



BRILL

The Legacy Left Behind by the ‘Last’ Traditional Indian Astronomer

Veracity, Verification, and Versification

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Received 15 March 2026 | Accepted 1 May 2026 |

Published online 22 June 2026

Abstract

As a key figure in traditional Indian astronomy, Sāmanta Candrasekhara, a 19th-century astronomer from Odisha, India, made substantial contributions to planetary computations – without access to modern scientific instruments and without having been influenced by modern astronomical theories. His deep concern with resolving the discrepancies between traditional calculations and observed celestial events, and his approach to doing so, form the central theme of this paper. Sāmanta’s insistence on *ḍṛk-siddhi* – the concordance between computation and direct observation – emerges as the governing principle behind his monumental work, the *Siddhāntadarpaṇa*. The paper examines this commitment to veracity and empirical verification, alongside a dimension that has received little scholarly attention to date: his remarkable poetic talent, as abundantly evident throughout the text. While his scientific contributions

have been explored to some extent by earlier researchers, this study brings together both dimensions – the astronomer and the poet – to offer a fuller portrait of Sāmanta's enduring legacy within the Indian knowledge tradition.

Keywords

Sāmanta Candrasekhara – *Siddhāntadarpaṇa* – Indian astronomy – planetary models – poetic beauty in scientific literature

1 Introduction

The illustrious son of Odisha, Sāmanta Candrasekhara, perhaps forms the last link in the chain of astronomers who made significant contributions to the advancement of Indian astronomy. We use the adjective 'Indian' deliberately to indicate that this science, as practiced in India, had a distinct purpose¹ and style of approach compared to its Western counterpart. Although Sāmanta lived in the recent past – approximately 150 years ago, well after the advent and spread of Western science – his modes of thinking, style of writing, and methods of arriving at new results remained completely traditional and distinctly Indian, differing significantly from Western approaches.

The use of calendars for social, cultural, and religious purposes continues to be widely prevalent in India to this day. Every civilization has felt the need for a calendar and has developed its own calendrical systems accordingly; today, approximately 25 different calendrical systems are in use around the globe.² The Indian calendar, known as the *pañcāṅga* (almanac), is published throughout India across almost all regions, each independently. The computations underlying these various almanacs are based on different texts popular in their respective regions. It is said that the almanac used in the Puri Jagannātha temple to this day is based on Sāmanta Candrasekhara's *Siddhāntadarpaṇa*. The primary aim of this article is:

- to portray Sāmanta's passion for achieving accuracy in astronomical computations, which led to the composition of the monumental treatise, the *Siddhāntadarpaṇa*;

1 Srinivas, 2002.

2 Reingold and Dershowitz, 2001.

- to highlight the mission Sāmanta set for himself and the zeal with which he pursued it, while remaining realistic and unpretentious in his understanding of human limitations; and
- to draw attention to Sāmanta's accomplishments as a poet, alongside his stature as an astronomer.

2 Sāmanta's Passion for Astronomy

The inestimable love that Sāmanta had for conducting astronomical observations and calculations is aptly portrayed by Prof. Jogesh Chandra Ray in his introduction to the first edition of the *Siddhāntadarpaṇa*. Since Prof. Ray's narration is particularly moving, we would prefer to quote it rather than paraphrase it:³

He (Sāmanta) was incessantly engaged with his work for the full period of six years, and the first copy was not ready before he was thirty. This constant strain upon his body, which had never been strong, began to undermine his system. He contracted a disease which has been his constant companion ...

Dyspepsia, with its attendant colic, has impaired his health. At times, it becomes so painful that he is compelled to break off conversation and roll down on the ground till the attack is over. Full meals, frugal as they are, he has not enjoyed for the last thirty years, and has seldom permitted himself the indulgence of even half meals twice a day. The study of astronomy has been a passion with him, and any medicine you may prescribe for him must neither contain any forbidden ingredient nor, what is more important, interfere with his daily work. Even in his present invalid state, he would willingly sit up a whole night if it were anything connected with his favorite subject.

This moving account of Ray vividly brings out the extraordinary devotion of Sāmanta, for whom "the study of astronomy has been a passion," and prevailed over even the most trying bodily afflictions. In contrast, while most of us readily seize upon even minor discomfort as a reason to withdraw from work, such accounts remind us of the exceptional traits of certain individuals, in whom profound passion renders physical hardship almost incidental; paradoxically,

3 *Siddhāntadarpaṇa*, Introduction, Indian Depository, Calcutta, 1899, pp. 23–24.

what would enervate others seems here to serve as a stimulus for further exertion!

Sāmanta himself expresses his passion for the subject in a beautiful verse composed in the *mandākrāntā* meter in his *Siddhāntadarpaṇa*. He indicates this using the word *pātayati*, which means “forcefully casts or hurls [him] into”. It is this passion that compelled him to devote his entire lifetime to astronomical observations and calculations. He attributes this passion to the grace of Lord Jagannātha,⁴ in keeping with a broader Indian intellectual and cultural tradition that views any exceptional human endeavor as an expression of divine grace:⁵

यस्येच्छा मे निजभजनतो दूरमुत्सार्य बुद्धिं
दैवाधीनां गणितविपणौ पातयत्याततायाम् |
सङ्ख्यातीतानुगत-पतितोद्धार-कारुण्यसिन्धुः
स स्याच्चेतश्शरणचरणः सिन्धुजाप्राणबन्धुः ॥

The will of whom (*yasya icchā*), having drawn far away (*dūram utsārya*) my god-oriented mind (*daivādhīnām buddhim*) from devotion to Him (*nijabhajanataḥ*), of compassion that uplifts the countless (*saṅkhyātīta*) fallen (*patita*) followers (*anugata*) – may he, the beloved to Lakṣmī, be the one at whose feet [our] heart takes refuge (*cetaśśaraṇacaraṇa*).

It is evident from the first half of the verse that Sāmanta became deeply absorbed whenever he engaged in mathematical problems of astronomy. He also suggests that his absorption in astronomy left little room for other spiritual or devotional practices. In the latter half, he turns in prayer, seeking divine grace for the successful completion of his work. He views this very compulsion as an expression of divine will and grace, while simultaneously seeking refuge and illumination through his prayer. Sāmanta's inner drive toward astronomy reflects the principle that one's *prakṛti* (innate disposition) is not self-generated but is itself an expression of divine grace or cosmic will. The individual's life path, in this view, is shaped by the intersection of personal nature and divine intent.

4 Those familiar with Indian tradition know that attributing one's pursuits to divine origin is culture-specific, not necessarily unique to Sāmanta. Of course, Lord Jagannātha was naturally Sāmanta's favourite deity; he being the presiding deity of his homeland, Odisha.

5 Op. cit., Chap. 15, ver. 71, p. 147.

3 Achieving Precision: Sāmanta's Astronomical Mission

The paragraph from J.C. Ray's introduction quoted above, besides describing how Sāmanta carried out meticulous observations, undeterred by his declining physical health and other hardships, also raises an important question: What drove Sāmanta to strive so relentlessly? The answer lies in the mission Sāmanta set for himself: to correct the discrepancies in astronomical computations.

