International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 10 | Oct - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

THE ROLE OF BHARAT ON SPACE-PHYSICS

N.V.L. Swathi[1], J.P. Pramod[2] & N V Prasad[3]

[1&2] Stanely College of Engineering and Technology for Women,
Abids, Hyderabad, TG-5000001
[3] Department of Physics, Osmania University, Hyderabad, TG-500007.

Abstract

This paper describes ancient Bharat (India) ideas of space and objects concept. The conceptual rituals of the ancient Indians were based on the scientific knowledge. Ancient civilization was used to observe the movements of the sun, moon, and stars. They practised these observations to develop sophisticated methods for determining time and direction. They created detailed star maps and developed treatises like the Surya Siddhanta, which explains the calculations for solar eclipses and celestial positions. This was an essential tool for agricultural activities and future forecasting. Exploring the ancient ideas on solar system is a matter of our curiosity and helps us for better understanding of our ancient philosophy.

1. Introduction

The couplet 'space-physics' has emerged from ancient Indian scientist (saints) observations and this word still prompted to modern scientific research, even today. The astronomical contributions of ancient Indians are still exploring to space-research. In this connection the couplet from Bhagavad Gita is adequate [1]:

कालोऽस्मि लोकक्षयकृत्प्रवृद्धो लोकान्समाहर्तुमिह प्रवृत्तः |
ऋतेऽपि त्वां न भविष्यन्ति सर्वे येऽवस्थिताः प्रत्यनीकेषु योधा"

"I am mighty Time, the source of destruction that comes forth to annihilate the worlds. Even without your participation, the warriors arrayed in the opposing army shall cease to exist".

The greatness of ancient Indian's civilization is their quest about space their practises became a way oy life. During 1500 BCE, the thought-provoking couplet was "If God created the universe; then who created God?" This statement is itself pretentious and illusory. The statement merely points out about the creation of the universe. This shows how people were thrust to know the things. This couplet started giving cumulative ideas for ancient Indian civilization. This approximates The Theory of Everything' in modern science [2].

It is a known fact that that the early human depended on celestial objects for navigation and agricultural planning. Ancient civilization was use to observe the movements of the sun, moon, and stars. They practised these observations to develop sophisticated methods for determining time and direction. They created detailed star maps and developed treatises like the Surya Siddhanta [3], which explains the calculations for solar eclipses and celestial positions. These observations were crucial for navigation, creating calendars based on the lunar and solar cycles.

The Upanishadic sages (ancient Indian text) clearly explain the attractive force of earth and the five vital air forces or the Pranas of all the living beings on earth [4]. From this one can extrapolates the ageing process and their deterioration. On the contrary, during space journeys of Rishis (or demigods), they lose contact with earth's gravitation and hence the total force stops the deterioration of their body. As a result, the life of Rishis gets extended or remains young. The same fact is seen in the episodes of Puranas (ancient history). The same can be proved in modern times by means of space-travelling devices.

The ancient Indians knowledge about different time speeds of planets in space proves that the life got extended during their space-journeys. Rishis used to call this subject as 'Vibhu-gamanam' [5]. They quoted more

advanced statement that the eternal element called Praana Brahma, which present within themselves as the vital force [6]. This is now called a string theory.

Bhagavad Gita quotes the following couplet on space and time [1]. This has been a subject of debate for the present astro-physicists that there are 10^{500} locas (solar systems) or states, corresponding to a different universe.

कालः पचति भूतानि, कालः संहरते प्रजाः |
कालः सुप्तेषु जागर्ति, कालो हि दुरतिक्रमः ||

Epics (Ramayana and Mahabharata) gives us the concepts of physics theories like the brahma-asthr (atom-bomb), pushpak-viman (helicopter) etc. Concepts like war-broadcasting and communication were explained in the epics. The rituals and adopted methodologies undertaken between the birth and death surprises the modern civilization. Even surrogacy and transplantations were discussed. From this one can conclude that the rituals were not orthodoxy instead they have built on the scientific basis. One cannot view these grate epics as the orthodoxy nature, emanating from some pre-historic ages. This itself dictates the thought-provoking temper between the religion and scientific evolution. Kalidasa's idea about orthodox is more adequate in this concluding remark [7].

पुराणमित्येव न साधु सर्वं न चापि काव्यं नवमित्यवद्यम्।
सन्तः परीक्ष्यान्यतरद्भजन्ते मूढः परप्रत्ययनेयबुद्धिः।।

2. Bharat philosophy

Our understanding of heritage should be in philosophical way and should confined to "orthodoxy". "Orthodoxy" suggests a finalized-lifeless structure. Ancient Indian philosophical systems, especially Samkhya, Nyāya–Vaiśeṣika, Mīmāṁsā and Vedānta, along with the poetry explained the concepts of time and atom. The matter is nothing but as the non-manifested of the spirit called Satchidānanda. The number '0' is the greatest gift of India to the world and without it, the prosperity of modern civilizations would not have been possible.

