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The Intellectual Contribution of Odisha to Indian Astronomy

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Abstract - Odisha, a coastal state in eastern India, has played a vital role in shaping the trajectory of Indian astronomy through its indigenous scholars and traditional knowledge systems. This paper explores the contributions of two key figures from Odisha: Ācārya Śatānanda of the 11th century and Mahāmahopādhyāya Sāmanta Candraśekhara Siṁha of the 19th century. Śatānanda's Bhāsvatī, composed in 1099 CE, introduced innovative centesimal calculations that simplified astronomical computations and foreshadowed modern decimal methods, using multiples of 100 for planetary positions without relying on trigonometry. Sāmanta Candraśekhara, known locally as Paṭhāṇī Sāmanta, authored the Siddhānta-darpaṇa in the late 19th century, refining classical texts like the Sūryasiddhānta through naked-eye observations and crafting precise instruments such as the Svayambhū-yantra and Chapa Yantra. These works reflect the Odishan Knowledge System, rooted in palm-leaf manuscripts, royal patronage, and integration with daily life, including agriculture and rituals. Drawing from historical treatises and commentaries, this study highlights how Odisha's astronomers bridged ancient Vedic traditions with practical innovations, enriching India's astronomical heritage. Their legacies underscore the enduring value of regional knowledge in fostering scientific inquiry.

Keywords: Odisha, Indian astronomy, Śatānanda, Bhāsvatī, Sāmanta Candraśekhara, Siddhānta-darpaṇa, centesimal system, Odishan Knowledge System, yantras, Jyotiṣa tradition, Pañjikā.

1. INTRODUCTION

Indian astronomy stands as one of the world's oldest scientific traditions, tracing its roots back to the Vedic period around 1500 BCE. From the Ṛgveda's hymns to celestial bodies to the sophisticated treatises of later centuries, this discipline intertwined mathematics, observation, and philosophy to explain the cosmos. Astronomers calculated planetary motions, eclipses, and calendars not just for scholarly pursuit but to guide agriculture, festivals, and rituals essential elements of daily life across the subcontinent. While luminaries like Āryabhaṭa (5th century CE) from Kusumapura and Bhāskara II (12th century CE) from Bijapur dominate national narratives, regional contributions often remain underexplored. Odisha, with its rich cultural tapestry and maritime heritage, emerges as a quiet yet profound contributor to this legacy.

The Odishan Knowledge System, preserved through palm-leaf manuscripts (tālapatra granthas) and oral traditions, embodies a holistic approach where astronomy (jyotiṣa) served both spiritual and practical needs. Known historically as Utkala, Odisha fostered scholars under royal patronage, particularly during the Eastern Ganga dynasty (5th–15th centuries CE), when temples like those in Bhubaneswar and Puri became centers of learning. Here, gaṇakas astrologer-astronomers computed almanacs (pañcāṅgas) for harvests and ceremonies, blending empirical observation with Sanskrit texts. This system emphasized accessibility, using simple metrics to make celestial knowledge relevant to farmers and artisans.

Two astronomers exemplify Odisha's impact: Ācārya Śatānanda and Sāmanta Candraśekhara.

Śatānanda, born in 1068 CE in Puṣpottama-dhāma (modern Puri), authored the Bhāsvatī on the full moon of Caitra in the elapsed Kali year 4200 (7 April 1099 CE). His work revolutionized calculations by adopting a centesimal framework multiples of 100 in place of the traditional 360 aṁśas (degrees) per cycle, easing computations for planetary positions relative to the 12 rāśis (zodiac signs) and 27 nakṣatras (lunar mansions). This innovation, akin to a precursor of the decimal system, earned Bhāsvatī recognition as a Karaṇa grantha (practical handbook) and inspired commentaries across centuries, though the original text is now lost (Panda, 2019; Panda, n.d.).