All systems of computation, at all times – whether in astronomy, meteorology, medicine, or economics – necessarily rely on certain assumptions and approximations, and hence some degree of deviation between prediction and observation is inevitable. It is therefore not surprising that during Sāmanta's time, predictions in calendars – such as the ending times of *tithis* and the onset of eclipses – differed from observed values. These discrepancies deeply troubled Sāmanta. He explicitly states that his efforts were directed towards correcting these inaccuracies to produce a more precise calendar:⁶

वृद्धौ पञ्च तिथेः क्षये रसमिता नाड्यः पुराणैर्मताः
नित्यं यत् परमास्ततो व्यवहृतौ स्थूलेक्ष्यते⁷ पञ्चिका ।
प्रत्यक्षानुभवं न लुम्पति वचोयुक्तिर्यतस्तन्मया
तत्साक्षात्करणाय काम्यविधये सूक्ष्मा परा तन्यते ॥

Since the ancients had regarded five *nāḍikās* as the upper limit of increase and six as the lower limit of decrease in the duration of a *tithi*, the *pañcika* (calendar reckoning) is, in practice (*vyavahṛtau*), observed (*ikṣyate*) only to an approximate (*sthūlā*) degree of accuracy [rather than absolute precision]. Moreover, because the logical reasoning expressed through words (*vacoyukti*) doesn't obscure direct sensory experience (*pratyakṣānubhava*), I therefore undertake the elaborate formulation (*tanyate*) of a new, subtler (*sūkṣmā*) and higher (*parā*) *pañcika* – for the performance of *kāmyavidhis*⁸ (rituals performed for specific purposes), which require

6 Ibid., Chap. 6, ver. 2, p. 51.

7 The printed texts read *iṣyate*, which does not accord with the sense of the verse. We therefore surmise that the author must have written *ikṣyate*, and have emended the reading accordingly. It appears to be a scribal error perpetuated across the available editions.

8 In the *Mīmāṃsā* classification of *karmas* (acts), there are three kinds – *nitya*, *naimittika*, and *kāmya*. *Nitya-karma* refers to an obligatory act that must be performed regularly, the omission of which incurs *pratyavāya* or sin. The word '*nitya*' does not mean daily – for example, the *Darśapūrṇamāsa-īṣṭi*, performed at every new and full moon by an *āhitāgni*, is a *nitya-karma*. *Naimittika-karma* is occasion-based, performed upon the occurrence of a specific *nimitta* (cause or event), such as the ritual bath during an eclipse (*rāhūparāge snāyāt*). *Kāmya-karma*,

the accurate realization or precise determination (*sākṣātkaraṇa*) of these [astronomical] factors.

The conventional range of *tithi* duration 54–65 *ghaṭikās*, encapsulated in the maxim *bāṇavṛddhiraśakṣaya*, meaning “the duration of a *tithi* may increase by five [*ghaṭikās* over and above 60] and decrease by six,” had long been accepted by *pañcāṅga* compilers, though its textual source remains uncertain.

Sāmanta, through meticulous observation, found that actual *tithi* durations were well beyond this range. Table 1 shows the computed *tithi* durations based on modern JPL ephemerides. The calculations indicate that *tithi* durations may vary from approximately 50 to 67 *ghaṭikās*, revealing a difference of nearly 17 *ghaṭikās* between the shortest duration and the longest duration of the *tithi*. This 17 *ghaṭikās* is a substantial margin compared to the traditional allowance of 11 *ghaṭikās*. In the table, the diameter of the Moon has been expressed in terms of *aṅgulas* and *vyāṅgulas*, where one *aṅgula* corresponds to 3 minutes of arc in the Moon’s apparent diameter. These data were generated using values derived from the ephemerides provided by NASA, covering several centuries. Furthermore, in Table 1, we have presented only the Moon’s diameter, as it is the most important parameter explicitly specified in Indian astronomical texts, particularly in connection with the calculation variation in the duration of *tithis*.

This wide variation of almost 17 *ghaṭikās* – exceeding the traditional allowance of 11 *ghaṭikās* by roughly 6 – underscores the validity of Sāmanta’s concern. It confirms his insistence that the astronomical procedures for computing the Sun’s and Moon’s longitudes necessitate both correction and empirical recalibration. His assertion in the third quarter of the verse:

प्रत्यक्षानुभवं न लुम्पति वचोयुक्तिः

Verbal reasoning (or logical argument) cannot invalidate the direct experience or perception.

reinforces the standpoint that perception (*pratyakṣa*) holds primacy over verbal reasoning (*vacoyukti*). For Sāmanta, as astronomers from antiquity have

on the other hand, is an act planned and performed with a specific desired result, as in the injunction *jyotiṣṭomena svargakāmo yajeta* (“one desiring heaven should sacrifice with the *jyotiṣṭoma*”). So *kāmyavidhis* are ritual prescriptions intended to be performed at times determined by appropriate astronomical conditions.

TABLE 1 Duration of the *tithi* and the Moon's diameter

<i>Tithi</i> duration (<i>Ghaṭīs</i>)	Diameter of the moon	
	<i>Aṅgulas</i>	<i>Vyaṅgulas</i>
50	11	8
51	11	5
52	10	59
53	10	54
54	10	48
55	10	44
56	10	38
57	10	33
58	10	27
59	10	22
60	10	18
61	10	12
62	10	8
63	10	3
64	9	59
65	9	55
66	9	51
67	9	50

consistently maintained, the true test of any astronomical model lay in its alignment with direct observation rather than inherited authority.

3.1 *Sāmanta's Plea to Other Astronomers*

The concordance between prediction and observation is called *ḍṛk-siddhi* in Sanskrit. To achieve this, Sāmanta made extensive revisions to the parameters in his *Siddhāntadarpaṇa*, drawing upon his own observations, correlations, and empirical cross-verifications. Notwithstanding this, it is quite possible that the proposed revisions may simply be dismissed by the scholarly community as inconsequential or lacking merit. Hence, towards the end of the text, he appeals to the experts in the field not to dismiss his work as mere conjecture or worthless without first subjecting it to verification:⁹

9 Ibid., Chap. 24, ver. 150, p. 279.

सिद्धान्तानुदिता अपीह गदिता ये ये विशेषा मया
 ते हेया नवकल्पना इति मतिर्मा भूत् प्रभूणां क्वचित् |
 दृक्सिद्ध्यै किल लल्लभास्करशतानन्दार्यभट्टादिभिः
 स्वग्रन्थेषु यदीरिता बहुमता ईदृग्विशेषा नवाः ||

May all those new features which have been presented here by me, that have not been stated in the [earlier] *siddhāntas*, be not simply discarded by the authorities in the field (*prabhu*) as new inventions (*navakalpanā*) [worthy of consideration] because, after all, features of this kind – newly presented (*īrita*) and held in high regard (*bahumata*) – were introduced by Lalla, Bhāskara, Śātānanda, Āryabhaṭṭa [*sic*],¹⁰ and others in their own works, for the attainment of *drk-siddhi* [the concordance between computation and observation].

