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Planetary Energy Dynamics, Part II: Cosmology and Cosmogenesis

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INTRODUCTION

By the end of the 20th century scientists had reached near-unanimous consensus regarding the cosmological origins of the universe. Based on evidence amassed over decades they claim the universe originated some 15 billion years ago due to an enormous explosion originating from a tiny subatomic particle they called the 'primordial atom' that subsequently gave rise to everything in the Universe.

How or why this primordial atom might have been present before space or time even existed is never explained. And why it purportedly destabilized and exploded is left to the imagination. Nonetheless scientists claim that in ~10^{-43} seconds this hypothetical particle measuring ~10^{-35} meters in size somehow exploded in a ball of flame and created the universe as we now know it. Or so the story goes.

In *Big Bang: The Origin of the Universe* (2004) particle physicist and science writer Simon Singh comments 'we are privileged to be part of the first generation who can claim to have a respectable, rational and coherent description for the creation and evolution of the Universe'. Singh describes the Big Bang as 'an elegant explanation for the origin of everything we see in the sky', calling it 'one of the greatest achievements of the human intellect and spirit'.

In *Genesis of the Big Bang* (2001) cosmologists Ralph Alpher and Robert Herman, contributors to the model, commented, 'although many questions about cosmological modeling are still unanswered, the Big Bang Model is in reasonably good shape. We

are certain that future theoretical and observational work will at the very least fine-tune this model, but we are also certain that the fundamental conceptual framework of the Big Bang—as a description of the origin and evolution of the universe—will remain valid'.

In *Conjectures and Refutations* (1962) science philosopher Karl Popper argues that scientific knowledge necessarily begins with speculative hypotheses, what he calls 'myths', that manifest through observation of natural phenomena. Myths are attempts to move beyond empirical description toward causal explanations. But for the most part such scientific myths are little more than untested belief and opinion.

Popper argues that for science to progress beyond its mythic stage and become 'real science' what is needed is not more observation or experimentation but subjecting its myths to critical examination. Since all scientific hypotheses are unprovable, Popper asserts that science can only follow a path of progressive refinement based on reflective critique and refutation of existing knowledge, i.e., scientists must rigorously scrutinize their theories for interpretive errors and inaccuracies.

When scientists fail to engage in such reflective dynamics their science ultimately degenerates into pseudoscience and dogma. Such developments have historical precedent and, paradoxically, led to the emergence of our own present era of science.

The first collision between dogma and real science involved observations that eventually overturned the ancient astronomical system. For nearly 1500 years Ptolemaic astronomy, based on the assumption that celestial objects revolved around a stationary Earth, was uncritically accepted. Over the centuries anomalies in the expected orbital paths of the planets continued to appear and, rather than questioning ingrained belief, astronomers made piecemeal emendations until, finally, planetary orbits had become so complex, laden with epicycle upon epicycle, that the system was incomprehensible. It collapsed into a heap once Copernicus showed that planets revolve around the Sun.

But circumstances surrounding Big Bang (BB) theory in other respects are quite different. Ptolemy's misinterpretation was based on empirical observation. BB architects, to the contrary, began with abstract mathematical suppositions as to how events *should* have occurred and attempted to apply their hypotheses to real world phenomena—a complete inversion of customary praxis. And instead of relying on observation to test and refute their beliefs, they cherry-picked data that conformed to their a priori assumptions.

The seemingly arbitrary introduction of mathematical reasoning and logic into what had traditionally been an empirically based discipline has no historic parallel. Mathematics became an indispensable part of modern physics in the 17th century under the influence exemplars like Isaac Newton and by the early 20th century its authority was unquestioned.

In the sixty years between its introduction and final triumph in the 1990s, BB theory had a sketchy history. Initially both scientists and public were either indifferent or outright skeptical as to its extravagant claims. Years passed without gaining traction. But a faction of ardent academics persisted in their attempts to rewrite history. And in the process history repeated itself.

BB first gained recognition based on a flimsy piece of evidence known as the redshift phenomenon which proponents took to indicate that the universe was rapidly expanding. Redshifting is said to represent a change in light frequencies caused by the movement of celestial bodies away from Earth—like the changing pitch of a siren as it moves toward and then away from an observer. Many astronomers

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questioned whether redshifts implied an expanding universe, even Edwin Hubble, whose observations were used to justify the BB, had serious doubts but no one had a better explanation. Over time it became accepted as fact like Ptolemy's geocentric universe.

The second thread of circumstantial evidence concerns what is called cosmic microwave background radiation. In the late 1940s scientists argued that as space stretched out to form the universe, primordial light waves would also have been stretched and they predicted the existence of electromagnetic radiation in the microwave range. When such radiation was accidentally discovered in 1964 proponents seized on this as confirmation of the BB despite caveats from other astronomers that such background radiation could have any number of different origins.

By the 1970s and 80s other lines of evidence had converged calling into question prevailing assumptions underlying BB theory. But then human nature intervened. When astronomers attempted to publish contravening evidence, it was rejected by academic journals and given the silent treatment. And if their claims did attract attention, they were widely denounced by scientific opinion leaders as flawed and incorrect. Astronomers who advocated alternative perspectives were denied telescope time at observatories and cut off from public-funded research grants.

Some pointed to parallels between orthodox science and the Medieval Church. Others claimed an elite cadre of scientists had undermined the spirit of science. The subtext of this 20th-century drama in search of 'real' knowledge in the end is only the perennial clash between truth and power. Like the Medieval Church orthodox science has evolved into an institution that stubbornly resists reform and renewal.

In this series of papers, we examine events leading to the rise of BB cosmology and the eventual emergence of counterevidence, much of which has been ignored by mainstream science. We'll see that BB has little basis in fact and might be one of the most outlandish creation stories ever concocted. Based on evidence we examine, only a few options regarding the supposed origins of the Universe are possible, none of which is the BB.

CREATION STORIES

It's a bit unsettling to realize, some 400 years into the modern era of astronomy, how much remains unknown about the Universe. Astronomers can only comment on what they observe but a large, perhaps major, portion of the Universe remains unobservable. Many fundamental questions persist.

Scientists estimate the Universe is about 93 billion (bn) light-years or ~8.8 X 10^{23} kilometers (km) in diameter but remain undecided as to whether it's finite or infinite. According to recent Hubble Space Telescope data the Universe is now thought to contain ~2 trillion (10^{12}) galaxies and ~10^{24} stars—a massive increase from earlier estimates. The discovery of galactic superclusters in the late 20th century prompted some astronomers to argue that the current estimated age of 15bn years is far too short and suggest instead the Universe may be 80-100bn years old (if indeed its age is even measurable). Rather than 'finite' or 'infinite' the most apt descriptives are 'indefinite' and 'indeterminate' **(Figure 1).**

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Figure 1: Milky Way over Quiver Tree. Photographed by Jianfeng Dai. Majestic celestial arch of the Milky way suspended over the Kalahari Desert near Keetmanshoop, Namibia. Just above the skyline of the image to the right are the Large and Small Magellanic Clouds.
https://iauarchive.eso.org/public/images/detail/ann23043o

Rational cosmology first appeared in Greece around 500 BCE. Anaxagoras of Ionia claimed the universe was infinite and composed of innumerable separate worlds. The *Kosmos* was said to originally consist of an undifferentiated cloudlike matrix containing all the ingredients that would later form the Universe. The composite was set into rotational motion by the agency of a metaphysical entity called the *Nous* or divine Intellect. This circular motion induced a separation of material producing 'seeds' that formed the visible structures of the Universe.

Rather than invoking metaphysical causes atomist philosophers Leucippus and Democritus envisioned a universe coming into being randomly. It began with a vast empty space, the Void, populated by an infinite number of atoms of all dimensions which, based on random collisions, gave rise to the suns, stars, planets and moons. Each celestial body was formed from its own kind of atom based on like attracting like. The atomist creation story bears likeness to the modern account. Beginning with Newton contemporary science conceived space as an empty vacuum filled with particles that aggregated and expanded due to random collisions: primordial particles combined to form atoms, atoms collided to form molecules and so on all the way up to gigantic celestial bodies.

In *Timaeus and Critias* Plato advances what would become the most enduring and influential creation account of the West. Rejecting atomism in favor of intelligent design, he argued that while random collisions may generate structure, they cannot explain the observed order and harmony of the Kosmos. Such order is not intrinsic to the physical Universe but rather imposed upon it.

In his theory of Forms, a central tenet in metaphysics, Plato claims that the physical world perceived by the senses is but a copy of a higher immaterial realm. The Forms (or Ideas), accessible only to the

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intellect, represent an eternal and changeless world of essences. The Forms are progenitors. Physical structures in the observable universe, including our own world, imitate and participate in the reality of the Forms. On this basis Plato claimed the Kosmos was alive.

In Plato's cosmology a divine craftsman, the Demiurge, imposes order on a pre-existing state of chaos, invoking the notion of a creator deity. This plays a role in the subsequent Christian account. But for Plato the Demiurge, which acted according to geometric principles, was an attempt to integrate mathematics and rationality into the Kosmos. Instead of random collisions it was artfully composed from five variously shaped geometric solids. This notion had profound impact on modern science and its pursuit of ideal mathematical laws.

One of the most intriguing concepts in Timaeus is what Plato calls *khôra,* meaning receptacle, an incorporeal entity which mediates the translation of the Forms into visible celestial objects. We might think of khôra as a gestational medium, a featureless precursor state out of which space and matter arise. Khôra is not entirely irrelevant to modern astronomy.

In the mid-18th century as the quality of telescopes improved astronomers observed fuzzy cloudlike structures that bore little resemblance to point-like stars. In an obscure work *Universal Natural History and Theory of the Heavens* (1755) philosopher and astronomer Immanuel Kant advanced his Nebular theory claiming that they were collections of gas and dust wherein planets were born. This same concept was independently advanced fifty years later by astronomer Pierre-Simon Laplace. While originally conceived as a medium in which planets were born, nebulae are now also regarded as a birthplace of stars, i.e., 'stellar nurseries' **(Figure 2).**

Figure 2: Pillars of Creation, a stellar nursery in the giant Eagle Nebula with its finger-like projections of accreted gas and dust invoking Plato's khôra concept. Photographed from the James Webb Space Telescope. **https://www.americaspace.com/2023/12/07/webb-space-telescope-celebrates-two-years-of-stunning-observations/**

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In contrast to Plato, Aristotle argues against a creation event arguing instead that the Universe is eternal. He invokes the primacy of organized motion which, he says, has neither beginning nor end. For Aristotle the Kosmos is an integrated functional nexus which he ascribes to the actions of a collective life principle, *de anima* or soul, that eternally perpetuates itself.

