# The story of gravity and Lambda—How the theory of Heraclitus solved the dark matter mystery

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**Abstract:** Two cosmologies are compared with the focus on gravity and Lambda and the relationship between these opposite dynamic effects. The traditional *World View* has—by maintaining gravity and Lambda as *opposites in conflict*—burdened itself with the so called *dark matter mystery*. The other, the *new cosmology*, by incorporating an ancient principle made famous by Heraclitus, models gravity and Lambda as complimentary and nonconflicting effects. Remarkably, the two effects on the cosmic scale actually *amplify* each other. It is clearly shown how gravity "pulls" a galaxy cluster together, while Lambda simultaneously "pushes" it together. The *dark matter mystery* simply vanishes. Based on the essential difference in the treatment of gravity, a new picture of the universe emerges. While Conventional Cosmology struggles to explain the large scale structure, the New Cosmology (the Dynamic Steady State Universe) incorporates the universe's natural processes to achieve its natural arrangement—cosmic cellular structure. © *2010 Physics Essays Publication*. [DOI: 10.4006/1.3293983]

**Résumé:** Deux cosmologies sont comparées avec un focus sur la gravité et le Lambda et la relation entre ces effets dynamiques opposés. La *Vision Mondiale* traditionnelle—en maintenant la gravité et le Lambda comme étant des *opposants en conflit*—s'est chargée du soi-disant *mystère de la matière foncée*. L'autre, la *Nouvelle Cosmologie*, en incorporant un principe antique rendu célèbre par Heraclitus, modèle la gravité et le Lambda en tant qu'effets complémentaires et noncontradictoires. Remarquablement, ces deux effets sur l'échelle cosmique s'amplifient réellement. Il est clairement montré comment la gravité "rassemble" un faisceau de galaxie tandis que le Lambda le "pousse" simultanément. Le *mystère de la matière foncée* simplement disparaît. Basé sur la différence essentielle dans le traitement de la gravité, une nouvelle image de l'univers émerge. Tandis que la Cosmologie Conventionnelle lutte pour expliquer la structure à grande échelle, la Nouvelle Cosmologie (l'Univers Équilibré Dynamique) incorpore les processus normaux de l'univers pour réaliser son arrangement normal—structure cellulaire cosmique.

Key words: Cosmology; Large-Scale Structure of the Universe; Gravitation; Cosmological Constant (Lambda); Dark Energy; Heraclitus; Opposites in Harmony; Cosmic Cellular Structure; Dynamic Steady State Universe; DSSU.

## I. INTRODUCTION

> "The hidden harmony is better than the obvious."
> —Heraclitus, Fragment No. 116[1]

> "The hidden harmony between *gravity and Lambda* is superior to the apparent harmonious Hubble expansion. A deeper unifying process, heretofore unsuspected and unrecognized, rules the universe accounting for not only its grand structure but also for the *unity of the opposites* of *gravity and Lambda.*"

When one takes a powerful but local theory and applies it beyond its natural range, strange things happen. When general relativity is applied to the universe as a whole, as is done in big bang (BB) cosmology, the apparent conclusion is that the entire universe is expanding. But if one ponders the conclusion for a moment, an expanding universe must seem a strange thing indeed. An expanding subuniverse is credible; but wholesale expansion of *the universe* is most strange. In the currently popular model of the universe, called the *dark energy dark matter model*, Lambda (the *dark energy* of the vacuum) dominates the combined gravity of the visible matter and the *dark matter* and, therefore, dominates the entire universe. Within the context of the BB model, this means that not only is the entire universe expanding but also that it is expanding at an increasing rate. Needless to say, this version of universe-wide expansion is even stranger.

In a cellular universe, the story of gravity and Lambda takes an unexpected turn and reveals a counterintuitive relationship. When gravity is applied strictly as a local theory—in its legitimate domain—the universe does *not* expand. Even though gravity and Lambda are *opposite dynamic effects*, the universe does not expand. This universe is not strange. This universe now reflects nature's preferred arrangement. Whenever and wherever dynamic effects are involved, nature prefers a *cellular structure*.

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The *Dynamic Steady State Universe* (DSSU)[1] is the name of a specific universe as well as the name of a comprehensive and functional theory of our universe. It is a relatively new model; it is the only nonexpanding cellular-universe model that has ever been seriously proposed. The following definitions will provide context and more meaning to the discussion.

The DSSU is defined as a universe consisting of *dual-dynamic space*—compatible with *process physics*—having true steady state processes that sustain a, more or less, static cellular structure of cosmic proportions. The structures are primarily the result of the *simultaneous expansion and contraction of space* in spatially separated large scale regions. Furthermore, the DSSU is infinite in time and in its three dimensions (in conformity with the *perfect cosmological principle*); it is uniformly cellular; and it is *nonexpanding*. Its defining structure is that of cosmic Voronoi cells of dodecahedral shape.[2]

The defining process is described as *the expansion of physical "*space*" within a nonexpanding universe.*

The terms *new cosmology, DSSU*, and *cellular universe* all refer to the same model.

## II. GRAVITY

### A. The range of gravity

One of the key differences between the *conventional cosmology* of universe-wide expansion and the *new cosmology* of cosmic cellular structure involves the range of gravity. Conventional cosmology permits the effect of gravity to have an unlimited range; the *new cosmology*, however, distinctly limits gravity's reach. In the big bang model of the universe, every particle, every star, and every galaxy has a gravitational influence on every other particle, star, and galaxy. Everything "pulls" on everything else in accordance with the inverse-square law. For example, the gravitational pull of our sun on a distant object decreases with the inverse of the square of the distance; as the distance approaches infinity, the strength of the sun's pull approaches zero. But it never becomes zero, meaning that the range of gravity has no limit. In terms of general relativity, we would say that the sun's mass tends to curve space and contributes to the curvature of the *entire* universe.