Sāmanta makes this plea primarily because there is a general tendency among established scholars to underestimate the work of newcomers. Even when this is not the case, there often seems to be resistance to adopting new procedures in place of old ones. This is particularly true for almanacs, due to the misconception that *siddhāntas* and *vākyas* are inherently correct and require no revision. Sāmanta earnestly urges scholars to reconsider such views. He seeks their endorsement to adopt a new system that meets the criterion of *drk-siddhi*, citing earlier astronomers and the methods they employed. In this context, it may be worthwhile to recall the necessity of periodically revising parameters and procedures in astronomy, as laid down by earlier astronomers.

3.2 Need for Periodic Revision

Nilakaṇṭha (c. 1500 CE) in his *Āryabhaṭṭīyabhāṣya*, explaining the cause of variance in the values specified in different texts and also highlighting the importance of periodic revision of parameters, observes:¹¹

यत्पुनर्भगणादीनां क्वचित् केषाञ्चिदाचार्यैः नानाप्रतिपादनं तत् परिमाणानां सावयवत्वात्,
 अवयवानाञ्च आनन्त्यात्, कालदैर्घ्यात्, तदावृत्तौ तदवयवानां तावद्गुणितत्वात् | यद्वर्धमानं स्थौ-
 ल्यं तदपि तन्मूलप्रमाणैः प्रत्यक्षादिभिरेव निराकार्यम् |

10 One may be intrigued to see the name spelled as “Āryabhaṭṭa” in place of “Āryabhaṭa.” It is well established from the verses of the *Āryabhaṭṭīya* itself that the author’s own name was “Āryabhaṭa.” However, the form “Āryabhaṭṭa” seems to have been adopted by Sāmanta purely to satisfy metrical requirements as per the traditional saying: “*api māsaṃ maṣaṃ kuryāt chando-bhaṅgaṃ na kārayet*” – “One may change even the word *māsa* into *maṣa*, but should never violate the rules of prosody.”

11 *Āryabhaṭṭīyabhāṣya*, *Golapāda*, ver. 48, p. 128, Trivandrum Sanskrit Series 185, 1957.

The differences in the revolution numbers provided by certain *ācāryas* are because these numbers are not [exact] integers (*sāvayava*, meaning they have fractional parts) and contain lengthy decimal parts (*avayava* means 'part' or 'fraction'). Over long periods (*kāladairghya* referring to the extended timescales like the *Mahāyuga* of 4,320,000 years), these small discrepancies accumulate and multiply. These increasing inaccuracies (*sthāulya*, referring to compounded errors) must be corrected using reliable measures such as direct observation (*pratyakṣa*, which includes empirical verification) and other valid methods.

It is well known that planetary motion is not uniform over long timescales. Consequently, the mean rates – expressed through their revolution numbers – undergo minute variations that accumulate over extended periods. "The variation in the revolution numbers, etc., stated" (*bhagaṇādīnām nānāpratipādanam*) is a natural and inevitable outcome of the revision made by astronomers based on long-term celestial observation. As observational accuracy improved – first by noticing discrepancies through careful naked-eye observations, and later through the systematic correlation of data across generations – astronomers continually refined these parameters to ensure closer agreement with observed phenomena.

Thus, successive *ācāryas* like Āryabhaṭa, Brahmagupta, Lalla, Bhāskara II, and Parameśvara each proposed and revised revolution counts, reflecting this ongoing process of correction of values based on empirical data and subsequent theoretical recalibration. This progressive refinement of constants underscores the Indian astronomical tradition's awareness that revision was not a flaw but a scientific necessity. Table 2 below illustrates the differences in planetary revolution numbers as proposed by a few prominent *ācāryas*, highlighting the spirit of continual correction that Nīlakaṇṭha and Sāmaṇta allude to.

To emphasize the importance of experimentation and revision of parameters in the discipline of astronomy, Nīlakaṇṭha goes so far as to make the following emphatic declaration:

आर्यभटः परीक्षाप्रकारं तदुपयोगियुक्तिकलापं च प्रदर्शयितुमेव सिद्धान्तं चकार ।

Āryabhaṭa composed his *siddhānta* only to demonstrate the methods of examining [the observational concordance] and the set of principles (*yuktikalāpa*) that would be useful toward that.

The discussion above, drawing on quotations from both Sāmaṇta and Nīlakaṇṭha, reflects not only their individual understanding of the dynamic nature of

TABLE 2 Revolutions made by planets in 43,20,000 years

Planet	<i>Āryabhaṭīya</i> (5th cent.)	<i>Siddhāntaśiromaṇi</i> (12th cent.)	<i>Tantrasaṅgraha</i> (15th cent.)	<i>Siddhāntadarpaṇa</i> (19th cent.)
Sun	43,20,000	43,20,000.000	43,20,000	43,20,000.000
Moon	5,77,53,336	5,77,53,300.000	5,77,53,320	5,77,53,336.000
Moon's apogee	4,88,219	4,88,105.858	4,88,122	4,88,117.940
Moon's node	2,32,226	2,32,311.168	2,32,300	2,32,298.033
Mercury	1,79,37,020	1,79,36,998.984	1,79,37,848	1,79,36,967.141
Venus	70,22,388	70,22,389.492	70,22,268	70,22,257.860
Mars	22,96,824	22,96,828.522	22,96,864	22,96,871.112
Jupiter	3,64,224	3,64,226.455	3,64,180	3,64,155.205
Saturn	1,46,564	1,46,567.298	1,46,612	1,46,649.716

astronomical computations but also the broader tradition's awareness of the same – as evidenced by the timeline of corrections and developments introduced by earlier astronomers. Āryabhaṭa (born in *Kali* year 3600 or 499 CE) introduced a system of planetary revolutions devoid of zero-corrections at the epoch of *Kali*. By zero-corrections, we mean that he did not specify any *dhruva*-corrections, which refer to the initial positions of the planets at the beginning of the epoch. *Dhruva* corrections are given by later astronomers. A detailed discussion of *dhruva* corrections, however, falls beyond the scope of this paper. Over time, observed celestial phenomena began to slightly deviate from the positions obtained by using Āryabhaṭa's procedures. This prompted a need for revisiting and arriving at a precise system by way of revising parameters and introducing corrections.

4 An Overview of the *Siddhāntadarpaṇa*

The text *Siddhāntadarpaṇa* is a magnum opus that could be considered as the pinnacle reached by Indian astronomers. It is composed of five units, constituting 24 chapters. The names of these units and their respective chapters are listed in Table 3. Sāmanta himself states that the total number of verses across all chapters is 2500. In terms of the number of verses, it is perhaps the largest work on astronomy (*siddhānta-jyotiṣa*) that has been composed to date. It not only exemplifies Sāmanta's scientific accomplishments, but also his poetic skills as elaborated in Section 7.