The most interesting paradox of Indian horoscope chart (astronomical analysis) is time-twin problem – a dissimilarity of individuals born at the same time. Many people also ask why astrologers assign significance to the time of birth rather time of conception. The answer is the only the force, that governs over millions of kilometres of interplanetary space. The following couplet is more adequate to explain the paradox scientifically [8].

"Different parts of the body cannot be correctly described who is not versed in anatomy. Anyone who desires to acquire proper knowledge (niḥsaṁśaya jñāna) should prepare and carefully observe by dissecting it, and examine its different parts. A thorough knowledge can only be acquired by comparing the accounts seen in the Śāstras (text of anatomy) with direct observation".

The questions like, how did the universe come into being? What is it purpose? What is the origin? These questions are still debatable and many researchers, globally, are interpreting in different way. The Upanishad gave an answer and this is considered to be a hallmark of the paradoxes. According to Rishis [9]:

"In *the beginning it was asat (void). Then sat (matter) came out of asat. From this all things were created. In the beginning it was ātman or Supreme One, Self-existent Consciousness and the Uncaused Cause. There was no other thing except that. It was neither sat nor asat, but sad–asat. The gradual development is as follows: sat–asat darkness (void) elemental universe sky wind heat water earth (in the form of an egg, i.e. brahmāṇḍa/hiraṇyāṇḍa divided into two parts – earth and the sky".*

The modern philosophy quotes that "Time is both linear and circular. The concept of time in modern and the ancient theory is quite different and it is the simple equation T = O. According to the Big Bang (or expanding theory of universe) theory, the concept of time and space is relative. The only one answers of the Upanishad solves all the said above puzzles or though provoking questing by the following couplets [9].

"The unchanging, infinite, immanent and transcendent reality which is the divine ground of all matter, energy, time, space, being and everything beyond this universe, that is the one supreme, universal spirit, – the highest universal spirit, – the highest universal principle, – the ultimate reality in the universe, the material-efficient-formal and final cause of all that exists. –

3. Ancient analysis

Vedas, described the universe as infinite and made up of the earth, atmosphere and sky. In addition, fire stays in the earth. The air occupies the atmosphere. The sun rules the sky and the moon accompanied the nakshatras or zodiacal star-groups. The nine planets are considered as God planets, namely the sun (*Surya*), moon (*Chandra*), Mars (*Mangala*), Mercury (*Budha*), Jupiter (*Brihaspati*), Venus (*Shukra*), Saturn (*Shani*), Rahu (north node of the moon), and Ketu (south node of the moon). Rahu and Ketu called are subtle *grahas* with no actual mass. They represent the two points in space where the orbital path of the sun and moon intersect. Since eclipses block light at the connecting nodes and therefore, Rahu and Ketu are coined as "shadow planets". These two planets are responsible for the growth and decay of individual life or Karmic action (Karma). It also mentioned the thirty-four lights, the combination of seven planets and twenty-seven Nakshatra together gives probability of past and future events.

The Rigveda describes that the sun rules the sky and sole light giver to the universe. Sun is the responsible for four seasons. It is also quoted that sun is responsible for wind and the moon shines by sun light (syrya-rasmi). The Moon's path was divided into 27 equal parts. Moon will take almost $27\frac{1}{3}$ days to cross the path. The equal parts are called nakshatras or stars. Again, these stars were classified into sub-stars (upa nakshatra). The Satapatha-brahmana [10] gives the names to all these 27 nakshatras as well as those of the 27 upa-nakshatras. The nakshatras were again categorized into male, female and neuter as well as into singular, dual and plural. It seems that the classification was made on the basis of brilliance. They coined constellations, other than nakshatra.

The Rigveda clearly explained the constellations what presently called Bears, the two divine Dogs (Canis Major and Canis Minor), and the heavenly Boat (Argo Navis). The Great Bear was called as Saptarsi (the constellation of the seven sages) and was mentioned_ by this name in the Satapatha-brahmana. The golden Boat (Argo Navis) is written in the Atharva-veda They also discussed the star Mrgavyadha (Sirius), and narrated an interesting story regarding them. Besides the Sun, the Moon, and the nakshatras, they have explained some of the other heavenly systems (locals). In addition, they have commented on ulka (meteors) and dhumaketu (comets). Eclipses have been discussed and narrates with interesting stories. The Rgveda describes the shadow planet Rahu is responsible for eclipse of sun.

The day was called vasara or ahan in the vedic literature. The variability of its day was well known. In the Rgveda, the couplet confirms the variability of a day:

"0 Somaraja, prolong thou our lives just as the sun increases the length of the days."

