

Evolution Of Indian Concept Of Gravitation Upto BŪGOLA-KHAGOLA-VARṆANA

Dr. Sudip Chakravortti

Assistant Professor of Sanskrit
Sidho-Kanho-Birsha University

(Project Director of *An Analytical Study of Bhūgola-Khagola-Varṇanam*)

Email: sudip.chakravortti@gmail.com

Mrs. Barnali Banerjee

Project Assistant

(ICSSR sponsored minor project on *An Analytical Study of Bhūgola-Khagola-Varṇanam*)

Email: barnalipurulia@gamil.com

Acknowledgement:

This paper is being prepared as a part of the minor research project entitled - *An Analytical Study of Bhūgola-Khagola-Varṇanam* which is sponsored by the Indian Council of Social Science Research (ICSSR) vide its F . No. – 02/330/2017-18/RP/Minor Dated – 29-12-2017. Again, authors are indebted to the Sidho-Kanho-Birsha University.

Key Words: Svadhā Skambha Kṛṣṭī Akṛṣṭīśakti Dhāraṇātmikāśakti Gurutva-Ākarṣaṇa-Śakti Dhāraṇāśakti

Abstract:

The term, Dhāraṇātmikāśakti which is used by Vidyāsāgara in his *Bhūgola-Khagola-Varṇanam* stands for Gravitation. In the *Taittirīya-Saṁhitā* of *Kṛṣṇayajurveda*, we get the term – Kṛṣṭī. The *Siddhāntaśiromaṇi* of *Bhāskarācārya* used the term - Akṛṣṭīśakti. *Sūryasiddhānta* by *Āryabhaṭṭa* supported the use of Dhāraṇāśakti. And this Dhāraṇāśakti ultimately termed as Dhāraṇātmikāśakti by Vidyāsāgara in his *śāstrakāvya* on geographical description. The mentioned terms are somehow standing for the English word, Gravitation. A few millennium ago of Sir Isaac Newton (17th CE), the Indians (*Āryabhaṭṭa* - 5th to 6th century AD, *Varāhamihira* – 6th century AD, *Bhāskarācārya* - 12th century AD etc.) recorded gravitational pull. After that, Indic theory did not get esteemed advertisement. Vidyāsāgara somehow tried to reinforce this in his book. But, the high publicity of the West suppressed that very Indic theory related to gravitation with a very weighty lid.

Aims & Objective:

This paper intends to –

1. Represent the ancient concept
2. Find out the role of Sanskrit in representing scientific theories
3. Search for interrelation between geography and physics in respect of gravitation

Methodology:

This paper is mainly an analytical study which is based on primary and secondary sources which appear in the ancient Indian scientific literatures. To serve this purpose, the contributors have visited Sanskrit Sahitya Parishat, The National Library, The Asiatic Society etc. resource centres in Kolkata.

Brief Review of Literatures:

Most of us consider Sanskrit as language of rituals, ethics, religion and philosophy. But we forget that it bears intimate relationship with science, technology, astrology, astronomy, mathematics etc. Ancient Indian texts like Vedas, Brāhṃṇas, Upaniṣadas, Vedāṅgas, Epics, Purāṇas and Philosophical Sūtras and so on have contributed a lot for the development of scientific theories.

Nārada-saṃhitā speaks off eighteen antique scientists like – Brahma, Ācārya, Vaśiṣṭa, Atri, Manu, Paulastya, Lomasa, Marici, Aṅgirā, Vyāsa, Nārada, Śaunaka, Bhṛgu, Cyavana, Yavana, Garga, Kaśyapa and Parāśara.ⁱ We are also aware of the fact that Prof. A. A. Macdonell's observation about the development of cultivation of science in Sanskrit.ⁱⁱ After that we received the books of Āryabhaṭṭa, Varāhamihira, Bhāskarācārya etc. famous scientists to deal with various scientific approaches.

Context:

Sir Isaac Newton presently wins the place of inventor of *gravitation* theory in 165 AD by seeing the falling of apple from the tree. But, really it was invented by the Indians long ago. But, they are not able to draw the attention in that very field. Veda makes mention about this force. Vidyāsāgara also somehow spoke about the same in his *Bhūgola-Khagola-Varṇana*.