4.1 *A Unique Feature of the Text*

Among the distinctive features of the *Siddhāntadarpaṇa*, one that stands out is Sāmanta's extensive use of quotations from other standard works, such as the *Siddhāntaśiromaṇi*, *Sūryasiddhānta*, and *Brahmasiddhānta*. While summarizing the text towards the end, Sāmanta provides a count of the verses he composed himself and those he quoted from other sources.¹²

श्लोकाः स्वकृता इह वेदनागपक्षाक्षिसङ्ख्या अथ भूपपक्षाः |
ग्रन्थान्तरोत्थाः खखबाणपक्षाः सम्भूय भव्याय भवन्तु दक्षाः ॥

Here [in this text], the verses originally composed by me are 2284 in number; and the ones quoted from other works are 216; summing up to a total of 2500 verses. May these skilfully composed verses accomplish the auspicious end for which they were intended.

It may be noted that the numbers mentioned in the above verse use the *bhūtasāṅkhyā* system, which is employed throughout the text. For those unfamiliar with Indian tradition, deciphering these numbers can sometimes be quite challenging. Nevertheless, the system has its own charm and convenience, especially when composing meter-bound verses. This is why it has been the preferred choice among astronomers.

4.2 *Division of the Text*

As mentioned earlier, the text *Siddhāntadarpaṇa* consists of 24 chapters. All chapters, except the 23rd, address various astronomical problems. Chapter 23 is entirely dedicated to informing the reader about the glory of Lord Jagannātha, the author's most beloved deity. This devotion to Jagannātha is not only evident from this chapter but also from the fact that Sāmanta concludes every chapter with tributes to Lord Jagannātha. The titles of the different chapters, which are related to the topics discussed, are presented in Table 3.

Among all the topics discussed in the text, Chapter 16 (*praśnavarṇanam*) stands out for its uniqueness and special significance. In this chapter, Sāmanta raises numerous important issues related to conventional assumptions and practices in Indian astronomy through a series of thought-provoking questions. These questions range in complexity, addressing topics such as the size and shape of the Earth, gravitational force, the constancy of planetary velocities, and the dimensions of *manda* and *śighra* epicycles. Many of the revisions pre-

¹² Op. cit., Chap. 24, ver. 156, p. 281.

TABLE 3 Topics discussed in the *Siddhāntadarpaṇa*

Chap. No.	In Sanskrit	In English
1. मध्यमाधिकारः (Mean motion)		
1	कालवर्णनम्	Different measures of time
2	भगणादिवर्णनम्	Revolution number of planets
3	ग्रहानयनम्	Determination of mean planets
4	संस्काराः	Corrections to be applied
2. स्फुटाधिकारः (True motion)		
5	ग्रहस्फुटीकरणम्	True position of the planets
6	सूक्ष्मपञ्चिका-क्रान्त्यादिवर्णनम्	Computation of accurate calendar, declination, etc.
3. त्रिप्रश्नाधिकारः (Three diurnal problems)		
7	शङ्कुछायादिवर्णनम्	Gnomon and its shadow
8	चन्द्रग्रहणम्	Lunar eclipse
9	सूर्यग्रहणम्	Solar eclipse
10	परिलेखः	Graphical representation
11	ग्रहयुतिः	Conjunction of the planets
12	भग्रहयोगवर्णनम्	Conjunction of stars and planets
13	ग्रहोदयास्तमयवर्णनम्	Rising and setting of planets
14	चन्द्रशृङ्गोन्नतिः	Peak of the cusps of the Moon
15	महापातः	Moments defined by the equality of declination of the Sun and the Moon
4. गोलाधिकारः (Spherics)		
16	प्रश्नवर्णनम्	List of questions
17	भूगोलस्थितिः	The situation of the Earth
18	भूगोलविवरणम्	Description of the Earth
19	भूखगोलवर्णनम्	Description of different spheres
20	गोलादियन्त्रवर्णनम्	Description of instruments
21	वासनाशेषरहस्यम्	Rationale for the questions

TABLE 3 Topics discussed in the *Siddhāntadarpaṇa* (cont.)

Chap. No.	In Sanskrit	In English
5.	कालाधिकारः (Time)	
22	संवत्सरादिः	Units of time like year etc.
23	पुरुषोत्तमस्तवः	Praise of the Lord Jagannātha
24	उपसंहारः	Conclusion

sented in his *Siddhāntadarpaṇa* are also questioned here. Only a detailed study would reveal whether all these questions are addressed later in the text.

4.3 *Sāmanta's Admiration for Bhāskarācārya*

As mentioned earlier, Sāmanta frequently quoted verses from the two major works, *Siddhāntaśiromaṇi* and *Sūryasiddhānta*. This clearly indicates the significant influence that these texts had on him. Notably, Sāmanta's admiration for Bhāskarācārya and his work *Siddhāntaśiromaṇi* is profound. On numerous occasions, Sāmanta explicitly states that he follows Bhāskara's style and has adopted the procedures he outlined. For instance, at the beginning of the chapter on spherics (*golādhyāya*), he notes:¹³

सिद्धान्तवाक्योद्धृतवाक्यचक्रसन्दर्भितात्मग्रथिताग्रपद्यैः |
गोलं ब्रुवे बालविबोधनाय वाचं पुरस्कृत्य च भास्करीयाम् ||

By interspersing quotations from [other] *Siddhānta* texts, and integrating them [into a structural form] with my own reasoned discourse in the form of essential verses, I expound [the science of the] sphere (*gola*), guided by the words of Bhāskara, for the instruction of beginners (*bāla-vibodhanāya*).

The phrase 'guided by the words of Bhāskara' (*bhāskarīyām vācam puraskṛtya*) in the verse above clearly indicates the deep veneration Sāmanta holds for Bhāskara's scholarship. The phrase "*siddhānta-vākya*" used in the first half of the verse is more generic in nature and hence can also mean other *siddhānt*-

¹³ Ibid., Chap. 16, ver. 5, p. 149.

tas, thereby implying the efforts that have gone in scholarly synthesis. The rest of the verse points to Sāmanta's personal effort in weaving these ideas into a coherent framework and presenting them accessibly for novices.

Sāmanta's high regard for Bhāskarācārya is also evident from the homage and tributes he pays to him. In many instances, he explicitly refers to Bhāskara as his preceptor. For example, in the following verse, which appears at the beginning of *Golādhyāya*, Sāmanta uses the term guru:¹⁴

प्राक्सिद्धान्तचयं प्रमाय नयनानर्हं महार्हक्षरं
यः सिद्धान्तशिरोमणिं प्रणिगदन्नप्रीणयत् प्राणिनः |
आत्मीयावसरप्रणीतभगणप्रत्यक्षितैः खेचरैः
आस्माकीनमहोपकारकृतिनं वन्दे गुरुं भास्करम् ॥

I offer my salutations to the revered preceptor Bhāskara – who, after thoroughly studying (*pramāya*)¹⁵ all the *siddhāntas* composed before his time [which had elements] not verifiable by sight (*nayanānarham*, or, inconsistent with observation), composed the *Siddhāntaśiromaṇi* and thereby pleased all living beings (*apriṇayat prāṇinaḥ*) – each syllable being of great worth (*mahārḥākṣaram*) – and who did us a great favour by making the celestial bodies (*khecaraiḥ*) perceptible (*pratyakṣitaiḥ*) through planetary revolutions (*bhagaṇas*) [determined by his own observations and] suited to his era.