However, this is not the case in our *cellular universe*. The reach of gravity of any particle, star, and galaxy has strict limits. The reason for the confinement of the range of gravity is inherent in the nature of the cellular structure and the underlying twin processes. We will return to this aspect later.

### B. Cause of gravitation

There is another important difference. Often overlooked is the fact that neither Newton's theory of gravity nor Einstein's general relativity theory includes an all-important *cause of gravitation*. Newton's gravity theory describes in mathematical terms the forces in a gravitational system—but not what causes the transmission of forces. Neither Newton in his day nor anyone else since could resolve the mystery of what became known as the *spooky action at a distance*—the instantaneous gravitational grabbing over astronomical distance across empty space! The question, "What causes matter to grab a hold of other matter?" is left unanswered. Einstein's gravity theory managed to resolve the instantaneity issue. His theory is based on the curvature-of-spacetime concept and uses a more advanced mathematical method involving *geometrics* and *tensor calculus* to describe the gravitational effect with remarkable precision—but again, the causative mechanism by which matter attracts other matter is absent.

> "Gravity as a warping of space was a credible notion, though it gave not the least hint as to the nature or origin of gravitation; why the presence of matter should affect 'space' was left unexplained."
>
> —Edward Milne[3]

The *curvature of space* is an abstract mathematical construction. But a mathematical formulation, in itself, cannot be the cause of anything. For Einstein's gravity, the question of cause is reframed as, "What is the physical meaning of *curvature of space*?"

During the 1990s, research into the field of process physics eventually led, in 2002, to the discovery of the cause of gravitation—something that had eluded theorists for centuries.[4] This remarkable achievement may yet become known as the greatest astrophysics discovery of the present age encompassing the 20th and 21st centuries. The cause was also found independently in that same year, 2002, during the development of the DSSU theory. And here is the formidable difference: BB cosmology has not yet incorporated this key component. The new cosmology makes full use of the cause of gravitation.

Before moving on to a description of the mysterious Lambda effect, the key role of gravity must be emphasized. There is simply nothing more important than a comprehensive fully-functional theory of gravity. The description of gravity is critically important because it must serve as the very heart of any realistic theory of the cosmos. Consequently, if one's theory of gravity lacks a causative mechanism, then the associated universe model will be flawed or incomplete at best.

## III. LAMBDA: GRAVITY'S OPPOSING FACTOR

### A. Generic Lambda

The lack of a *modus operandi* for the gravitational force of Newton's theory, or the lack of a physical meaning of positive curvature of space of Einstein's theory, did not in any way prevent cosmologists and philosophers from constructing models of the universe. But there was a problem. "Limitless" gravity, it seemed, was too powerful. Almost invariably theorists found that they needed to tame this universal and domineering "force" tending to crush everything in the cosmos into some doomsday black hole, leading to the

[1]The Dynamic Steady State Universe theory was conceived in the year 2001 and first presented at the 2002 ESA/ESO/CERN Astrophysics Symposium in Munich, Germany.

end of a functional universe—not to mention all the painstakingly crafted world models. In the attempts to address this need, theorists have postulated various ways to counteract the effect of gravity. They have, at one time or another, invoked: a new force, some mysterious energy, a dynamic effect, and more curved geometry—all with the express purpose of opposing gravity. And they all share a wonderfully simplifying commonality.

The proposed opposites of gravity all produce the same result as can be had with the process of *space expansion*. Each could be replaced by some appropriate degree of quantum-foam space growth. *Space expansion is like a generic cosmological constant*. In the light of space expansion, the cosmological constant or Lambda loses much of its mysterious nature. It is equivalent to a straightforward concept.

Lambda, symbolized by the Greek letter $\Lambda$, is the generic name herein given to any cosmic phenomenon that opposes gravity. And as it is applied to the various posited opposites of gravity, it really does not matter how space is defined. *Generic Lambda* simply means there is more and more of it. If we think of gravity as decreasing the space between cosmic objects, then $\Lambda$ *is the increase of space*.

### B. Historic examples of generic Lambda

History presents us with examples of the early use of $\Lambda$. Lambda made its first appearance in 1917 when Albert Einstein used it in a failed attempt to model a static universe. His choice of a motionless universe reflected the consensus belief at that time in the history of cosmology, that the universe is static on the large scale. In his famous 1917 model, Einstein equated $\Lambda$, which he called *the cosmological constant*, to the curvature of space.[2 5] Gravity and Lambda were designed to oppose each other with mathematical exactness. Of course, Einstein really had little choice in ascribing the geometric concept of curvature to the $\Lambda$ constant. When you deny the existence of a physical space, it becomes rather awkward to attribute physical properties to space itself. Einstein could not very well say that absolute space was expanding or that a *force* was acting against gravity; that would represent a reversion to Newtonian cosmology.

Nevertheless, the experts tell us that his *cosmological constant*, while not the same as a force, was equivalent to a force. Nothing more could be said. The equations had revealed what they could.

But in the light of our discussion, we recognize that Einstein's $\Lambda$ constant is equivalent to generic $\Lambda$—or *space expansion*. In fact, we can go further. Since no physical meaning is assigned to his *cosmological constant* and also since we (at least those who are proponents of the *new cosmology*) do not presume to deny physical space, we are free to assign our own real physical process. Einstein's symbolism is open to interpretation—and we assert that $\Lambda$ *is* the physical space expansion. (But rest assured, this is exceptionally unlike Newton's static space.)

