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Albert Einstein As Father Modern Physics And Isaac Newton As Father of Classical Physics

Dr. Om Pal Singh

Officiating Principal, Salawa Inter College, Salawa (Meerut)

ABSTRACT

Albert Einstein (1879–1955) was the most influential physicist of the 20th century. Less well known is that fundamental philosophical problems, such as concept formation, the role of epistemology in developing and explaining the character of physical theories, and the debate between positivism and realism, played a central role in his thought as a whole.

Aristotle was a Greek Philosopher and was the most prominent product of the educational system developed by Plato. He spent 20 years learning at the institution developed by Plato, known as the Academy. He later became Alexander the Great's teacher on his return to Macedonia. Aristotle wrote on a range of topics, such as physics, arts, government, biology, politics, and music, and is credited for profoundly shaping medieval physics. His ideas broadened well into the Renaissance, although they were replaced by other scientists and scholars, notably Galileo Galilei, Descartes, and Sir Isaac Newton. Aristotle's contribution to the field of physics was on matter, motion, optics, and metaphysics, among others (Aristotle, 1961, pp. 3-7).

Aristotle posited that the universe consists of two parts: the terrestrial and the celestial regions and that in Earth, all bodies were made up of a mixture of four types of matter: *earth*, *water*, *air*, and *fire*. He said that other heavenly bodies past the moon were made of a fifth substance, the *quintessence* of Aether. Heavy or dense objects such as iron were mainly made of the *earth* while less heavy objects consisted of a mixture of the four elements (Jones, 2010, para. 4).

The basic postulation in Aristotelian physics was that the natural setting of the sublunary matter is rest, i.e. the first three elements must seek their natural place at rest on Earth unless changed by some impenetrable plane, such as a table. The fourth element (*fire*), resides somewhere above us, but below the Moon. Thus, the air is a combination of *air* and *fire*.

This model gave a simple, perfect justification for falling rocks, rising flames, and the motion of air, but was deficient in clarifying the 'violent motion'. For example, when a stone is hurled from a sling, it continues to move even after it had left the sling, yet, by Aristotelian physics, the stone's natural state is rest and should have dropped to the ground soon after leaving the sling. He explained that the air in front of the stone was disturbed, swirled behind and pushed the stone forward, thus the difference between 'natural' downward movement and unnatural violent movement.

Aristotle also delved into optics and offered very accurate information regarding the same as compared to the information available then, for example, he was among the first people to write on the workings of the camera. He constructed a device with a dark compartment and with an aperture to let in light and used this device to study the sun. He concluded that the sun would still be shown as a circular object irrespective of the shape of the hole. This has been modified in modern cameras where it is known as the diaphragm. Aristotle also noted that the size of the image depended on the distance between the aperture and the screen (Cooper, 2007, pp. 175)

Another of Aristotle's contributions to classical physics was on Causality; he asserted that there were four kinds of causes:

- A substance's *material cause* is the material that it comprises of, e.g. for a chair, this might be wood, or bronze/ marble for a sculpture;
- A substance's *formal cause* is its form, that is, the organization of that substance;

- A substance's *efficient* or *moving cause* is the key cause of the change or rest;
- A substance's *final cause* is its purpose or objective, for example, for a seed, it might be a fully-grown plant, for a ball at an incline, this might be sloping to rest at the bottom.

Aristotle's description of motion was quite dissimilar from that of modern science, as his comprehension of motion was strongly linked to the actuality-potentiality concept he had developed. In simple language, he described motion as the actuality of a potentiality *as such*. This statement has received numerous interpretations as actuality and potentiality were opposites according to Aristotle, while some said that the addition of the word *as such* made it harder to understand (Barnes, 1995, pp. 40).

A distinct feature of the Aristotelian theories was their lack of experimentation for proof, rather, they were based on assumptions and natural logic, and this was to contribute to their downfall several years later. Although there was some level of observation in Aristotle's physics, the core proof was a philosophical approach where the laws of nature were modified to obey a specific philosophical viewpoint. This weakness was to lead to the demise of his ideas by later day scientists such as Galilei Galileo.

GALILEO GALILEI

Galileo Galilei, born in 1564 in Pisa, Italy, was a physicist, mathematician, and philosopher who made key contributions to classical and modern physics. His accomplishments include improvements to the telescope and the resultant astronomical observations, a feat that earned him the title of the Father of Modern Observatory Astronomy, Physics, and Science. His theoretical and practical work on the motion of objects was a forerunner of classical mechanics later advanced by Sir Isaac Newton.

