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Laws of Gravitation and Motion in The Ancient Indian Texts

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Abstract

In this study, various verses from the Vedic Texts, which directly explains the fundamental laws of Gravitation and Motion in physical science are summarized. The correlation of each verse (mantra/ shloka) to the existing fundamental theory of Physical science shows the compatibility of Physical science with the Vedic Texts and we hope that the thorough analysis of all these ancient texts may open door to many probable insights to the undiscovered fundamental laws of basic science and its applications.

Keywords: Gravitation, Laws of Motion, Physical Science, Vaisheshika Sutra, Veda

1 Introduction

The theories of Physical Science have always been of utmost importance to humankind, as these laws have shaped the way human life has progressed over the years. The laws and theories of physical science have fundamentally influenced the advent of the technologies and the development of modern science [1].

Ancient Indian scriptures, such as the Vedas, Upanishads, and Puranas are known for their philosophical and spiritual insights, as well as observations about the natural world. In the Vedic Texts, everything in the universe is seen as interconnected and interdependent. Similarly, in Physical Sciences, the behavior and nature of the particles are interdependent, be it the particles of smaller dimension or the particles with larger dimensions. Another similarity between the two is their emphasis on the role of consciousness in shaping reality. In the texts pertaining to the Vedic period,

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consciousness is believed to the root of everything, including the creation of the universe. Similarly, in Physical Sciences, the act of observing a particle can change its behavior, suggesting that consciousness plays a role in shaping physical reality [2].

It is a significant observation on the part of the researcher is that the concepts underlying the theories of physical science are very much in agreement to the ideas expressed in the holy texts of ancient India, namely the Vedas, Upanishads, Puranas and other notable ancient Indian texts.

However, the fundamental concern that arises is that whether we can make any comparison between an exact science and spiritual ideas, which is the crux of Hindu philosophy. The authenticity of the translation of the verses of the ancient Indian Text that are written in the Sankrit language to the theories of Physical Science which are basically accepted in the English language worldwide is also a challenging task. The spiritual insights are often not completely expressible verbally, rather they pertain to some wonderful and amazing experiences of the inner self of a person. On the other hand, the theories of Physical Science are based on Experiments performed in the physical world. Often, mathematical equations are used to explain the outcomes of an experiment, which ultimately helps a scientist to formulate a theory. However, any scientific experiment is limited by different sources of error and there may arise the scope of an alternate explanation to the results of an experiment. In the words of Werner Heisenberg “every word or concept, clear as it may seem to be, has only a limited range of applicability.” While the intuitive element of a scientist comes handy for a researcher pursuing scientific research, the scientist prefers to follow the standard scientific method while navigating through his research. Similarly, the thoughts expressed in the verses of the ancient Indian texts are also governed by the quench for finding out the truth and to be able to give a rational explanation to the findings around us [3].

Not only the fundamental theories of Physical science, but also the key concepts behind the modern technologies developed by the scientists are already mentioned in Vedas, Puranas and Upanishads [4]. It is seen that these ancient texts contain many scientific truths, as explained by many scientists as well as spiritualists. However, even though the Vedic Texts contain so many scientific truths, the technology of Western world is proven to be more reachable to the masses as well as authenticated than that of

Eastern World. Most of the fundamental scientific discoveries are credited to the scientists of the Western countries. The underlying reason for this may be lack of awareness among the people to study the ancient texts carefully, analyze them, publish and authenticate the discoveries mentioned in the Vedic Texts. It is heartening to observe that over the last decade, more thorough studies of the Vedas and Upanishads are given importance to find answers to various unexplored and complex scenarios of the human life. Exploring the vast ancient Indian Texts can be extremely helpful in finding solutions to the complicated and unsolved situations of the world.

Keeping this objective in mind, in this paper, the correlation of the fundamental theories of motion and gravitation in Physical Science with reference to the mantras and shlokas of Vedic Texts are analyzed and presented.