Aristotle rejects the atomist's void and points to the impossibility of empty space. Instead, he advances the notion of the *Plenum* or 'primordial fullness', arguing that all space throughout the Kosmos is continuous and interconnected. The plenum and its corollary 'nature abhors a vacuum' dominated ideas about space into the 1700s. In the 1970s and 80s satellite data confirmed that the Universe is 'full', i.e., ~99.9% occupied, by an energized substance called plasma composed of branching electromagnetic filaments as well as ionized particles of hydrogen and helium. Plasma is now conceived as the 'fourth state' of matter **(Figure 3).**

Figure 3: The plasma Universe from the James Webb Space Telescope affirming Aristotle's Plenum concept. https://thesublimeblog.org/2023/12/19/beautiful-science-the-plasma-universe/

A core Aristotelian organizational theme is the Four Causes, the existential categories which define structure and function of both animate and inanimate objects. All things can be classified on the basis of material causes, that out of which something is composed; efficient causes, an energetic milieu of flowing fluids which generate motion (*kinesis*) and the actualization of potential; formal causes, i.e., the Forms, the essential attributes and functions that define an object; and final cause with its enigmatic Unmoved Mover, the ultimate cause of all structure and function in the Kosmos, the closest Aristotle comes to invoking a deity figure. Final cause is *telos*, the purpose of why things exist and the goal toward which they move and evolve.

In the Platonic and Aristotelian Kosmos all phenomena, animate and inanimate, are organized hierarchically, i.e., everything interacts along a vertical causal axis. If one begins with Form and,

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say, a supposed nebular cloud as the gestational medium, we might then regard plasma with its stellar-born energy flow as the efficient cause which effects the translation of the pre-existing functional and structural attributes into physical form. Extending this analogy further we could also say that hydrogen and helium ions within plasma, which scientists claim serve as malleable 'proto matter' for chemical elements, represent the layer of material cause in this cosmic chain of events.

Five hundred years later Plotinus, Alexandrian philosopher living in Rome, crafted what is generally regarded as the final great synthesis of ancient cosmological thought, aka Neoplatonism, which became the established conceptual framework in the West for 1500 years until it was discarded and replaced by modern science. In *The Enneads*, Plotinus advances a profoundly spiritual view of the Universe, again strictly vertically and hierarchically ordered, composed of four distinct layers of reality: the One, the supreme unchanging source of all; Intellect (Divine Mind) the realm of the Forms and true being; Soul, the translational medium interposing Intellect and the visible universe; and the material world accessible to the senses. The parallels to Plato and Aristotle are apparent but in other respects Plotinus' cosmology is far more aethereal and otherworldly.

The Universe isn't an intentional creative act nor is it even 'created' in the sense of being a finished product. Instead, it is perpetual activity, an eternal dynamic set into motion by the transcendent One. Like Aristotle's Unmoved Mover, the One engages in actionless activity that gives rise to all phenomena. Its motionless motion overflows in the form of 'emanations' (or radiations) which spontaneously organize into hierarchical layers of collective being. Plotinus likens the One to the Sun whose continuous radiant energy engenders and sustains the solar system.

Thus, in the Plotinian cosmology unity begets multiplicity as all reality flows from the single Supreme source. Entities emanate 'downward' (or outwardly?) they acquire physical form and, in the process, become less perfect, less divine and susceptible to corruption and degradation. This sets the stage for the second part of the cosmic cycle, what Plotinus calls the epistrophe, in which all created things return to their source and multiplicity reverts to unity. Nor is this concept irrelevant to astronomy.

Evidence suggests planets, stars and galaxies regularly come into being throughout the Universe and, while their life spans may measure in the billions of years, they eventually undergo degeneration and pass out of being. This raises questions as to the purpose of supermassive black holes found at the center of most large galaxies which seem to be actively pulling stars and other objects back into the nothingness from which they came. From where do celestial objects come and go? **(Figure 4)**. And with recognition of these cosmic life-death cycles, we confront the paradox that while celestial elements have a finite span of existence the Universe itself may in fact be eternal.

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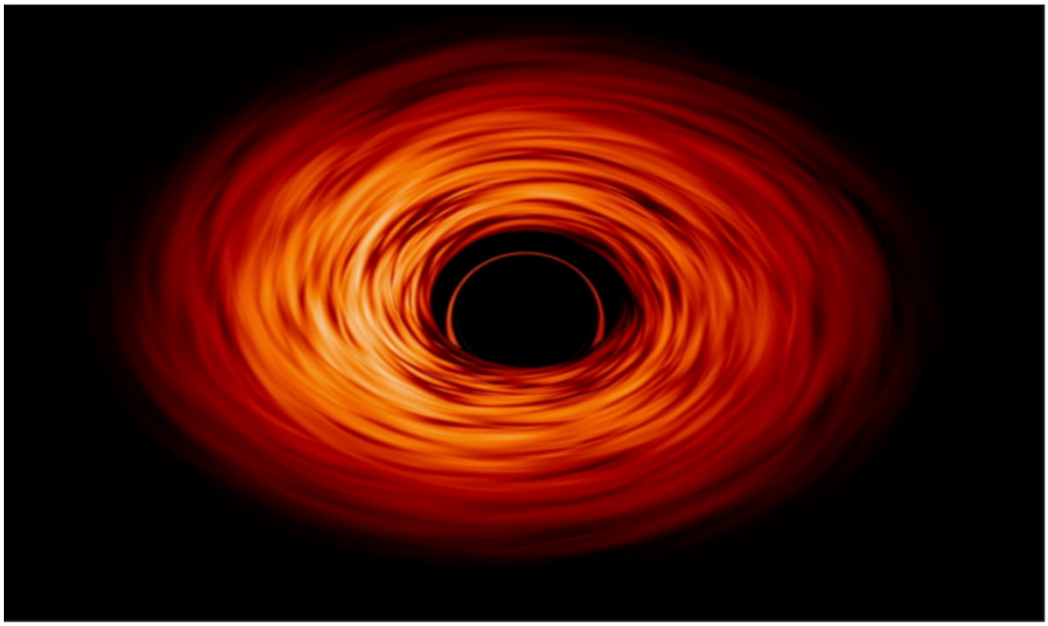

Figure 4: Black hole. Simulation showing turbulent plasma flow around a black hole from NASA's Goddard Space Flight Center/J. Schnittman. https://physics.aps.org/articles/v15/20

Early Christian Fathers, Theophilus of Antioch, Irenaeus of Lyons, and Tertullian of Carthage, developed a cosmology that had both Platonic and Plotinian elements. They argued for a primal creation scenario in which a supreme deity generates everything out of nothing, i.e., *creation ex nihilo*, thus imputing an eternal god but a temporally finite Universe. Parallels to Plato's Demiurge and the Plotinian One are apparent. By the 4th century this had become Church doctrine.

Based on this brief review it seems there are but a few recurrent themes at play in the various cosmological accounts. One inevitably draws conclusions based on a priori assumptions. Even the Cosmic Egg hypothesis is premised on such arbitrary judgments. BB theory, for example, advocates a creation ex nihilo scenario (though not quite along the lines of the Christian account) while relying on Greek atomism to provide a mechanism: 'ex nihilo' becomes the empty space of modern physics while atoms become material cause, but how it all unfolds remains a supreme act of imagination.

BIG BANG ORIGINS

Because it was incomplete from its inception, BB theory unfolded in a stepwise manner making its history more complicated than perhaps its architects had envisioned. The unfolding sequence doesn't lend itself well to a storybook format. Rather than attempting a linear exposition of its history we examine its underlying assumptions against a broader background of unfolding scientific discovery over the past several centuries.

What makes the BB story intriguing and particularly relevant is that it was a concerted effort by physicists to expand the scientific framework beyond Newtonian mechanics, which could never explain the origin of forces like gravity despite subjecting them to extensive mathematical analysis. But in the end physicists were never able to escape from under Newton's shadow.

In the 1840s Michael Faraday became the first to describe the principles of electromagnetic

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induction. Within decades physicist James Maxwell published mathematical treatises detailing the laws of electromagnetism. This seminal work paved the way for a flood of scientific research that eventually led early 20th century scientists in two opposing directions: 'downward' into the atomic realm, exemplified in the ideas of Max Planck, Neils Bohr and others, and 'upward' into the furthest reaches of space which became the domain of astrophysics. And at some point these two extremes had to be reconciled.

For science to move ahead it needed hypotheses that could be rigorously tested. Einstein's General Relativity theory was the first systematic attempt to use mathematical principles and logic to decode the Universe [1,2] **(Figure 5)**. In his theory Einstein combined space and time into a hypothetical entity he called spacetime. In his earlier Special Relativity theory[3] he had shown that time has no fixed basis and, instead, is relative to physical states such as motion. Einstein regarded the speed of light as the only universal constant. He then integrated gravity into the mix forming so-called curved spacetime. It was a radical departure from Newton's Universe.

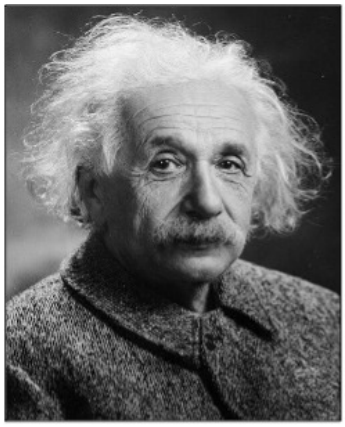

Figure 5: Albert Einstein. https://commons.wikimedia.org/wiki/File:Albert_Einstein_Head.jpg

In Newton's system gravity is a property of celestial objects, an attractive force that acts through open space. Objects attract each other based on their mass and distance: the greater the mass the stronger the force; the farther the distance the weaker the force. Einstein's gravity, on the other hand, confers upon spacetime its essential properties: celestial objects, possessing mass and motion, induce distortions in spacetime causing them to move along curved trajectories. Some have compared it to how the weight of a bowling ball deforms a trampoline.

In a much-publicized *experimentum crucis* during a 1919 total solar eclipse, astronomer Arthur Eddington observed bending of light rays in accordance with Einstein's prediction leading to the upending of Newton's framework. Einstein's curved spacetime became the cornerstone of 20th century cosmology. But it had a major flaw: it led to an unstable Universe.

Based on a single unopposed force the Universe would be unable to reach a state of equilibrium and gravity would draw celestial objects ever closer together until, eventually, the Universe collapsed upon itself. To resolve the problem Einstein, in the mode of Ptolemaic astronomers, introduced a correction factor, aka the 'cosmological constant,' into his equations to balance things out and preserve cosmic order. But he openly disparaged it as being 'gravely detrimental to the beauty of the theory' [4].

