

## Seminar on “Indian Philosophy & Gravitational Theory”

### Vedic Reflections on Gravitation

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#### *Summary*

Text books of Vedic Physics are not available to study their concepts of gravitation and hence Astronomic text books of the ancient periods are taken as secondary evidence for this study. Clear references of gravitational pull are available in the Astronomical works of as early as 6<sup>th</sup> century A.D. and they continue upto 12<sup>th</sup> century. Eventhough they new about gravitational pull of earth their understanding of the effects of this pull do not seem to be comprehensive. That is why they denied rotation of earth on her axis and tried to prove that earth is static in all respects. An attempt is made to trace out the reasons of this incomprehensive thinking on gravitation and it appears that the reasons are the apparently contradictory statements from Vedas. It is also proposed in this paper that the thinking of the scientists of the Pre-Siddhantic and Post-Mahabharata war period on gravitation is better as compared to that of the Sidhantic period.

**Key Words:** *Gurutva Aakarshna Shakti, Graha Panjara, Panchabhootamaya, Krishti, Dhruva Fish, Aakrishti Shakti, Superluminal , Serius, Elliptical Spiral.*

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The subject of Gravitation, as a matter of fact, belongs to physics and if we want to know the Vedic reflections on this subject, we have to browse, infact, the text books of Vedic physics. Unfortunately no text books on Vedic Physics are available today. As a result of which, we are forced to depend on text books of Vedic Astronomy, as a secondary source of information, since definite references about the gravitational pull of earth are available in them. As only a few books are left behind for us in this field also, our study in this direction may not be exhaustive and may not reveal the thinking levels of those days exactly. Yet, relying on the Ancient literature available as on today, a humble attempt is being made, in this paper, to trace the thoughts of Vedic Scientists of the Siddhantic and Pre Siddhantic periods of India.

At the out set, I would like to submit to the august galaxy of the scholars present here that I am not a proper person to speak on the captioned subject either from the modern angle or from the ancient angle. To speak from the ancient angle, one should be conversant with what is called the theoretical part (Siddhantha Bhaga) of *Jyothishya Shastra* along with many other relevant texts. Even though I don't have proper entry into these textbooks, I am commanded by the learned organizers to flash the glimpses of ancient thinking on this subject. With my meager acquaintance with the ancient wisdom of India, I will try to obey the commands.

Sir Isaac Newton is said to be the father of modern concept of gravitational pull. On seeing a fruit falling down from a tree, the story goes, Newton (17<sup>th</sup> century AD) got

the idea that earth must be similar to a magnet. After that, over these three centuries and odd, modern scientists have worked a lot on this and proved many things which are vital for modern science.

Paradoxically, the Indians had the thoughts of Newton, millenniums before. They recorded them, but further work in the line of gravitational pull did not seem to progress.

The words gravity and gravitational pull are generally translated into Indian languages as “GURUTVA AKARSHANA SHAKTI”. The word ‘*Gurutva*’ means ‘*mass*’ and ‘*Aakarshana*’ means ‘*attractive pull*’. The very name indicates that the ancient Indians observed some relation between the mass of a body and the gravitational pull.

The Taittiriya branch of Krishna Yajurveda says -

मित्रोदाधार पृथिवीमुतद्यां । मित्रः कृष्टी रनिमिषाभि चष्टे ॥

This means, the sun is holding the earth and the heaven in the space. The sun has the power of attraction (*kristheeh*) and shines without interruption.

The word “*Kristhee*” in the above sentence is derived from the root “*krish*” which has no other meaning, but attraction. Saying that the sun is holding the earth in the space through his power of attraction, implies that the earth also is a body with a different type of force of attraction. Otherwise, if the sun is like a magnetic ball and the earth is like an iron ball, they would have collided with each other long back. The same idea is reflected very clearly in the following famous Sloka of Varahamihira (6<sup>th</sup> century AD)

पंचभूत मयस्तारा , गणपंजरे महीगोळः ।  
ख्रे अयस्क्रांत लोह , इव अवस्थितो वृत्तः ॥

The ball of the earth which is made up of the five fundamental elements, is placed in the center of a cage, which is made up of the stars of the galaxy and hence it is hanging in the sky, like an iron ball in the center of a cage of magnetic balls.