2 Brief Outline of the Vedic Texts

Vedas and Upanishads

Vedic and Upanishadic thoughts are directed towards enquiry into the nature of truth. Not only that, the Vedas are also the discovery of truth, the laws of nature, the universe, and beings thus leading to ultimate truth (the enquiry into truth means the discrimination and determination of “real” and “unreal”). The Vedas are supposed to be “apauruseya granthi”, meaning not authored by man. These were revelations of the ultimate masters/sages while they were in deep meditation. The Vedas are believed to be the sacred scripture originated around 1500 to 500 BCE which originated through oral tradition passed down through generations as a Guru (Teacher)- Shishya (Student)- Parampara (Tradition). The word "Veda" comes from a Sanskrit word that with the meaning "knowledge". The Vedas are written in Classical Sanskrit language and are the oldest layer of Sanskrit literature. The four Vedas are Rigveda, Yajurveda, Samaveda, and Atharvaveda [5].

The Upanishads are the last component of the Vedas and are esoteric texts that emphasize philosophy and spiritualism. The word ‘Upanishad’ means "sit down carefully" which implies that the shishya should pay close attention to the Guru and memorize the verses. The Upanishads were written between 700 and 400 B.C.E in

Classical Sanskrit and convey religious teachings and ideas that are mostly based on philosophy [5].

The Vedas provide information about the origins of existence and one's reaction to it, while the Upanishads emphasize knowledge of the ultimate identity of all phenomena. The primary content in the Vedas are significant to the ritualistic details of worshipping the Gods/deities, while the Upanishads emphasize spiritualism and philosophy through the enchanting method of storytelling. The philosophical ideologies arising from the study of the Vedas and the Upanishads deal with going deeper into the understanding of reality, mind and the self. The study of these texts help an individual to hold a grasp of the way the universe functions based on observation and reasoning. Moreover, these studies help in the spiritual growth of an individual providing an excellent framework for moral comfort and intellectual courage [6].

Vaisheshika Sutra

The founder of the Vaisheshika school of Indian philosophy, Acharya Kanada, also known by the name Mahsrshi Kashyap, contributed a lot to the development of the ealiest Indian Physics. During the 6th century B.C., he formulated the theory of atoms, which is considered to be the basis of the atomistic approach to Physics and Philosophy. The ideas put forwarded by Maharshi Kanada are collectively known as Vasisheshika Sutra or Aphorisms of Kanada. According to this great saint, the characteristics of all that can be conceptualized and hence named and defined in the world through comparison and contrast, is the science of Vaisheshika [7].

Maharshi Kanada was one of the earliest persons in the world to investigate the way atoms and molecules behave. He was the first saint who proposed that “Paramanu” (atoms) is an eternal particle of matter. Everything that is a part of the entire universe is consisting of “Paramanu” (atoms). He propounded that, when the matter is divided and subdivided till a stage is reached beyond which no division is possible, what remains is the “Pramanu” (atoms). According to him, this indivisible and indestructible “Paramanu” (atom) cannot be sensed through any human organ. However, the movement of the atoms is responsible for the effect of motion involving observables (matter), and Maharshi

Kanada offered a consistent framework for describing the motion involving physical entities in terms of certain laws [8].

Maharshi Kanada also gave the concept of biatomic molecules and triatomic molecules ("Dvyanuka" and "Tryanuka") by stating that atoms of the same substance can be united with each other under certain conditions. He also gave the concept of chemical changes involving the atoms under certain factors such as heat, light or collisions.

The Vaisheshika sutra consists of 10 chapters with two sections each involving 370 sutras in total. The first chapter defines and discusses the three categories of substance, solid, liquid and gas, their attributes and their behaviours or actions. The second chapter describes the nine substances, while the third chapter deals with the self and the mind. The first part of the fourth chapter describes of the eternality of atoms and how sensory perception leads to acquisition of knowledge, while the second part of the fourth chapter deals with the composition of the physical bodies. The fifth chapter deals with actions involving the physical bodies, and the sixth chapter deals with the way of life that facilitates acquisition of knowledge. The seventh chapter explains the properties of atoms and further discusses the nature of ether, mind, space and time. The eighth and ninth chapters describe certain concepts psychology, like various types of cognition and negation, which contributes to the overall development of the personality. The tenth chapter discusses cause and effects of the actions of the physical entities under different conditions. Thus, the Vaisheshika Sutra encompasses a systematic exposition of principles and laws to describe the behaviour of the physical world [9].