Others followed the lead of Einstein and throughout this period and into the 1920s, generic $\Lambda$ could be recognized as the central ingredient of various universe models. The Willem de Sitter universe (1917) gave $\Lambda$ an arbitrary positive value and used it as the expansion of flat (noncurved) space; it had no connection with gravity since the de Sitter universe had no mass. It clearly showed that $\Lambda$ was indeed the opposite of gravity. Alexander Friedmann (1922 and 1924) discarded the original cosmological constant and instead used the curvature constant, which he set equal to $-1$, to produce a "space curvature" expansion of his universe (and in another version in which $k=+1$ he produced a "space curvature" contraction). It did not represent space expansion in the absolute sense (as it does in the DSSU theory) but rather it modeled the expansion of the esoteric kind of space used in Einstein's general relativity—a geometrically dynamic curved space. But no matter, the results are the same as if absolute space itself expands.

Lambda was used to model a big bang. Georges Lemaître, instead of aiming for harmonious stability in the universe, gave Lambda the upper hand. In his universe (1927–1929), Lambda is more than the simple counterbalance to gravity, $\Lambda$ is decreed the dominant role. While gravity as usual pulls everything in the universe together, Lambda works even harder pushing everything, notably the big stuff like galaxy clusters, apart. Net result?…Runaway universal expansion. Acceleration. Final result?…Decreasing matter density and the thermal death of the BB universe. A model with problems.

Lambda also became useful in "correcting" major problems with the Big Bang. As detailed in the historical records, the Lemaître big bang had big problems. Some of these were of the worst kind—outright paradoxes! And as it happened, generic $\Lambda$ was called upon "to save appearances" as it were. The early universe needed adjusting; the initial phase of the primordial explosion (expansion) had to be speeded up. After considerable trial and error, several American cosmologists, including Alan Guth and Paul Steinhardt, and Russian experts, notably Andrei Linde, came up with a new and improved expansion mechanism—a reformulation of $\Lambda$, which became known as *inflation*. They devised a supercharged $\Lambda$-effect with superfast *space expansion*. As a method of control, *inflation* left gravity in the dust.

What happens when a model does not invoke a force, a cosmological constant, energy, or curvature as methods to oppose gravity? For many years during the 20th century, the Einstein–de Sitter universe served as the standard model. It was the "simplest" of all known universes; no curvature ($k=0$), no cosmological constant ($\Lambda=0$), with a critical mass density. There was just enough matter in this universe to make its curvature "flat" and just enough to decelerate the cosmic expansion but never quite stop the expansion completely. Thus, it would seem that by simply reducing the quantity of mass, by simply making the matter density low enough, cosmic gravity could be brought under control.

But it could not. Adjusting the matter density was insufficient. The Einstein–de Sitter universe still needed a generic $\Lambda$ to make it functional. And sure enough, it had an opposing agent; the designers had incorporated *expanding flat space*.[6]

During the years in which the Einstein–de Sitter was the favored model, $\Lambda$, as the cosmological constant, was not in

[2] $\Lambda=K=4\pi G\rho$, as in Ref. 5.

the picture. Its role was merely as an historical relic or as a theoretical speculation. Then in the pivotal year 1998, when the anomalous distance of type 1a supernovae was analyzed, it became clear that Lambda does exist and plays a paramount role in the dynamics of the universe. And so, to make a long story short, the revised model of the universe acquired a significant *positive vacuum energy*. Also known as *dark energy*, it is said to be powerful enough to cause the BB universe to accelerate its expansion. And again, we recognize it as generic Λ.

Lambda has indeed been posited under many guises. It debuted as an *antigravity effect* in the 1917 Einstein static universe. In the Friedmann models, Λ takes the guise of *space curvature*. It manifests as a *hyperlightspeed explosion* under the dictates of the Inflation theory. And sometimes it appears in the equations describing a universe model just in case it is needed; the model might not actually need Λ but nevertheless is retained, set to zero, and serves to represent some unknown phenomenon that just might permeate the cosmos. In some theories, Λ morphs into something called *quintessence*. And under the auspices of current orthodoxy in cosmology, Λ rules as *a mysterious force* appropriately called *dark energy*.

Cosmologists have enlisted Lambda in so many ways that it is sometimes called a "fudge factor"—a highly useful, easily adjusted term in the equations. It is this and much more.

> "It stands for the unknown, spiritual element that the scientist desperately hopes will make each cosmological model more beautiful, more complete, more true."
>
> —Corey S. Powell[7]

In some theories, Lambda manifests as *negative pressure* and, equivalently, *tension*. William McCrea, the British cosmologist, is credited with this remarkable method of controlling gravity; in 1951, he proposed that a negative pressure may be present in the universe and affect its dynamic processes.[8] *Pressure* and *tension* are clearly physical characteristics of space. Not surprisingly, a region of space that is subjected to *negative pressure* EXPANDS. A region of space that is subjected to *tension* EXPANDS. (This also happens to be the method used in the DSSU model.)

In the end, whatever one may choose to label it, *generic* Λ is necessary, is equivalent to space expansion, and is the countereffect to gravity. And Λ in the DSSU is no exception.

### C. Heraclitus and the doctrine of opposites

In all the above instances, theorists were searching for gravity's opposite factor. Knowingly or unknowingly, they were complying with the Heraclitian doctrine of opposites.…This is most appropriate since his doctrine specified not only that the universe is constituted by opposite factors but also that everything is permanently in a state of flux. It means gravity and Λ are opposite states representing some form of motion.

Heraclitus of Ephesus, ca. 535–475 BCE, known as the "weeping philosopher," is generally seen as a precursor to process philosophy and *process physics*. He seems to have been the first proponent of a dynamic and steady state universe. In his *process physics* everything is "in flux," everything is in a state of permanent flux making reality a perpetual transitory state: He emphasizes the universe's dynamic nature:

> "Everything flows and nothing is left (unchanged),…Everything flows and nothing stands still,…All things are in motion and nothing remains still."[9]

And the universe's steady state aspect,

> "This universe, which is the same for all, has not been made by any god or man, but it always has been, is, and will be…"
>
> [Fragment No. 29][10]

Heraclitus' whole outlook involved the pairing of related phenomena into a unified concept—opposites are seen as fundamentally interrelated. For a simple example, we recognize that the dramatically different phenomena of day and of night are united in the concept of planetary rotation. For examples of relative opposites expressed in the manner of the Greek philosopher, consider the following: "The way up and the way down are one and the same." [Fragment No. 108][11] "In the circumference of the circle the beginning and the end are common." [Fragment No. 109][12] And returning to our original comparison: gravity and Λ are opposite states and according to the Heraclitian doctrine are locked in some unifying process.

