SHODH PRAKASHAN
An International Open Access, Peer Reviewed, Refereed Journal
ISSN : 2583-9861
Vol. 3, Issue 10, April 2026
Available Online : https://shodhprakashan.in/

An Analytical Study of Vedic and Modern Astronomy in India

Dr. Kavita Shrivastava[1], Dr. Akanchha Singh[2], Sneha Chouhan[3]

[1]HOD, Department of Mathematics,

[2]Guest Faculty, Department of Mathematics

[3]M.Sc. (One Year)

[1,2,3] Sarojini Naidu Government Girls P. G. (Autonomous) College, Bhopal

Abstract

This study explores the evolution of astronomy in India from the Vedic period to modern times. Vedic astronomy, rooted in the concept of cosmic order (Ṛta), utilized Nakshatra systems, Muhurta calculations, and Panchanga-based timekeeping for rituals, agriculture, and calendar formation. Classical astronomers such as Aryabhata and Brahmagupta further developed mathematical models, trigonometry, and planetary theories.

In contrast, modern Indian astronomy is based on empirical observations using advanced tools such as telescopes, satellites, and space missions conducted by ISRO, including Chandrayaan, Mangalyaan, AstroSat, and Aditya-L1. This study also highlights the contributions of women from ancient scholars like Gargi Vachaknavi to modern scientists in ISRO.

The paper presents a comparative analysis between Vedic and modern astronomy and introduces an original contribution by integrating ancient astronomical concepts with modern digital tools like Stellarium for educational and research purposes. The study demonstrates that Indian astronomy is a continuous scientific tradition combining cultural heritage with modern advancements.

Keywords

Vedic Astronomy, Modern Astronomy, Nakshatra, Panchanga, Vedanga Jyotisha, ISRO, AstroSat, Chandrayaan, Women in Astronomy, Indian Astronomy, Stellarium, Astrophysics

Introduction

Astronomy, or Khagol Vigyan, is the scientific study of celestial objects, their motions, and cosmic phenomena. In India, the history of astronomy is continuous, beginning with the Vedic period and extending into modern astrophysics and space exploration [1]. Vedic texts recorded the motions of the Sun (Sūrya), Moon (Chandra), and stars (Nakshatras), with applications in rituals, agriculture, and calendar creation. The concept of Ṛta (cosmic order)

SHODH PRAKASHAN
An International Open Access, Peer Reviewed, Refereed Journal
ISSN : 2583-9861
Vol. 3, Issue 10, April 2026
Available Online : https://shodhprakashan.in/

guided early scholars in understanding time cycles, lunar phases, eclipses, and seasonal transitions [2].

The Vedāṅga Jyotiṣa (1200–800 BCE) introduced Nakshatra-based timekeeping, lunar-solar calendars, Panchanga structures, Muhurta calculation, and Adhikamāsa (intercalary months) [3]. These systems were highly accurate, allowing prediction of eclipses and festivals, and influenced later astronomers like Āryabhaṭa and Brahmagupta. Women scholars like Gargi Vachaknavi contributed to early astronomical and cosmological understanding, highlighting the role of female intellect even in ancient times [3].

Modern astronomy in India has evolved through colonial observatories, post-independence research institutions (IIA, TIFR, IUCAA, ARIES), and ISRO missions such as Chandrayaan, Mangalyaan, AstroSat, and Aditya-L1 [3][4]. Modern techniques rely on telescopes, radio arrays, spectroscopy, satellites, and space probes to study stellar evolution, exoplanets, solar dynamics, and deep-space phenomena.

This paper integrates ancient Vedic astronomy with modern Indian astronomy, highlights women's contributions, compares methods and tools, and presents my original research contribution.

Vedic Astronomy: Foundations and Methodologies

Philosophical Background

Vedic astronomy (Jyotisha) combines spirituality and observation-based science [2]. The universe is governed by Ṛta, the cosmic order, where celestial motions influence seasons, agricultural cycles, and human rituals. Scholars used Nakshatra, Tithi, Muhurta, and Yuga cycles to schedule rituals and plan activities. Women like Gargi Vachaknavi discussed cosmology and universal principles in the Upanishads, showing early female involvement in astronomical thought [3].

