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Physics in Ancient India: An Introspective Study

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ABSTRACT: *Ancient India is the origin of so many inventions and discoveries of today's modern science and technology of the world. Many modern philosophers and scientists have taken the idea from our ancient religious books and epics for their discoveries and inventions. She was the hub of knowledge of all disciplines. What is thought today by the world, ancient Indians did it in the Vedic period? The objective of the study is to search some contributions of ancient India for the development of physics. This study is a descriptive type of research based on secondary data gathered from Indian ancient books, epics, articles, websites, and web-based journals.*

KEYWORDS: *Inventions and discoveries, Science and technology, Philosophers and scientists, Vedic period*

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I. INTRODUCTION

The world's first University was established at Takshila in India in 700 BCE where more than 10,500 students from all over the world studied in more than 60 subjects. Next, the University of Nalanda built in the 4th century BCE was one of the greatest achievements of India in the field of education. During the Vedic period, India had reached its zenith in all fields of education especially in science. But the present world is unaware of this fact and the contribution of ancient India to the field of science and technology. The causes of deterioration of India's strength in discoveries/inventions are very complicated. Why this has been happened is more difficult to unravel. This is due to the fact that all the discoveries/inventions and ideas were either destroyed or stolen or due to a lack of proper documentation. Our theories are used as a base for many modern concepts such as weather forecast, Astronomy, Aviation, Mathematics, Physics, Chemistry, etc. India had produced some of the world-class mathematician (Aryabhata), physicist (Rishi Bhaskaracharya), astronomer (Varahamihira), chemist (Nagarjuna), Cosmology related (Rishi Kapil), aviator (Bharadwaja), surgery-related (Sushruta), atomic theory related (Rishi Kanada) and many others. Many of these geniuses were not given credit for their works. The intellectuals of ancient India explained their discoveries and inventions in science mostly in the Sanskrit language. During British rule, the factual Vedic version was examined, scrutinized, and interpreted according to their capacity, and the new-found knowledge of India was suitably altered and adapted to serve their needs. Much of the ancient texts of India were translated into English, German and other languages and carefully kept in the British libraries. Instead of honouring the genius of India, they had superseded and minimized the ancient glory of India and documented it in their own names. The foreign invaders were free to utilize India's heritage for their own so-called 'scientific discoveries'. The Vedas are known as the manual of the Universe. All information in science are either in latent or in obvious forms in the vast creations of Lord Krishna as stated in Srimad Bhagavata Gita (1.2.32): "The Lord as super soul pervades all things, just as fire permeates wood, and so He appears to be of many varieties, though He is the absolute one without a second." The foreigners have followed the Vedic Theories AS IT WAS and its Community Living and later they have claimed it as their own. [8] So, ancient India was the hub of so many inventions and discoveries of today's modern science and technology of the world.

Today what we see from missile to atom bomb, from car to airplane, etc., all were written mostly in Sanskrit in the shape of *Shloka* in Vedas, Vishnu Purana, Ramayana, Mahabharata, Srimad Bhagavata Gita, and so many other books. After launching the missile, it could be returned back, changed its target, and it could hit on one or multiple targets at a time without missing the target(s). There were different types of missiles. It had been mentioned especially in Srimad Bhagavata Gita.

Time Period: No historian can tell the exact date and time of different discoveries/inventions in ancient India, because India's ancient civilization is unimaginably old. As much as research is going on, the date is going back and back. From the different sources, it is known to us that the science in ancient India was developed step by step before the age, during the age, and after the age of Vedic period (1700-600 BCE). Here we discuss some of the discoveries/inventions of Physics in ancient India.
Objectives: The objective of the study is to search some contributions of ancient India in the development of Physics.

II. METHOD AND MATERIALS

This study is a descriptive type in nature based on secondary sources of ancient knowledge in India.
Sources of Data: The data of secondary sources are collected from ancient books, epics, articles, websites, and web-based journals published at different times.
Analysis: The different materials collected from the different sources have been scrutinized, verified and set up systematically under appropriate heading to hold requisite presentation and conclusion. In support of ancient knowledge of India, I have quoted some remarks of modern scientists from the rest of the world.

