Bhaskaracharya: A Pioneer of Gravity

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Abstract:
When we talk about gravity, the first name that pops into our heart is "Sir Isaac Newton". In school we all have been told the story of how Newton was inspired to formulate "The Universal Law of Gravitation" when an apple fell from a tree. The world believes that Newton was the first to discover the gravitational concepts. But it is a matter of startling fact that the theory of gravitation was created 1200 years before Newton by an Indian Mathematician Bhaskar Acharya. The present paper tries to explore the unveiling theories of Bhaskar Acharyain the field of discovery of gravity beforeSir Isaac Newton.
Keywords: Bhaskaracharya,Gurutvakarshan Shakti, Surya Siddhanta, Lilavati

I.   Introduction

India is considered as a traditional country, but the world is unaware of our contributions to this modern world. Our theories were used as a base for many concepts such as weather forecast, astronomy, astrology, aviation etc. India has developed some of the best mathematicians the world has ever seen. Among themBhaskaracharya was one of the prominent figures. He was an Indian mathematician and astronomer who extended Brahmagupta's work on number systems and was born near Bijjada Bida (in present day Bijapur district, Karnataka state, South India) into the Deshastha Brahmin family. Bhaskaracharya was head of an astronomical observatory at Ujjain, the leading mathematical centre of ancient India. His predecessors in this post had included both the noted Indian mathematician Brahmagupta and Varahamihira. He lived in the Sahyadri region. It has been recorded that his great-great-great-grandfather held a hereditary post as a court scholar, as did his son and other descendants. His father Mahesvara was as an astrologer, who taught him mathematics, which he later passed on to his son Loksamudra. Loksamudra's son helped to set up a school in 1207 for the study of Bhaskara's writings.

Bhaskaracharya's work in Algebra, Arithmetic and Geometry catapulted him to fame and immortality. His renowned mathematical works called Lilavati and Bijaganita are considered to be unparalleled and a memorial to his profound intelligence. Its translation in several languages of the world bears testimony to its eminence. In his treatise Siddhant Shiromani he writes on planetary positions, eclipses, cosmography, mathematical techniques and astronomical equipment. In the Surya Siddhant he makes a note on the force of gravity:*"Objects fall on earth due to a force of attraction by the earth. Therefore, the earth, planets, constellations, moon, and sun are held in orbit due to this attraction."*

Bhaskaracharya was the first to discover gravity, 500 years before **Sir Isaac Newton**. He was the champion among mathematicians of ancient and medieval India. His works fired the imagination of Persian and European scholars, who through research on his works earned fame and popularity.Before discussing Bhaskaracharya's contribution let us understand the basic concept of gravity. Gravity is a universal force that allows a mass of body to attract other masses of body. The bigger a mass of body is, the higher will be the force of gravity.

1.1 Importance 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.Let us get back to the work of Bhaskaracharya.

1.2 The first principle of gravity was stated by "Bhaskaracharya" and "not Newton."

Bhaskaracharya stated the laws of gravity in the book Surya Siddhanta in 11[th]century. Thus, the law exists even before the birth of Sir Isaac Newton (Newton was born in the 16th century). Here are some of the slokas from his book Surya Siddhanta that mentions how gravitation work:

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

This means: The spherical earth stands at the centre of earth 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 Sloka]

This means: 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 name ***Lilavati*** where he answers a question posed by his little daughter. In this book, he answers his daughter Lilavati's curious questions.

In this book, he explains 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 while answering his daughter's question. Bhaskaracharya states that what we see is not the reality, Earth may appear flat but it is spherical in reality. He further explains 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." This historical mentions are the proofs that laws of gravity was first discovered in India by Bhaskaracharya. His laws predates the law of Newton, he did not wait for the apple to fall. Everybody knows about Newton's law of Gravity but we don't have any idea about "Bhaskaracharya's Law of Gravity".

II. Conclusion:

Bhaskaracharya and his works represent a significant contribution to mathematical and astronomical knowledge in the 12th century. He has been called the greatest mathematician of medieval India. He calls himself a poet and most probably he was Vedanti, since he has mentioned 'Parambrahman' in that verse. He was the champion among mathematicians of ancient and medieval India. Some historical mentions are the proofs that laws of gravity were first discovered in India by Bhaskaracharya. His laws predates the law of Newton, he did not wait for the apple to fall. Everybody knows about Newton's law of Gravity but we don't have any idea about ***"Bhaskaracharya's Law of Gravity"***.

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