We will return to Heraclitus shortly, for there is another aspect to his *doctrine of opposites*—one that will shed new light on the relationship between gravity and Λ.

## IV. THE TRADITIONAL STORY OF GRAVITY AND LAMBDA IS ONE OF OPPOSITES IN CONFLICT

Throughout the 20th century and into the present, the conventional view on gravity and generic Λ has been twofold: First, they were considered to be opposites in which gravity tends to pull things together and Λ tends to push things apart, as described in Sec. III. Second, they were seen to be in conflict with each other. The traditional view has been that of *two opposite effects in conflict*. This view is embodied in BB cosmology. It may seem an oversimplification, but it is fundamentally sound, the Big Bang universe is a construction in which gravity pulls everything radially inward and Λ, as a cosmic repulsion, pushes radially outward. A schematic representation of this view is shown in Fig. 1. Although the drawing suggests the presence of a centerpoint, one need not be presumed; with or without such a center, gravity and Λ are viewed as opposing each other.

Observations of our real universe reveal no center. The universe appears to be homogenous and isotropic; it is assumed to comply with the cosmological principle. Nevertheless, the BB universe does have a center and, moreover, it functionally demands there be one. The presence of a center

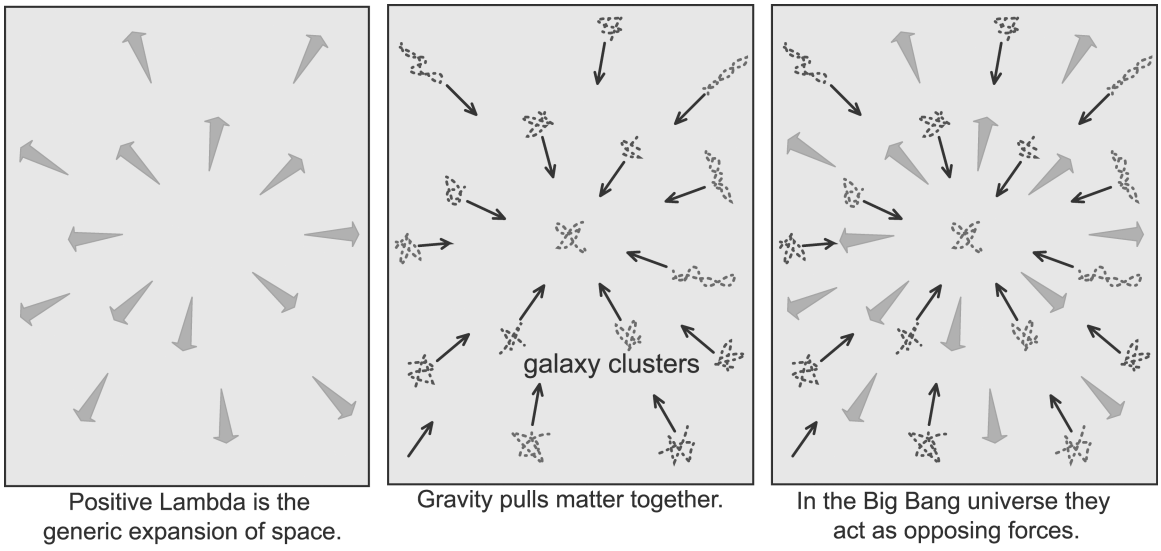


FIG. 1. (Color online) Gravity and Lambda are treated as forces-in-opposition by the 20th century cosmology. In the schematic representation of the BB universe, the two effects clearly behave as opposites in conflict.

is based on two arguments. The first holds that since the BB universe is expanding (from that primordial singularity), it IS finite and HAS a diameter. And, undeniably, a diameter *does* have a midpoint! It follows that a symmetrical universe has a center-point. There are cosmologists who assert that the BB universe may actually be infinite in size and therefore has no center. The expanding-diameter argument is unlikely to sway them; which brings us to the second, and more convincing, argument.

David Layzer at Harvard in 1954 updated the notion that *gravity is impotent in a universe without center and edge*.[13] If gravity is to serve as a force that is fundamentally involved in shaping the traditional universe, then it demands that there be a *cosmic center* and a cosmic edge. Essentially, the choice for expanding-universe theorists is this: deny a center-point and thereby violate the relevancy of gravity; or accept a center-point and yield to the Layzer gravity paradox. (Choose the negative and you doom the most powerful cumulative effect in the universe; choose the affirmative and find yourself in contravention of the cosmological principle. And in the context of BB cosmology, there is no third choice, except, of course, abstention. This is but one of many irresolvable issues in expanding-universe cosmology.) Argue as you please, but gravity demands a cosmic center. Deny gravity its center-and-edge and it becomes irrelevant in determining the cosmos. It would be difficult to imagine any theorist willing to do this.

In any case, what is important for the story of gravity is that whether argued from the perspective of (1) an expanding universe with a growing diameter or (2) the demands of the Layzer gravity principle, the expanding universe must have a center-point.

Thus, the radial pattern shown in Fig. 1 is justified.