Main observation of the Indic science related to gravitational power are:

- Sir Isaac Newton anyhow cannot be considered to be the inventor of the theory of gravitation.
- Every single body in this universe attached with gravitational power.
- All planets are revolving around the sun.
- The nature of the motion of the planetary system.
- Day and night and seasonal changes are the resultant factors.
- The support-less Earth stays on its orbit due to pace and gravitation.
- The nature of the relationship among the Earth, other planets and the Sun.

Indian texts mentioned about gravitation:

In dealing with the creation, the second mantra of *Nāsadīyasūkta*ⁱⁱⁱ speaks off that except *svadhā* nothing was in existence. According to *Sāyaṇa*, *svadhā*^{iv} refers to that which exists depending on itself. Simultaneously, the force of stability and motion are represented by the *svadhā* which is one universal force that lead to creation which is nothing other than gravitation.

The term, *skambha* is available in *Atharvaveda*. According to *Pāṇini*, *skambhu* comes from root, *skambhu* or *skumbha* which means – arresting or holding or stopping which is supreme power or force and somehow identical with gravitation. Lord is called as *skambha*^v as because this force holds the whole universe. Therefore, the whole solar system and the movement of planets and secondary planets even satellites come under this preview.

All planets remain stable in their orbit due to a force or attraction towards the sun. They move for this attraction. And depending on distance, their speed increases or decreases proportionately. Here, the gravitational pull of Sun works a lot. In the mantra no. – 8.12.28 of *Ṛgveda*, we get few words like – *haryatta* (come closer through attraction), *varvṛdhate* (increases proportionately), *yemire* (remains stable).^{vi} These word reveal a power or force like gravitation control the solar system.

The *Taittirīyasahitā* of *Kṛṣṇayajurveda* announces that the Sun holds the Earth and it has a power of attraction.^{vii} The word, *kṛṣṭī* refers to the meaning of attraction. The suffix, *Ktin* is added with the word, *Kṛṣ*. The word, *Dyām* signifies the meaning of heaven. At present we are unable to find out a place which is called as heaven.

Then, the word, *Dyām* may be compared with the meaning of “celestial region.” Rotation and revolution of the Earth are resultant factors due to *gravitation*. The sun is compared with a magnetic element and the Earth is like iron based.

The *Praśnopaniṣad* which came into existence nearly about 6000 years ago, also talks about gravitation power. There is consultation related to *pañcapraṇa*. *Apāna* is one of them. This *apana-vayu* resides in anus and genitals.^{viii} The two words, *apa* and *ana* makes the word *apana* by means of grammatical process of *Sandhi*. *apa* stands for the meaning of downwards and the *ana* reflects the sense of carrying out. The function of this *apāna* is to throw out the things like – stool, urine, semen, menstruation blood etc. This is being nicely explained by *Śaṅkārācārya* in his *bhāṣya* of the said mantra. The God-like downward power or force is only responsible to out the stool, urine, semen, menstruation blood etc. as the things which go to downwards. In space, the astronauts considers the outing of stool, urine etc. in a different way. According to their concept, this happens due to the absence of gravitation or the presence of microgravity. The earth stays far away from the space. So, power of gravity gradually decreases herein.

Vaiśeṣikasūtra of *Kaṇāda* explains the falling rain as due to the lacking of conjunction with any force.^{ix} The loss of *gurutva* force causes the falling of rain. So, downward movement or falling anything causes in the lossing capacity of gravitation which has been stated by Isaac Newton in the fact of falling of apple. Whenever gravitation works in human body, it is *apāna* and simultaneously in rainfall it is *gurutva*.

From here, it is clear that in the nearby places of the Earth, the gravitation of the Earth becomes more powerful and attracts each and everything towards it. It may be from human body, or tress or any non-life element. When the gravitational power of other stars or planets decrease in the closer portion of the Earth, the gravitation of the Earth increases. But, the Earth itself can not stand against the gravitation of the Sun. So, it revolves round the Sun with a great speed on its axis.