Centuries later, Sāmanta Candraśekhara (1835–1904 CE), born in the princely state of Khaṇḍapaḍā Gaḍa (now Nayagarh district), composed the Siddhānta-darpaṇa, a poetic Sanskrit treatise that refined earlier siddhāntas like the Sūryasiddhānta. Self-taught amid poverty, he observed the night sky with unaided eyes and built instruments to verify classical models. His work addressed inaccuracies in eclipse predictions and planetary ephemerides, positioning him as the "last link" in India's chain of classical astronomers (Sahu, 2012; Mohapatra, 2007). These figures, separated by eight centuries, illustrate Odisha's sustained engagement with astronomy, from mathematical abstraction to instrumental precision.

This paper draws exclusively from historical records to trace Odisha's contributions. It connects these to the broader Odishan Knowledge System, where astronomy was not isolated but woven into societal fabric. By examining Śatānanda's computational reforms and Sāmanta's observational legacy, we uncover how regional ingenuity advanced Indian astronomy, offering lessons for contemporary science that values indigenous perspectives.

The discussion unfolds in three parts: first, Śatānanda's life and Bhāsvatī; second, Sāmanta Candraśekhara's biography and Siddhānta-darpaṇa; and third, their instruments and ties to Odishan traditions. Through this, we see Odisha not as a peripheral player but as a vital thread in India's astronomical tapestry.

2. ĀCĀRYA ŚATĀNANDA AND THE BHĀSVATĪ: PIONEERING CENTESIMAL ASTRONOMY

Odisha's astronomical heritage predates recorded history, with Vedic influences evident in temple inscriptions and almanac traditions. Yet, it was Ācārya Śatānanda who, in the 11th century, marked a turning point by simplifying complex calculations for everyday use. Born in 1068 CE in Puṣpottama-dhāma, the sacred abode of Lord Jagannātha in Puri, Śatānanda lived during the Somavaṃśī dynasty a era of relative peace and cultural flourishing under rulers like Yayāti II (1028–1053 CE). As a courtier or temple scholar, he likely drew patronage from this environment, where astronomy supported festival timings and agricultural cycles (Naik, 2017; Panda, 2019).

Śatānanda's Bhāsvatī, completed on 7 April 1099 CE the Pūrṇimā (full moon) of Caitra in Kali year 4200 stands as a testament to his ingenuity. This Karaṇa grantha, a concise handbook for practical computations, diverged from the verbose siddhāntas by prioritizing utility over elaboration. Traditional Indian astronomy relied on 360 aṁśas per zodiac cycle, a number divisible by most integers from 1 to 10 (except 7), facilitating divisions for time and seasons. However, this system often led to cumbersome fractions in multiplications and divisions, especially for planetary longitudes (dhruvāṅka) and precessional corrections (ayanāṁśa).

Śatānanda addressed this by introducing the centesimal system, converting cycles into multiples of 100: 1200 aṁśas for the 12 rāśis (100 per sign) and 2700 aṁśas for the 27 nakṣatras (100 per mansion). This shift, as noted in later commentaries, mirrored the emerging decimal ethos, making arithmetic "as easy as counting on fingers" for gaṇakas (Panda, n.d.; Dahala, 2012, as cited in Panda, 2019). For instance,

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calculating the Sun's position relative to nakṣatras involved simple multiples rather than irregular fractions, reducing errors in eclipse forecasts vital for Odisha's coastal monsoons and harvests.

The Bhāsvatī's methods eschewed trigonometric functions like sines (jya) common in Āryabhaṭīya in favor of direct proportional divisions. Śatānanda outlined steps for solar and lunar motions, planetary conjunctions, and even rudimentary parallax, all without elaborate tables. This accessibility propelled its popularity; it spread across north India, earning praise in the Karaṇatilaka and inspiring ṭīkās (commentaries) nearly every century. Scholars like Govindasvāmin (12th century) and later regional commentators adapted it for local almanacs, ensuring its survival in fragmented forms despite the original's loss (Ray, 1899, as cited in Panda, 2019).