At that time six days were considers in a week, called 'sadaha (six-day week). They used to consider 5-sadahas in a month and 12-months in a year. Later six-day sadha was replaced with by the present seven-day week (saptaha) which had made easy calculations in the astrology (jyothisha). The duration of daylight, reckoned from sunrise to sunset, was divided into two parts called purvahna (forenoon) and aparahna (afternoon). The day was again divided inti five parts, pratahj sahgava, madhyahna, aparahna and sayahna. The days and nights were also divided into 15-parts, called muhurtas. The muhurtas were given specific names.

In the Vedic period, the year was supposed to consist of six seasons and each season of two solar months. The six Vaidik seasons were named as: Vasanta (Spring), Grisma (Summer), Varsa (Rainy), Sarada (Autumn), Hemanta (Winter) and Sisira (Chilly Winter). In ancient period, the lunar (or synodic) months (full moon period) used to consider in all the calculations. But in due course, the lunar month were reckoned with solar months, where the sun enters into the tara-mandala (zodiac) sign. If sun did not enter in a sign, then it was treated as an intercalary month. Periods bigger than a year were named as Yuga, in vedic literature. The period of youga ia almost five solar years. The names Krta, Treta, Dvapara and Kali which are often used in the present days belong to longer yugas. This was reported in B.C. 1150 or about B.C. 1370 [10]. These practises were based on the vedic sacrifices and other religious observances.

The five-year yuga consist of 61-civil, 62-lunar and 67-sidereal months. The year consisted of 366-civil days. The day was treated from sunrise to sunrise. A noteworthy aspect is that for every thirty lunar months their exist one intercalary month. This brings a concordance between solar and lunar years. The calendar constructed

based on this was served for a long time. If we calculate the actual dates in a period of 62-lunar months is 1830-89 but not 1830 what they reported. The adjustment of a thithi is needed for every yoga of five solar years. This discrepancy has been rectified by introducing seven days in a week, but authors could not find any reports when and how this was done. From this one can conclude that the names of week days Sunday (Aditya), Monday Bhauma, the son of Earth), Wednesday (Budh planet), Thursday (Bruhaspati, Jupiter), Friday (Sukra, the venues), Saturday (Sani or the Saturn) are undoubtedly originated from Indian vedic or Jythtish (astrological) text.

Some of the post-vedic calculations and the modern calculations are discussed here.

1. In the post-vedic period the the astronomical calculations were made widened. The original purpose of making calendar was to serve the needs of the civilization for harvesting and other future plans like marriages, constructions etc. They extended their work to study of the path and velocities (gatis) of sun and moon.
2. The calculation of rotation was explained in Sphujidhvaja Yavanesvara [10], during 269 A.D. The revolution of the Moon was made into 248 equal parts (called pada). Each part (pada) corresponding to 1/9 of a day. It was assumed that the moon moved through 111 revolutions -3/4 signs +2 mins To obtain the moon's motion for p-padas in the first half of its anomalistic revolution, the formula used for these calculation was [10]:

   Moon's motion for p padas in the first half revolution =

   $$\text{p degrees} + \frac{[1094+5\,(p-1)]p}{63} \text{ mins.}$$

   in the second half of its anomalistic revolution =

   $$\text{p degrees} + \frac{[24l4-5\,(p-1)]p}{63} \text{ mins.}$$
3. In the case of Jupiter, the sidereal revolution was divided into 391 equal parts (padas) an again divided into three unequal segments. The first, second and third segment contain 180, 195 and 16 padas respectively.

   The first segment, $\lambda_1\,(p) = \frac{p(1456-p)}{24}$ 24 mins.

   The second segment, $\lambda_2\,(p) = \lambda_1(180) + \frac{q(1165+q)}{24}$ mins.

   Third segment, λ_3 (p) = $\lambda_2(195) + \frac{r(1486-r)}{24}$ mins.

4. In the case of Saturn, the sidereal revolution was divided into 256 equal parts (padas). Pada is again divided into three segments. The first segment consisting of 30 padas and the second consisting of 127 padas. The third consists of the remaining 99 padas.

   The first segment, $\lambda_1\,(p) = \frac{p(2416+2p)}{27}$ 24 mins.

   The second segment, $\lambda_2\,(q) = \lambda_1(30) + \frac{q(2519-2q)}{27}$ mins.

   Third segment, λ_3 (p) = $\lambda_2(127) + \frac{r(2037+2r)}{27}$ mins.

   The above formulae show that the Jupiter's and the Saturn apogees were as 165.7 and 220.8 degrees respectively.
5. The length of the sidereal year was explained in the Paulisa-siddhanta. The value was reported to be 355 days 6 hours 12 seconds. Vasistha used to approximate rules to get the longitudes of the Sun and Moon. After some corrections, it was reported that the centre for the Sun has intervals of 30^0 at the starting point and lying 20^0 behind the point of zero longitude.
6. Aryabhata's astronomy was formulated based on three fundamental assumptions: (i) An average planet revolves in a geocentric circular orbit (ii) True planets move in epicycles or in eccentrics (iii) All planets have equal linear motion with their respective orbits. Here, it should be noted that the Aryabhata's epicycles vary in size from place to place.

