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The Infinite Cosmos

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Abstract

The cosmos is a puzzle that all learning is trying to unravel. It has neither a user manual nor an easily apparent order that would have served as its ultimate un-riddling. Man is fated to confront the comprehension of the cosmos with bare intellect in order to eke out meaning from the enormously vast order that is the cosmos. The critical issue to be determined is the extent of the cosmos. The extent of the cosmos might not be determined without determining the nature of the cosmos. If the properties that make up the cosmos could be measured, the extent of the cosmos perhaps could be measured as well. But there is a linguistic twist to comprehending the extent of the cosmos. If the cosmos meant the world, could we accurately measure it without stepping outside the world? If we are in the cosmos, we cannot possibly step out of it because the cosmos is the entire universe. There cannot possibly be an "outside" to the universe. The reality of the universe as the only existent world creates a puzzle of boundaries since the cosmos is generally assumed to be material. If matter is finite, the cosmos definitely has to be bounded. But the cosmos could not possibly be bounded. If it were to be bounded, the phenomenon beyond the boundary would simply be an extension of the cosmos for, linguistically, the cosmos means the entire universe. By logical imperatives, the cosmos is necessarily infinite. There cannot be a possibility of a boundary, a container nor a hold. Such hold would necessarily be part of the cosmos. What possibly could contain the cosmos? Where is the fulcrum upon which that could have a footing? This work is based on library research, using the speculative method of philosophy.

Key Words: Infinite, Cosmos, Man, Learning, Universe

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Introduction

The quest to comprehend the cosmos is at the basis of learning. Man, in existentialist terms, finds himself arbitrarily thrown upon the world. He has neither any prior knowledge of the world nor is he empowered with any custom-made key that would un-riddle the world. He is condemned to fathom the world. Man is likely the only specie that is studying the universe. The limitations of his epistemological faculties notwithstanding, man continues to unravel the puzzles that shroud the cosmos. This work is about the extent of the cosmos. Should the cosmos be thought of as a bounded finite entity or as an infinite, boundless entity? How does one logically reconcile the notion of boundlessness with finitude? In plain language, finiteness is the opposite of boundlessness.

But we measure the multitude of things in the cosmos, how are we able to measure parts of the cosmos but never able to measure the entire cosmos? The critical factor is that the cosmos by definition is the entire thing in physical existence. It has no boundaries. If the cosmos were to be immeasurable, it would have violated one of the chief characteristics of matter (matter is popularly assumed to be measurable). In the same vein, the cosmos could not be said to be continually expanding. Expansion is not possible on a cosmic scale for there is nowhere for the cosmos to expand into. The cosmos has no container; it is not contained in anything. In a nutshell, everywhere is the cosmos.

But research on the nature of the cosmos is not a recent activity. Philosophy, from the Egyptian era to the Greek era, has been preoccupied with the nature of the cosmos and its contents/components. That fascination has not waned. The quest to comprehend the cosmos is as fresh today as it had been in the classical times. The answers are far from complete. The puzzles abound still. Like ever before, man stands in curious awe before the cosmos. What is the nature of the cosmos? This question is as fresh as it was when the earliest Egyptian philosophers and the Greek Thales asked the same question. The fascination still draws thinkers and scientists to probe deeper and further, in the universal and timeless quest to provide a satisfactory explanation of the events that constitute the cosmos.

The Cosmos in Pre-philosophic Times

How did man relate to the cosmos in the years before the establishment of philosophy as a formal enterprise? Certainly, the ancient man was no less curious about the world around him than the contemporary man is. Curiosity is one of the ontological characteristics of man. Beyond awe and wonder, man even in the earliest times did indeed ascribe meaning to the cosmos. The meaning was expressed in myths, folklores and worship. Those were the pre-scientific eras. There was what would today be called an "over-spiritualization" of reality. Man gave meaning to the cosmos largely in spiritual terms. The cosmos was centered on spirits. Life itself was seen as a spiritual phenomenon. The heavenly bodies were more or less viewed as gods and their actions were said to affect the fates of men. The sun was the ultimate god as it energized the entire earth (James, 1954). Thales of Miletus would eventually declare that "the cosmos is full of gods" (Stumpf, 1994).