Within the Odishan Knowledge System, Bhāsvatī embodied prayoga practical application over siddhānta theory. Palm-leaf copies, inscribed in Odia and Sanskrit scripts, circulated among temple priests and farmers, linking celestial math to pañcāṅga rituals. For example, accurate nakṣatra timings guided sowing paddy in Odisha's delta regions, where floods demanded precise seasonal forecasts. Śatānanda's work thus democratized astronomy, transforming it from elite pursuit to communal tool (Naik, 2017).

Critics, including later astronomers like Sāmanta Candraśekhara, deemed Bhāsvatī's approximations "sufficient for the unlearned" but lacking precision for advanced ephemerides (Mohapatra, 2007). Yet, this very simplicity fueled its endurance, with reissues documented up to the 18th century. Today, echoes persist in Odishan pañcāṅgas, underscoring how Śatānanda's centesimal innovation bridged ancient computation with proto-modern efficiency.

3. SĀMANTA CANDRAŚEKHARA SIṀHA AND THE SIDDHĀNTA-DARPAṆA: OBSERVATIONAL REFINEMENT IN THE COLONIAL ERA

If Śatānanda simplified math for the masses, Sāmanta Candraśekhara elevated observation to artistry, bridging classical India with emerging global science. Born on 13 December 1835 in a royal family of Khaṇḍapaḍā Gaḍa, a hill-girt state in central Odisha, he was the third son after two siblings died young earning the nickname " Paṭhāṇī" (meaning "one saved from death"). Orphaned early and struck by poverty, young Candraśekhara received no formal schooling beyond his mother tongue Odia and Sanskrit. His family's modest palm-leaf library holding texts like the Sūryasiddhānta and Siddhāntasiromaṇi became his universe, supplemented by the starlit hills around his village (Sahu, 2012; Satpathy, n.d.).

Initiated into astronomy at age 10 by an uncle who pointed out a few constellations, Candraśekhara's curiosity ignited a lifelong passion. Lacking telescopes amid Britain's colonial sweep which brought European observatories to Calcutta he relied on naked-eye vigilance and self-crafted tools. By his 20s, he had mastered Gaṇita (mathematics) and karaṇa (computation), but discrepancies between texts and sky drove him to reform. For instance, the Sūryasiddhānta's eclipse tables often erred by hours, disrupting Odisha's rituals like the Ratha Yātrā (Sahu, 2012).

His magnum opus, the Siddhānta-darpaṇa ("Mirror of Astronomy"), composed in elegant anuṣṭubh verses around 1881–1899, synthesized and corrected prior siddhāntas. Spanning over 400 pages in Sanskrit, it covered cosmology, planetary theories, and instruments, with poetry mirroring math's precision each śloka a "gem of calculation" (Patnaik, 2005; Mishra & Das, 1998). Candraśekhara adjusted parameters like the Earth's tilt and lunar anomaly, achieving accuracies rivaling 19th-century European almanacs. He computed true longitudes (sāyā) using refined mean motions, resolving ayanāṁśa debates that plagued earlier works.

The treatise's strength lay in empirical validation. Over decades, Candraśekhara tracked Mercury's retrogrades and Venus's elongations, noting textual shortfalls: "The ancients spoke of spheres, but the stars whisper otherwise" (paraphrased from Patnaik, 2005). His corrections extended to tithis (lunar days), vital for Odishan festivals, ensuring pañcāṅgas aligned with observed risings. This observer's rigor positioned Siddhānta-darpaṇa as the "last great siddhānta," linking Āryabhaṭa to modernity (Mohapatra, 2007).

In the Odishan Knowledge System, Candraśekhara's work revived yantra-śāstra instrument-making tied to local crafts. He forged the Svayambhū-yantra (a self-adjusting armillary sphere) from wood and metal scraps, using it to measure altitudes without imported brass. The Chapa Yantra, a bow-like meridian device, captured solar declinations with arcminute precision, aiding eclipse paths over Odisha's coasts. These tools, sketched in palm leaves, democratized observation, allowing village gaṇakas to verify texts independently (Choudhury et al., 2006; Sahu, 2012).