In the 1920s, Russian mathematician Alexander Friedmann, also ill-disposed to the constant, reworked Einstein's equations and stumbled upon an expanding Universe. Friedmann died soon afterward and never completed his work. Georges Lemaître, Catholic priest and astronomer, working in the same direction, deduced that expansion must be a fundamental feature of the Universe. Furthermore, he deduced that if it is now actively expanding then at some point it must have been very small. Based on such logic he advanced the notion of an explosive origin [5] **(Figure 6).**

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Figure 6: Father Georges Lemaître
https://catholicscientists.org/scientists-of-the-past/georges-lemaitre/

Meanwhile Edwin Hubble, who had been mapping galaxies for years, realized that light from more distant galaxies had higher redshift values. Redshifting was first described in 1912 by Vesto Slipher who ascribed it to the Doppler effect. He interpreted redshifts to mean that galaxies were moving away from Earth causing their light waves to stretch and shift toward the red end of the color spectrum. Hubble, taking this one step further, found that redshifts increased with galactic distance implying that their velocities must also be increasing. This relationship, aka Hubble's law, became the basis for the expanding Universe [6] **(Figure 7).**

Figure 7: Edwin Hubble.
https://www.thoughtco.com/edwin-hubble-3072217

By 1931 Einstein had publicly acknowledged Hubbell's law and endorsed the BB. With this acquiescence his General Relativity theory, in which he sought to depict a stable and orderly Universe, became the theoretical underpinning for a cosmology espousing its explosive origin from a tiny subatomic particle. This transmutation did not sit well with many scientists **(Figure 8).**

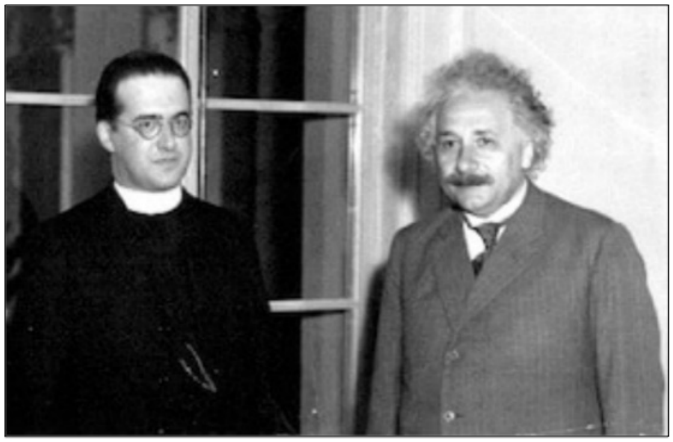

Figure 8: Lemaître and Einstein, May 1931.
https://catholicscientists.org/articles/monsignor-georges-lemaitre-originator-of-big-bang-theory/

In his 1931 paper *The Velocity-Distance Relation among Extra-Galactic Nebulae* Hubble cast aspersions on the expanding Universe interpretation of redshifts: 'the writers are constrained to describe 'apparent velocity displacements' without venturing on the interpretation of its cosmological significance' [7]. And in a letter to Dutch astronomer and cosmologist Willem de Sitter he stated, 'we use the term 'apparent' velocities to emphasize the empirical features of the correlation. The interpretation, we feel, should be left to you and the very few others who are competent to discuss the matter with authority [8].

Arthur Eddington was more emphatic: 'Philosophically the notion of a beginning of the present order of Nature is repugnant to me. I should like to find a genuine loophole . . . As a scientist I

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do not believe the Universe began with a bang…... It leaves me cold . . . too unaesthetically abrupt' [9]. Not quite the open-armed reception one would have expected for what, by the end of the century, would become a widely held article of faith among scientists.

HOT BIG BANG

The next step in the evolution of BB theory came in 1946 with the publication of *Expanding Universe and the Origin of Elements* by physicist George Gamow [10] **(Figure 9).** By this time spectroscopy had advanced and, based on the solar frequency spectrum, i.e., emitted electromagnetic radiation, scientists had fairly detailed knowledge of the Sun's physical conditions such as temperature (T°) and density as well as nuclear reactions in stars. It was known that hydrogen and helium are by far the most common elements in the Universe and are continuously emitted by the Sun in plasma generated by nuclear reactions.

Figure 9: George Gamow.
https://physics.columbian.gwu.edu/george-gamow

From such insights Gamow deduced that the generation of chemical elements depended on physical conditions immediately after the Bang. He assumed that these transformations were driven primarily by extreme heat and pressure and that early on a hot broth of rapidly moving particles filled the expanding Universe. It seemed to him highly probable that the timing of events was related to T° variations. Over the decades Gamow's predictions required some fine tuning but his basic scheme is now a central part of the BB.

The generally accepted scientific creation scenario begins at ~10^{-43} sec, aka the Planck Epoch, with an infinitely hot and dense point measuring ~10^{-35} meters that undergoes rapid inflation at about 10^{-36} sec. During this inflationary period space is literally being created. As this occurs the four fundamental forces, gravity, the strong and weak nuclear forces, and electromagnetism somehow come into being and separate from the mixture. From ~10^{-12} to 10^{-6} sec, when the exploding universe has cooled to about 10^{12}°C, the strong nuclear force separates and subatomic particles begin to form. From ~3-20 minutes into the event the universe has supposedly cooled to ~10^{9}°C and the synthesis of protons and neutrons occurs. Atomic nuclei begin to congeal. After ~20 min the T° and density have dropped below the point at which such nuclei can form **(Figure 10).**

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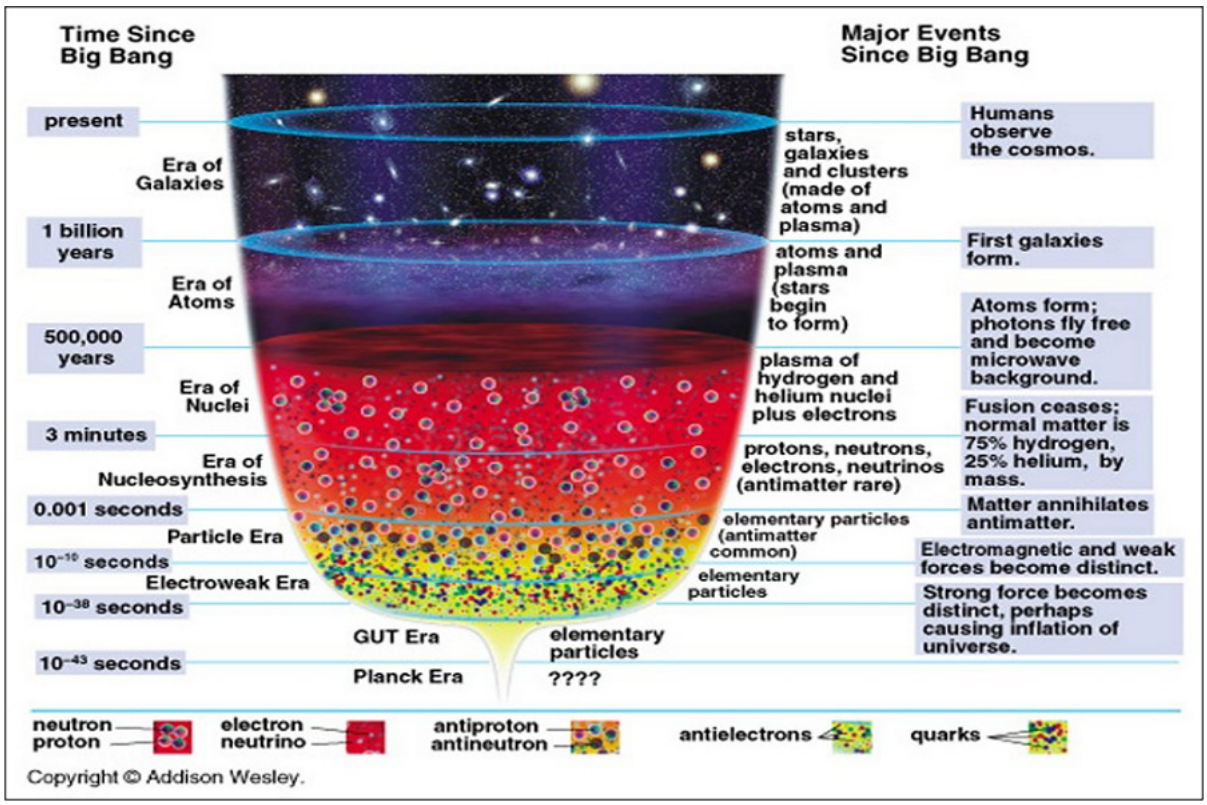

Figure 10: Big Bang timeline. https://www.physicsoftheuniverse.com/topics_bigbang_timeline.html

Over the next 240,000 years during the Photon Epoch, the early universe, now pure plasma, undergoes cooling. Once it reaches ~3000°C ionized hydrogen and helium atoms capture electrons and morph into gases. In the process, the primal broth begins to clear and universe becomes transparent to light. Of course, there are no stars yet and for the next 300-500 million years the universe remains in total darkness. Over the eons gravity slowly works its magic and primordial gas clouds, i.e., nebulae, become progressively denser as star and galaxy formation begins. Eventually the clouds collapse under their own weight dramatically raising their internal T°s and become stars. And through all this the universe continues to expand as it does to this day.

This alluring myth provides enough fact and detail to allow one to extrapolate from the moment of the Bang to the present Universe but can't escape the pesky fact that aside from an infinitely hot, dense point ~10^{-35} meters in diameter nothing else existed. How did all the major forces of the Universe suddenly appear when before there were none? From where did elementary particles like quarks, hadrons and protons come? Before we can even begin to intellectually grapple with the details of their myriad theories, they thrust upon us a contemporary rendition of the Cosmic Egg myth.

The real sleight of hand, however, is how they introduce thermodynamics as an efficient cause to bring about the formation of the Universe. Infinitely high T°s are posited to raise the energy level of the primordial broth and with cooling there ensues a congelation of particles from the mixture. This notion was not concocted by BB theorists but had been a recurrent motif since the beginning of modern science. Moreover, the mathematical justifications for this scenario had already been formulated and only needed to be dusted off to fit the circumstances.

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In the mid-18th century what we now know as the Earth sciences—geology, astronomy, oceanography and meteorology—began to take shape and the most pressing questions had to do with the origins and evolution of the planet. One of the early works, *Protogaea*, penned by philosopher Gottfried Leibniz in the 1690s, tendered the concept that the Earth began as a molten ball of liquid and that as this fiery orb gradually cooled it hardened into solid rock [11].

Early geologists, examining the evolutionary trail of evidence, divided into two opposing factions: the catastrophists, arguing in favor of a cataclysmic origin of Earth, and the uniformitarians who espoused slow, incremental change. The back-and-forth sallies between these two rival camps continued into the 20th century without abate. No matter the aspect of creation in question—Earth, Moon, solar system, etc.—catastrophists argued for a violent origin inevitably involving explosions and collisions. The BB is simply a recapitulation of this theme. But we need to examine how scientists turned a psychological predisposition into a dominant rational worldview.

By 1800 Laplace's nebular hypothesis, the basis for modern ideas regarding the genesis of galaxies, suns and planets, had become a popular item among scientists. He claimed that the solar system began as a hot gaseous cloud slowly rotating around the Sun. As the T° gradually cooled small planetary bodies precipitated from the cloud like raindrops in a storm. As cooling and contraction progressed the speed of rotation increased causing the cloud to flatten into a disk-like structure. Such entities, called accretion discs, have been documented by modern astronomers in remote solar systems. The similarity to Plato's khôra is obvious. But Laplace, instead, was bent on showing that Newton's mechanical laws were applicable to the solar system and astronomy [12].