The word “*Panchabhoota Maya*” in the above Sloka is important.

In the context of the solar system, our ancestors did not see the earth as a simple mass of mud. The globe of earth, the oceans, the air and the clouds around it put together, is treated as “*Bhugola*”.

Bhaskaraacharya (12<sup>th</sup> century AD) made this very clear in his “*Goladhyaya*” of Siddhanta Siromani.

भूमेः पिंडः शशांक ज्व कवि रवि कुजेज्यार्कि नक्षत्र कक्षा  
वृत्तैर् वृत्तो वृत्तस्सन् मृदनिल सलिल व्योम तेजोमयोयम् ।  
नान्याधार स्वशक्त्यैव वियति नियतं तिष्ठतीहास्य पृष्ठे  
निष्ठं विश्वंच शश्वत् सदनुज मनुजादित्य दैत्यं समन्तात् ॥

(सिद्धान्त शिरोमणि - भुवन कोशाध्याय श्लो . २)

This means that the earth is hanging in the space without any support, except her own internal energy (shakti), and the whole solar system is rotating around her, in specified orbits, while all the creatures like humans, demons etc are resting on her surface. Please note that adjective given to the earth in this Sloka is मृदनिल सलिल व्योम तेजोमय.

मृत् = mud  
अनिल = air  
सलिल = water  
व्योम = space  
तेजस् = light.

All these put together is the earth.

Another point to be noted in this Sloka is that the earth is hanging in the space only by virtue of her own energy.

But what is that energy? Bhaskara himself answers in the subsequent Sloka

आकृष्टि शक्तिश्च मही तया यत्  
स्वस्थं गुरु स्वाभिमुखं स्वशक्त्या ।  
आकृष्यते तत्पततीव भाति  
समे समन्तात् क्व पत्त्यिं खे ॥ (श्लोक - ६)

The energy within the ball of earth is *aakrushti shakti* “attraction”. Because of this attractive force, the earth pulls a piece of any thing in / on her (*svastham*) towards herself and this power is her own and natural to her. Because of this pull, every object on this earth appears to be falling down. Bhaskara did not stop here. He concludes the Sloka with the question, where can this earth fall down in space?

In the subsequent Slokas, he refers to a group of scholars who proposed that the earth is always falling down, eternally, in the space. The idea of this group is as follows. Since every heavy object is traveling in a downward direction, and since the earth is heaviest of all other objects on the earth, she must be traveling down with a greater speed. Since the space is endless, the travel of earth also endless and since this travel is natural to the living beings on the earth’s surface, they are not able to feel it.

Bhaskara quotes this school of thought and offers the following arguments -

He starts with one assumption that, heavier substances fall down with a greater speed as compared to lighter ones. Suppose an arrow is shot up, it goes up to some extent and then starts falling down. At this moment, since the earth is traveling down, and since the earth is the heaviest of all other objects on the earth, hence her speed must be the

greatest. Consequently the arrow can never meet the earth. But it is meeting the earth. So, we should accept that the earth is not falling down.

We, today, do not accept that heavier objects fall down with greater speed and that bodies fall down to the lower levels with an acceleration, which is governed by the formulae  $F = \frac{GMm}{r^2}$  and  $a = \frac{v-u}{t}$

Bhaskara gives one more argument to support his theory. He says that for a person standing on the northern hemisphere of the earth, the word 'downward' means a direction from his head to feet. At the same moment, for a person who is standing on the southern hemisphere the same word means exactly opposite direction. Now, if the earth has to travel in a down ward direction, she has to go which way? So, it is meaningless to say that the earth is traveling down.

