthā nakshatra*[6]. This leads to an interval of 400-500 years between the observations of MAU and PT. Since the MAU oral tradition has a mark of being more ancient it might have had some influence on PT. Significantly this *āranyaka* makes an interesting observation about drifting of Dhruva the Pole Star (MAU 1.4).

PT contains chapters on earthquakes, rainfall, meteors and a few other topics of general interest. Natural events were observed and classified as celestial, atmospheric and terrestrial. Some type of normal state for an event was arrived at by direct observations or by inherited tradition. Deviation from this normal state was considered a precursor for prognostication of good or bad effects on earth. This type of empirical approach is in vogue even to this day, although in a better statistically quantified fashion, for forecasting seasonal atmospheric conditions based on antecedent anomalies.

PT knows clearly that planets become invisible as they travel in the firmament against the background of fixed stars. The visible movement of all the planets is described verbally in detail. Parāśara knew visibility numbers for planets with the exception of Mars. As per PT the visibility of Venus in east is for 270 days followed by an average invisibility of 68

[5] W. Jones, Asiatic Researches; 1799, Vol.II p.399

[6] *.....vatsarametasya āgneyamardhamardham vārunamaghādyam śravishthārdham āgneyam kramena utkramena sārpādyam śravishthārdhāntam soumyam...*|| (MAU 6.14)

days. Similarly in the west visibility of Venus is for 240 days followed by 13 days of invisibility on average. Thus the Venus cycle, on average, according to Parāśara is of 591 days. As per modern astronomy it is known that Venus as morning star is seen for some 263 days and afterwards it remains invisible for nearly 50 days. Then it rises in the west, to be seen for another 263 days and to be invisible for about 8 days before rising in the east. The average synodic period of Venus is 584 days (solar). Since in ancient India counting in terms of *tithi* was common PT might have reported Venus numbers in terms of *tithis*. In such a case 591 *tithi*s are actually equal to 582 (solar) days, which is an accurate number.

The sage Agastya is known to Indian cultural history from the Rgvedic period. He along with the Seven Sages is considered the originators of the *gotra* system to which all Hindus owing allegiance to Vedas trace their lineage[7]. Like the seven Vedic seers getting identified with the constellation Saptarshi-mandala (U.Major), Agastya is identified with the southern star Canopus. This has remained an unbroken astronomical tradition of historical significance. The belief that great sages after their worldly sojourn remain as celestial beings, that is stars, is a tradition going back to Vedic times. The Taittirīya Āranyaka declares that the Seven Sages and Agastya live with the nakshatras[8]. The statement of Parāśara that Agastya arose when Sun was with star *Hasta* and set when Sun was with star *Rohinī,* is a valid naked eye observation for the Pushkara-Kurukshetra region in the period 1000-1400 BCE.

Thus, PT represents the most ancient Indian tradition on astronomy and natural sciences in matter of fact language. This text is a link between the most ancient Vedic literature and the more modern siddhantic literature starting with Aryabhata and others.

Parāśara-tantra has been reconstructed with Sanskrit text, translation and notes by the present author using the three sources mentioned previously. The text was recently published by the Jain University Press, Bangalore (ISBN 978-81-9209-924-8). The book, with a foreword by Dr.B.V Subbarayappa renowned science historian, was released in November 2013, by Prof. Roddam Narasimha renowned aerospace engineer and historian of Indic intellectual traditions.

The scientific contents of the book will be highlighted in the talk.

[7] *viśvāmitro jamadagnirbhāradvājo'tha gautamah|atrirvasisthah kaśyapa ityete saptarshayah||*
saptānām rsīn.ām agastyāshtamānām
yadapatyam.tadgotramityācakshate||
(Āśv.Śr.Sū; pariśiśta)

[8] *r.shayah saptātriśca yat| sarve'trayo agastyaśca| nakshatraih śaṃkr.to'vasan||* (Tai. Ara. 1.11.2)