Gurutva is one kind of force. For the first time, *Bhāskara* in his *Līlāvātī* told that the Earth *Gurutvakarṣaṇasakti*. *Gurutva* stands for *ākaraṣaṇa* or the attraction. Thus, it is evident that the gravitation is termed as *Gurutvakarṣaṇasakti* in Indian context. Thus, *Vaiśeṣikasūtra* also made mention or aware us about the existence of gravitation.

Patanjali in his *Mhābhāṣya*, strongly declared that anything which is thrown toward above, does not stay on the above. The thrown thing comes back towards the Earth. It does not come back in diagonal way. The diagonal coming is being felt, but it is unreal. It happens due to the movement and attraction of the Earth.^x So, *Patanjali* also was aware of the fact that the Earth has gravitation and it is revolving continuously.

One another great astronomer of India, *Āryabhaṭṭa* (5th to 6th century AD) in his *Sūryasiddhānta*, clearly stated that the Earth is a member of the *Viśvva-brahmaṇḍa*. His opinion is that the Earth stays in the centre of the *Viśvva-brahmaṇḍa* by its own force. So, the Earth itself bears a separate force for its own. This force is termed as – *Dhāraṇātmikāśakti*.^{xi}

In 12 century AD, one another great scientist of India, *Bhaskara* gifted a famous book, *Siddhāntaśiromaṇi* to the world. In that very text, two statements regarding the Earth's gravitational pull are seen.

In his opinion, the Earth stays in the sky without any support. But, it has an internal power.^{xii} Whole solar system, along with the planets and stars are roaming around on their orbit.

Another point mentioned by him is आकृष्टिशक्तिश्च गुरुत्वाभिमुखं स्वशक्त्या (*Ākṛṣṭiśaktiśca gurutvabhimukhṁ svasaktya*). Here term, *ākṛṣṭi* is identical with the attraction power of the earth. As a sequel to this, all celestial bodies are being powerfully attached and attracted towards the Earth. Every object nearer to this force is bound to be come under its preview.^{xiii} The eternal energy of the Earth, the *ākṛṣṭiśakti* is nothing other than the gravitational pull. *Bhaskara* is the pioneer in this regard.

Being inspired by *Āryabhaṭṭa* and *Bhaskara*, the great social reformer and Sanskrit scholar of India, *Paṇḍit Īśvaracandra Vandyopādhyāya* (*Vidyāsāgara* in 19th century AD) in his *Bhūgola-khagola-varṇana* represented his views. The *dhāraṇāśakti*^{xiv} is the gravitational pull of the Earth . It is being eventually established by him.

Āryabhaṭṭa in his *Sūryasiddhānta*, called the power of the Earth as *dhāraṇātmikāśakti*. In *Bhūgola-khagola-varṇana* this *dhāraṇātmikāśakti* is termed as *dhāraṇāśakti*. There lies no difference between *dhāraṇātmikāśakti* and *dhāraṇāśakti*. Both are similar. Only two separate authors in their two separate books stated the same conceptual theory with two terms which are more or less indifferent. But, their target was to indicate the gravitational pull.

On the overall analysis, it may be said that the Isaac Newton is not an exception. It is the continuation of earlier trend which gains its essence in India. But, unfortunately, the contribution of India is sagaciously ignored. The credit of invention of gravitation is only the

invention of ancient Indian scientist. Early oriental civilisation, especially the Indian civilisation was famous cultivation of science. The Indic science became deteriorated gradually due to various causes and the gush of time. Once again, thanks to ICSSR for providing this opportunity.