III. RESULTS AND DISCUSSION

We discuss some geneses of today's Physics in ancient India, which is not known to most of the people in the world. Physics as a part of natural science was developed initially in ancient India. Here we have tried to highlight some contributions of ancient India to the field of Physics.

1**. Universe:** Lord Krishna showed the solar system (Biswarupa) while bestowing Srimad Bhagavata Gita to Arjuna (3rd brother of Panch Pandava), and also said about the existence of the universe where there are countless galaxies. Each galaxy consists of uncountable stars. The Sun is one such star. There are nine planets revolving around the sun. The earth is one of nine planets. The composition of the universe has been described in our Srimad Bhagavata Gita. Lord Krishna gave Dviya Drishti (super eyes) and power to Arjuna because he with his limited capabilities of the material body could not see or hear or feel Lord Krishna's teachings. It is one kind of subatomic particle's trajectory. This is because they are trying to observe something that is of the same scale as the photons they are using to observe it. In the 1920′s Werner Heisenberg (1901-1976) formulated his famous uncertainty principle, which states when a physicist attempts to observe a subatomic particle, the experimental apparatus inevitably alters the subatomic particle's trajectory. Many mysterious functions of the universe and planets in the solar system were explained in our Srimad Bhagavata Gita before 5000 years. Again many inexplicable things in the universe are explained in Veda also.[8] The Indians were worshiping the 9 planets of our solar system when the rest of the world did not know about the planet. Ancient India discovered the shape of Earth; the Earth moves/revolves around the Sun while others were busy claiming that earth is flat. But now, the people who laughed at Indians are agreeing that India was the hub of knowledge. Rishi Bhaskaracharya calculated the time taken by the earth to orbit the sun hundreds of years before the astronomer Smart. Time taken by the earth to orbit the sun is 365.258756484 days. In his treatise "Siddhant Shiromani", he wrote on planetary positions, eclipses, cosmography, mathematical techniques and astronomical equipment. [7] Brihath Sathaka operates with the divisions of the time of a day into 60 Kalas. Each Kala equals to 24 minutes. [Total minutes of a day = 24 × 60= 1440]. The smallest unit of time (3×10^{-8} second) is surprisingly close to the life-spans of certain mesons and hyperons. In the 14th century as per Rigveda, the speed of light has been calculated as 300,000 kilometers per second, and the age of the universe is 8.64 billion years. Both figures are fairly equal to the modern day measurements. [6] An exhibition was held to spread awareness on India's rich scientific heritage. The exhibition coordinator, Ashish Manjramkar stated, *"Very few of us know that speed of light was known to Indians in Vedic period. A shloka says that the speed of light is 2202 yojana per half nimish. Yojana is a unit of distance which equals to 9.06 miles and half a nimish (nimishardha) is one tenth of a second. The figure is very close to the modern measurement of speed of light".* [7]

2. Theory of Panchapootha: In order to explain the heterogeneity of nature, five element theory 'Panchapootha' was developed. According to this theory, nature consists of five components i.e., Solid, Water, Gas, Radiance (or fire) and Space. The concept of space- *Akasa* is considered as eternal. It was developed to provide a positive frame of reference for material objects. It is quite similar to the western thought of all-pervading ether medium. Even the concept of atom (tiniest indivisible particle) and molecule has a clear forerunner as *anu* in Vedic philosophy. [4] John Dalton is often said to be the inventor of the atomic theory, but this is not true. The concept of the atom and atomic theory appeared 2600 years ago by Rishi Kanada. He was the first man in history to describe *anu(*molecules) and *paramanu* (atom). He explained that: "every object of creation is made of atoms which in turn connect with each other to form *anu* (molecules)". Rishi Kanada's Vaisheshika Sutras (Laws) were used by modern physicists as a basic foundation to initiate their so-called experiments in atoms. Even today comparison of Vaisheshika Sutras with modern theories show that