Later many scholars came up with their own elaboration or explanataion for the Vaisheshika Sutra. One of those scholars is Prashsaptada, who wrote two books namely 'Padartha-dharma-sangraha' (collection of [roperties of matter) and a commentry 'Prasastaptada Bhasya'. In these texts, the properties of motion are discussed by Prashaptada. 'Prasastaptada Bhasya' may also be considered as an independent compendium of the tenets of the Vaisheshika School of Philosophy [10].

3 Concepts of Gravitation in the Vedas

The natural phenomenon by which all things having a mass or energy are brought towards each other is known as gravity or gravitation. Gravity is the reason why the

universe exits. Gravitational force or gravitational interaction is one of the four fundamental force or interaction, and is the weakest of them all. That is why gravity has no significant influence at the level of subatomic particles, but it is the most significant interaction between objects at the macroscopic scale. Thus, gravity determines the motion of planets, stars, galaxies, and even light. The famous scientist Sir Isaac Newton is credited with the discovery of the fundamental law of Gravitation, which he explained in his ground-breaking book called Philosophiæ Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy). In this book, Newton described gravitation as a universal force, and claimed that "the forces which keep the planets in their orbits must be reciprocally proportional as the squares of their distances from the centers about which they revolve." [11]

In this section, we have correlated and summarize the laws of Gravitation, which are mentioned in the holy Vedas.

Table 1. Laws of Gravitation as mentioned in the holy Vedas.

Veda Mantra	Meaning
1) Rig Veda 2.11.20 अ॒स्य सु॑वा॒नस्य॑ मन्दि॒नस्त्रि॒तस्य॒ न्यर्बु॑दं वावृधा॒नो अ॑स्तः । अव॑र्तय॒त्सूर्यो॒ न च॒क्रं भि॒नद्बलमिन्द्रो॒ अङ्गि॑रस्वान् ॥	"Indra had destroyed Arbud by attaining progress by the trita, who was pleased and squeezing the som. Just as the Sun moves the wheel of his chariot forward, Indra, with the help of the angiras, wielded his vajra and destroyed the force." "The sun rotates like a wheel on its axis and the existence of the solar system is due to the Gravitational law of attraction and Gravitational force." [12]
2) Rig Veda 10.149.1 स॒वि॒ता य॒न्त्रैः पृ॑थि॒वीम॑रम्णाद॒स्कम्भ॒ने स॑वि॒ता द्याम॑दृंहत् ।	"The sun has bonded the Earth and other planets through attraction and moves them around itself as if a trainer moves newly

अश्वमिवाधुक्षद्धुनिंमन्तरिंक्षमतूर्ते बद्धं संविता संमुद्रम् ॥	trained horses around itself holding their reins." [12] "As a trainer moves the horse around him in circle by holding their reins, similarly Earth revolves around the Sun in an orbit, with the Sun at the centre. Similar to the rein of horse, there is a force of attraction between the Earth and the Sun, which is known as gravitational force, which allows Earth to revolve around it. The same sun is also the reason why humans enjoy the rain."
3) Rigveda 10.22.14 अहस्ता यदपदी वर्धत क्षाः शचीभिर्वेद्यानाम् I शुष्णं परि प्रदक्षिणिद् विश्वायवे नि शिश्नथाः II	"This earth does not have hands and legs, still it can move ahead. It moves around the sun. All the objects on the Earth also move along with it." [12] "Earth revolves around the Sun."
4) Rigveda 1.35.9 हिरण्यपाणिः सविता विचर्षणिरुभे द्यावापृथिवी अन्तरीयते। अपामीवां बाधते वेति सूर्यमभि कृष्णेन रजसा द्यामृणोति॥	"The Savita (light energy), with its hands of gold Savitā travels between the heaven and earth, while connecting everything together, diminishes diseases, approaches the sun, and overspreads the sky with brilliant radiance." [12] "Sun orbits in its orbit in the galaxy, holding earth and other heavenly bodies in such a manner that they do not collide with each other by the force of attraction."