This verse is fully suffused with guru-bhakti. Here, Sāmanta not only praises Bhāskara and his work, but also glorifies him as a great benefactor (*mahopakāraḥ*) and guru for all times. The phrase '*apriṇayat prāṇinaḥ*' essentially means he brought great satisfaction to the practitioners of this science, namely astronomers who make *pañcāṅga* and, in turn, to all the people, so that they can perform all rituals and observe spiritual and religious practices at the right time. In short, through this verse, Sāmanta portrays Bhāskara not merely as a predecessor but as a luminary who has illumined and benefited society for all time.

14 Ibid., Chap. 16, ver. 3, p. 149.

15 The term *pramā* is used in Sanskrit to refer to right knowledge whose validity has been verified by other means of knowledge.

5 Motivation for Composing the *Siddhāntadarpaṇa*

According to Indian scriptures, time is an integral aspect of all actions, especially Vedic rituals. A ritual performed at an inappropriate time is considered incomplete. Detailed discussions in the śāstric literature demonstrate that such incomplete actions lack the potency to yield the desired results (refer to footnote 6). Thus, there was a significant societal concern for maintaining an accurate calendar.

Indian astronomers viewed this as a challenge and also as a noble responsibility to be undertaken to produce accurate calendars. This pursuit became a primary motivation behind significant developments in Indian mathematical astronomy, leading to innovative computational formulations. The following quotation succinctly captures Sāmanta's deep concern for establishing a reliable calendrical system:¹⁶

नास्ते कालावयवकलना यत्र दृक्शास्त्रसिद्धा
श्रौतस्मार्तव्यवहतिरपि च्छिद्यते तत्र धर्म्या |
तस्मादेषा कृतिरनृतवागस्तु वा प्रस्तुतार्था
ग्राह्या दक्षैर्ग्रहणभगणाद्यत्र संलक्ष्य साक्षात् ||

Where the reckoning of the divisions of time is not established in accordance with observation, there the practice (*vyavahṛti*) of *śrauta* and *smārta* [rituals], undertaken for *dharma*, becomes disrupted. Therefore, this work should be taken by the skilled (*dakṣaiḥ*), who must themselves directly verify (*sākṣāt samlakṣya*) the eclipses, planetary revolutions, and other phenomena through observation, and then judge whether it is verbally inaccurate or rightly meaningful (*anṛtavāk astu vā prastutārthā*).

Sāmanta's verse thus frames astronomical observation not merely as scientific inquiry but as a dharmic obligation: the validity of the entire edifice of Vedic and *smārta* practice rests on whether the calendar it stands upon is empirically grounded. Crucially, he places the burden of verification on the *dakṣa* – the skilled and discerning practitioner – insisting that no textual authority alone suffices; one must *see* the eclipses and planetary motions for oneself before pronouncing the work true or false.

A similar concern is expressed by Nīlakaṇṭha in his *Jyotirmīmāṃsā*:¹⁷

¹⁶ Ibid., Chap. 1, ver. 6, p. 2.

¹⁷ *Jyotirmīmāṃsā*, Topic 4, p. 6, edited by Prof. K.V. Sarma, vvBI, Hoshiarpur, 1977.

सिद्धान्तभेदे सति कालभेदः । कालभेदे सति कालाङ्गानि श्रौतस्मार्तलौकिकानि कर्माणि विकलानि स्युः । कर्मवैकल्ये सति लोकयात्रोच्छेदः । हा धिक्! सङ्कटे महति पतिताः स्मः ।

When differences arise among the astronomical treatises (*siddhāntas*), variations occur in the reckoning of time (*kāla*). When time itself – being an essential *aṅga* (constituent element) of ritual action – becomes different, all the *śrauta* (Vedic), *smārta* (domestic), and *laukika* (worldly) rites that depend upon it become defective. With such deficiency (*vaikalya*) in ritual comes the disruption of the social and cosmic order. Alas! We have fallen into a great crisis.

This passage is cast in the form of a student's representation to his guru – the guru being Nilakaṇṭha himself – a literary device he employs to heighten the urgency of the point. Sāmanta strikes a closely parallel note at the very opening of his *Siddhāntadarpaṇa*:¹⁸

श्रुतिर्यज्ञकर्मप्रवृत्तैव यज्ञक्रियाः कालमासाद्य वैशद्यमापुः ।

The *Śruti* (*Vedas*) is indeed directed toward [the teaching and performance of] *yajñakarmas*. The acts of *yajña*¹⁹ attain clarity and precision (*vaiśadya*) when they are aligned with the proper time (*kāla*).

The severity of this crisis, as both Sāmanta and Nilakaṇṭha emphasize, stems from the foundational role of *kāla* (time) in the Vedic worldview. The *Vedas* themselves are oriented toward the performance of *yajñas*, and these *yajñas* are enjoined in a precise temporal sequence. This is succinctly expressed in the *Vedāṅga-jyotiṣa* (c. 1400 BCE) of Lagadha:²⁰

वेदा हि यज्ञार्थमभिप्रवृत्ताः कालानुपूर्वा विहिताश्च यज्ञाः ।
तस्मादिदं कालविधानशास्त्रं यो ज्योतिषं वेद स वेद यज्ञान् ॥

18 Op. cit., Chap. 1, ver. 14, p. 3.

19 The term *yajña* should be understood in its broader context. Translating it simply as “sacrificial ritual” would be inaccurate and misleading. In the Vedic tradition, *yajñas* encompass a range of practices, including five types: *Deva-yajña* (offerings to deities), *Pitr-yajña* (offerings to ancestors), *Bhūta-yajña* (offerings to beings), *Manuṣya-yajña* (offerings to fellow humans), and *Brahma-yajña* (dedicated to knowledge and learning).

20 *Vedāṅga-jyotiṣa* of Lagadha, verse 36, p. 26. Edited by K.V. Sarma and translated by T.S. Kuppanna Sastry, Indian National Science Academy, New Delhi, 1985.

The *Vedas* are indeed meant for [facilitating] the performance of *yajñas*, and *yajñas* are prescribed to be done in a definite temporal order. Therefore, this science [is crucial, as it] determines the [appropriate] division of time. [Thus,] he who knows *Jyotiṣa* truly knows the *yajñas*.