Vaisheshika Sutras were far more advanced and covered the explanation in simplistic ways considering constituents of every element.[8] [10] **J. Robert Openhymer**, the father of Atom bomb has invented it after the study of the Hindu Epic Vedas, Puran and Srimad Bhagavata Gita. The destruction through the application of Brahmmastra and other different weapons in the war of Kurukshetra and Lanka were studied by him. His mission under a team of scientists was named 'Trinidi' from 1939 to 1945 under his leadership. The first atom boom was tested on July 16, 1945. Now John Dalton is the father of today's application of atom boom. **Rishi Kanada** wrote the law of the atom boom in the Vedas. The famous historian **J. N. Kolebrok** wrote in his book that **Rishi Kanada** had more knowledge in comparison to the European scientists.[11] & [12]

3. Quantum Physics: Vedas explained Quantum Physics in Vaisheshika Atomic theory in 600 BCE. It dealt with nuances of atomic particles in detail. The famous **Danish physicist** and Nobel Prize winner, **Laureate Niels Bohr** (1885-1962) was a follower of the Vedas. He said, "I go into the Upanishads to ask questions." Both **Bohr and Schrödinger**, the founders of quantum physics, were enthusiastic readers of the Vedic texts and tried to validate their experiments in quantum physics consistently with what they had read in the Vedas. They always aligned their experiment with the teachings of the Vedas. **Niels Bohr** explained in 1900 why atoms emit and absorb electromagnetic radiation only at certain frequencies. Then, in the 1920′s **Erwin Schrödinger** (1887-1961), an Austrian Irish physicist, who won the Nobel Prize, came up with his famous wave equation that predicts how the Quantum Mechanical wave function changes with time. Wave functions are used in Quantum Mechanics to determine how particles move and interact with time. [8]

4. Electricity: Thomus Edition is called the father of electricity. He has admitted that the study of the book 'Agastha Sahita' written by Agastha Rishi was full of knowledge about electricity. The Shlokas in the 'Agastha Sahita' are shown below.
Shloka in Sanskrit: Samsthapya mrinmayam patram tamrapatram susamskritam |
Chadayet sikhigrivena cardrabhih kasthapamsubhih ||
Translation: After placing earthen vessel as well as the copper vessel securely, close (the vessels) with copper sulphate and saw dust,

Shloka in Sanskrit: Dastalosto nidhatatva hparadacchaditastatah |
Utpadayati tanmitram samyogastamradastayoh ||
Translation: Lumps of gems generate electricity by the union of copper and zinc.

Ancient Theory: Agasthya samhita was an ancient book written by Rishi Agasthya around 7000 years ago. Agasthya explains the methodology involved in the construction of electric battery. He also described that water could be split into oxygen and hydrogen. An earthen pot was taken and covered with a clean copper plate. On the copper plate was the copper sulphate above which moist saw dust was placed. On top of all these, zinc amalgam sheet was placed known as Mitra–Varuna. Here Mitra means the cathode and varuna means anode. In order to intensify the power of electricity, a hundred of such jars known as Shata Kumbha were connected in series. When the reaction took place, water was split into Pranavayu (Oxygen) and Udanavayu (Hydrogen). The floating hydrogen was taken in air tight cloth and could be further used in aerodynamic applications. [13]