Bhaskara gives a third argument which is more technical in nature. Suppose the Sun is in the star "Bharani". On such a date, at the time of sunset, the face of the *Dhruva fish* (fish shaped group of stars around dhruva the pole star) moves to the western direction. The next morning when the Sun rises in the east, the face of Dhruva fish, turns to the eastern side. This can be clearly observed by any body. If the earth is falling down, the same Sun, who was on the western end of the *Dhruva fish* yesterday, cannot appear on the eastern end of the same fish in a gap of 12 hours. If that is the case, we may have to agree that there are two Suns, which is absurd.

So, Bhaskara concluded that it cannot be said that the earth is falling down. Only due to the attractive pull of the earth, objects are falling towards the surface of the earth.

Aryabhata who belongs to the 5<sup>th</sup> century AD holds the same idea and says that only because of power of attraction, the living beings in different locations of earth are not being scattered away into the space. He says –

यद्वत् कदंबकुसुम  
ग्रंथिः प्रपंचितः समन्ततः कुसुमैः ।  
तद्वद्विष्वक् सत्त्वैर्  
जलजै रस्थलजैश्च भूगोलः (गीतिकापाद - श्लो ७)

Kadamba flower is a peculiar one. Each flower is a cluster of co-centric smaller flowers, all of which put together make a ball like single flower. Aryabhata says, just as the smaller flowers of the Kadamba flower are tied to the center of the cluster, all the water living, the surface living and the sky living creatures are tied to the center of the earth .

By this poetic expression, Aryabhata of the 5<sup>th</sup> century AD, indicates that the center of gravity of the earth is at her own centre.

Even though, such clear indications of the knowledge of gravitational pull are available in India 5<sup>th</sup> century it self, strangely, we find a lot of confusion as regards to the spin moment of the earth.

All the famous textbooks on Jyotisha, from Suryasiddhanta to Bhaskara, confirm that the earth is static in all respects and it is the solar system which is rotating around her. All of them say that some people are thinking that the earth is spinning in eastward direction and then dismiss this postulation as absurd. The set of reasons for this, proposed by them, is almost the same. The main points in their arguments are as follows.

- 1) If the earth is spinning towards the east direction, this spin should generate a constant flow of winds towards the west. As a result of this, all flags and clouds in the air should always flow towards western side, which is not a reality.
- 2) If an arrow is shot vertically, it should fall towards the west side of its point of origin.
- 3) A bird, which traveled towards the west of its nest, could have never returned back.
- 4) And some more points of the same category.

All these points clearly indicate their lack of understanding of the effects of gravity. Even though they say that the earth includes not only mud, but also the air and the light around it, it seems that they are not able to extend the same of logic, in studying the gravity.

Strangely, none of them names the one who proposed the spin to the earth. If we go back, we find that Veda itself mentions the spin moment of the earth -

आयं गोः पृश्चिन्न रक्रमी दसनन्मातरं पुनः। पितरं च प्रयन्सुवः ॥

This is a mantra which is available in all the four Vedas. This mantra refers Surya as the father (i.e. a bull), earth as the mother (i.e. a cow) and the moon as the son (i.e. a calf). By this simily the mantra indicates that the moon is rotating around the earth and the earth is rotating around the Sun. There are some more mantras in Rigveda, which clearly indicate that the earth is spinning. Some more statements in Veda say that the Sun is also rotating in an orbit. For example:

त्रिनाभि चक्र मजर मनर्वं येनेह विश्वा भुवनानि तस्थुः ॥

This mantra which is available in all the Vedas clearly indicates that the Sun is rotating in an elliptical orbit. Trinabhi chakra means an elliptical orbit. (The main center & the other two force on either side)

अपश्यमहमेत त्सूर्यं मंडलं परिवर्तमानं गार्ग्यः प्राणत्रातः ॥

This is a mantra from Aruna Prashna of Krishna Yajurveda. This is a statement by a sage, by name Pranatrata, who was the son of Gargi. He says “I have seen the Sun rotating in an orbit.”