Returning to the opposites in conflict. The expanding-universe paradigm is, of course, the traditional view. Its currently popular variant is called the *dark energy dark matter* model. It goes under other names but their meaning is practically the same. A *mysterious* energy (generic $\Lambda$) and a *mysterious* form of matter (making *gravity* much more potent) are involved in a *mysterious* struggle that somehow shapes the model (the universe). Using our new understanding of gravity and $\Lambda$, let us examine their interaction.

The traditional story of gravity and $\Lambda$ is burdened by an invalid conclusion. Although it is true that positive-valued Lambda behaves as a cosmic repulsion, *it does not follow* that it also acts in opposition to gravity. Although it is true that the two effects are opposites, *it does not follow* that they act in opposition to each other in the manner astronomers and theorists have long assumed.

The adherents of the traditional view must consider the following consequence.

If you accept the invalid conclusion (or assumption) that $\Lambda$ opposes gravitational clustering, then you will have immediately burdened yourself with an artificial mystery. Allow me to explain. By placing gravity and $\Lambda$ in conflict with each other, you are in effect weakening the force of gravity; weakening the tendency of galaxies to cluster; weakening the cohesion that binds clusters and superclusters. Consequently, you will now be confronted with the task of explaining *what in the world…what in the name of heaven…keeps any galaxy cluster together?* Astronomers have accumulated abundant observations and theorists have the detailed calculations and together we have a sea of data that embodies the mystery: Galaxy motions within a cluster are far too high; the cluster should be flying apart! Individual galaxies should be fleeing the cluster. But, to almost everyone's dismay, they are not. What is it then that holds the cluster together?…The insurmountability of this problem is so enormous that only by introducing speculative hypotheses and artificial components into the model does it become possible to uphold an outmoded tradition.

The conventional speculation goes like this. Evidently, something must be maintaining the integrity of the clusters and superclusters. Something is holding them together and their observable self-gravitation is insufficient for the task.

Something mysterious is augmenting gravity. And what better way is there to solve a gravity mystery than with some kind of unseen mysterious material?

> "…[M]odels worked a lot better if they added certain kinds of unseen material, or "dark matter," into the mix. Dark matter could provide the extra gravitational pull needed to build galaxies and flatten out [i.e., reduce expansion of] the universe, and if its properties were just right, it might not interfere with the [other aspects of the BB model]. The mystery material was…designed to amplify rather than counteract the pull of gravity."
>
> —Corey S. Powell[14]

Here is the insurmountable part of the problem: No dark matter has ever been found. Although the search has been and continues to be intensive, no laboratory experiment has ever produced a dark matter particle and no detector has ever recorded one. The list of the possible candidates for the elusive particles is long and growing: weakly interacting mass particles (WIMPS), neutrinos, axions, photinos, neutralinos, and so on. All have been more or less disqualified. Although the futility of the search is disheartening, in the long run it is unimportant. As stated above the mystery is artificial. It actually does not exist. Nevertheless…

> "Nonetheless, the dark matter search goes on, ***because without dark matter our picture of the universe makes no sense***. Visible matter alone cannot explain the gravitational dynamics of galaxies and clusters of galaxies." (Emphasis added)
>
> —Corey S. Powell[15]

As if to deny the BB model the plausibility it so desperately seeks, Powell then pens these discouraging words: "Even the addition of dark matter did not solve the essential mysteries of the big bang."

If tragedy in a story appeals to you, this comes close. With or without dark matter, the BB model makes little sense. While the symbolism of its construction grows, the connection with reality suffers. The astroscientists tackling the "mysteries of the big bang" have been unable to figure out how the space in the universe is expanding while all the material stuff is sticking together!…What is going on?…

Something surely is assisting gravity.…It is *not* dark matter.

But wait, there is something more, something unexpected and sinister, in this substory of conflict. Standard cosmology has added a new dimension to the alleged conflict between gravity and Λ. In the fateful year of 1998, when the Einstein–de Sitter model was laid to rest, it was found that Λ does more than simply reduce the effect of gravity. As was mentioned earlier, it was determined, or so they claim, that Λ completely overpowers gravity. Henceforth, Lambda becomes the dominant force in the BB universe. This new enhanced Λ-effect is the reason that the revised model is sometimes called the BB-*accelerating* universe—with the emphasis on *accelerating*. It is the reason that the BB universe faces a future of relentless dilution and lifeless darkness.

The conventional view that gravity and Λ are opposites-in-conflict will now be challenged.

## V. THE NEW-COSMOLOGY STORY OF GRAVITY AND LAMBDA AS OPPOSITES IN HARMONY

> "One seldom sees what one is not looking for"
> —saying
>
> "If one is looking for conflict in opposites, one may miss seeing their harmony."

When we think of opposites, we normally think of them as having the ability to cancel each other. For instance, consider the two opposite parts of a propagating wave—crests and troughs. In the simple interference pattern of light or water waves, the crests and troughs certainly cancel each other. The opposites *hot and cold* produce canceling effects. Mix the contents of a hot cup of tea and a glass of ice tea and you will end up with neither. The cold air of a winter's day coils up the bimetallic strip of a household thermostat; the hot air of a furnace uncoils it. In the nuclear reaction between electron and proton, the negative charge of the electron cancels the positive charge of the proton resulting in a neutron (and a neutrino).

But sometimes the interaction of opposites will actually amplify each other—opposites will act in harmony. It simply depends on the configuration. The deflection of the bimetallic strip could be increased substantially by applying heat on one side and simultaneously cooling the other side.

Since the gravitational and electrostatic forces share certain properties and are in some ways comparable, it may be interesting to look at the interaction of electric fields due to opposite charges.

