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AN INTROSPECTIVE STUDY ON CONTRIBUTION OF INDIANS TOWARD PHYSICS: ANCIENT ERA TO PRESENT

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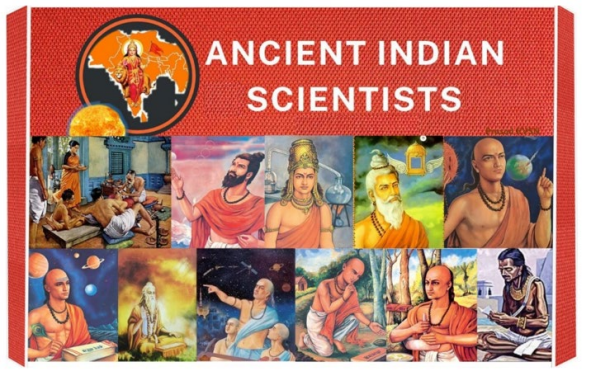
ABSTRACT



Ancient India has been a storehouse of comprehensive knowledge, and so the origin of many inventions and discoveries of today's modern science and technology of the world. If we look at the various scientific theories, we find that the first experimenter of each theory has been forgotten. We remember Darwin, who propounded the principle of survival of the fittest, but we have forgotten many Physicists of ancient India, who have breeded ground for many scientific advancements, including mechanics, astronomy, mathematics, metallurgy, and medicine. What is thought today by the world, ancient Indians have done it in the Vedic period. The objective of this study is to search some contributions of ancient Indian intellectuals towards the development of physics. The research presented here is based on secondary data gathered from Indian ancient books, epics, articles, websites, and web-based journals.

Keywords: Ancient Indian Scientists, Modern Influence, Indian Heritage

1. INTRODUCTION

Indian heritage is one of the richest and oldest among the world. From the time of ancient India, scientific and technological developments have been done. Indian civilization has a long-recorded history of scientific culture that goes back to more than 5000 years. Indian heritage has been known for its various developments like gemstone therapy, ayurvedic medicine, physics, farming, literature and many more. Many famous mathematicians from India contributed a lot in the development of theories that we still use and apply in the majority of fields. Science has come to its existence through spirituality, in fact science is only an extension of spirituality.

Knowledge of the inner senses and inner world has been achieved mostly with the help of the experience of the ancient sages. Indian sages with their many day-to-day experiences and evidence, have presented many concepts, which scientist have then proved in the laboratory. The world's first university was established in Takshashila (India) in 700 BC. More than 10500 students from all over the world studied more than 60 subjects. The University of Nalanda built in the 4th century was one of the greatest achievements of ancient India in the field of education.

2. PHYSICISTS IN ANCIENT INDIA

Science and Mathematics were highly developed during the ancient period in India. Ancient Indians contributed immensely to the knowledge in various branches of science. However, in the absence of good documentation and dissemination as their counterparts in the modern western world, these contributions did not find the place they deserved. Moreover, the western world ruled over most of the world for a long time, which empowered them to claim superiority in every way, including in the field of knowledge.

3. BAUDHAYAN

We remember Pythagoras and Euclid. But we have forgotten Baudhayana. Baudhayana (800 BC - 740 BC) was the first one ever to arrive at several concepts in Mathematics, which were later rediscovered by the western world. Baudhayan is said to be the original Mathematician behind the Pythagoras theorem. Pythagoras theorem was indeed known much before Pythagoras, and it was Indians who discovered it at least 1000 years before Pythagoras was born! In Baudhayan theorem, there is a concept to tell a relation between the three sides of a right-angle triangle. The credit for authoring the earliest Sulva Sutras goes to him. The value of pi was first calculated by him.

4. ARYABHATTA

Aryabhatta was a fifth century mathematician, astronomer, astrologer and physicist. Discovery of zero by him, enabled Aryabhatta to find out the exact distance between the earth and the moon. The discovery of zero also opened up a new dimension of negative numerals. Aryabhatta contributed greatly to the field of science, particularly Astronomy. In ancient India, the science of astronomy was well advanced. It was called Khagolshastra. Khagol was the famous astronomical observatory at Nalanda, where Aryabhatta studied. Infact science of astronomy was highly advanced, and our ancestors were proud of it. The aim behind the development of the science of astronomy was the need to have accurate calendars, a better understanding of climate and rainfall patterns for timely sowing and choice of crops, fixing the dates of seasons and festivals, navigation, calculation of time and casting of horoscopes for use in astrology. Knowledge of astronomy, particularly knowledge of the tides and the stars, was of great importance in trade, because of the requirement of crossing the oceans and deserts during nighttime. Disregarding the popular view that our planet earth is ‘Achala’ (immovable), Aryabhatta stated his theory that ‘earth is round and rotates on its own axis’ He explained that the appearance of the sun moving from east to west is false by giving examples. One such example was: When a person travels in a boat, the trees on the shore appear to move in the opposite direction. He also correctly stated that the moon and the planets shined by reflected sunlight. He also gave a scientific explanation for solar and lunar eclipse clarifying that the eclipses were not because of Raahu and/or Ketu

or some other rakshasa (demon,). The first satellite sent into orbit by India has been named after Aryabhatta.