On astronomy, for which he is best known, Galileo, using his highly improved telescope, observed four of Jupiter's biggest satellites, and Venus' orbit around the sun. He was also the first individual to observe that the Milky Way consisted of millions of stars and that the Moon's surface was uneven and had many craters, opposing Aristotle's assertion that the moon's face was smooth. He also observed Pluto but did not identify it as a planet as it was not as bright as Jupiter (Famous Scientists, 2010, para. 3).

Galileo Galilei performed an experiment from the Leaning Tower of Pisa in which he ascertained that the velocity of descent of two objects was not dependant on their mass. This discovery also went against Aristotle's teachings that the velocity of fall of bodies depended on their relative weights. He performed an experiment using rolling balls and slant planes, which proved the same point: the rate of acceleration of falling or rolling bodies is independent of their mass. Galileo also observed that a pendulum's oscillations take the same duration of time irrespective of their amplitude i.e. isochronous, an assertion that was later proved almost true. He found out that the square of the period was directly proportional to the length of the pendulum (Hilliam, 2005, pp. 35).

Galileo suggested that a falling object would do so with a regular acceleration, given the resistance of the medium through which it was falling was insignificant, nearly tending to that of a vacuum. He developed an accurate kinematic law for the distance covered during an even acceleration starting from rest, i.e. the acceleration is directly proportional to the square of time that lapses ($d \propto t^2$). However, this was not a discovery as Nicole Oresme had deduced the same in the 14th century, and Domingo de Soto in the16th. Galileo, however, stated the time-squared law in algebraic form and this was adopted by latter-day scientists.

Galileo set the foundation for Newton's first law of motion by stating that bodies maintain their velocity except when a force (mainly friction) acts on them, this brought an end to Aristotle's assertion that bodies naturally reduced speed and stopped unless a force acted on them. His Principle of Inertia stated: "An object moving on a flat surface will continue to do so in the same direction at a uniform speed unless disturbed". This was integrated into Newton's first law of motion (Næss, 2002, pp. 112).

In 1632, Galileo gave a physical theory to explain tides due to the movement of the earth. Had this been true, it could have been a strong point for the actuality of earth's motion. The theory gave the first understanding of the significance of the shapes of ocean basins on the degree and timing of tides, for example, he rightly explained the reason for the minor tides that occur at the center of the Adriatic Sea as contrasted to those at the end. However, his general explanation of the cause of tides was unsatisfactory (Galilei, 1967, pp. 276).

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Conclusion

As mentioned, Isaac Newton was a realist science reinforcer, with his discoveries deeply imprinted in our understanding of existence in the physical world. His laws of motion, contributions to the science of mathematics, and insights into the cooling remain basic parts of science and technology up to now. Newton's capacity to create the principles which described the behavior of the object and force set a background for many discoveries that followed. His heritage continues to be a source of motivation for scientists and students around the world: exploring, discovering, and understanding the mysteries of the universe.

Reference

- Aristotle. (1961). *Physics*. Nebraska: University of Nebraska Press.
- Barnes, J. (1995). *The Cambridge Companion to Aristotle*. Cambridge: Cambridge University Press.
- Cooper, S. K. (2007). *Aristotle: philosopher, teacher, and scientist.* Minneapolis: Compass Point Book.
- Famous Scientists. (2010). *Galileo Galilei*. Web.
- Galilei, G. (1967). *Dialogue Concerning the Two Chief World Systems*, 2nd Revised Edition. California: University of California Press.
- Hall, A. R. *Isaac Newton's Life.* Web.

- Hilliam, R. (2005). *Galileo Galilei: father of modern science*. NY: The Rosen Publishing Group, Inc.
- Jones, A. (2010). *Physics of the Greeks: The Natural Philosophy of Aristotle.* Web.
- Næss, A. (2002). *When the World Stood Still.* Heidelberg: Springer.
- NASA. (2010). *Newton's three laws of Motion.* Web.
- Newton, I. S. (1704). *Opticks*, 4th. Ed. London: Weft-End of St. Paul's, 1730.
- Newton, I. (1729). *The Principia: Mathematical Principles of Natural Philosophy, Vol. 1*. London: Middle-Temple Gate.