Consider two sheets of a *nonconducting* material with equal but opposite charge densities. Each sheet is surrounded by its own electric field produced by the presence of the charge. The electric field is directed *outward* for the positively charged sheet, *inward* for the negatively charged sheet. See Figs. 2(a) and 2(b). A test charge placed near the isolated positive sheet will be subjected to a certain electrostatic force, likewise, when placed near the negative sheet. Now when the configuration of the charged sheets is parallel and proximate, as in Fig. 2(c), the electrostatic force will be amplified to double the former magnitude. At least this is true for the region between the sheets. (Note that the configuration also has regions where the force is zero. The regions to the right and left of the pair of sheets is where the two fields cancel; proving that we are dealing with opposites.) Cancellation or amplification, the key is in the configuration.[16]

### A. Gravity and Lambda amplify each other

Now returning to gravity and Λ. A simple arrangement of regions of gravity and Λ reveals that it is entirely possible to have the two opposite effects reinforce each other, as shown in Fig. 3.

Hidden in the configuration of our *Dynamic Steady State*

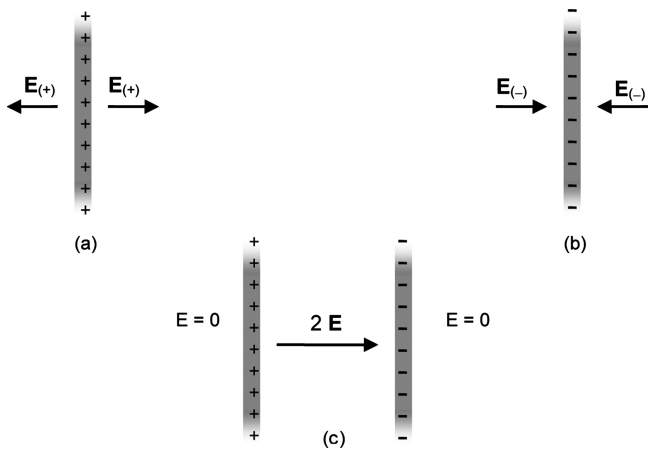


FIG. 2. Amplification of the electric field depends on the configuration. (*a*) and (*b*) Large nonconducting charged sheets viewed edge-on, and their associated electric fields. (*c*) The superposition of the two fields reveals a region where "opposites" act in harmony.

*Universe* lies the harmony between gravity and Lambda. These opposites do amplify each other. As we have seen, Lambda involves the dynamic expansion of space. Ordinary gravity involves the dynamic contraction of space. (These are basic postulate Nos. 1 and 2 of the DSSU theory.) They appear to be, and really are, opposite effects. And it is agreed that in expanding space galaxies move apart and in contracting space galaxies move closer together. It certainly sounds like these "forces" are in conflict.…And yet Lambda and gravity are actually oriented in a *common* direction.

Both effects work toward a common purpose and a common outcome. On the size-scale of greatest importance—of greatest importance for shaping our universe—Λ *pushes matter together* while *ordinary gravity (as always) pulls matter together.* This harmony of forces is made graphically clear in Figs. 4 and 5.

The unexpected twist in the story of Lambda and gravity is that their vectors (representing a forcelike effect or a comoving acceleration) are contiguous and directed toward the same destination!

### B. A look at the comoving trajectories in the cellular universe

The scale of importance in the DSSU is the scale of its component unit-universes, which have a nominal diameter of

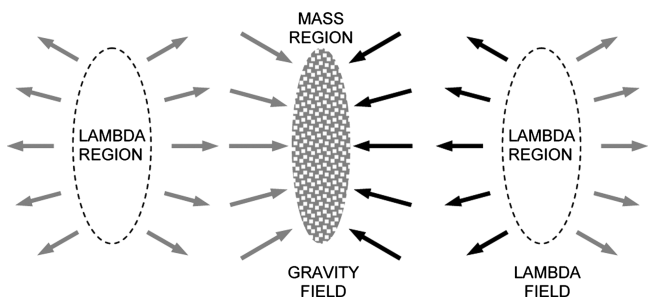


FIG. 3. Amplification of gravity and Λ posited for a nonexpanding universe (i.e., Λ is not part of a Hubble flow). In the region between the centers of gravity and Λ, the two effects clearly reinforce each other. Force (field) vectors have components with a common direction.

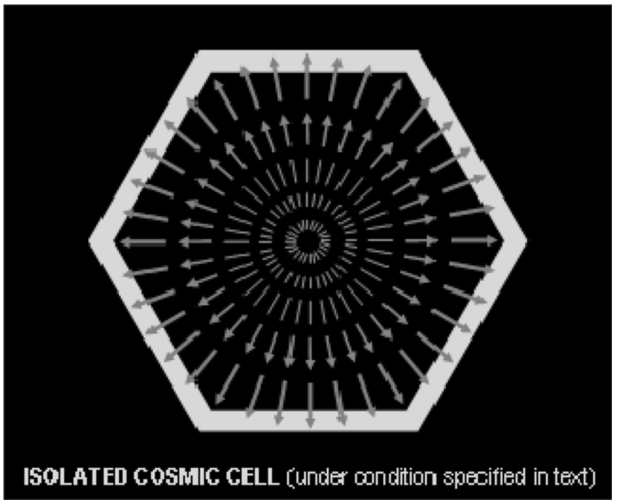


FIG. 4. (Color online) **Opposites in harmony**. The arrows represent the direction of the Lambda effect (long dashed red arrows) and the gravitation effect (outer circle of blue arrows) under the unrealistic condition in which matter is uniformly distributed within the cell "walls" (the yellow hexagon border). The arrows also serve to indicate the direction of movement of space itself and the comovement of contained objects.

$300\times10^6$ lightyears (in reasonable agreement with astronomical observations). These unit-universes are not spherical bubbles, but rather cosmic polyhedral cells. Specifically, they tend to be dodecahedral in shape according to the Voronoi cellular principle. A hexagon is used in the diagrams as a two-dimensional approximation; and also serves as the cross-section view of a polyhedral unit-universe. Space within the cell (and *of* the cell) is, of course, dynamic. The interior void is analogous to a de Sitter region—expanding space mostly empty of mass. If we imagine placing luminous markers, or sprinkling a "handful" of galaxies, into this region, then they will comove *with* the space into which we have placed them.