Around 1810 mathematician Joseph Fourier, attempting to determine how much time it took for a molten Earth to cool down to its present T°, developed the first theory of heat dissipation. Fourier noted that 'when heat is unequally distributed among different points of a solid body it tends to come to equilibrium and pass successively from its hotter to colder parts' [13]. The tendency toward equilibrium through heat dissipation became a central theme of 19th century physics and formed the basis for what Eddington later coined the 'arrow of time' in which heat dissipation and the passage of time became linked to the irreversibility of natural processes.

By mid-century scientists had come up with thermodynamic laws that ostensibly govern energy dynamics in the Universe. These laws, a product of the so-called Age of Steam, are entirely derived from Newtonian mechanics. The first law is easy enough to swallow: energy is neither created nor destroyed but only changes form. Who could argue with this? But the second law, based on the behaviors of mechanical devices, gave rise to an alien concept that may or may not apply to the Universe.

Circa 1850 Rudolph Clausius argued that whenever 'work' is performed a portion of the required energy is dissipated as heat due to mechanical inefficiencies like friction. Heat thus became regarded as an energetic waste product. Based on such reasoning Clausius advanced the concept of 'entropy' which is a measure of energy dispersion or disorder. Organized systems, like galaxies or the Universe, begin with very low degrees of entropy (because by their very nature they are 'organized'), but over time are said to 'wind down' as the available productive energy decreases and entropy or unusable energy increases. This winding down process, i.e., the arrow of time, is inherently irreversible [14].

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Mathematician William Thomson (Lord Kelvin) deduced that if natural processes continue to lose mechanical energy as unusable thermal energy, the system must inevitably reach a logical terminus. In the 1850s he argued that the Universe was progressively deteriorating, that it was winding down toward a uniform state of thermodynamic equilibrium in which T° would become everywhere equal, a so-called 'heat death,' and would cease to exist. On this basis Thomson argued against an infinite and eternal Universe claiming instead that it must be temporally finite, necessarily possessing both beginning and end [15].

Various scientists argued against the catastrophist's claims and there was by no means uniform consensus. American geologist Thomas Chrowder Chamberlin, arguing that the evidence for an explosive origin of Earth was weak, rejected the catastrophist theory and instead proposed that it had formed gradually by cold accretion of small particles he called 'planetesimals'. The planetesimal concept has gained wide currency in contemporary astronomy. We examine this at greater length in the next paper.

The final step in the unfolding 19th century chain of logic, advanced by physicist Ludwig Boltzmann in 1877, provided a statistical bridge between a system's thermal energy and the behavior of its constituent parts. Boltzmann's constant, a numeric conversion factor, translates measurements at the macroscopic level into events at the atomic level. Thus T° can be said to reflect the average kinetic energy of a population of oscillating molecular elements. Boltzmann's work would become the basis for core ideas in quantum physics.

In a 1979 piece, *Singularities and Time-Asymmetry*, physicist Roger Penrose, building on Boltzmann's entropy framework, calculated that the probability of the Universe arising from a massive explosion was infinitesimally small, so small as to be impossible [16]. The Penrose number, 1 followed by 10^{123} zeroes, larger than the calculated number of atoms in the Universe, excludes any kind of accidental origin. For the Universe to come into being it must have already been in a highly organized state with near-zero entropy. So much for thermodynamics.

THE QUANTUM PROBLEM

The first insights came around 1900 in *On the Law of Distribution of Energy in the Normal Spectrum* by physicist Max Planck who had been studying blackbody radiation [17]. First described in the 1860s it was known that the energy emitted by a perfectly black, i.e., absorptive, object depends on ambient T°. To make his calculations fit the data he introduced the novel idea that energy was released in discrete packets or 'quanta'. He devised an equation relating energy to the frequencies of the radiation. To tie it into the atomic level he applied Boltzmann's constant. By introducing frequency, a property of electromagnetic radiation, he set the stage for what would later become known as the wave-particle duality.

In 1905 Einstein published *On a Heuristic Viewpoint Concerning the Production and Transformation of Light* in which he used Planck's quantum concept to explain the photoelectric effect [18]. Discovered in 1887 the photoelectric effect is the emission of β-radiation, i.e., electrons, from the surface of materials after being struck by electromagnetic radiation. Seeing parallels with Planck's work, Einstein redefined light as discrete energy quanta or photons. In the same year he published *Does the Inertia of a Body Depend on the Energy it Contains?* with the famous $E = mc^2$ equation positing the equivalence of mass and energy [19]. If a photon contains sufficient energy, under appropriate conditions it ostensibly transmutes into a particle. Clearly this aligns with catastrophist and BB theories.

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In *The Scattering of α and β particles by Matter and the Structure of the Atom* (1911) Ernest Rutherford reports on experiments in which he fired α-particles, i.e., helium nuclei, at a thin sheet of gold foil behind which he placed a fluorescent screen. Based on observed scatter patterns he deduced that atoms must contain a dense core of mass with positive charge, i.e., the nucleus, surrounded by 'empty' space. He didn't take it any further [20].

In *On the Constitution of Atoms and Molecules* (1913) Neils Bohr expanded on this and, applying quantum logic, conceived the atom as a field of negatively charged electrons with defined energy gradations orbiting the nucleus at fixed distances. When electrons changed energy states they absorbed or emitted energy in precise quantum values and 'jumped' into different orbital pathways. Bohr's synthesis bears resemblance to the solar system in which planets orbit the Sun except that electromagnetism rather than gravity provides the motive force [21].

The next step came with *Research on the Quantum Theory* (1924) by Louis de Broglie who advanced an all-encompassing wave-particle duality by arguing that if electromagnetic radiation, wave-like in nature, possesses particle attributes, then all matter, i.e., atoms and subatomic particles, must possess both wave and particle properties as well [22].

In 1926 Erwin Schrödinger published a series of papers entitled *Quantization as an Eigenvalue Problem* out of which came the famous Schrödinger equation and the framework for modern atomic theory. Instead of regarding electrons as formed particles orbiting the nucleus he modeled them as charge-density clouds or stationary standing waves, i.e., a resonance field, distributed around the nucleus possessing both spatial and temporal attributes [23]. But at this point quantum theorists parted ways.

In *On the Quantum-Theoretical Reinterpretation of Kinematic and Mechanical Relations* (1925) Werner Heisenberg, also skeptical of orbiting electrons, and content with leaving intra-atomic events undefined, took a different tack [24]. In his functionally oriented matrix mechanics theory, Heisenberg assumed that transitions between energy states drove all atomic events and focused solely on the frequency and intensity of absorbed or emitted electromagnetic radiation. In *On the Perceptual Content of Quantum Theoretical Kinematics and Mechanics* (1927) he introduced the Uncertainty Principle stating that it is impossible to simultaneously determine certain properties such as the position and momentum of a particle with any precision precision [25].

It is remarkable that while Schrödinger and Heisenberg, working independently, laboring under entirely different assumptions regarding quantum mechanics, and using different mathematical approaches, arrived at identical predictions about the nature of events at the atomic level. And yet their conclusions are in diametric opposition: Schrödinger's wave mechanics are strictly deterministic while Heisenberg's matrix theory is irreducibly probabilistic. How can this be?

Such wave-particle duality has historical origins. In the 1660s Newton performed his camera obscura experiments by placing a glass prism in the path of sunlight streaming through a small aperture in a darkened room. After calculating the angles of refraction of the various colors by the prism he deduced that the colors were composed of 'corpuscles' of differing size. Shortly later Christian Huygens, performing optical experiments with crystals, deduced that light was wave-like in nature. Huygens' work was ignored while Newton's corpuscular theory dominated 18th century thought. In 1801 Thomas Young published his famous double-slit experiment showing wave interference patterns and supposedly proving Huygens' wave theory.

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But the double slit experiment hasn't helped resolve the modern wave-particle duality. In fact, it has only compounded the problem. It appears so straightforward at first: small solid objects fired through the slits produce two lines on the screen behind them. Waves, conversely, produce an interference pattern, a series of alternating light and dark lines: when the crest of one wave interacts with the crest of another, they additively superimpose to form a light line, aka constructive interference; when the crest of one wave interacts with the trough of another, they cancel out forming a dark line, aka destructive interference. Seemingly so simple. **(Figure 11)**

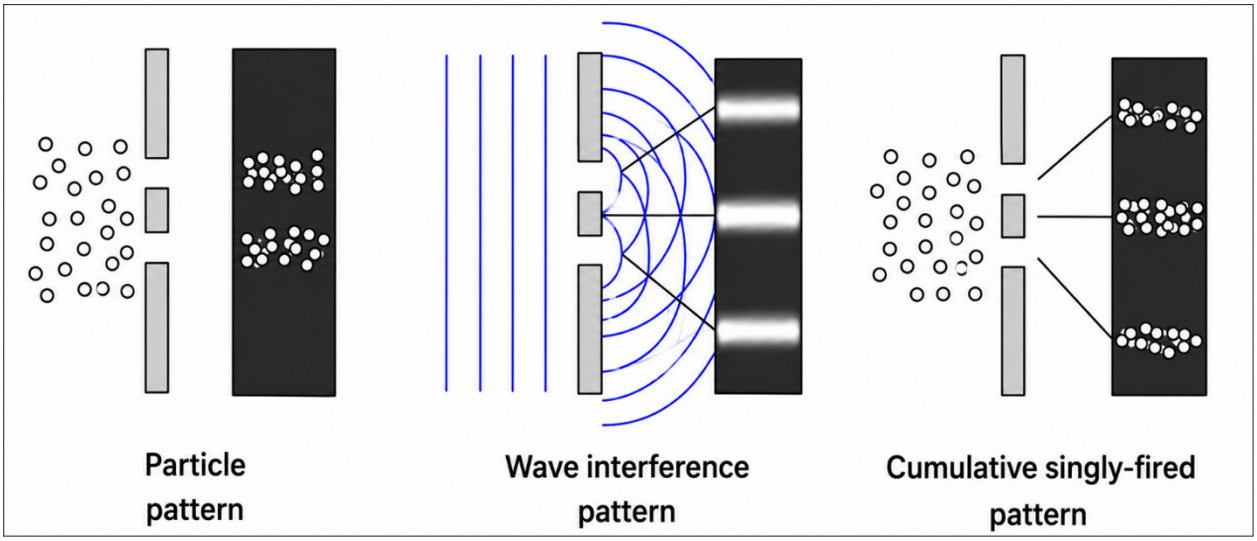

Figure 11: Double slit images. https://plus.maths.org/physics-minute-double-slit-experiment

When many electrons are fired simultaneously through the slits an interference pattern arises. But if they are emitted serially one by one, they strike the screen as discrete points like a particle, but after many successive firings spontaneously organize into an interference pattern. The same results occur with protons, neutrons, atoms and even large molecules. This violates all Western logic since Aristotle's 'excluded middle' and suggests that A = B and B = A. How can this be?