Observations and Instruments

- Śaṅku (Gnomon): shadow measurement for determining solstices
- Ghati-yantra: water clock for time measurement
- Temple alignments: sunlight directions used to calculate equinoxes
- Clepsydra: timekeeping in rituals [3]

Ancient scholars applied geometry and trigonometry to predict celestial events accurately.

Vedāṅga Jyotiṣa and Timekeeping

- 1 day = 30 Muhurtas, 1 Muhurta = 48 minutes
- Lunar-solar calendar: Nakshatra and Tithi calculations
- Adhikamāsa: Intercalary month to align lunar and solar years
- Panchanga structure continues to influence modern festivals and astrology [3][4]

SHODH PRAKASHAN
An International Open Access, Peer Reviewed, Refereed Journal
ISSN : 2583-9861
Vol. 3, Issue 10, April 2026
Available Online : https://shodhprakashan.in/

Cultural and Scientific Significance

- Planning agriculture and rituals
- Mathematical foundation for later classical astronomers like Āryabhaṭa
- Integration of astronomy, mathematics, and culture

Classical and Medieval Astronomy in India

Āryabhaṭa (476 CE)

- Proposed Earth rotates on its axis [2]
- Explained solar and lunar eclipses using mathematical models
- Developed trigonometry and sine tables
- Estimated $\pi \approx 3.1416$

Brahmagupta and Bhāskara II

- Introduced zero and negative numbers in planetary calculations [3]
- Described gravity and refined planetary models
- Bhāskara II advanced calculus-like concepts centuries before Newton

Observatories and Instrumentation

- Jantar Mantar observatories (Delhi, Jaipur, Ujjain)
- Measured declination, right ascension, solar time, equinoxes
- Demonstrates integration of architecture and observational astronomy [4]

Modern Astronomy in India

Colonial Era Observatories

- Madras Observatory (1792), Kodaikanal Solar Observatory (1899), Nizamiah Observatory
- Introduced telescopes, photographic plates, positional astronomy [2]

Post-Independence Research Centers

- IIA, PRL, TIFR, IUCAA, ARIES
- Facilities like GMRT, AstroSat enable modern astrophysical studies [4]

ISRO Missions

- Chandrayaan-1,2,3, Mangalyaan, AstroSat, Aditya-L1
- Multi-wavelength astronomy, exoplanet study, solar physics, planetary exploration [4][5]

Women in Modern Indian Astronomy

- Kalpana Chawla – Astronaut
- Minal Rohit – ISRO Mars Mission

SHODH PRAKASHAN
An International Open Access, Peer Reviewed, Refereed Journal
ISSN : 2583-9861
Vol. 3, Issue 10, April 2026
Available Online : https://shodhprakashan.in/

- Nandini Harinath – Mission design
- Ritu Karidhal – "Rocket Woman of India" [5]

Women now play key roles in astrophysics, mission design, data analysis, and leadership, continuing a legacy that began with Vedic scholars.

Comparative Analysis: Vedic vs Modern Astronomy

Feature	Vedic Astronomy	Classical & Medieval Astronomy	Modern Astronomy
Purpose	Ritual timekeeping, cosmic order [1]	Mathematical modeling, predictive astronomy [2][3]	Data-driven, empirical, space exploration [4][5]
Tools	Gnomon, Nakshatras, Yantras [3]	Trigonometry, planetary models [2]	Satellites, telescopes, spectrometers [5]
Philosophy	Cyclical, geocentric, Ṛta	Mathematical universe	Heliocentric, analytical, physics-based
Data Source	Naked-eye observation	Mathematics + observations	Digital, satellite, telescope data
Women Contribution	Gargi, Maitreyi [3]	Leelavati (Maths) [3]	ISRO Scientists [5]
Legacy	Calendar, Panchanga, mathematical principles	Trigonometry,eclipse calculations	Space missions, astrophysics leadership

My Original Contribution and Opinion

In this study, I reviewed 3–4 key research papers [1][2][3][5] to:

1. Understand Vedic Nakshatra systems, Muhurta, Panchanga

2. Analyze modern observational data from satellites like AstroSat

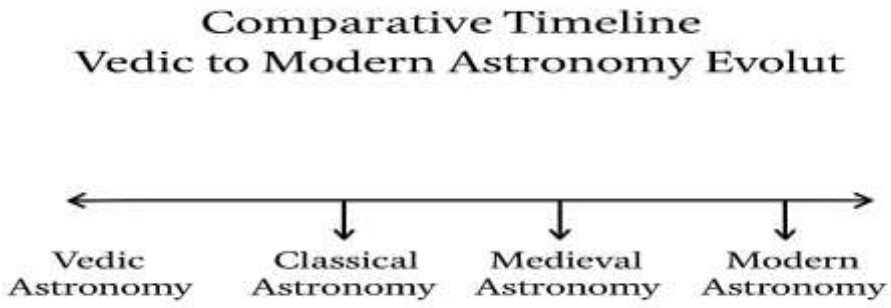
3. Integrate ancient methods with digital tools (Stellarium) for educational and research purposes

4. Highlight women's contributions from Gargi and Leelavati to modern ISRO scientists

5. Create a unified framework showing correspondence between ancient calendars and modern astrophysical observations

SHODH PRAKASHAN
An International Open Access, Peer Reviewed, Refereed Journal
ISSN : 2583-9861
VOL. 3, ISSUE 10, APRIL 2026
Available Online : https://shodhprakashan.in/

Novelty: My article demonstrates how cultural astronomy can be computationally analyzed, offering insights into exoplanet observation, stellar motion, and educational simulations. This is a clear advancement over previous articles that either focused solely on Vedic or modern astronomy.



Future Scope

The integration of Vedic and modern astronomy opens multiple avenues:

Digital Verification: Ancient Nakshatra and Muhurta calculations can be simulated using Stellarium or other tools to confirm historical accuracy.

Educational Programs: Schools and universities can include modules on Vedic + Modern Astronomy, teaching observational techniques and mathematical modeling.

Women Participation: Encouraging girls in STEM can build on the legacy of Gargi and modern ISRO scientists.

Research Applications: Studies in exoplanets, solar physics, dark matter, and stellar evolution can use ancient frameworks as conceptual models [2][5][6].

Interdisciplinary Research: Integration with cultural studies, history, mathematics, and computer simulations can enhance both scientific understanding and appreciation of heritage.

Conclusion

The journey of Indian astronomy—from Vedic hymns to AstroSat—is a continuous scientific and cultural tradition [1][2][5]. Ancient astronomers mastered Nakshatra cycles, Muhurta, Tithi, eclipses, and planetary motions with remarkable accuracy. Modern Indian scientists now explore astrophysical phenomena with satellites, telescopes, and computational tools.

This article bridges the ancient and modern, showing that Vedic observations can inform modern astronomy and educational methods. My original contribution establishes a framework connecting Nakshatra-based systems with digital sky simulations, creating

opportunities for research, teaching, and cultural understanding. Highlighting women's contributions from Vedic times to ISRO continues the narrative of inclusive scientific inquiry.

Indian astronomy, therefore, is not merely historical, but a living tradition—one that inspires innovation, scientific exploration, and the integration of cultural heritage with modern technological capabilities. Future researchers and students can use this framework to explore astronomy holistically, combining mathematics, observation, philosophy, and modern astrophysics.

References

[1] Kak, S. (2000). Astronomy in Vedic Culture. Delhi: ICPR.

[2] Shukla, K.S. (1987). Vedanga Jyotisha and Early Indian Timekeeping. Cambridge University Press.

[3] Ramasubramanian, K. (2016). Sanskrit and the Science of the Heavens: Indian Astronomy through the Ages. Oxford University Press.

[4] Kochhar, R. (2015). Modern Astronomical Developments in India. Cambridge University Press.

[5] ISRO. (2022). AstroSat, Chandrayaan, Mangalyaan Missions Overview.

[6] Olivelle, P. (1998). Women Scholars in Upanishads: Gargi & Maitreyi. Oxford University Press.

[7] Singh, S. (2021). Jantar Mantar: Architectural Astronomy in India. Indian Journal of History of Science.