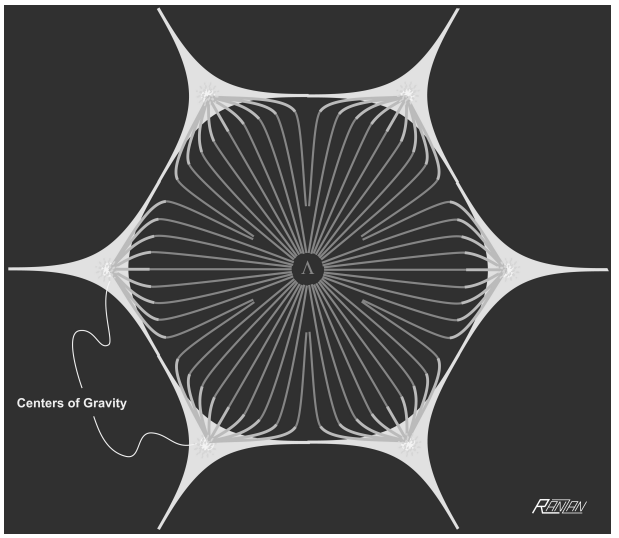


FIG. 5. (Color online) ***Opposites in harmony*** *in an idealized dynamic Unit-Universe.* The curves are the trajectories of the movement of space itself and the idealized comovement of contained objects. There is a perpetual flow; first through the ***Lambda*** region (along the diverging red paths), then through the ***gravitating*** region (along the converging blue paths) and into the very cores of the nodal galaxy clusters. (The hexagon is a schematic cross section of a single cell of the DSSU.)

Over time, the motion of each marker becomes a comoving trajectory. By the definition of comovement, the trajectories must coincide with the Λ and gravity vectors.

Consider, for the moment, the situation in which all the matter in the universe was somehow evenly distributed around the perimeter of each cosmic cell. Then the Λ-effect and gravitation effect and the resulting trajectories would be approximated by a simple radial pattern, as shown schematically in Fig. 4. Notice that *both* the Λ and the gravity vectors are directed *toward* the mass concentration—shown as the yellow-colored hexagonal border.

Matter in a real cosmic cell, however, is not evenly distributed. Like a beehive honeycomb, the cell walls at midpoints have very little material, while the cell nodes are substantially reinforced. Matter, in the form of galaxies, tends to clump together at the cosmic-cell nodes—as any astronomer will verify. These accumulations are aptly called rich galaxy clusters. Away from the nodes, the cell walls—or cell interfaces—contain considerably fewer galaxies. And these galaxies are in transit toward the nearest node. In fact, it is a law of cosmic motion obeyed by all galaxies regardless of where they originate or where we may place them in our diagram: all follow a trajectory toward the nearest node (allowing for the occasional momentary detour and the possibility of galactic cannibalism).

For a cosmic cell in which the mass distribution is more realistic, the trajectories are curved. And Λ and gravity trace these curves, *always in the same direction*.

In the DSSU, the Lambda effect actually reinforces gravity! No mathematical proof is required; one need only look at the graphical representation (Fig. 5) and visualize "force" vectors (or simply motion vectors) along the curved paths. The Λ-effect radiates from the geometric center; the Λ-effect vectors, as they approach the mass regions, actually transform into gravity vectors. In the DSSU, objects subjected to either Λ or gravity will move in the same general direction. On the unit-universe scale, the Λ vectors are directed toward mass concentration regions, as are the gravity vectors.

### C. Heraclitus' principle of the harmony of opposites

The Heraclitian *doctrine of opposites* had another perspective, another principle. It is called the *principle of the harmony of opposites*. Across twenty-five long centuries, could anyone have foreseen its significance?

Heraclitus placed great importance on this one principle in which opposites are seen as fundamentally interrelated. There is the idea, as in the broader doctrine, that opposites cannot exist without each other. But there is a more profound aspect to the relationship between opposites. It is the deeper nature of the interrelationship, and the outcome, that gives the principle its power:

> "Opposition brings concord. Out of discord comes the fairest harmony."
>
> [Fragment No. 98][17]

> "… that which is at variance with itself agrees with itself. There is a harmony in the bending back, as in the cases of the bow and the lyre."
>
> [Fragment No. 117][18]

Heraclitus' whole outlook verges toward simplification of concepts and processes; pairs are unified into one. When opposites unite, unexpected harmony emerges. The modern philosopher, Bertrand Russell, summed it up this way,

> "Heraclitus develop[ed] a new theory…and this is his signal discovery and contribution to philosophy: the real world consists in a balanced adjustment of opposing tendencies. Behind the strife between opposites, according to measures, there lies a hidden harmony or attunement which is the world."[19]

The *new cosmology* picture—based on an ancient theory—reveals the beauty and symmetry of the harmony of opposites. Lambda "pushes" galaxies, and any other comoving objects, toward the cell's interfaces where gravity takes over and "pulls" them in. The direction of the vectors confirms that Lambda does indeed amplify gravity. When it comes to holding galaxy clusters together, ordinary gravity will not do it on its own; Lambda—not dark matter—partakes in the effort. By grasping the underlying principle, the *harmony of opposites*, we have gained crucial insight and effectively solved the *dark matter mystery*.

Heraclitus "The Obscure" (as Aristotle called him), the ancient Greek originator of the theory of the harmony of opposites and a participant in the first revolution in cosmology, had paved the way in resolving the *cluster-cohesion mystery*. Long ago the ideas of this man contributed to the overthrow of the cosmology of the rule of gods, replacing it with the cosmology of the rule of natural law; today these same ideas are instrumental in the fourth revolution in cosmology.