In *The Character of Physical Law* (1965) Richard Feynman describes the double-slit experiment as 'a phenomenon which is impossible, absolutely impossible, to explain in any classical way, and which has in it the heart of quantum mechanics. In reality, it contains the *only* mystery' [26]. Calling it 'deeply and profoundly disturbing' he argued that 'we can safely say that nobody understands quantum mechanics.' In the century since the development of quantum theory not a single scientist has offered a compelling explanation for the double-slit experiment. There are presently over a dozen different theories purporting to explain it.

In summary, to substantiate their claims regarding the origins of the Universe BB theorists drew upon three sources: 1) Einstein's General Relativity Theory with its curved spacetime shaped by the universal gravitational force; 2) modern thermodynamics which holds that infinitely high T°s provided the motive force that energized the primal broth; 3) quantum mechanics with its interconvertibility of matter and energy doctrine. If any or all of these tenets are shown to be either wrong or critically deficient in some manner, this would cast serious doubt on the plausibility of BB cosmology.

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UNIVERSAL DYNAMO MECHANISM

While BB theorists were piecing together different parts of the puzzle one of the most consequential discoveries of 20th century science was quietly unfolding. The Earth's magnetic field was first described around 1600 by Englishman William Gilbert and rather soon became a topic of great intellectual interest among scientists and the public. By the end of the century global magnetic lines of force had been measured and mapped out by Edmund Halley. But it would be another 250 years before scientists discovered the origins of the geomagnetic field.

In 1919 Joseph Larmor, drawing on Faraday's work 80 years earlier, proposed the existence of a mechanism at the Earth's core responsible for the generation of the field. By the 1940s critical mathematical underpinnings had been laid by Walter Elsasser. In the mid-1990s geophysicists developed accurate 3D models of the field and the dynamo mechanism is now universally recognized as the accepted explanation for the geomagnetic field [27, 28].

The field arises and functions in precise accordance with principles advanced by Faraday. At Earth's center is an iron core ~7000 km in diameter, the interior of which is a solid ball ~2500 km in diameter and an outer layer of molten liquid. As Earth rotates on its axis differential movements between the solid and liquid strata generate electrical currents which induce the magnetic field (MF). The magnetosphere, a comma-shaped structure surrounding the Earth, extends ~60,000 km into space on the side facing the Sun and up to 6 million km in the tail region. The principle of magnetic induction is stupidly simple: fluctuating electric currents induce a MF in ferrous objects [29-31] **(Figure 12).**

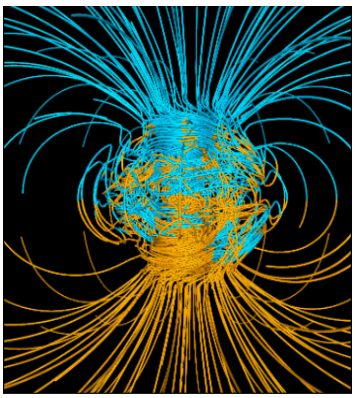

Figure 12: The Glatzmaier-Roberts computer-assisted 3D simulation of the geodynamo introduced in 1995 with its chaotic flow patterns induced by liquid iron in the outer core.
https://commons.wikimedia.org/wiki/File:Geodynamo_Between_Reversals.gif

Such rotational motion and the primal MF were undoubtedly present long before Earth reached its present size and must have been set into motion during the early nebular phase of solar system formation. But for this to be the case it must have already been present and active in the Universe. On the other hand, how the rotational motion and MF inexplicably appeared out of nowhere during the early moments of the Bang is mystifying. One is drawn to reconsider Aristotle's notion of the eternality of celestial motions.

A similar but more powerful dynamo mechanism is at play in the Sun (and all stars) but is based, instead, on plasma. Superheated, ionized hydrogen and helium nuclei form a highly conductive fluid whose continuous motion generates the solar MF. The Sun, pure liquid plasma, is composed of layers rotating at different rates thus generating electric currents and MFs everywhere [32-35]. In the outer convection zone, for example, differential rotation is based on latitude with rotation occurring faster at the equator than in the polar regions. This supercharged plasma medium permeates the solar system and defines its boundaries **(Figure 13)**. This is to say that the dynamo literally creates 3D space. But here we encounter a grave problem.

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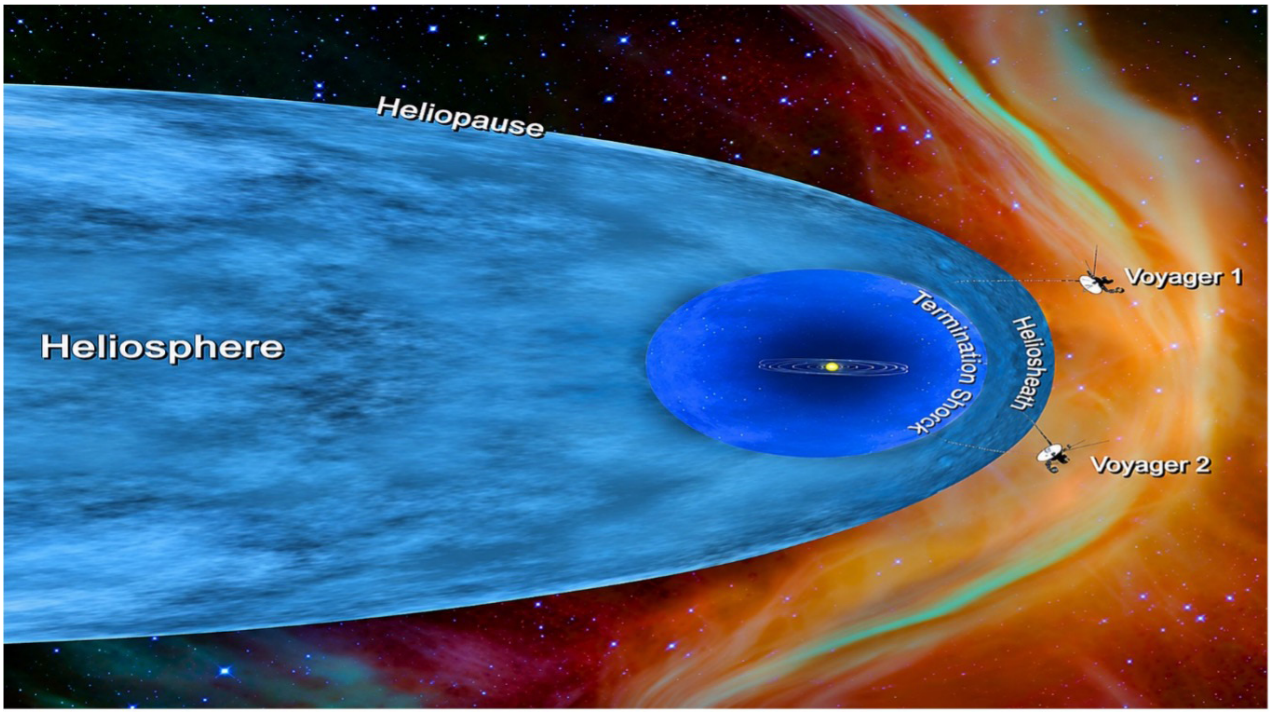

Figure 13: Schematic depiction of heliosphere, a spherical space inflated by plasma from the Sun, i.e., the solar wind, and shaped the solar (interplanetary) MF from the inside and the interstellar plasma medium on the outside. Heliopause represents the interface between the heliosphere and the interstellar medium. Solar system represents the central dark blue area with the lighter blue circle. https://universemap.net/heliopause/

Based on Newton's law of universal gravitational attraction the rotation of the Sun and all the planets in the solar system ascribed to gravity. And yet nowhere in Faraday's descriptions (or in the annals of scientific research) is there the slightest hint that gravity is capable of magnetic induction. How did this come about?

At the same time Newton proclaimed his gravitational law he also asserted that gravity caused the tides. He provided mathematical equations but they only applied in a few instances. For the next three centuries, despite much evidence to the contrary, scientists labored under the premise that the tides were a result of fluctuating gravitational forces. In the previous paper of this series, I show that this is not and cannot be the case [36].

All tidal phenomena are caused by oscillations in the geomagnetic field induced by the overhead passage of the Moon. The tides are not produced by the bulk movement of water but, instead, represent standing waves generated by the expansionary magnetic force. There are measurable changes in voltage potentials in the affected seawater which extend far into inland rivers. I provided diagrams of tidal patterns in the Arctic Circle showing striking resemblance to converging MF lines **(Figure 14)**. The other inescapable conclusion is that seawater is a resonant medium. Inconsistencies with Newton's gravitational law cropped up in astronomy as well.

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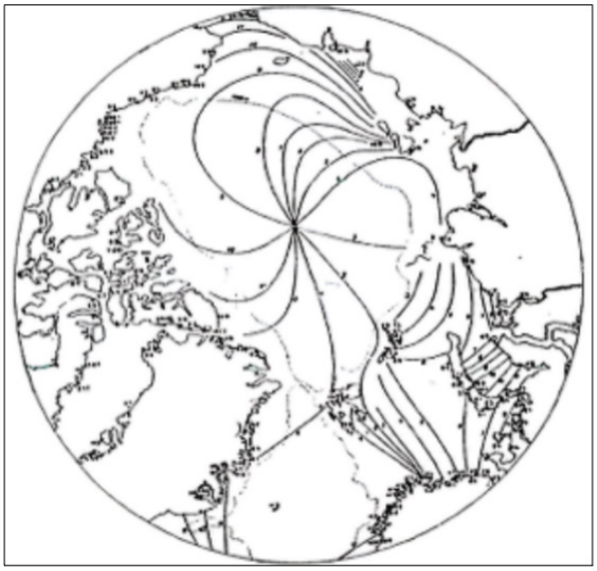

Figure 14: Illustration of the amphidromic tidal system over the Arctic Ocean published in 1928 by Defant and von Sterneck showing striking resemblance to expected magnetic flux line patterns. From *Tides: A Scientific History* David Edgar Cartwrigh.

In the 1930s Swiss astronomer Fritz Zwicky, studying the massive Coma Galaxy Cluster, observed that celestial objects were moving at speeds far in excess of what could be explained by gravity [37]. To account for such enormous velocities, he calculated the Coma Cluster must have over 400X the mass that was visible and speculated there must be a vast quantity of invisible material he called 'dark matter'. In 1970 Vera Rubin tripped across the same problem while studying the Andromeda galaxy and, once again, concluded that huge quantities of unseen matter must be present [38].

Scientists now estimate there is ~5-6X more dark matter than visible matter in the Universe. But dark matter has never been shown to exist. Dark matter can only represent a hidden force that was left out of Newton's original equations, which had assumed that gravity was the sole force at play. And rather than question the pronouncements of the Great One, like Ptolemaic astronomers they added another conceptual epicycle into 20th century astronomy and set out in search of an elusive phantom. The problem traces back to the 19th century.

When Faraday described electromagnetic induction, he conceived three different forces as being in play. Obviously, there is electricity and magnetism but that begs the question as to how they take origin. He conceived a progenitor force, what he called the dielectric field, present in all solid objects which, when acted upon by electric currents, generated an external MF. In some conducting materials like silver or copper the MF is quite weak, barely detectable, while in others like iron it is relatively strong.