7. Some of the astronomical parameters, proposed by Aryabhata were found to be useful and yielded to accurate results. His theory of the rotation of the earth was described by a spherical, like a bulb in the kadamba flower. The pi value was found to be 3.1416. Fixation of the Sun's greatest declination is at 24°. The Moon's greatest celestial latitude is at 4°30'. These values were adopted by many astronomers.
8. Some of the synodic periods of the planets, calculated by Vasistha, Paulis'a, Aryabhata, Ptolemy and modern astronomers were shown in the Table 1. The values were found to be almost same to the modern scientific values.

Table 1. Synodic periods calculated in days for the five planets by different ancient scientists

Planet	Vasistha	Paulisa	Aryabhata	Ptolemy	Modern calculation
Mars	779.955	779.978	779.92	779.943	779.936
Mercury	115.879	115.875	115.87	115.879	115.877
Jupiter	398.889	398.885	398.889	398.886	398.884
Venus	583.909	583.906	583.89	584.000	583.921
Saturn	378.1	378.110	378.08	378.093	378.092

9. Surya Siddhanta was originally written by Aryabhatta. The famous couplet written by ancient Indians in th period of 11th Century is as follows [11].
“ृध्येस्ततन्त्स्य रुगोलो व्योत्न त्तस्थत्त त्वभ्रानुः पि्ृृ सत्क्तं ब्राह्मणो धिणात्ृक”ृ
२. [सूयमत्सद्धान्तत १२ अध्याय ३२ श्लोक]
The spherical earth stands at its centre in space due to the dharanatmikam sakti which prevents earth from falling away and helps it to stand firm [11]
“अिस्त सत्क्तश्च ृत्ह ताय यत्स्वस्थं गुरु स्वात्र्ुुखंस्वसक्मत्य अिस्यतेतत्पततीव र्ात्त स्ान स्ततत्क्मव पातत्वय्ृखे”
[त्सद्धान्तत श्शिोत्ण, रुवनकोस, ६ श्लोक]
Every object falls on the ground due to earth‟s force of attraction. This force allows the sun, earth, moon and constellations to stay in the orbit

आत्ृ त्य वणमुः त्सुः पिस्ता त्| यत्आत्ृ त्यस्तन्त्स्तुत्व द्या त्| तपसो िजस्त्सो ृत्य ज्यो त्त रुत्तिं | धा िा आपो अपा ृतृ ृदभुतं हव्य्रम| आत्ृ त्यस्य र्ा नो ेवो जा तो वनस्पत्त षु| त्व श्वेेवाु: सत्व तुयमज्ा नो यज्ञ्ा ृधा त ||[

Let us invoke today the effulgent powers of the radiant rising of the sun, that they may guide us on the path of goodness, and that we may see the light that leads to the highest goal. May the sun, who is the source of all life and energy, Fill us with vitality and strength, And may his light shine upon our path of righteousness.

In conclusion**, t**he ancient Indian astronomers did not possess any telescope. The observations were made with a naked eye by using suitable devices for measuring the angles. Therefore, their calculations were restricted up to the studies of moon, sun and few planets. Aryabhata meticulously calculated the orbits of planets and their periods of revolution around the Earth. He devised a method for determining the positions of planets at different times using elliptical paths rather than circular ones. This was a significant leap in understanding how planetary motion could be predicted with greater accuracy.

References

1. Ancient Indian Scientific Thought and Modern Theories, DK publication, 2019.
2. *Bhagavad Gita*
3. Bharadwaj, Sudhikant, 1991, Sūryasiddhānta: An Astro-linguistic Study, New Delhi: Parimal Publications
4. Data, Amartya Kumar, 2009, "Mathematics in Ancient India: Some Glimpses", in Bharatatattva, Kolkata: Ramakrishna Mission Institute of Culture.
5. Main characteristics and achievements of ancient Indian astronomy in historical perspective kripa shankar shukla hussainganj crossing, lucknow-226 001, India
6. S. Dasgupta, 1975. A History of Indian Philosophy. Motilal Banarsidass, Delhi.
7. S. Dasgupta, 1975. A History of Indian Philosophy. Motilal Banarsidass, Delhi.
8. S. Kak, 1990. Kalidasa and the Agnimitra problem. Journal of the Oriental Institute 40: 51-54.
9. S. Kak, 1998c. Early theories on the distance to the sun. Indian Journal of History of Science 33: 93-100.
10. Sastry. T.S.K. (1984). Vedanga-jyautisa of Lagadha, Ed. & Tr. Indian Journal of History of Science, 19 (3 & 4).