5. RISHI KANAD

One of the notable scientists of the ancient India was Kanad. Around 200 BCE, Maharshi Kanad systematically deduced a theory related to atomism. He is said to have devised the atomic theory centuries before John Dalton was born. He speculated the existence of anu or a small indestructible particle, much like an atom. He also stated that 'anu' can have two states — absolute rest and a state of motion. It was further developed during the first millennium by Dignāga and Dharmakirti. Dignāga was an Indian Buddhist philosopher and logician. He is credited as one of the Buddhist founders of Indian logic (hetu vidyā) and atomism. Another Indian philosopher Pakudha Kaccayana also put forward concepts about the atomic nature of the physical world. He was an atomist who believed in atomism which believed that everything is made of seven eternal elements – earth, water, fire, air, happiness, pain and soul.

6. BHASKARACHARYA

Bhaskaracharya, a leading light personality, was an Indian polymath, mathematician, astronomer and engineer of 12th Century. He is famous for his book Siddanta Shiromani. It is divided into four sections: Lilavati (Arithmetic), Beejaganit (Algebra), Goladhyaya (Sphere) and Grahaganit (mathematics of planets). Bhaskara introduced Chakrawat Method or the Cyclic Method to solve algebraic equations. This method was rediscovered six centuries later by European mathematicians, who called it inverse cycle. In the nineteenth century, an English man, James Taylor, translated Lilavati and made this great work known to the world.

7. MAHARISHI BHARADWAJ

Visionary Aeronautics Maharishi Bharadwaj's (1st century BCE) Brihatsamhita unveiled aeronautical marvels, including descriptions of flying machines like hot air balloons, gliders, and helicopters. His visionary concepts hint at ancient India's grasp of aeronautics, inspiring modern aerospace innovations. Maharishi Bharadwaj's ideas continue to fuel discussions on ancient aviation technology and its potential influence on contemporary aeronautics.

8. VARAHAMIHIRA

Cosmic Visionary Varahamihira's (505-587 CE) astronomical insights were pioneering. His works, Brihat Samhita and Pancha Siddhantika, encompassed astronomy, astrology, and mathematics. His accurate calculations of planetary motions and celestial phenomena laid the groundwork for modern celestial observations. Varahamihira's celestial theories have provided crucial insights into the understanding of planetary orbits and astronomical phenomena.

9. RISHI LAGADHA

Celestial Luminary Rishi Lagadha's (600 BCE-200 BCE) 'Vedanga Jyotisha', an ancient astrological treatise, introduced the zodiac, planetary concepts, and star observations. His work catalyzed the evolution of astrology and continues to

influence celestial studies. Rishi Lagadha's astronomical insights have contributed to modern star mapping and celestial navigation.

Further, if the creation process of the Sankhya philosophy and the Higgs boson experiment are studied in a comparative perspective, then it can be inferred that the element which has been called Tanmatra in the Sankhya philosophy is the latent form of energy, which scientists have called the Higgs boson. After that, the Panchamahabhutas are the particles of mass and weight visible in the manifestation of that energy. In this way, the speed of philosophy is from subtle to gross, whereas science is moving from gross to subtle.

These remarkable minds, often hidden in the annals of history, embody the spirit of inquiry, innovation, and holistic understanding that defined ancient India's scientific heritage. Their exceptional contributions continue to illuminate the path of human progress, serving as an enduring source of inspiration for generations to come.

In examining the legacies of these trailblazing ancient scientists, we witness a profound bridge between eras. Their ideas, unshackled by temporal boundaries, persist as intellectual beacons, guiding humanity's progress. As we unearth the depths of their wisdom, we stand humbled by their foresight and tenacity, embarking on a journey of rediscovery that intertwines past, present, and future.

The early 20th century is considered a time when the foundation of modern physics was established around the world. Despite being a colonised nation, Indian physicists were not far behind in contributing to this revolutionary change in physics.

The pioneers of modern physics in India were C.V. Raman, J.C. Bose, Satyendra Nath Bose, etc., who inspired the next generations to take a leap forward in research and development, thereby playing an important role in the growth of scientific temper in India.

Table 1

Table 1 List of Modern Indian Physicists and Their Invention

Indian Physicists	Invention
C.V Raman	Raman Effect
Jagdish Chandra Bose	Crescograph
Satyendranath Bose	Bose-Einstein Statistics and Bose-Einstein Condensate
Meghnad Saha	Thermal Ionization Equation
Subrahmanyan Chandrashekhar	Colliding gravitational waves and stellar evolution
Vaina Bappu	Wilson-Bappu Effect
G. N. Ramachandran	Computerized Axial Tomography, or CAT
E.C. George Sudarshan	Quantum representation of coherent light
J.V. Narlikar	Hoyle-Narlikar Theory
Ashoke Sen	Sen conjecture

10. CONCLUSION

The history of ancient India is a treasure trove of remarkable minds whose profound contributions laid the foundation for modern science, technology, and innovation. These visionary scientists, philosophers, and thinkers pushed the boundaries of human knowledge, shaping the course of history and influencing the world in profound ways.

The legacy of these ancient Indian scientists extends far beyond their time, shaping the very fabric of modern science, technology, and innovation. Their

insights and contributions have provided a solid foundation for various fields, influencing both ancient and contemporary knowledge.

As we stand on the shoulders of these intellectual giants, their legacies echo through time, reminding us of the enduring power of human inquiry and innovation. From atomic theory to linguistic analysis, from surgical precision to mathematical abstraction, the contributions of these ancient Indian scientists continue to inspire and guide the modern world, reaffirming the timeless connection between the past and the future.

By recognizing and celebrating the profound impact of these ancient scientists, we pay homage to their unwavering dedication and remarkable insights that have shaped and continue to shape the course of human progress. Their stories serve as a testament to the boundless potential of human intellect and the profound influence of scientific inquiry on the tapestry of civilization.

CONFLICT OF INTERESTS

None.

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