Although the pre-philosophic man did not know the cosmos beyond his visible surroundings, he did, nonetheless, conceive the cosmos as infinite. This is not as a result of any scientific measurement but simply because he conceived the cosmos as fundamentally spiritual. Spirits are by nature infinite, eternal and unlimited. Subsequently, the cosmos which was viewed as spiritual, necessarily shared the aforementioned characteristics. The pre-philosophic cosmos was an act of the gods. As such, it knew no limitations beyond the gods.

The Cosmos in the Egyptian Era

How did ancient Egyptians who were historically the first to engage in philosophy and science view the cosmos (Diodorus, ca. 60; James, 1954)? Ancient Egyptian thinkers viewed the cosmos as an ordered act of god (Diodorus, 60 BC). Interestingly, they did not locate the gods outside the cosmos (James, 1954). The gods were in the cosmos, therefore, could not possibly give the cosmos an "outside" by existing in a location other than the cosmos. They upheld that there was a principle of reason in the cosmos. Therefore, nature was necessarily ordered (James, 1954). Ancient Egyptians neither conceived the spirit as outside of nature nor as the opposite of nature. The spirits also were part of the ordered cosmos. They created the impression of an unbounded but finite cosmos. But boundlessness and finitude cannot coexist. If the cosmos

were to be boundless, it would necessarily be infinite. How can something without boundaries be finite? It is an apparent logical impossibility. But more than anything else, they conceived the cosmos as measurable and subject to eternal and immutable laws. Thus was born the scientific era belief in the measurability of the cosmos (Diodorus, 60BC).

The Cosmos in the Classical Greek Era

Although the philosophic thought in its formal form flourished in ancient Egypt before anywhere else, due to the vicissitudes of history, that philosophy was conveyed to the contemporary civilization by classical Greek scholars who were generally educated in Egypt (Diodorus, 60 BC; James, 1964). The earliest known of these Egypt trained Greek philosophers was Thales. European scholars often regard Thales as the first recorded philosopher in history. This is in spite of abundant documentary evidence to the contrary and even Thales' own proud testimonies that he was copiously educated in Egypt (Diodorus, 60 BC; James, 1964; Stumpf, 1994).

Thales considered the cosmos as fundamentally wet (Diodorus, 60 BC). He was neither concerned about the dimensions of the cosmos as such nor did he conceive the cosmos beyond the Earth which he thought was a flat disk floating on water (Stumpf, 1994). He deferred to the ontological perplexities of the cosmos by declaring it is fundamentally one (water) and "full of gods" (O'Grady. 1995). Although his declarations could not stand the rigours of logical relations, he nonetheless stands out in Western intellectual tradition as the first to render a naturalistic interpretation of the cosmos. By declaring the cosmos as full of gods, he implied that there was no other reality beyond the cosmos. If there were no reality beyond the cosmos, it would be boundless, and if it were to be boundless, it would necessarily be infinite. However, it is doubtful if Thales ever realized this. His successor, Anaximander would eventually harp on it.

Unlike Thales, Anaximander realized the futility of reducing the cosmos to a particular substance. He was perhaps the greatest cosmologist of antiquity. His insights into the nature and extent of the cosmos remain relevant even to this day. Anaximander declared the cosmos to be boundless (Burnet, 1930). Since finitude is not possible in

the cosmos, whatever that is source of everything must be indeterminate. It must be everything in general and nothing in particular. It must be infinite just as infinity is indeterminate. A boundless cosmos is an indeterminate cosmos. Whatever that is indeterminate has infinite possibilities. A boundless cosmos cannot be finite. It must be limitless, therefore, necessarily infinite. Editors of Anaximander may not have represented his views so succinctly, but his declaration of the cosmos or the cosmic substance as "boundless" says it all.