5) Rig Veda 8.12.28 यदा ते हर्यता हरी वावृधाते दिवेदिवे । आदित्ते विश्वा भुवनानि येमिरे ॥	"When your beloved horses had augmented day by day, then all existent beings were subject unto you." [12] "The glorious sun, by putting forth his powerful rays, which possess the properties of attraction, illumination and motion, keeps all the worlds in order through the force of his attraction."
6) Rig Veda 8.12.30 यदा सूर्यममुं दिवि शुक्रं ज्योतिरधारयः । आदित्ते विश्वा भुवनानि येमिरे ॥	"O God! You have created this Sun, which possess infinite power. You are uploading the Sun and the other spheres (planets) and you render them steadfast by your power of attraction." [12]
7) Rig Veda 1.164.13 पञ्चारे चक्रे परिवर्तमाने तस्मिन्ना तस्थुर्भुवनानि विश्वा । तस्य नाक्षस्तप्यते भूरिभारः सनादेव न शीर्यते सनाभिः ॥	"All beings abide in this five-spoked revolving wheel; the heavily-loaded axle is never heated; its eternal compact navel is never worn away." [12] "Sun moves in its orbit which itself is moving. Earth and other bodies move around sun due to force of attraction, because sun is heavier than them."
8) Rigveda 5.81.4 उत यासि सवितस्त्रीणिं रोचनोत सूर्यस्य रश्मिभिः समुंच्यसि । उत रात्रींमुभयतः परीयस उत मित्रो भवसि देव धर्मीभिः ॥	"Either you traverse, Savitā (light), the three regions, or combine with the rays of Sūrya (sun); or you pass between the night on either hand; or you, divine Savitā are Mitra, through your benevolent functions." [12] "The gravitational effect of solar system makes the earth stable. The axle of the

	Earth does not get rusted, the Earth continues to revolve on its axle.”
9) Atharvaveda 4.11.1 अ॑न॒ड्वान्दा॑धार पृथिवीमुत द्यामनड्वान् दाधारोर्वन्तरिक्षम् I अनड्वान् दाधार प्रदिशः षडुर्वीर्नड्वान् विश्वंभुवनमाविवेश ॥	“God (Sun) has held the Earth and other planets, the way a bull pulls a cart.” [13]
10) Yajurveda 33.43 आ कृ॒ष्णेन॒ रज॑सा॒ वर्त्त॑मानो नि॒वेश॑यं॒न्नमृ॑तं॒ मर्त्यं॑ च । हि॒र॒ण्ययें॑न सवि॒ता र॒थे॒ना दे॒वो या॑ति॒ भुव॑नानि॒ पश्य॑न् ॥	“The sun moves in its own orbit in space taking along with itself the mortal bodies like earth through force of attraction.” [14]

4 Concepts of Gravitation in the Vedas

Sir Isaac Newton, who is credited with the three fundamental laws of motion involving all physical bodies, are the basis of understanding how a force acts on a physical object and how different bodies in motion interact among themselves. Newton’s first law states that “Every object will remain at rest or in uniform motion in a straight line unless compelled to change its state by the action of an external force.” This tendency to resist changes in termed as ‘inertia’. If all the external forces cancel each other out, then there is no net force acting on the object. If there is no net force acting on the object, then the object will maintain a constant velocity. Newton’s second law states that “The acceleration of an object depends on the mass of the object and the amount of force applied.” This law defines a force to be equal to change in momentum (mass times velocity) per change in time. Newton’s third law states that “For every action in nature there is an equal and opposite reaction.” Whenever one object exerts a force on a second

object, the second object exerts an equal and opposite force on the first. In other words, forces result from interactions [11].