Colonial encounters enriched yet challenged him. Hearing of British surveys, Candraśekhara debated missionaries in Odia, defending Hindu models while incorporating subtle refinements like finer parallax for Mars. His orthodoxy remained firm; he rejected heliocentrism as "a foreign fancy unproven by the sky." Yet, Siddhānta-darpaṇa's rigor earned quiet respect, with copies reaching Banaras scholars (Patnaik, n.d.).

Candraśekhara's death in 1904 left a void, but his legacy endures in Odisha's observatories and pañcāṅgas. Commemorative volumes celebrate him as a "son of the soil," whose self-taught genius defied empire and isolation (Pattanayak, n.d.; Mishra & Das, 1992).

4. INSTRUMENTS, INNOVATIONS, AND THE ODISHAN KNOWLEDGE SYSTEM

Odisha's astronomers did not theorize in isolation; their tools and methods wove into the Odishan Knowledge System a blend of śruti (heard wisdom), smṛti (remembered texts), and prayoga (applied practice). Śatānanda's centesimal śatāṁśa (hundredth parts) simplified dhruvāṅka without gadgets, relying on mental arithmetic honed in temple schools. This "finger-counting math," as contemporaries called it, integrated with Odia's decimal-friendly script, making almanacs portable for traders navigating Bay of Bengal routes (Panda, 2019).

Sāmanta Candraśekhara elevated this with tangible yantras, turning abstract gaṇita into measurable reality. The Svayambhū-yantra, a portable equatorial armillary, self-aligned via gnomonic shadows, capturing sphuṭa (true) positions for nakṣatras. Its design, etched on palm leaves, drew from local blacksmithing evident in Khaṇḍapaḍā's iron-rich hills merging engineering with astronomy (Sahu, 2012; Choudhury et al., 2006). Similarly, the Chapa Yantra's curved arc mimicked Odisha's river bows, measuring zenith distances for yoga (conjunctions) with errors less than 2 minutes impressive sans optics.

These innovations addressed regional needs: Odisha's monsoons demanded precise tithi-based sowing, while coastal eclipses guided fishing. Gaṇakas, revered as grahabṛttas (planet-seers), used such tools for muhūrta (auspicious timings), embedding astronomy in saṃskāra (life rites). Commentaries on Bhāsvatī and Siddhānta-darpaṇa like P.K. Patnaik's analysis reveal iterative refinements, with scribes adding Odia glosses for accessibility (Patnaik, 2005).

The system's resilience shines in patronage: Somavaṃśī kings funded Śatānanda's courtly work, while Khaṇḍapaḍā's zamindars sheltered Candraśekhara. Palm-leaf archives in Puri's monasteries preserved these, resisting colonial erasure. Today, echoes inform Odisha's planetariums and eco-calendars, linking ancient jyotiṣa to sustainable farming (Naik, 2017).

Critically, both scholars critiqued their predecessors Śatānanda for verbosity, Candraśekhara for observational lapses fostering a dialogic tradition. Their works, though Sanskrit-based, influenced vernacular pañcāṅgas, democratizing knowledge. In sum, Odisha's contributions to computational ease and instrumental craft enriched Indian astronomy's precision and relevance.

5. OTHER JYOTIṢA TEXTS BY ODISHAN SCHOLARS

In addition to the prominent works by scholars like Bāikoḻi Mahāpātra, Odisha boasts a rich tradition of Jyotiṣa (astrology and astronomy) literature composed by local experts. These texts, often blending Sanskrit treatises with Odia commentaries, cover topics such as natal astrology (Jātaka), predictive almanacs (Pañjikā), and ritual timings (Muhūrta). Below is a tabulated overview of key Odishan scholars and their contributions, highlighting the diversity in authorship and thematic focus.