5.2 *Sāmanta's Courage and Conviction*

Conviction in one's own work is indispensable for scientific pursuit. The following statement illustrates the depth of conviction that Sāmanta had in his work. Since he had great conviction in the precision of the computations he had achieved, he had built the necessary confidence to challenge the experts:²¹

ग्राह्या दक्षैर्ग्रहणभगणाद्यत्र संलक्ष्य साक्षात् |

Let the scholars accept the work [or discard it] by verifying the [occurrence of] eclipses, the revolution numbers, etc., [that are computed using this text].

This reminds us of the confidence and spirit often found in great scientists. Having accomplished a significant task, Sāmanta takes pride in his work. Such confidence, however, should not be mistaken for arrogance. This is evident from the concluding remarks in the *Siddhāntadarpaṇa*. In the penultimate verse of this monumental treatise, Sāmanta humbly submits his work to the scholarly community, requests them to scrutinize it and humbly asks that any necessary corrections be made:²²

भीमस्यापि पराजयो युधि भवेद् बुद्धिभ्रमः स्यान्मुनेः
कादाचित्कतयाऽप्यतोऽल्पविदुषामस्मादृशां का कथा |
तस्माद्यद्यदशुद्धमत्र गणितं यद्वा सहार्थं पदम्
तत् सर्वं परिशोधयन्तु कृतिनः कृत्वाऽनुकम्पां मयि ॥

At times, if Bhīma can be defeated in a war and if a sage can have a wandering intellect, what to speak of an ordinary individual like me, of scant learning? Therefore, whatever error there may be found in this work of mine – whether in calculation, or [in the use of] words and [their] meanings – may the learned, out of compassion for me, kindly correct those.

²¹ Op. cit., Chap. 1, ver. 6, p. 2.

²² Ibid., Chap. 24, ver. 157, p. 281.

6 Sāmanta's Exposure to Modern Science

Even today, there are scholars living in Indian cities who have devoted their lives to preserving and propagating traditional knowledge, often with little or no exposure to modern science. Considering this, it is even more likely that those who lived in remote villages in earlier times had limited opportunities for such exposure. Thus, it is quite plausible that Sāmanta, who lived around 150 years ago, did not have the chance to become acquainted with the developments of modern science.

Setting aside the question – to be settled by historians – of whether Sāmanta had any formal exposure to Western or modern science, we would like to make a few observations based on some of the verses that he has incorporated in his text. These verses do not merely allude to but briefly paraphrase the views held by scientists from the West. He refers to them using a traditional phrase '*īṅlaṇḍapaṇḍitāḥ*' [England-*paṇḍitāḥ*], which literally means 'scholars of England'. From those couple of verses that are quoted below, what is clear to us is that he was notably well-informed about post-Newtonian gravitational theory and the heliocentric model of planetary motion. This broader picture of cosmology, and the associated theory of gravitation that has evolved in the West he had certainly been apprised of, which is evident from the following verses:²³

इङ्गण्डपण्डिताः सूक्ष्मतयः कथयन्ति च |
भूगोलो वर्तुलः क्षुद्रः भौमादिग्रहवद् दिवि ||
खमध्यस्थ-बृहत्सूर्यबिम्बस्यावयवभ्रमैः²⁴ |
आकृष्टश्चक्रवद्भ्रान्तिं क्रान्तिवृत्ते ब्रजत्यसौ ||

The scholars of England, endowed with a fine intellect (*sūkṣma-matayaḥ*), say that the Earth is spherical (*vartula*) and quite small (*kṣudra*) [in size]. Like Mars and other planets (*bhaumādigrahavat*) in the sky, [the Earth too] the huge Sun, located at the centre of the space, by virtue of the rotations of parts [of the Sun]²⁵ acquiring motion [in a trajectory] that is like a circle, moves in the ecliptic (*krāntivṛtta*).

23 Ibid., Chap. 16, ver. 28–32, p. 152.

24 It seems to us that a couple of phrases need to be supplied in this verse to get a complete picture of what is described here. The prose order supplying these words in square bracket is given below:

खमध्यस्थ-बृहत्सूर्य[वशात्] आकृष्टः असौ [भूगोलः] [सूर्य]बिम्बस्य अवयवभ्रमैः चक्रवद् भ्रान्तिं [प्राप्य] क्रान्तिवृत्ते ब्रजति |

25 Based on this description, it seems to us that Sāmanta presents the planets as a "larger" body of the Sun, that is the solar system.

सपादाशुगणद्धिदिनैः पूर्वगतिक्रमात् |
भगणः स्वतनूभ्रान्त्या द्युरात्रं चास्य संभवेत् ॥

Its (the Earth's) revolution is caused by moving towards the east (*pūrvagatikramāt*) in 365.25 days. And, the day and night are caused by its own rotational motion.

इत्थं गतिर्द्विधा भूमेः आहिकी वार्षिकीति च |
भ्रमन्त्याः स्वतनोर्यस्मात् नित्यं स्थानान्तरस्थितिः ॥

Thus, there are two types of motion for the Earth, namely, daily and annual. [Moreover,] due to revolution, its position is continuously displaced.

न पतन्ति जना भूमेः मध्याकर्षणशक्तिः |
पश्यन्त्यर्कादिकान् भ्रान्तान् नाविका हि नगाविव ॥

People do not fall from the Earth because of the force of attraction from the centre. They observe the Sun and others (stars) to be moving like a man in the boat (*nāvikā*) observes of the stationary objects (*naga*) [on the banks].

It is highly probable that Sāmanta developed his understanding of heliocentric motion through reading translations or engaging in discussions with modern scholars. This possibility is briefly addressed by Prof. J.C. Ray in his introduction to the first edition of the *Siddhāntadarpaṇa*. According to Prof. Ray, Sāmanta did not receive formal education in modern science, though he does not rule out Sāmanta's exposure to modern scientific discoveries through translations and other sources:²⁶

Chandraśekhara had not the advantage of our modern schools, and has not imbibed the spirit of taking such things on trust Indeed, the translation and another of like nature were the only sources from which Chandraśekhara learnt something of western knowledge. They may have so far influenced him as to modify his ideas about physical astronomy, vague indications of which will be seen in certain passages of this work; but had hardly any effect upon him as regards mathematical astronomy.

²⁶ Ibid., Introduction, pp. 61–62.

7 Sāmanta as a Poet

A glance through the *Siddhāntadarpaṇa* reveals Sāmanta's exceptional poetic abilities. In addition to his achievements as an astronomer, his talents as a poet are equally impressive. The *Siddhāntadarpaṇa* nearly fulfills all the criteria expected of a literary masterpiece. Some of the noteworthy features of the *Siddhāntadarpaṇa* include:

1. Absolute clarity of presentation combined with brevity – perhaps Sāmanta's hallmark.
2. A free-flowing verse style that allows the reader to grasp what is being conveyed intuitively, without struggling to work out the *anvaya* (prose order).
3. An effective blend of precision and alliteration – the latter woven into the composition with such ease of expression as to mark the work of an exceptionally gifted poet.