Hence the idea of inertia, acceleration and force are of utmost importance for the understanding of any theory or experiment involving mechanics. The concept of acceleration is identified as the basic building blocks of scientific theories that are highly successful in explaining and predicting observable phenomena. The ability to apply this concept correctly is an essential prerequisite for any scientific work [15].

In this section, the researcher has summarised the laws of motion as mentioned in the Vaisheshika Sutra.

Table 2. Laws of Motion as mentioned in Vaisheshika Sutra.

1) Vaisheshika Sutra 1.1.11 कर्मं कर्मसाध्यं न विद्यते॥ [10] [16]	"From motion, new motion is not known".
2) Vaisheshika Sutra 1.2.1 कारणाभावात्कार्याभावः [10] [16]	"In the absence of cause, there is an absence of effect (motion)."
3) Vaisheshika Sutra 5.2.7 संयोगाभावे गुरुत्वात् पतनम् [10] [16]	"In the absence of conjunction, gravity causes objects to fall."
4) Vaisheshika Sutra 1.2.7 सदिति यतोद्रव्यगुणकर्मसु सा सत्ता॥ [10] [16]	"Existence is self-defined. Thus, substance, attribute, and motion are potential (sattā)".
5) Vaisheshika Sutra 5subhaskak.2.8 नोदनविशेषाभावान्नोर्ध्वं न तिर्य्यग्गमनम् [10] [16]	"In the absence of a force, there is no upward motion, sideward motion or motion in general."
6) Vaisheshika Sutra 5.2.17 नोदनादाद्यभिषोः कर्म तत्कर्मकारिताच्च संस्कारादुत्तरं तथोत्तरमुत्तरञ्च्	"The initial pressure on the bow leads to the arrow's motion; from that motion can have momentum, from

[10] [16]	which is the motion that follows and the next and so on."
7) Vaisheshika Sutra 1.2.14 कार्य्यविरोधि कर्म [10] [16]	"Action (kārya) is opposed by reaction (karman)."
8) Praśastapāda Bhāṣya, (a commentary on Vaisheshika Sutra) वेग: निमित्तविशेषात् कर्मणो जायते [10] [16] [17]	"The change of motion is due to applied force."
9) Praśastapāda Bhāṣya, (a commentary on Vaisheshika Sutra) वेग निमित्तापेक्षात् कर्मणो जायते नियत्दिक् क्रिया प्रबंध हेतु [10] [16] [17]	"The change of motion is proportional to the motive force impressed and is made in the direction of the right line in which the force is impressed."
10) Praśastapāda Bhāṣya, (a commentary on Vaisheshika Sutra) वेग: संयोगविशेषाविरोधी [10] [16] [17]	"To every action there is always an equal and opposite reaction."

5 Conclusions

Vedas are often mentioned as Anadi and Sanatana, which means Vedas are eternal and has no beginning and end. Further, it is a fact that Vedas were revealed to the world at the very ancient period of time, by the great Rishis of our Nation. Hence, these Rishis are often called as Mantra Drushta, i.e. who has seen the Vedic Mantra and not as Mantra Karta i.e. the creator of Veda Mantra. This is because Veda Mantra is in subtle form and these Rishis realised and experienced them through their penance and for the benefit of mankind, they revealed them to the world. Thus, even at the remotest antiquity itself, our Rishis clearly explained the cosmology and the process of creation of our Universe in a

better and complete manner. Hence, these Rishis can be called as Rishi Scientists. Thus, all these narrations clearly prove the greatness of our Nation and our ancestor's admirable and adorable high knowledge and wisdom. An analysis and thorough study of all these ancient texts can surely open door to many insights to the yet undiscovered fundamental laws of physical science and its applications.

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