On the other hand there are other more mantra from “*Taittiriya Brahamana*” 2<sup>nd</sup> kanda, 8<sup>th</sup> Prashna.

भूरिद्वे अचरंती चरंतम् पद्वंतं गर्भमपदीदधाते ॥

This means that both the space and the earth are motionless and they do not have legs. But they give birth to those creatures which have motion and legs.

Such apparently conflicting and contradicting statements of Veda might have created some confusion in the minds of the scholars of the medieval period. By the term 'medieval period' I refer to the post Mahabarata war period. It is very clear to the historians of ancient India that there was a gulf of gap in the process of the flow of knowledge after the Mahabarata war. Even though Vyasa Maharshi made some efforts to keep the knowledge flow intact, the efforts do not seem to be totally successful. The situation worsened with the growth of Buddhism, during which period developed a tendency to counter and condemn whatever was Vedic. After a gap of around 3000 years, Sri Shankaracharya emerged and revived the spiritual side of knowledge. But the material side of the Vedic knowledge remained buried. During those shaky periods, original Indian brain started reworking and tried to bridge the gaps. It is during those periods, that genius people like Aryabhatta, Varahamihira, Brahma Gupta, Bhaskara etc sprouted up. I sincerely feel that is because of this reason viz., the gap of flow of knowledge the scholars of that day could not comprehend and correlate the seemingly contradicting statements from Veda and in the effort of redeveloping a Vedic science, they preferred to make the earth as the centre of whole Universe and the Solar system and then correlate the other astronomical calculations found in the available Vedic texts and their commentaries. Since their stress was more on astronomical calculations and such calculations depend totally on the relative speed of celestial bodies, their calculations never went wrong, but when it came to the question of gravity, it seems that medieval mathematicians missed a few points.

To justify my thought, I would like to take the support of a passing reference of Yogavashishta of Valmiki Maharshi. Even though the time of origin of Yoga Vashishta is not a definite one and the modern historians prefer to say that it is not a work of Valmiki, nevertheless, it must be a work belonging atleast to the post Mahabarata war period. It is a textbook of philosophy and it has not much to do with material sciences. But, in one context of the Utpatti Prakarana of the said book, there are two Slokas which are relevant to our context -

अस्वातंत्र्यात् प्रधावन्ती पदार्था सर्वएव यत् ।

ब्रह्मांडे पार्थिवो भागः तदधस्तूर्ध्वं मन्यथा ॥

The Sloka says that it is not right to say that every object in this earth falls down. The fact is that, every element of this Universe has an intrinsic quality of attracting other objects of its own class, and repelling those of other classes. The term 'element' here means element of Panchabutras. In the subsequent elaboration, the author takes the example of the falling fruit.

He says that, since the fruit is a smaller part of the earth, it is attracted by the earth and hence it travels towards earth. It is neither going down nor up. It is going towards earth.

To establish this statement, the poet gives another example. Take a ball, which is hanged in the space by the help of a small thread. Send some ants onto the ball. They will walk all around the ball in a zigzag way. Now, you enter into the minds of the ants and search for a downward direction. Every ant says that his legs are in the downward direction and his back is towards the upper direction. Which ant is right and which is wrong? No one can decide. So, there is nothing like a downward or upward direction. There is only a travel of an object towards another object of its own class. This is the essence of the Sloka quoted above and its subsequent Slokas in the text. Interestingly the same example is repeated in Surya Siddhanta.

After this discussion, Valmiki Maharshi tookup the following Sloka.