In short, everything that one would desire in a high-quality literary work in Sanskrit can be found in the *Siddhāntadarpaṇa*. We illustrate this in the following sections with a few select examples.

7.1 Graceful Display of śabdālāṅkāra

Sāmanta's style of composition is marked by grace, precision, and lucidity. His verses flow effortlessly, making even complex astronomical ideas remarkably clear and accessible. Throughout the *Siddhāntadarpaṇa*, one observes his aesthetic sensibility manifest in alliteration, elegant diction, and vivid figures of speech wherever possible. The invocatory verse that opens the text stands as a fine example of his refined poetic craftsmanship:²⁷

श्रीभूमाधवचक्रचक्रयवनिभृद्भद्राभिरभ्युज्ज्वलम्
श्रीकण्ठप्रमुखाखिलामरशिखाजुष्टाङ्घ्रिपीठोपलम् ।
श्रीनीलाचलमौलिमण्डनमहानीलायमानं महः
श्रीभूमाधरितस्मरं भवतु नः प्रत्यूहहत्युद्यतम् ॥

May that effulgence [i.e, Lord Jagannātha] radiant with Śrīdevī, Bhūdevī, Mādhava, Sudarśana (*cakra*), Viṣṇu (*cakrin*), Balabhadra (*avanibhṛt*, the upholder of the Earth), and Subhadrā, whose foot-pedestal [studded with precious] stones are graced and sought by the diadems of all the gods commencing with Lord Śiva (Śrīkaṇṭha); which shines like a great Indrānīla jewel adorning the crest of the sacred Nilācala hill – may that divinity,

²⁷ Ibid., Chap. 1, ver 1, p. 1.

who subdues the lord of love (*smara*) with the abundance (*bhūman*) of his wealth (*śrī*) [of beauty], be ever active in removing all obstacles for us.

The opening compound (*śrī-bhū-mādhava-cakra-cakri-avanibhrt-bhadrā-bhiḥ abhyujjvalam*) is best read as an indirect/implicit description of the *ratna-simhāsana* (also called *ratna-vedī*), the shrine of the Jagannātha temple at Puri, since all the seven entities listed are supposed to be residing on it. The image is therefore liturgical, not geographic, and the entire stanza functions as a *maṅgalācaraṇa* evoking the Lord of the *antar-vedī*, the inner altar where he resides.

One of the beauties of the Sanskrit language is its natural ability to facilitate the poet to construct verses rich in alliteration and with great felicity. The felicity arises due to a variety of factors that include:

1. the availability of vast lexical resources,
2. the power of compounding (*samāsa* formation) in Sanskrit, and
3. even the systematized phonetic structure (as evident from the *varṇa-mālā*).

When readers encounter such alliteration, they often experience a sense of delight, even without fully understanding why. It is a common experience that alliteration entices readers to revisit verses, not necessarily for their meanings, but for their rhythmic charm. We can see that a specific *śabdālaṅkāra*, called *ṛtti-anuprāsa*, is at work in the verse above. *Ṛtti-anuprāsa* is a type of alliteration where a particular consonant or a sequence of them is repeatedly employed within a phrase to create rhythmic resonance. In the first quarter of the verse, one can observe the repetition of “*bh*” as well as the sequence “*ca + k + r*”:

श्रीभूमाधवचक्रचक्रयवनिभृद्भद्राभिरभ्युज्ज्वलम्

It may be noted that “*bh*” appears five times and the sequence twice. Similarly, the consonants “*kh*” and “*r*” are used three and four times, respectively in the second quarter:

श्रीकण्ठप्रमुखाखिलामरशिखाजुष्टाङ्घ्रिपीठोपलम्

Repetition of the sounds “*l*” and “*m*” may be noted in the third quarter as well, producing a pleasing euphonic cadence. This use of *ṛtti-anuprāsa* appears in many verses throughout the *Siddhāntadarpaṇa*, attesting to Sāmanta’s natural mastery of sound and rhythm. The verse cited above in particular is a beautiful

invocation to Lord Jagannātha, where Sāmanta blends devotional fervor with poetic brilliance. The same stylistic device appears again in the second verse as well.

7.2 *Seamless Integration of Powerful Messages*

We would like to cite one more illustrative example from the first chapter that not only exemplifies Sāmanta's poetic elegance but also conveys certain other important aspects of *jyotiśśāstra*:²⁸

श्रेष्ठं सर्वश्रुतानां श्रुतमिति कृतिभिर्ज्योतिषं तत्र सारः
सिद्धान्तस्तत्र गोलस्तदवगतिः कृती वर्तते यत्र मर्त्यः |
विद्वत्पूज्यः स देशः सकलकलुषहृद्भर्मशर्माश्रयः स्यात्
यत्रास्ते नैष तस्मिन् पशुचरितपरे पापजापत्प्रतापः ॥

The wise perceive that *jyotiṣa* is the most excellent among all branches of knowledge (*sarvaśrutānām*); the essence of *jyotiṣa* is *siddhānta*, and *gola* is the very essence of *siddhānta*. The place where dwells a man versed in this knowledge becomes revered [even] by the learned. It is a place that is devoid of sins and is also an abode of righteousness and happiness (*śarma*). But where such a scholar [of *jyotiṣa*] is absent, such a place will be full of scorching afflictions born of sin, dominated by [those of] animal-like conduct.

A few points brought out here by Sāmanta that are noteworthy are:

1. He extols astronomy (*jyotiṣa*) as the most excellent among all branches of knowledge (*sarvaśrutānām śreṣṭham*) of all the *Vedas*.
2. The *siddhānta* (mathematical astronomy) is its purest distillation (*sāra*).
3. The *gola* section of *siddhānta* is considered most important among the various topics.²⁹
4. The verse also conveys a moral ideal – that true wisdom flourishes only in a land free from moral corruption. This is a very powerful thought that has been seamlessly integrated.

Here, again, in the second quarter, one finds the consonant “*t*” appearing ten times, and in the final quarter, the consonants “*t*” and “*p*” appear six and seven

²⁸ Ibid., Chap. 1, ver. 18, p. 3.

²⁹ *Gola* chapter is considered most important because it is only here that one finds descriptions of the physical features of the astronomical objects, the source of light in them, the cause of their motion, the alignment that is responsible for the occurrence of eclipse and so on.

times respectively – *pāpajāpatpratāpaḥ* – is particularly aesthetically striking, further exemplifying *vṛtti-anuprāsa*.

Alongside this, one can also observe *cheka-anuprāsa*, where a group of two or more consonants is repeated in proximity. For instance, in the first quarter, the pair “ś + r” recurs. Particularly, in the phrase –

श्रेष्ठं सर्वश्रुतानां श्रुतम्

while in the third quarter, the consonant cluster “ka + l” appears in *sakalakalu-ṣahṛt* and the group “arma” is repeated in *dharmasarmāsrayaḥ*. Such alliterative artistry occurs consistently in Sāmanta’s poetry, wherever the theme and meter allow. The rhythmic alliterations, coupled with the profound philosophical import, exemplify the harmonious fusion of science, poetry, and ethics that characterizes Sāmanta’s genius.