For reasons unknown this primal source field was overlooked or lost in Maxwell's equations on electromagnetism and it fell into obscurity. Decades later it was 'rediscovered' by Dutch physicist Hendrik Lorentz and thereafter became known as the Lorentz force which, inexplicably, was said to be generated by charged particles moving through an electromagnetic field. The Lorentz force forms the basis of the famous 'right hand rule' that describes the 3D relationship of electromagnetic forces. Obviously, scientists got the causal sequence backwards.

As I also point out in the previous article, Faraday's dielectric field is one and the same as what astronomers now call the accretion (or protoplanetary) disk, said to form within nebula and induce aggregation of particulate matter, planetesimals and planets **(Figure 15)**. Not surprisingly scientists claim such disks are produced by gravity. We will continue to use the term 'accretion disk' (or field) since it is in widespread use and far more descriptive than 'dielectric field', but one must bear in mind that this entity is causally potent down to the subatomic level and, as we will see later, induces the formation atoms. How do we know this force is real?

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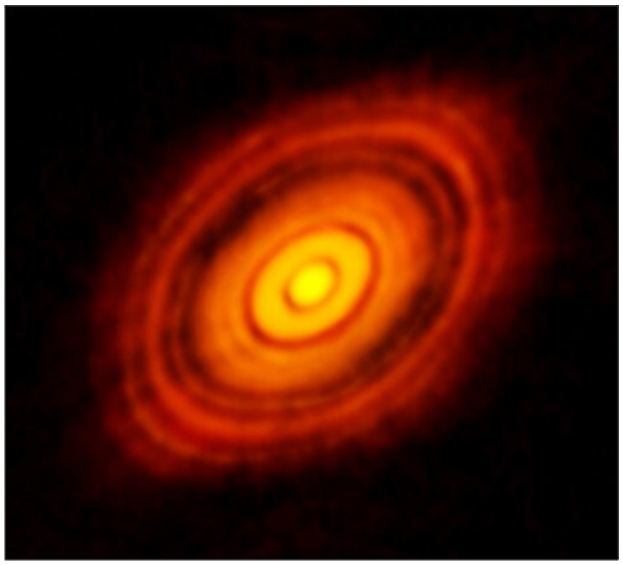

Figure 15: Atacama Large Millimeter/ submillimeter Array (ALMA) image of HL Tauri, a very young star in the constellation Taurus with distinct protoplanetary disk in the process of forming planets.
https://en.wikipedia.org/wiki/HL_Tauri

Aside from 3D space produced by the magnetic expansionary force, the actions of the accretion disc/field are the most obvious feature of the solar system: it induces rotary motion of celestial bodies about their axes and the revolution of planetary bodies around the Sun. This force, directed counter-spatially, exhibits a circular, inwardly spiraling motion that assumes disk-like configuration. The force is strongest and most obvious in the equatorial region of celestial bodies where it actively attracts other formed bodies. It is not coincidental that all the planets rotate and revolve around the Sun in the same direction along its equatorial plane (with the exception of Venus which rotates in a clockwise manner compared to other planets and must have undergone a pole reversal at some point in its history). Nor is it accidental that the orbit of the Moon tracks along Earth's equatorial plane or that Saturn's ring system is located equatorially. By the same token it is the source of black holes at the centers of large galaxies.

The accretion field is forceful testimony against the BB. An explosive origin should scatter materials in all directions and the Universe should be roughly circular and relatively homogenous. But it isn't. Instead, it is 'clumpy' with asymmetric congelations of matter separated by vast stretches of open space. The accretional force is why our solar system, many galaxies, and the Universe are flat and disk-like in conformation **(Figure 16).** And obviously so-called spiral galaxies must be subsumed under the same dynamics.

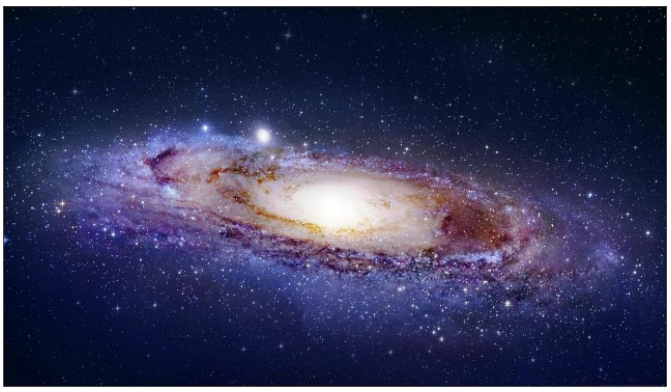

Figure 16: Milky Way seen obliquely highlighting its thin, flat disk-like shape produced by the dominant accretional force.
https://cosmosatyourdoorstep.com/2023/02/16/the-composition-of-the-milky-way/

Besides overcoming the deficiencies of the gravitational concept, the accretion disk provides another essential: Einstein's General Relativity failed because it was based on a single force which led to an unstable Universe. If the accretion disk were the sole force, it too would lead to instability. But in our electromagnetic model we have two opposing forces, the circular, inwardly spiraling, counter spatially directed accretion field that gives rise through electrical induction to the 3D MF. The two forces repel one another as can be shown in simple experiments with magnets [39]. While the solar accretion disk pulls objects centripetally toward the Sun, the intervening magnetic heliosphere provides an expansile, outwardly directed counterforce. This

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is also why Earth and Moon don't collide. Einstein's curved spacetime is a far-fetched leap of imagination with little basis in fact: what 'curves' in open space are the planetary orbitals under the aegis of the accretion disk.

The dynamo mechanism is equally detrimental to catastrophist thermodynamics. Ostensibly all the heat that will ever be in the Universe was present during the early moments after the Bang at which time T°s reached 10^{12}°C. The first stumbling block obviously is how such impossibly high T°s are attainable from a miniscule subatomic particle when our own Sun generates T°s of only ~15 million°C and even the hottest stars, red supergiants, only reach ~1.5 bn°C. How were such astronomical T°s possible when there was negligible matter in the Universe to absorb the heat? We can't ignore that the average T° in open space where little matter is present hovers around -270°C. All heat in the Universe is generated in real time by celestial bodies via the dynamo mechanism and rapidly dissipates in open space. But this in no way implies the Universe is heading toward an inevitable heat death as our scientists claim.

The most radical departure from modern scientific thought involves ideas relating to time. The ancient Greeks had two concepts of time: *kairos*, eternal or cosmological time, generated by the motion of celestial objects in the heavens, was pure duration without cessation, possessing neither past nor future; *kronos*, named after the titan king Kronos who devoured his offspring, is linear, sequential, quantifiable time, in which one moment precedes the next engendering before and after, past and future.

Time, as we know it empirically, derives from the motions of celestial objects in relation to one another. The rotation of Earth about its axis with respect to the Sun gives rise to the day-night cycle, the basic unit of natural time, and its yearly revolution around the Sun in conjunction with the obliquity of its axis, aka 'axial tilt, is responsible for the seasonal cycles. Absent these celestial motions induced by the accretion disk and time as we know it ceases to exist.

When Einstein conceived the relative nature of time he explained it in terms of subject-object relations. A perceiving subject is necessary to experience time's relativity and such relativity always occurs in relation to some other moving object. Phenomena are obviously perceived quite differently by someone traveling at the speed of light compared to someone who is stationary. No argument there.

But one doesn't need to go to such lengths to appreciate the relativity of time. Not a single planet in the solar system shares the same day-night and annual periods. While it takes Earth 24 hours to rotate about its axis, Jupiter, many times larger, completes its spin in just under 10 hours. And while Earth revolves around the Sun in 365 days, it takes Jupiter almost 12 earth-years to complete its circuit. Venus, on the other hand, Earth's inner neighbor of roughly the same size, requires 243 earth-days to rotate about its own axis while orbiting the Sun in 225 earth-days.

And if these numbers don't convince consider matters on a cosmological scale: Andromeda, one of the nearest large galaxies, is about 2.5 million light-years away while the farthest, JADES-GS-z14-0, is said to be about 13.6 billion light-years away. By the time light from these two systems reaches observers on Earth it is literally a relic from the far-distant past and each of the galaxies exists in vastly different temporal epochs. Who needs Einstein's abstract speed-of-light thought experiment to establish the relativity of time?

Aristotle claimed that time as we know it doesn't exist and is simply a number applied to motion. Viewer-dependent time, representing the basis

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for all scientific measurement and calculation, is obviously relative and exists as a subset of the more fundamental cosmological time. Without the ceaseless spinning of celestial bodies driven by the accretion field, clock-time could not exist. On a cosmological scale perceived time is insignificant if not meaningless.

If time is not the measure by which to make sense of the Kosmos how do we conceive phenomena not only in our little corner of space but across the vast (and seemingly limitless) expanse of the Universe? From mathematical calculations and experiments, quantum physicists determined that phenomena apparently interact over such distances at 'superluminal velocities,' i.e., faster than the speed of light, seemingly violating distance/time constraints [40-42]. How do celestial events simultaneously cohere in an 'eternal now' in which objects separated by vast quantities of space and time can be said to exist in relational unity? What is the basis of so-called quantum entanglement?

In the mid-19th century American astronomer Daniel Kirkwood sought to determine whether the axial rotations of planets were governed by some law analogous to how Kepler's third law describes their revolutions around the Sun. Working under the hypothesis that the rotational motions of all the planets were driven by a single force he compared the mass, volume, density and distance of each planet and found a relation between the number of rotations a body makes during its passage around the Sun and the diameter of its orbit, what became known as Kirkwood's analogy [43] **(Figure 17).** The mathematical basis for his claim was ostensibly shown to be incorrect but more recent evidence based on quantum mechanics suggests otherwise.

In recent decades theoretical physicists found intriguing relationships between the orbital periods of planets and their distance from the Sun. Rather than being a function of the rotational periods of the planets, however, the sole determinant is rotational frequency of the Sun. This is hardly surprising given that its accretion disk provides the force for planetary motions.

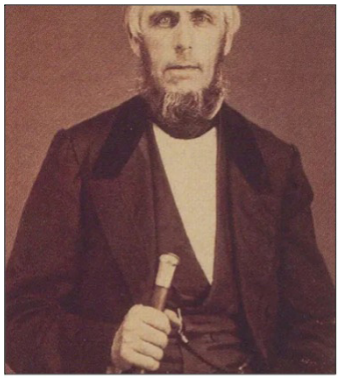

Figure 17: Daniel Kirkwood
https://www.lindahall.org/about/news/scientist-of-the-day/daniel-kirkwood/

Evidence suggests that planetary orbitals are not random but follow behaviors predicted by quantum models. Not only are orbital pathways determined by such relationships but so too is a planet's speed of rotation around the Sun, the rotational frequency of the planet about its own axis, as well as its mass, i.e., size and density. Similar patterns have been observed in distant solar systems as well. The relational dynamics derived from a central star's rotation rate produce striking similarities to atomic orbital quantization patterns which also appear as integer multiples. This is to say that celestial phenomena, like events at the atomic level, must be governed by resonance [44-47].