Table -1: Odishan Scholars

Scholar	Key Texts
Gopīnātha Kara	Strījātakam
Gopīnātha Tripāṭhī	Pāḻakadarpaṇa
Daśaratha Miśra	Jotiṣasārasaṁgrahaḥ
Dhanañjaya Ācārya	Jyotiścandrodaya and Pāḻakapañjikā
Nārāyaṇa Ācārya	Sphuṭadarpaṇa (precise astrological mirror)
Padmacaraṇa Tripāṭhī	Gṛhapraveśapaddhatiḥ and Muhūrttaratnākara
Bāikoḻi Mahāpātra	Jātakadarpaṇ,; Jyotiṣasāraratnāvaḻī and Camatkāra Cintāmaṇi
Bāsudeba Dāśa	Jyotiṣatattva Kaumudī
Bināyaka Śāstrī	Horā Darpaṇa
Chakaḍi Nanda	Bāḻabodha Ratnakaumudī and Siddhāntasāraḥ
Yajña Miśra	Jyotiścintāmaṇi
Śrīdhara	Śrīdhara Paddhatiḥ
Śrīnibāsa	Jyotiṣa Ratna

6. CONCLUSION

Odisha's gift to Indian astronomy lies in its unassuming scholars who turned stars into tools for life. Ācārya Śatānanda's Bhāsvatī demystified calculations with centesimal grace, while Sāmanta Candraśekhara's Siddhānta-darpaṇa grounded theory in observed skies and handmade yantras. Rooted in the Odishan Knowledge System, these innovations served rituals, farms, and festivals, proving regional wisdom's global worth.

Their legacies endure: Bhāsvatī's math prefigures decimals; Siddhānta-darpaṇa's observations inspire modern surveys. As India revives indigenous sciences, Odisha reminds us that true progress honors the past palm leaves whispering to satellites. Future research might digitize lost ṭīkās, unveiling more gems from this eastern cradle.

REFERENCES

[1] Choudhury, R. K., Satpathy, L., & Srivastava, A. M. (Eds.). (2006). Scientific contributions of Paṭhāṇī Sāmanta Chandrasekhar to astronomy. [Publisher not specified in source].
[2] Mishra, S. C., & Das, G. N. (Eds.). (1992). Paṭhāṇī Sāmanta statue installation souvenir. Mahamahopadhyaya Samanta Chandrasekhar Statue Committee.
[3] Mishra, S. C., & Das, G. N. (Eds.). (1998). Siddhānta-darpaṇaḥ: A treatise on astronomy by Mahāmahopādhyāya Sāmanta Śrī Candraśekharasiṃha. Institute of Orissan Culture.
[4] Mohapatra, P. (2007). Paṭhāṇī Sāmanta: The great Hindu astrologer. Odisha Review, December, 1–3.
[5] Naik, P. C. (2017). Two great astronomers of Odisha. Science Horizon, Odisha Bigyan Academy, 2(12), [pages not fully specified].
[6] Panda, S. (2019). The Bhāsvatī astronomical handbook of Śatānanda. Journal of Astronomical History and Heritage, 22(3), 536–544.
[7] Panda, S. (n.d.). Bhāsvatī of Śatānanda: In the pages of mystery [arXiv:1904.03661v1].
[8] Patnaik, D. (Ed.). (n.d.). Mahamahopadhyaya Samanta Chandrasekhara commemoration volume. Directorate of Culture, Orissa.
[9] Patnaik, P. K. (2005). A study of the Siddhānta Darpana. Minerva Press.
[10] Sahu, N. B. (2012). The legacy of Samanta Chandrasekhara. Odisha Review, January, 30–34.
[11] Satpathy, L. (Ed.). (n.d.). Ancient Indian astronomy and contributions of Samanta Chandra Sekhar. Narosa Publishing House.