Anaxagoras would further embrace the hypothesis of an infinite cosmos by declaring the cosmos not to have originated from a single or definite substance but from infinity of substances. For him, there was a measure of everything in everything (Anaxagoras, ca.440 BC). The dynamism of being or manifestation of reality in the cosmos is infinite. The cosmos as envisaged by Anaxagoras had neither an outside nor an exterior mover. It was a spontaneous cosmos with spontaneous motion. There was no finitude to the manifestation of things in the cosmos. He recognized a rational principle in the cosmos which he called the *nous* – universal mind (Anaxagoras, ca.440 BC).

Atomists like Leucippus and Democritus would eventually conceive the cosmos as full of free flying atoms colliding in space to form the multitude of things (Taylor, 1999). The fact that they did not attempt to number or limit atoms indicated the presumption of an infinite cosmos. Space was necessarily boundless as it was everywhere as the limitless medium in which the cosmic atoms could operate.

Plato envisaged a cosmos that was fundamentally incorporeal. In that right, the cosmos he envisaged was necessarily infinite. It was a cosmos that was made of infinite ideas and indefinite matter upon which the ideas would always assume corporeality. Plato posited a dual cosmos composed of imperfect matter and perfect ideas. The dynamism in Plato's cosmos lay in the ideas (Mammino et al, 2020).

Aristotle conceived the cosmos as finite and spherical (Aristotle, ca.302 BC). His cosmos had boundaries as there was an anti-cosmos which was not part of the cosmos but set the cosmos in motion. This, he termed the unmoved mover. This hypothesis would imply that Aristotle conceived the cosmos as being finite with infinite motion. But that is completely impossible. If the cosmos required an external substance to set it in motion, it meant that the cosmos had no

spontaneous (self) motion, it cannot move infinitely. For the cosmos to move infinitely, the unmoved mover would have to keep moving it since the cosmos as conceived by Aristotle was not capable of self motion. There was no Galileo yet that would inform Aristotle that what the unmoved mover would have exerted on the cosmos was force. Force, being energy, would be expended as the cosmos moved. The motion could not last forever as the force causing it was not within the cosmos but came from the unmoved mover which was clearly not part of the cosmos. Aristotle's limitation would eventually be removed by Newtonian physics.

The Cosmos in the Medieval Era

The medieval era was the apogee of the triumph of the Christian ideology as the dominant worldview. All thought, scientific or otherwise, was filtered in through the prism of Christian dogmas. The greatest sources of truth were the Scriptures. The firmest proof for the truth was the authority of the Church. It was an era when all learning was theological in perspective. Cosmology in the same era was no different. Although the Church did indeed recognize science and intellectual thought, the recognition was only to the extent the science or thought was in agreement with the established dogmas of the Church. The medieval Church broached no dissent. It held sway in much of the Western world. It did, indeed, exercise its authority over thought firmly.

Medieval cosmology was more or less a copy and adaptation of the Ptolemaic cosmology which was in turn a copy of Aristotelian cosmology. Aristotle himself looted the libraries of Waset and Alexandria which housed thousands of manuscripts containing the works of thousands of Egyptian thinkers over thousands of years (James, 1954). Aristotle did indeed plagiarize Egyptian philosophy and Egyptian science (Diodorus, ca.54; James, 1954).

The Ptolemaic cosmology saw the Earth as a sphere fixed firmly at the centre of the universe. It was surrounded by concentric spheres, and had the sun moving around it. The Ptolemaic cosmos had a moon just above it. The spheres surely moved in perfect circles and at the outer layer of the Ptolemaic cosmos was the Aristotelian prime mover which set the entire cosmos in motion. All this was adopted by the medieval Church, however with some modifications. The cosmos was seen not as

finite but as unlimited. Since the Church attached another layer above the Ptolemaic outer layer of the cosmos which contained the prime mover. They added the empyreal layer where God acted on the prime mover (Grant, 1996). A cosmos that has an infinite God as part of it could not possibly be finite. Since angels acted on the world, there was a layer where angels dwelt in the outer cosmos (Grant, 1996).