Kirkwood took his explorations a step further with recognition of 'gaps,' i.e., intervals of open space, in the asteroid belt which he too ascribed to resonance. Located between Jupiter and Mars the asteroid belt is composed of innumerable bodies ranging in size from small pebbles up to 250 km. Rather than orbiting synchronously as a disc-shaped agglomeration, the belt spontaneously 'quantizes' to form discrete concentric rings each orbiting at

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different speeds **(Figure 18)**. Kirkwood found that when an asteroid's orbital period was in simple ratios like 2:1, 7:3, 5:2, or 3:1 with that of Jupiter gaps formed at specific distances from the Sun. Kirkwood also showed similar gaps in Saturn's rings induced by resonance with its moons. But a familiar problem resurfaces.

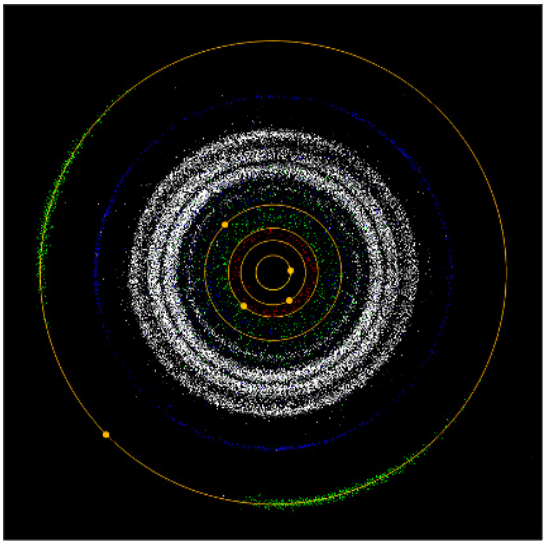

Figure 18: Diagram depicting the inner solar system with planets and asteroid belt. Orange dots toward the center represent Mercury, Venus, Earth, and Mars, while the outermost orange dot is Jupiter. Asteroid belt, between Jupiter and Mars, represented as varying shades of white while the gaps seen as darker shades of gray. The gaps represent specific distances from the Sun where an asteroid's orbital period corresponds to a simple numeric ratio with that of Jupiter, such as 3:1, 5:2, 7:3 and 2:1.
https://commons.wikimedia.org/wiki/File:Kirkwood-20060509.png

Kirkwood, and every astronomer since, ascribed such resonance to 'gravitational perturbations.' Resonance, ubiquitous throughout nature, described in acoustic, optical, mechanical, and electromagnetic systems, is purely oscillational in origin and related to vibrational frequencies between interacting events. How does gravity apply to such phenomena? In the case of resonance in the solar system (and beyond) we can only draw parallels to magnetic resonance imaging (MRI) which functions in accordance with principles established by Faraday **(Figure 19).**

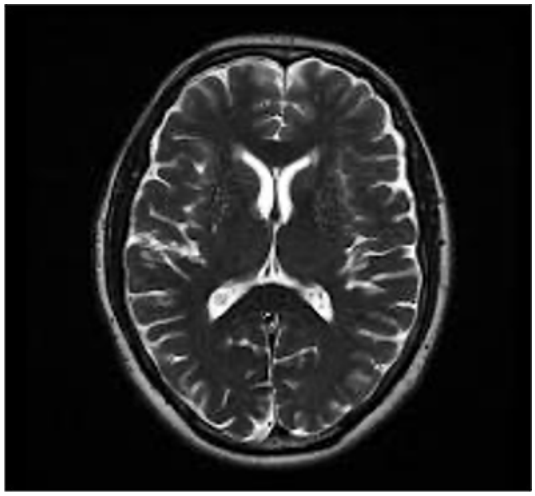

Figure 19: MRI depicting brain structure on the basis of resonance, i.e., interactions between radiofrequency pulsations and the ambient magnetic and accretion fields. Note the bright white signal in the fluid-containing spaces of the brain confirming the resonant properties of water.

REDSHIFTING & COSMIC BACKGROUND RADIATION

In this final section we examine two critical pieces of evidence that form the cornerstone of BB cosmology: Redshifting and Cosmic Background Radiation (CBR), both of which represent empirical facts that BB cosmologists mobilized in support of their theory. Both represent general features of electromagnetic radiation which, in the final analysis, is the sole means by which scientists are even able to study the Universe and spin their grand theories. The electromagnetic spectrum represents energy that flows through open space as continuous oscillating waves, i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays. As we know, wavelength and energy content are inversely proportional.

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BB theorists reached consensus regarding the significance of redshifting and CBR concurrent with the discovery of plasma and, as in the case of the dynamo mechanism, seemed oblivious to its wider ramifications. Our purpose here is simply to ascertain whether or not plasma may in any way be involved in the expression of redshifting and CBR.

In the late 1930s Swedish electrical engineer Hannes Alfvén began research on plasma which, I assert, is the second most consequential discovery in 20th century Earth science after the dynamo mechanism. This project culminated in his groundbreaking *Cosmical Electrodynamics* (1950) and the 1970 Nobel Prize in physics. Yet even into the late 1960s Alfvén's ideas were rejected by physicists whose thought was dominated by the abstract mathematical concepts of the early 20th century. His work is thoroughly grounded in Faraday principles **(Figure 20).**

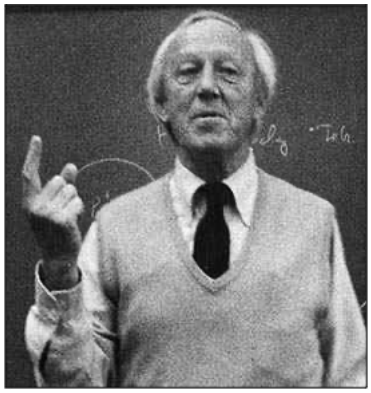

Figure 20: Hannes Alfvén.
https://mathshistory.st-andrews.ac.uk/Biographies/Alfven/pictdisplay/

In his 1943 'frozen-in magnetic flux' concept, magnetic lines of force are bound into plasma and the two entities always and everywhere flow in unison. Clearly plasma binds not only with MFs but by necessity the accretion field. Such electromagnetic-hydrodynamic structures form the functional basis of plasma which connects the entire Universe. Aristotle's Plenum is alive and well. The broader implications of Alfvén's concept should not be missed.

We return briefly to MRI to gain insight into one critical attribute of plasma. An individual is placed in an MR device causing atoms in his/her body to align with the outer field. A series of radiofrequency (RF) pulses are applied in short bursts. During the interval when the pulses are 'off' atoms relax, realign themselves and, in the process, throw out 'information' which is collected by receiver coils enabling generation of 3D body images. What is this emitted information? RF pulses. Electromagnetic dynamics are entirely self-contained and self-interactive. Same with plasma.

Plasma both receives and emits electromagnetic currents. Auroral displays in the northern and southern latitudes are spectacular examples plasma physics in action **(Figure 21).** At all points in open space, wherever plasma flows (which is everywhere) it is receiving and interacting with electromagnetic radiation, i.e, radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays, and emitting signals. Plasma continuously undergoes change. As per Heraclitus one never steps into the same river twice [48-51].

Figure 21: Aurora borealis. Photographed by Vincent Beudez, Tromsø, Norway
https://capturetheatlas.com/northern-lights-photographer-of-the-year/

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The dynamic nature of plasma is reflected in its structure. Plasma flows in long, thin, spiraling filaments, aka Birkeland currents, that spontaneously form branching patterns as they traverse open space **(Figure 22).** While MFs create the 3D structure of filaments, the twisting, spiraling motion is induced by the accretion field. The two always travel in tandem. There is an inverse relation at play in plasma: electric currents flowing along the central axis of a filament generate circular external MFs while spiraling currents along the outer margin of the filament generate straight, longitudinally directed internal MFs.

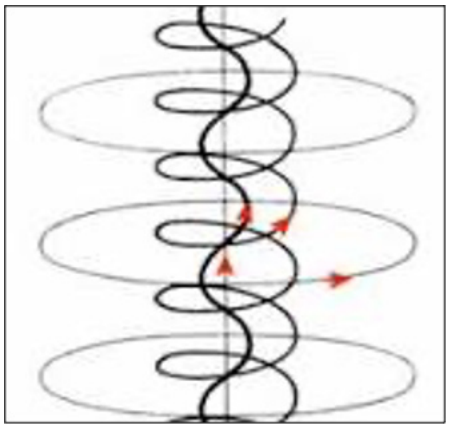

Figure 22: Simplified filamentous structure of plasma. As electric currents travel through highly conductive plasma both longitudinal and transverse MFs spontaneously form. The twisting and 'pinching' motions are generated by the spiraling accretion field. https://www.plasma-universe.com/birkeland-current/

In a 1948 paper *Evolution of the Universe*, physicists Ralph Alpher and Robert Herman, expanding on Gamow's work, posited that as the Universe was expanding after the Bang and space was actively being created, the wavelength of primordial light somehow stretched from an original length of ~10^{-6} meter to ~10^{-3} m beginning about 300,000 years after the BB [52]. Such longer wavelength radiations are purportedly the oldest in the Universe. As wavelength increased and the energy of waves diminished the T° of the Universe supposedly decreased. By this time longer wavelength radiations had spread throughout the Universe forming a diffuse background 'echo' or 'afterglow' of the primal Bang event.

The paper was largely forgotten until 1964 when two astronomers, Arno Penzias and Robert Wilson accidentally discovered microwave radiation in the frequency range predicted by our BB cosmologists. They had been attempting to determine the source of an irritating background noise generated by their radio telescope and improve its signal quality. To add to the improbable chain of events, Penzias and Wilson had no idea what they had stumbled upon until informed by a colleague at which point they enthusiastically jumped onto the BB bandwagon. Other BB proponents needed no coercion to embrace this as ultimate confirmation of their theory. Penzias and Wilson were awarded the 1978 Nobel Prize for their role in this fluky series of events.

Alfvén was skeptical of the BB from the beginning. Lemaître had come to Stockholm to speak on the primordial atom. 'I felt at the time', Alfvén recalled, 'that the motivation for his theory was [his] need to reconcile his physics with the Church's doctrine of creation ex nihilo' [53]. Alfvén contended that the BB was essentially a return to a mythical cosmology based on some supposed primordial state. It demands unquestioned belief in a set of conditions that can never be known or proven. And it is propagated by authority figures, i.e., mathematicians and cosmologists who, like the religious priesthood, make broad assertions based on pure speculation.

Did an explosion cause longer wavelength radiations? Given that all frequencies in the electromagnetic spectrum are intertwined into an unbroken continuum one is led to question how specific groups of waves might have been acted upon and 'stretched'

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without affecting all waves simultaneously. In redshift and blueshift phenomena, for example, the entire spectrum is similarly affected. Alfvén argued that CBR radiation was purely an electromagnetic phenomenon generated by plasma. Since it is uniformly distributed throughout open space and detected in any direction a radio telescope might be pointed his assertion is hard to refute.