प्रत्येकस्यांड गोळस्य स्थितः कटक रत्नवत् ।  
भूताकृष्टि करो भावः पार्थिवः स्वस्वभावतः ॥

In this sloka he takes the question, if every element of *panchabhutas* has a quality of repelling the other *bhutas*, how is it that water, air and fire are also available on the surface of the earth itself. He says that the other elements on the earth are studded in her, just like a few gems in a big golden bangle. What he means is this. The panchabhutas available to us are not pure ones. They are intermixed by a process called “*panchikarana*.”

Hence, every particle in this Universe has a few traces of other elements also with in itself. Hence, the earth cannot totally repel other elements living on her surface. That is why they stay there, just like studded stones in a bangle.

If it were a piece of her own category, that would not have remained like a stone in a bangle, but it would have been totally absorbed in the earth in due course. That means, the power of attraction between two atoms of the same category is maximum and this fact is expressed by the word भूताकृष्टि करो भावः in the above Sloka.

This statement straightaway reminds us about the most recent EPR paradox, which was established by Einstein and others and its subsequent development by Dr. Bell. According to Bell’s theorem, it was proved experimentally that two atoms of the same category, separated by seven to eight lakh miles, behave as if they are inter connected. They have termed this connection as “superluminal”.

I am not sure weather Valmiki Maharshi had a clear idea of this superluminal effect or not. But, it is very clear that Valmiki’s understandings of the principle of gravity is subtler and more logical than that of the medieval Vedic scientists.

Now, we can reconsider the theory of falling earth also, from a different angle. According to modern concept of cosmos, no celestial body is static in space. Each and every celestial body is rotating about itself and also about another heavier one, nearby. The earth does so about sun. Like wise, the sun also is revolving about a celestial body named by scientists as “SERIUS” . As such, the entire solar system is to be considered as rotating about that ‘Serius’.

That being so, the locus of Earth in space, or of any other member of the solar system, can not be considered as a simple ellipse ( which is a closed conic). It may , for the time being, be assumed to be an Elliptical spiral. The statement that the orbit of Earth is elliptic is only relative and limited to the solar system – only under the assumption that the Sun is static – which is not a reality.

That being so, we have come, in some other path, near to the concept of earth's falling down. As falling down or jumbling up or sliding aside are only relative and are of same category in our space, since we can not dismiss the falling down concept in toto. On the other hand, as the concept is countered by scholars as earlier as Aryabhata, it is clear that the concept is more ancient. Hence, it is more likely that it may have its roots in the Veda. We have to search.

I would like to raise one more point, before I conclude. In one of the Veda Mantras that is quoted just now, it is said that

भूरिद्वे अचरंती चरंतम् पद्वंतं गर्भमपदीदधाते ॥

In this Mantra it is said that space also has no motion. How does this statement make a sense?

But, we have, in our modern cosmology, the famous theory of expanding Universe. If we accept that expansion also is a type of motion, we have to accept that there is motion to space also. This implies that there is a conflict between the Vedic verse ( as we understand now) and the modern concept. One thing is sure, whether the universe is expanding or not, our knowledge of Universe is certainly expanding. And in its limiting case, it may even coincide with the Vedic idea. Or, we may get more literature and evidence to understand the Vedic statements in a better way. We need not deny any of these possibilities. This aspect deserves serious and sincere further study.

In the philosophical parlance, the gravitational pull is compared to the attractions and repulsions between two individuals on one hand and those between a soul (jeeva) and his body or the sense organs and the sensory objects on the other hand. However, that may not be much relevant for a scientific study of the principle of gravity. This may be more relevant from the angle of philosophy. But, today, knowledge on this side also is not available comprehensively.

Unfortunately the tender plant of Vedic knowledge, which was resprouting during the days of medieval periods, faced several more deadly blows during the subsequent periods of history. As a result of this, we are deprived of that meager treasure also. It is for this reason, we in the I-SERVE, are trying to trace back our lost treasures, up to the Vedic periods. This is a search and research for the sake of that treasure which equally belongs to us all.

I take this opportunity to make a call for helping hands to carry out this onerous but pious job.

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