This cosmology was tenaciously embraced by the Church as it had striking similarities with the cosmology assumed in the Bible (Lindberg, 1992). Of course, the two cosmologies had Egypt as a common source ultimately, hence, the similarities (James, 1954). Suffice it to say that the greatest contribution of the medieval era to cosmology was its subjection to religious control. This control was not just intellectual; it was political and administrative. As a matter of fact, a thinker could burn at stake for expressing the wrong thought. Many a thinker did indeed burn. The Inquisition carried out this enforcement with gleeful brutality.

The Cosmos in Modern Thought

Thinker after thinker simmered with disdain of the Church's insistence on religious control of intellectual thoughts. Towards the end of the 15th century, the Church's political authority waned. By early 16th century, there were open challenges to the authority of the Church. This loosened the stranglehold of the Church on learning and birthed the resurgence of free and unhindered intellectual thought known as the Renaissance. The Renaissance was basically a return to the classics, and it heralded the modern era.

Although Copernicus is credited with the formulation of the heliocentric revolution, it is worthy of note that Aristarchus in the classical era did indeed state that the earth went round the sun (Dreyer, 1953; Linton, 2004). However, Copernicus popularized the heliocentric revolution by giving out a detailed mathematical hypothesis that though fraught with errors was nonetheless plausible. The earth goes round the sun; not the other way round. Indeed the cosmos has an immobile center but it is the sun rather than the earth. The earth orbits the sun once every year. Like Ptolemy, Copernicus also held that the earth rotates in its spherical orbit in perfect circles. For Copernicus, the planets were fixed on solid spheres and the stars were fixed on solid outer space. Like

Ptolemy, the cosmos he envisioned was definitely a finite cosmos.

The heliocentric theory of the earth was a very bold idea in Copernicus' day. He presented it as a mere hypothesis in order to escape the ire of the powers that be. He was a very shrewd thinker. After vigorously arguing for the heliocentric revolution in the body of the work, in his conclusion he wrote safely that his hypothesis needed not to be true or even probable. He confessed that as an astronomer he was incapable of knowing the nature of the cosmos with certainty. However, he merely assumed whatever suppositions that would help him calculate the motions of the heavenly bodies more accurately according to the principles of geometry (Rabin, 2019). That concluding declaration was the safety net that saved his skin. He understood his political and religious environments perfectly and smartly circumvented them. His admirer Giordano Bruno was not that circumspect.

Following the implications of Copernicus' heliocentric hypothesis, Bruno declared that the cosmos was indeed heliocentric and infinite. Unlike Copernicus, Bruno refused to have his thoughts subjected to the limitations of ecclesiastical demands for conformism. He took several steps further than Copernicus. Copernicus recognized a center of the cosmos but called it the sun rather than the earth chosen by Ptolemy. Bruno recognized no center at all for the cosmos. If the cosmos has no center, it is infinite and if it is infinite, there is definitely a possibility of other worlds than ours. An infinite cosmos will not be bounded. Therefore, it is necessarily one. If it is unbounded, it is indeterminate. If it is indeterminate, it cannot be completely comprehended. Of course, this would be a cosmos that is infinite and one is necessarily immobile (Knox, 2019). There is no place for it to move as it is the only reality. It has no beyond.

To his credit, Bruno was the first thinker to regard the stars as other suns with their own planets (Knox, 2019). Bruno was not unaware of the theological implications of his cosmology. A sole, unitary and infinite cosmos that was the only reality would logically lead to the identification of the cosmos as God; pandeism. That was a thought the Church would not want to entertain. Multiple worlds/solar systems with intelligent beings would make nonsense of the Christian doctrine of

salvation. Were those other worlds visited and saved by their own messiahs? What then would happen to the doctrine of trinity? Which of the possible messiahs would be the Son? The Church was understandably uncomfortable with Bruno's cosmology. It was, hence, not surprising that the Church found reason to murder him in 1600 by burning him at the stake in Rome on ridiculous charges. Bruno was a martyr for science.

Kepler did much work to improve on the heliocentric hypothesis advanced by Copernicus. His most significant contribution to cosmology was his discovery that the planets revolved around the sun in elliptical orbits, thus doing away with the Ptolemaic epicycles (Di Liscia, 2015). His religious convictions significantly limited his cosmology. Kepler is remembered for making a decisive break with the Aristotelian cosmological assumption that the motions of heavenly bodies must confirm to a circle, the acclaimed most perfect of geometric figures.