History has sided with Alfvén. By the late 1970s satellite data revealed filamentous structures and twisting plasma vortices throughout the solar system. It is now accepted that plasma emits radio waves and microwaves as he predicted in the 1950s. But we stumble upon another incongruity. Based on Alfvén's plasma cosmology it would be logical to assume that intergalactic plasma fields absorb wave energy as it travels through open space which would explain why distant celestial objects have less radio radiation than closer objects. But according to BB theory this isn't the case: distant celestial objects have less radio radiation because the Universe is rapidly expanding.

It is hard to overstate the absurdity of the BB and its improbable dogma of an expanding Universe. To date the edges of the Universe have never been observed. It is said that there are points in the known Universe separated by greater distances than light could have even traveled since the putative BB event. And ostensibly at its outermost regions it is expanding faster than the speed of light thus insuring that, regardless of its size, its boundaries will never be located. BB cosmology is based on a long string of unprovable assertions, premised on Einstein's flawed Theory of Relativity and a misinterpretation of redshifting.

Two assumptions underlie the BB interpretation of redshift phenomena: The first is that redshifting increases with distance so that the farthest observable galaxies are receding at the greatest velocities; the second is that electromagnetic radiations are not being acted upon or altered in any way as they travel through open space. Since it has been established that such radiations do in fact interact with plasma, the intractable problem of an unstable and expanding Universe can be overcome simply by providing a plausible account of how such waves are physically altered in proportion to the distance they travel. This is where Alfvén's frozen-in magnetic plasma comes into play.

Electromagnetic radiations flowing through open space interact with plasma and generate MFs possessing both transverse and longitudinal components within magnetohydrodynamic waves [54]. Given that these MFs literally create the 3D space comprising the wave, and are in intimate relation with electromagnetic currents, it is not at all hard to envision such currents being stretched thereby producing longer wavelengths. While this effect may be negligible at smaller astronomical distances, over vast expanses the effect summates giving rise to redshifting in the absence of an expanding Universe. There is another compelling explanation for redshifting that dovetails nicely with this account.

In the mid-1960s American astronomer Halton Arp **(Figure 23),** while researching atypical galaxies for his acclaimed work *Atlas of Peculiar Galaxies* (1966), observed that galaxies in closer regions of space had redshift values that violated the orthodox distance relationship. Such incongruities were frequently seen in association with quasars, highly luminous active galactic nuclei powered by massive black holes and spinning accretion disks. Quasars, trillions of times brighter than our Sun, emit concentrated beam-like plasma streams, aka relativistic jets, laden with gas, dust and the entire electromagnetic spectrum. Such jets, produced in pairs, shoot out in 180° opposite directions perpendicular to the accretion disk and travel through open space over distances of millions of light-years [55-59] **(Figure 24).**

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Figure 23: Halton Arp. Obituary photo NY Times, January 7,2014
https://www.nytimes.com/2014/01/07/science/space/halton-c-arp-astronomer-who-challenged-big-bang-theory-dies-at-86.html

Figure 24: Huge quasar with its galactic jets powered by a supermassive black hole. Such concentrated beams of energy and matter, pointed in opposite directions, may extend for millions of light-years through space. Image credit: NASA, European Space Agency, and J. Olmsted (Space Telescope Science Institute)

As he observed more active galaxies, he noticed that other galaxies with different morphologies tended to concentrate along the lines of the jets leading back to the active centers. He gradually realized that galactic jets must be involved in new galaxy formation [60]. Larger, older galaxies eject plasma which then forms younger, smaller companion galaxies around them resulting in an 'age hierarchy.' This is now accepted by many astronomers [61, 62].

Evidence suggests galactic jets represent a cosmic gestational medium, i.e., Plato's khôra, giving rise to new matter that goes on to form new galaxies through the agency of the accretion disk [63-70]. This raises questions as to the relationship between black holes and quasars [71-73]. As proto galaxies emerge from the nebular cloud they grow in size and mass over eons and eventually eject succeeding generations of galaxies like our Milky Way [74-76]. All driven by interactions between the accretion disk and MFs [77-82]. By the time we reckon with the power needed to drive such transformations gravity has lost all explanatory capacity beyond why apples fall from trees.

Arp observed discrete quantized steps in redshift values throughout this evolutionary process, what he called 'intrinsic redshift' [83-85]. Redshift values were very high as newly created matter emerged from its 'zero-mass' cloud state and continued to diminish in quantized steps as galactic mass increased. Numerous studies now confirm high redshift values in active star-forming galaxies [86-93]. A 1997 survey of over 250 galaxies in our Local Supercluster found 'strongly quantized' redshift distributions with significant 'step-like periodicities' with respect to the galactic centers. The probability that such periodicities should arise by chance was less than one in one hundred thousand [94]. Intrinsic redshifting establishes direct continuity between plasma and events at the atomic level via resonance **(Figure 25).**

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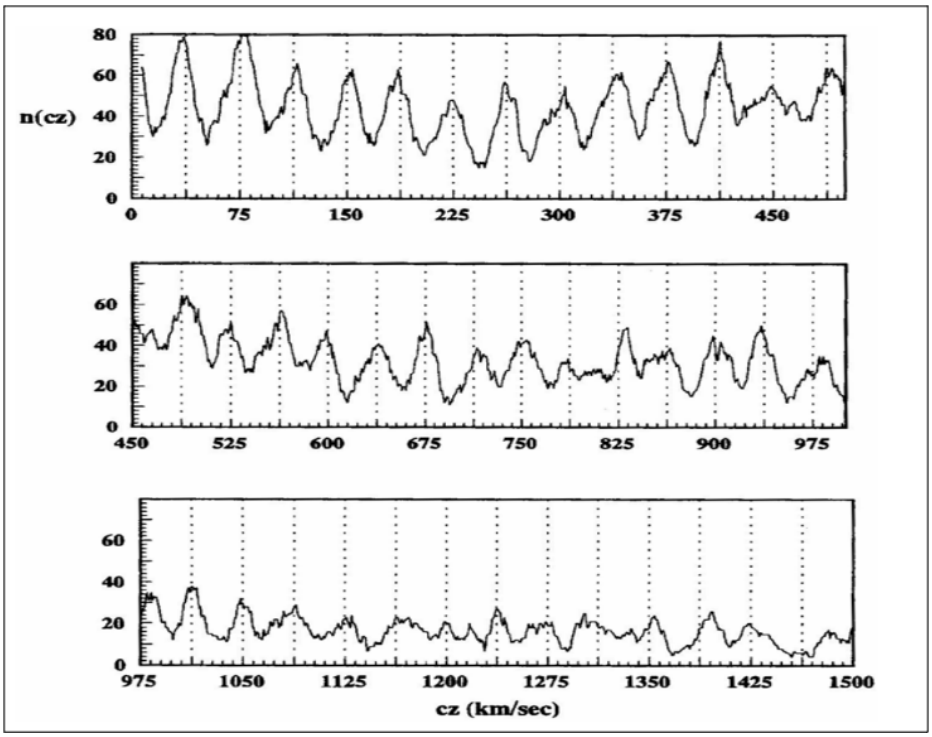

Figure 25: Quantized periodicity of ~37.5 km/sec observed in differential redshifts with respect to the galactic center of 97 bright spiral galaxies scattered throughout the Local Supercluster.
https://www.researchgate.net/publication/226666995_Quantized_redshifts_A_status_report

Such evidence is diametrically opposed to BB theory in which all matter that will ever exist in the Universe is supposedly created instantaneously during the Bang and precipitates out of a homogenous hot gas as it gradually undergoes cooling. Arp argued that it is more realistic to assume that matter is continuously being created and that protogalaxies evolve over a finite period of time, perhaps 6-7 million years. The most recently formed stars in any galaxy will be composed of recently formed matter.

Arp was highly critical of the academic community for propagating such a wildly speculative theory as the BB. It was portrayed by the media as the crowning achievement of modern learning and research and yet it is based on a long trail of spurious claims. If the cause of redshifting has been misinterpreted, Arp argued, then cosmic distances could be wrong by factors of 10-100X and luminosities and masses of celestial objects by factors of up to 10,000X. We would have a totally erroneous notion of intergalactic space and be forced to confront one of the most embarrassing boondoggles in intellectual history [95]. Is 20th-century astronomy really so different than the discredited Ptolemaic paradigm?

'I know that if academic theoreticians at [the time of Hubble's discovery] had not forced his observations into fashionable molds', Arp later wrote, 'we might at least not have started off modern cosmology with the wrong fundamental assumptions. We could be much further in understanding our relation to a much larger, older universe—a universe with is continually unfolding from many points within itself' [96].

Arp passed away in December 2013 at the age of 86 in Munich, Germany. Unlike Penzias and Wilson, he never received the Nobel Prize or even acknowledgement for what will likely come to be recognized as one of the greatest discoveries in the history of astronomy. And in

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the process of challenging BB cosmology and its misinterpretation of redshifting he was ostracized by his academic peers, had his telescope time at Palomar Observatory and Mount Wilson telescopes cancelled, lost research funding, faced numerous rejections of articles by academic journals and, finally, was forced to resign his academic position and seek employment in Germany.

COSMOLOGY & COSMOGENESIS

It has been nearly a half-century since the Penrose number quantitatively defined the infinitely negligible possibility of a cosmological event like the BB and now the reasons are clear: it was premised on obtuse mathematical logic positing a fictitious curved spacetime induced by the universal attractive force of gravity; a highly flawed 19th century thermodynamics in which impossibly high T°s drove all subsequent events and which would inevitably culminate in the heat death of the Universe; and the specious quantum concept of wave-particle duality in which electromagnetic radiations allegedly transform into matter.

Having eliminated the BB as a legitimate cosmological contender we are left with but one remaining possibility to explain cosmogenesis, i.e., the coming-into-being of the Universe, namely, the ancient cosmology advanced by Plato, Aristotle, and Plotinus. But, on the other hand, in the past half-century thousands of satellites have been launched into space to study the Universe and the knowledge derived from such exploration is both staggering and unparalleled in human history. Can the evidence point us in a different, perhaps more satisfying direction?

What we now know is that the Universe is a vast, highly dynamic structure that continues to evolve and transform while at the same time seeming to remain stable over incalculable eons. It displays distinct hierarchical causality: planetary systems emerge and develop under the aegis of suns; innumerable stars form within vast galactic systems sometimes millions of light-years in dimension; and galaxies, in turn, inhere within apparently self-organizing superclusters which may contain tens of thousands of galaxies. The sheer scope of these conjoined cosmic dynamics is mind-boggling.

In the next three parts of this series, we examine generative dynamics at each of these hierarchical layers: planetary formation within solar systems, the birthing of suns and stars at the galactic level and, finally, the genesis of new galaxies by active galactic nuclei (quasars) with their accretion disks, black holes and relativistic jets. Taking electromagnetic principles, we have established in this present work we apply them to phenomena at these upper layers and see if they retain their explanatory power and indeed represent fundamental organizing dynamics of the Universe. And in the process, we seek to gain further insight into the putative origins of the Kosmos. Stay tuned.

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