5. Laws of Motion and Theory of Gravitation: We, all are familiar with Newton's Laws of Motion that Sir Isaac Newton, the physicist who formulated the laws of motion first in 1687. But before Newton, the laws were discovered by Indian scientist Rishi Kanada who had given Vaisheshika Sutra in 600 BCE which describes the relationship between force and motion.[1] & [9] The world believes that Newton was the first to discover the gravitational concepts. You will be surprised to know that the theory of gravitation was created 1200 years before Newton by an Indian Mathematician Bhaskaracharya. He explained that gravity is a universal force that allows the mass of a body to attract other masses of bodies. The bigger a mass of a body, the higher will be the force of gravity. Objects stay on earth because of the gravitational pull. Every single body in the universe is affected by gravitational forces which also include the earth, sun, and the moon. Tidal waves are created by the gravitational pull of the moon. Sun's gravitational pull keeps all the planets in the orbit. Earth's gravity allows it to revolve around the sun. **Bhaskaracharya** was one of the most prominent astronomers and mathematicians of the 12th century. He is also considered as the greatest mathematician from the medieval era. He is known amongst the theorist for discovering principles on astronomy and calculus. He wrote "Siddhānta Śiromaṇī" at the age of 36 in 1150 AD. He also contributed to "Surya Siddhanta" that was originally written by Aryabhatta. **The first principle of gravity was stated by Bhaskaracharya and not Newton.** Bhaskaracharya stated the laws of gravity in the book Surya Siddhanta in 11th century. Thus

the law actually existed even before the birth of Sir Isaac Newton (Newton was born in the 16th century). Here there are some of the shlokas from Surya Siddhanta that mentions how gravitation works:

"madhye samantandasya bhugolo vyomni tisthati
bibhranah paramam saktim brahmano dharanatmikam"
[Surya Sidhantha 12th chapter 32 shloka]

Translation: 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.

"akrsta saktisca mahi taya yat svastham guru svabhimukham svasaktya
akrsyate tatpatativa bhati same samantat kva patatviyam khe"
[Sidhanta Shiromani, Bhuvanakosa, 6th shloka]

Translation: 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.

Bhaskaracharya wrote a treatise '**Lilavati'**, he explained that earth has gravitational force (**gurutvakarshan shakti**). There is a mutual attraction between the planets and this allows them to hold themselves firmly in space. He also mentioned the shape of the earth that "what we see is not the reality, Earth may appear flat but it is spherical in reality'. He further explained this theory by stating: *"if you draw a very big circle and look at one fourth of its circumference, you see it as a straight line. But in true sense it is a circle. Similarly earth is spherical in shape."* These historical mentions were the proofs that law of gravity was first discovered in India by Bhaskaracharya. His law predated the law of Newton. Everybody knows about Newton's law of Gravity but we do not have any idea about "Bhaskaracharya's Law of Gravity". [7]

6. The Airplanes and Flying Objects of Maharshi Bhardwaj: The achievements of the sage Maharshi Bhardwaj are described in the texts called "Purana". He was one of the Seven Great Sages or Rishis. His wisdom is recognized up to the present day. In the distant past, in the Mahabharata and Ramayana, aeronautic inventions were used - a domain which was highly advanced at that time. Maharshi Bhardwaj discovered and wrote about the way in which airplanes or space ships appeared and disappeared and the way in which they traveled from one planet to another. [10]

7. Vishwamitra–The Inventor of Missiles: Vishwamitra was one of the most venerated and appreciated sages of India. Thousands of years ago, he invented missiles and taught his disciples the way, missiles work and function. The missiles described by him were of many types. Some had fire; others had smoke, radiation, electric spark or different weapons, etc. In addition, there were also missiles like the moon and sun. Again the missile could not fail the target to hit. [10]

8. Sound Frequency: Some Scientists acknowledged the Vedic contributions. **Nikola Tesla** has gained popularity through his exploration in the studies of frequencies or the power of sound which was well known in the Vedas. Even common Indians knew that chanting mantras at specific frequencies can generate positivity in the atmosphere and lead to the emergence of energy. The secret of sound and its vibration are known to common Indians since the Vedic age. Vedas were full of such theories and explanations, how chanting mantras and then aiming arrow in that direction could create or destruct lightning or fire or any form of energy which got triggered with that particular sound resonated in that suitable frequency. It is like everything is locked in nature and universe by Lord Krishna himself, and we just have to know the password (sound frequency) to unlock it for everyone's benefit. [8]

IV. REMARKS OF MODERN SCIENTISTS

In support of the scientific development of Ancient India, the following modern scientists/philosophers have remarked the following:

1. **Car Sagan** said, "The Hindu religion is the only one of the world's great faiths dedicated to the idea that the cosmos itself undergoes an immense indeed an infinite number of deaths and rebirths.[8]

2. **Dr. George Gheverghese Joseph** from the University of Manchester has revealed that several inventions and discoveries that were originally the work of Hindus were hijacked by foreigners at the course of time. [11] Many mechanical devices and machines were invented in the 19th century leading to increased production with a result that populations now began to centralize in the cities. Such sophisticated mechanics are well described

in the Vimana Shastra and Vedic Sutras which deal with the science of aerodynamics and mechanics within their shlokas. Even today, if it is properly applied, these Vedic Sutras can create the most advanced technological instruments and mammoth machines ever known to mankind. [8]

3. Professor Max Muller: The gramophone was invented by Thomas Alva Edison in the United States in the 19th century, based purely on sound vibration theories of Vedas. For the first recording, and to demonstrate the new machine, Edison requested Professor Max Muller, an eminent scholar of Sanskrit in England, to speak in front of an audience. In his speech, Max Muller openly confessed that Vedas were the gifts to mankind by God himself. He recorded the first shloka of Rig Veda, 'agni meele purohitam' in his voice. He said, "Vedas are the oldest text of the human race and 'agni meele purohitam' is the first verse of Rig Veda. In the most primordial time, when the people did not know how to even cover their bodies and lived by hunting and housed in caves, Indians had attained the highest civilization and they gave the world universal philosophies in the form of the Vedas." [4][8]

4. Albert Einstein stated, "We owe a lot to the ancient Indians, who taught us how to count, without which no worthwhile scientific discoveries could have been made." He also said, "Whenever I found difficulties in experiments, I referred Vedas for insights". He added that "When I read the Srimad Bhagavata Gita and reflect about how God created this universe, everything else appears superfluous". [4]

5. **Hermann Hesse** said that the marvel of Srimad Bhagavata Gita is its truly beautiful revelation of life's wisdom, which enables philosophy to blossom into religion. [8]

6. Mark Twain admitted, "India is the cradle of the human race, the birthplace of human speech, the mother of history, the grandmother of legend, and the great grandmother of tradition. Our most valuable and most constructive materials in the history of man are treasured up in India only." [8]

7. The French scholar Romain Rolland wrote, "If there is one place on the face of earth where all the dreams of living men have found a home from the very earliest days when man began the dream of existence, it is India." [4]

8. **Prof. Will Durant** (American author and historian) said, "India was the motherland of our race, and Sanskrit was the mother of Europe's languages; she was the mother of our philosophy; mother, through the Arabs of much of our mathematics; mother, through the Buddha, of the ideals embodied in Christianity; mother, through the village community, of self-governance and democracy; Mother India is in many ways the mother of us all. [4]

V. CONCLUSION

Today's development of science and technology is based mostly on the hint of knowledge of ancient India. Many instruments, machines, missiles, laws, etc. described especially in Srimad Bhagavata Gita and other epics are yet to invent/discover. If we give importance on the applications of our ancient science probably in every step of our lives, we can get strength to fight against all evils existing in society. Our ancient science can surely play a pivotal role in shaping our present as well as future development. Our past glory needs to revive with some innovative ideas. A special research team can be set up with full facilities by the government to explore the knowledge of ancient India from administration to war apprehension. Many scientists in the world have accepted that the books of ancient India especially Srimad Bhagavata Gita written before the Vedic period translated in many languages is full of knowledge. When the scientists of the rest of the world have searched the knowledge from ancient India and discovered/invented many new laws and instruments, why we are lagging behind them when everything is at our hands. We can easily extract the knowledge and bring our country to the highest position of development in all respects.

Commitment: I would not like to hurt any person. If any gentle person wants to verify the truth, he/she can do with the help of the following references.

Dedication: I have dedicated this article in the name of Lord Sri Krishna, Who governs the universe and enlightens the whole world through His science.

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