Galileo Galilei, by the invention and use of an improved terrestrial telescope, was able to confirm the Copernican and Keplerian heliocentric hypotheses. Until his use of the telescope in the observation of heavenly bodies, there was no demonstrable way of proving or disproving the heliocentric hypothesis. Galileo broke away from the literally interpretation of the scriptures in matters of science as the scriptures were no scientific treatises but moral guides to life. His observation of rough spots on the moon retired the Aristotelian/Ptolemaic dictum that the celestial bodies were in perfect geometric expressions. Galileo rooted for the superiority of scientific observation over the Bible on matters of physics, a position that piqued the Church against him. Galileo was careful never to make his thoughts on the theological implications of his cosmological discoveries public. He was already under the scrutiny of the Church and never wanted the Church to have reasons to persecute him. At a point in time he had to recant some of his views at the request of the Church. Despite his precautions, Galileo was eventually arrested, tried and sentenced to life imprisonment by the Church. His fate notwithstanding, the triumph of scientific observations over biblical positions on matters concerning the physical world eventually prevailed.

The Newtonian Cosmos

Kepler was preoccupied with planetary motions and heliocentricism. He observed that the planets revolved around the sun in elliptical orbits. He was silent on what actually moved the planets. Galileo, on the contrary, discovered that rather than the Aristotelian unmoved mover, there is a force in nature that is responsible for the motion of cosmic bodies. Newton took these discoveries further by propounding a new theory of moving bodies which would change the course of physics forever. Newton stated that earth bodies exude a drawing force known as gravity. That falling bodies are drawn naturally to the earth center because of the force of gravity. This drawing force or gravity among heavenly bodies creates the tension that triggers off cosmic motions (Newton, 1729; Snith, 2007).

Although many of his contemporaries dismissed the concept of gravity as somewhat occult, it nevertheless explained the motion of heavenly bodies and why they are firmly in space rather than freefalling (Edelglass et al, 1991). Newton assumed the cosmos to be infinite but fell short of explicating it beyond its motions. He was obviously trying to avoid a clash with the religious authorities of his day which were mostly same as the state. A statement on the origin or ultimate nature of the cosmos would definitely have religious implications. In his era, that was not tolerated, especially when it went against orthodoxy. Newton kept his religious beliefs to himself and refrained from drawing any religious conclusions from his cosmological discoveries. In so doing, he successfully insulated his works from religious controversies and scrutiny.

While Newton advanced the science of the motions of the heavenly bodies significantly, his era set back significantly the science of the meaning of the cosmos. He fell short of addressing the ultimate question of the nature of the cosmos as an entity. Scientists succeeding him would follow that trend.

Einstein

Keying into the tradition of theological neutrality established by Newton, Einstein steered clear of the meaning and nature of the cosmos in his theory of the cosmos. Like Newton, he focused more on the motion of the cosmos than on its origin and possible end. Einstein

propounded the theory of special relativity and later on, the theory of general relativity (Major, 2007). He equally merged space and time as a single entity at the cosmic level. His equation of energy to mass became the most popular equation in the world. Einstein's genius was not in doubt universally. While as a matter of fact his theory of relativity overthrew the Newtonian physics, his cosmology was nonetheless poor. It woefully failed to address the question of origin and end of the cosmos.

The Big Bang Cosmos

The big bang theory is a cosmological model that seeks to explain the universe but ends up shutting out entirely from the intellectual discourse, the question of the origin of reality. It is a misleading acronym that gives out so much information about the workings of the universe but is paradoxically silent on the origin of matter. As a matter of fact the big bang theory does not even pretend to answer the question of origin in relation to the universe. On the contrary, it is a largely speculative but seemingly scientific account of a supposed bang at a point in time, in the existence of reality. The big bang theory does not claim to be an explosion of matter out of nothing to create the "something" that is the universe (Kragh, 2013). It is no *creatio ex nihilo*. It is at best the reorganization of matter into forms that we are more familiar with today. It does not give any account of the origin of matter per matter.