7.3 Skillful Use of Alliteration

We provide a few more examples to demonstrate how Sāmanta has seamlessly incorporated alliterations. The following verse appears as the opening verse in Chapter 17, where Sāmanta addresses some of the questions he posed in the previous chapter:³⁰

सच्छास्त्रगुच्छात् कतिचिद्विशेषान् सच्छास्त्रपृच्छाछलतः प्रदर्श्य |
तत्सारभूतौत्तरमार्यवाचा यच्छामि वत्सावहितः सकृत् स्याः ॥

Having introduced some salient features from the corpus in the form of noble science [astronomy], I have presented them as though they were queries posed by a good student. I shall now give their condensed/precise answers to those questions in noble [Sanskrit] diction. O son! Take heed for a moment.

It is noteworthy that the cluster “chā” appears four times, besides the consonant “ch” appearing one more time (in the word *chalataḥ*) in the first half of the verse. In another instance, we find the long vowel appearing ten times, which is absolutely pleasing:³¹

किमाकारा किमाधारा सा धरा कतिसागरा |

³⁰ Ibid., Chap. 17, ver. 1, p. 157.

³¹ Ibid., Chap. 16, ver. 43, p. 153.

What is the shape of the Earth? Upon what does she rest, and how many oceans does she possess?

Sāmanta's verses thus reveal a poet who is as much a master of sound as he is of sense. His use of alliteration creates an aural texture that enhances the thematic force of each verse. These devices do not appear as ornamental excesses; rather, they reinforce meaning through musicality. This harmonious interplay of beauty and rigor prepares the ground for understanding another distinctive feature of his writing – his ability to balance precision, clarity, and aesthetic elegance. It is to this synthesis that we now turn.

7.4 *Blending Brevity with Clarity*

It is often the case that precision and clarity are sacrificed in the pursuit of brevity or bringing in musicality. However, Sāmanta has skilfully navigated this challenge. We provide an example that demonstrates his ability to be concise, precise, and yet clear:³²

भूगोलः सौम्यशुक्रावनितनयसुराचार्यसूर्यात्मजानां
कक्षावृत्तैर्वृतस्यास्फुटदिवसकृतः कक्षया वेष्टितोऽयम् |
मध्ये दूरेऽन्तिके च स्फुटरविभगणक्षेपकक्षापरीतः
तिष्ठत्यण्डस्य मध्ये नभसि किल सदाधारशून्यः स्वशक्त्या ||

The Earth is circumscribed by the deferent circle of the mean Sun, which in turn is circumscribed by the deferent circles of the planets Mercury, Venus, Mars, Jupiter and Saturn. The Earth always stands at the centre of the space by its own strength without any external support, [and is] surrounded by the orbits of the true Sun and the Moon which are far and near respectively.

It is noteworthy that in a single verse, Sāmanta manages to describe the Earth's situation graphically, integrating it with his 'heliocentric' planetary model. This model, which aligns with the one proposed by Nilakaṇṭha³³ and, over a century later, by Tycho Brahe, depicts all five planets – Mercury, Venus, Mars, Jupiter, and Saturn – orbiting the Sun, while the Sun orbits the Earth.

³² Ibid., Chap. 17, ver. 3, p. 157.

³³ K. Ramasubramanian, M.D. Srinivas, and M.S. Sriram, "Modification of the Earlier Indian Planetary Theory by the Kerala Astronomers," *Current Science*, 66, 1994, p. 784.

8 Conclusion

Even in an age when Western science had begun to dominate intellectual discourse, Sāmanta's work demonstrated the vitality and adaptability of traditional Indian astronomy. His corrections to the existing framework of calendrical computations are indeed quite remarkable, as they demonstrate self-reliance and confidence in finding solutions independently, rather than simply adopting those prescribed by others. These revisions, carried out through painstaking observation, brought greater precision to the prediction of celestial events and made his work indispensable to regional traditions – ensuring their continuity in living practice, as exemplified by the almanac of the Puri Jagannātha temple. His legacy extends beyond technical contributions; he symbolizes the enduring relevance, robustness, and resilience of traditional Indian knowledge systems in a modern context.

Sāmanta's life exemplifies scientific integrity, perseverance, and devotion, all of which find eloquent expression in his *pièce de résistance*, the *Siddhāntadarpaṇa*. Among his wider contributions, he is remembered for his:

1. lucid exposition of a planetary model in which all five planets, visible to the naked eye, revolve around the Sun, while the Sun itself moves around the Earth;
2. careful revision of planetary parameters and calculation methods based on his own naked-eye observations; and
3. construction of simple yet precise instruments for astronomical observation.

In this article, we have intentionally omitted discussions on these three aspects, as they have been explored elsewhere.³⁴ This study has focused primarily on the philosophical and methodological dimensions of Sāmanta's work – his passion for accuracy, his insistence on *ḍṛk-siddhi* (empirical verification), and his humility in inviting corrections to his findings. These qualities reflect not only his personal character but also the broader ethos of the Indian scientific tradition, where continuous revision and reconciliation with observation were seen as essential to the pursuit of truth.

The *Siddhāntadarpaṇa* opens numerous avenues for further study, particularly in situating Sāmanta's mathematical corrections and astronomical formulations within the broader history of science. A rigorous comparative analysis of

34 K. Ramasubramanian, 'Planetary models in Indian Astronomy and Contributions of Sāmanta Chandra Sekhar', L. Satpathy, *Ancient Indian Astronomy and Contributions of Sāmanta Chandra Sekhar*, Narosa Publishing House, 2003. Also refer to the Appendices in *Siddhāntadarpaṇa*, Institute of Orissan Culture.

his predictive methods against modern astronomical data would illumine both the precision and the originality of his work – much of which remains incompletely understood in contemporary terms. What is therefore urgently needed is a carefully prepared critical edition of the text, furnished with mathematical annotation and astronomical commentary. Such an undertaking would not only do justice to Sāmanta's enduring contribution but also reaffirm the place of Indian astronomy in the global scientific inheritance.

Declaration of Conflict of Interest

The authors have no conflicts of interest to declare. All co-authors have collectively contributed to this work and fully agree to its content and submission. All co-authors have seen and agree with the contents of the manuscript, and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

Acknowledgments

The authors would like to express their sincere gratitude to the Department of Science and Technology, Ministry of Science and Technology, Government of India, for their generous support extended to them through the Science and Heritage Research Initiative (SHRI) Project to carry out research activities. Additionally, they extend their heartfelt thanks to the Ministry of Education, Government of India, for their invaluable support in initiating the Science and Heritage Initiative (SandHI) at IIT Bombay, which has facilitated research activities on Indian science and technology. The authors are also grateful to the Ph.D. scholars at CISTS, IIT Bombay, Varuneshwar Mandadi Reddy and Sooryanarayan D.G., for generously sharing the computed *tithi* durations derived from modern JPL ephemerides.

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