End Notes:

-
- i ब्रह्माचार्यो वसिष्ठोऽत्रिमनुः पौलस्त्यलोमसो मरीचिरंगिरा व्यासो नारदो शौनको भृगुः ।
च्यवनो यवनो गर्गः कश्यपश्च पराशरः अष्टादशैते गंभीरा ज्योतिः शास्त्रप्रवर्तकाः ॥
(Chapter – I, Verse – 2)
- ii “The debt of Europe to India has been considerable. There is in the first place, the great, fact that the Indians invented the numerical figures, used all over the world. The influence which the decimal system of reckoning, dependent on those figures has had, not only on mathematics but on the progress of civilisation in general, can hardly be over estimated. During the eighth and ninth centuries, the Indians became the teachers in arithmetic and algebra...” (The History of Sanskrit Literature, p. 424)
- iii अनीदवातं स्वधया तदेकं तस्माद्धन्य परः किं चनास ॥ (*R̥gveda*, X.129.02.)
- iv स्वस्मिन् धीयते ध्रियत आश्रित्य वर्तत इति स्वधा (*Sāyaṇabhāṣya* of *R̥gveda*, X.129.02.)
- v स्कम्भे लोकाः ... सर्वं समाहितम् ॥ (*Atharvaveda* – X.7.29)
स्कम्भो दाधार द्यावापृथिवी ... स्कम्भ इदं विश्वं भुवनमाविवेश ॥ (*Atharvaveda* – X.7.29)
- vi यदा ते हर्यत्त हरि ववृधते दिवेदिवे विश्व भूवानि आदित्य येमिरे । (8.12.28 of *R̥gveda*)
- vii मित्रो दाधार पृथिवीमुत द्याम् । मित्रः कृष्टीः ... ॥
(03.04.10 of *Taittirīyasahitā* of *Kṛṣṇayajurveda*)
- viii पायुपस्थेऽपानम् .. । (1st portion of mantra no. – 5, *Praśnopanisad*)
- ix संयोगोभावे गुरुत्वात् पतनम् .. । (*Vaiśeṣikssūtra* – 5.1.7)
- x लोष्ठक्षिप्तो बाहुवेगं गत्वा नैव तिर्यग् गच्छति ।
नोर्ध्वमारोहति पृथिव्विकारः पृथिवीवमेव गच्छति ॥
(*Mahābhāṣya* – 1.27)
- xi विभ्राणः परमां शक्तिं ब्राह्मणो धारणात्मिकाम् ।
(Verse no. – 32 of *Bhūgolādhyāya* of *Suryasiddhānta*)

- xii नान्याधारः स्वशक्तैव वियति नियतं तिष्ठतीहास्य पृष्ठे ।
तिष्ठं निश्चयं शश्वत् सदनुजमनुजादित्यदैत्यं समन्तात् ॥
(Verse no. – 2, Bhūvankośādhyāya of *Siddhāntasiromaṇi*)
- xiii आकृष्टिशक्तिशत मही तथा यत् स्वस्थं गुरु स्वाभिमुखे स्वशक्त्या
आकृष्यते तत्पततीव भाति समे समन्तात् पतत्वियं खे ॥
(Verse no. – 6, Golādhyāya of *Siddhāntasiromaṇi*)
- xiv विभ्राणाधारणाशक्तिमैश्वरीं परमाद्भुताम् ।
(Verse no. – 181 of *Suryasiddhāntamate Bhūgolaṽṛttānta* in *Bhūgola-khagola-varṇana*)

Reference Books:

- Basu, B.D. (Ed.). *Vaiśeṣika Sūtras of Kaṇāda (Volume - VI)*. Allahabad: The Pāṇini Office, 1928.
- Bhattacharya, Amit (Ed.). *Īsvaracandra-praṇīta Bhūgola-khagola-varṇanam*. Kolkata: Parul Prakashani Private Limited, 2016.
- Caturvedi, Mulalidhar (Ed.). *Siddhāntaśiromaṇi*. Varanasi: Sampurnanada Samskrita Viswavidyalaya, 1998.
- Joshi, Pandit Krdarnath (Ed.). *Siddhāntaśiromaṇi – Golādhyāy*. Delhi: Motilal Banarasi Das, 1988.
- Pandey, Ramachandra (Ed.). *Suryasiddhānta*. Varanasi: Chaukhamba Surabharati Prakashan, 2010 (reprint).
- Sen, Atulchandra (Ed.). *Upaniṣad – Akhaṇḍa Saṁskaraṇa*. Kolkata: Haraf Prakashani, 2013 (reprint).