The big bang theory is fraught with many logical inconsistencies. Not only that it continues in the Newtonian and Einstein's traditions of staying mute on the theological implications of cosmological propositions, it ups the ante by shying away from the question of the origin of matter but focusing on the reorganizations of natter instead. It is not possible to talk about an origin of the universe in an already existing universe. The supposed bang did not take place in nothingness. Absolute nothingness is not possible in the universe. Like Parmenides said, "nothing can come out of nothing" (Diels, 1897). Matter must be necessarily eternal. In that case, no bang could have possibly called it into existence. It has always been.

The big bang model of the universe gives an account of the expansion of the universe from initial high density and high temperature to its present state (Bridge, 2014). It clearly does not give an account of

the universe but the expansion of the universe. Yet, the phrase, "expansion of the universe" is not logically tenable. The universe is all that there is. There is nothing outside the universe. There cannot possibly be an "outside" to the universe since it is all that there is. How can the universe possibly expand? Which other universe is it expanding into when it is the entirety of all that there is? For the universe to expand there must be something out there that it is expanding into; there must be room that it is expanding into. However, there is no such room since even the space is part of the universe. Galaxies might expand but that does not mean that the universe is expanding. Galaxies are in, and are a part of the universe, but not the universe.

The only definite way to logically express the extent of the universe is by ascribing infinity to it. The universe cannot be bounded. If it were to be bounded, what would the reality beyond the boundary be called? Such a space is not possible because, as aforementioned, the universe is the sum total of all existing physical realities.

The value of the big bang model lies in its explanation of some physical realities in space. It gives no clear account of the origin or ultimate fate of the universe. The question of the origin and future of the universe remains largely unanswered. Even the idea of a bang appears metaphorical.

Meta-Science

Current laws of science give empirical accounts of events and realities in the cosmos. But the laws as they are at present might not yield a satisfactory answer to the nature of the cosmos as an entity. Scientific laws account for finite events. They basically operate by relating effects to causes. In the case of the universe which so far demonstrates infinity, scientific laws as they are at the moment become handicapped. When an effect is continuously changing because it is infinite, it becomes difficult to pin it to a cause. Therefore, there is need for a new science, an advanced science that can take off from the limits of the current science. That is metascience.

Unlike metaphysics that is based purely on ratiocinations, imaginations and, sometimes, religious doctrines, metascience is based on the empirical measurements of the units and implications of infinity. It is the science of infinity in relation to the cosmos. It is the science of

cosmos as an unbounded entity. It is cosmology operating on advanced laws of physics. It is a scientific probing of the objects of metaphysics. There is nothing mythical about metascience; rather, it boldly probes realities that conventional science shies away from. It probes infinity.

The behaviour of the cosmos at the macro level is as important as the behaviour of the cosmos at the micro level. Conventional science often is fixated on micro portions of the cosmos, and rarely focuses on the cosmos as an entity. Conventional empiricism deals with finitude. It majorly deals with accomplished events. Infinity however is an accomplishing event rather than an accomplished event. Conventional science and empiricism cannot adequately explain it. Therein is the subject matter of metascience.

Material Implications of an Infinite Cosmos

The cosmos is thoroughly made of matter. An infinite cosmos implies the infinity of matter. The implication is that matter is infinite in kind and dimension. All kinds of matter can never be discovered neither can matter be reduced to the barest division. No particle of matter can be indivisible in an infinite cosmos, for infinity is inversely in dimension. "Infinity" must necessarily be listed as a property of matter.

Conclusion

The cosmos has always been a continuous puzzle for ages. Every era does its best at the task of giving meaning to the cosmos. From the Ptolemaic era to the present era, that quest has not subsided. Since the Copernican revolution, scientists and philosophers have in their discoveries and writings pointed to an infinite universe. An infinite universe has far reaching implications. These implications ought to be scientifically investigated even if it means inventing an advanced form of science known as metascience. A science based on finite events, such as we have practised thus far and up until now, cannot apply to the cosmos as an infinite entity. New rules ought to apply. A new science ought to be invented.

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