### D. Space expansion and space contraction in harmony

Now let us attack the gravity-Lambda mystery by explicitly relating Λ and gravity to *space expansion* and *space contraction*, respectively. We are confronted with the most fundamental fact of astrophysics—the fact that cosmic space expands. It is immediately recognized as a process—the real growth of quantum-foam space. According to the theory of the *harmony of opposites*, a process demands that there be a harmonious opposing process. There must be a process to counteract the established process of *space expansion*. The *harmony of opposites* requires our universe to have a *balancing space contraction*. By so introducing the appropriate harmonious opposite, we are simultaneously complying with another famous Heraclitian doctrine—the one that holds all things are in "flux" in the sense of being involved in some kind of motion. *Space expansion* and *space contraction* are the essence of motion. In fact, they are the very cause of gravitational motion. These two harmonious opposites impart motion on anything that resides within the respective regions that they dominate. Any astronomer will verify that galaxies everywhere are indeed involved in some degree of motion. And anyone living in a gravity sink will verify that, yes, people, rain, and apples do fall toward the local center of

*space contraction*. In the Dynamic Steady State Universe, *all things* are involved in the motion of either expanding space or contracting space. With *all things* and *all quantum space* (space being dynamic) being in motion, that means…

It means the entire universe is in motion. Heraclitus taught that the whole universe was forever in a state of complete flux or change.[20] This leads to a remarkable conclusion. There is only one way that *space expansion* and *space contraction* can proceed harmoniously (i.e., simultaneously and in equilibrium) in the boundless (i.e., infinite) universe. The universe must be cellular. There is no alternative.

To be more precise, if *space expansion* and *space contraction* proceed by immediately negating each other, then the two processes have no independent meaning and no conclusion can be drawn. If, however, the two processes are independent (such as causally independent), then the conclusion that the universe must be cellular becomes unavoidable. In fact, under the given conditions, the universe must be *cellular and also nonexpanding*. Since the cells are not expanding, then neither is the universe. And the truly meaningful question to ask is, "How big are the cells?"

As for the gravity-Lambda mystery, it simply does not arise in this cellular universe.

### E. The hidden harmony involving matter

The astute reader will now wonder: If matter incessantly flows into the node structures as described, then would not the ensuing matter-accumulation tend to increase the gravity?—and throw it out of balance with Λ?

The *Story of Gravity and* Λ deals with the harmony between Lambda (the expansion of space in the cosmic voids) on the one hand and the gravitational contraction of space (at the nodes of the cosmic cells) on the other. This is the *harmony* implied in the main title. However, there is a key element in "the harmony" that has not been mentioned and is not detailed.

This other aspect of *the harmony* is between (1) primitive matter formation (from the release of energy due to space expansion) occurring in the voids and (2) the negation of a loosely balancing quantity of gravitating matter within the cores of sufficiently massive black-holes (a more accurate term is "superneutron stars"). In blunt terms, the matter, flowing into these cores, leaves the universe. The so fated matter then, literally, no longer exists. The descriptive term for this process, the term used in the DSSU theory, is suppression-annihilation. (Be assured there is no First Law violation.) The two processes lead to a simple self-balancing mechanism. And when the matter formation-and-negation pair is combined with the space expansion-and-contraction pair, then the gravity and Λ harmony becomes a complete, self-sustaining, and self-balancing system.

The processes of the *harmony of matter* are hidden—hidden in the unimaginable smallness of scale of quantum space and in the unimaginable density of the cores of *superneutron stars*.

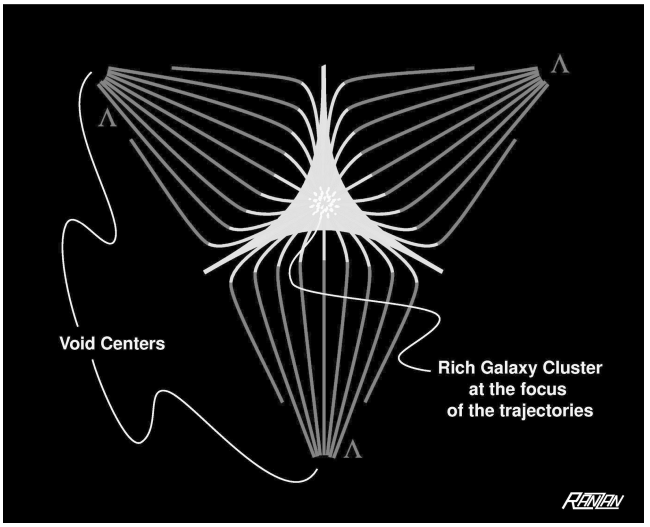


FIG. 6. (Color online) The idealized trajectories of space and comoving matter through regions dominated by Lambda (Λ) and the central region dominated by normal gravity. The paths *diverge* (red lines diverging from void centers) where space expands and *converge* (blue lines converging on cluster) where space contracts. The drawing reveals two crucially important properties: (1) Any comoving or freefalling particle is accelerated toward the center of the cluster by ***both* Λ *and gravity***. Both effects act in unison to hold the cluster together. And (2) the galaxy cluster (yellow) within the gravitating region has ***no*** gravitational influence on anything outside this clearly defined (trefoil-shaped) gravity-and-Λ region.

## VI. IMPLICATIONS OF GRAVITY AND LAMBDA IN HARMONY

### A. Stable universe

Einstein was correct in principle when in 1917, he envisioned a universe in which Λ would exactly balance the effect of gravitation and keep the universe motionless (nonexpanding, noncontracting). It was the *pattern* of the balancing dynamics that eluded him. I do not make the following claim lightly, but it seems that it never occurred to Einstein that he could use Λ—even keep it positive—to *magnify* gravity and still achieve the realistic goal of a static universe.

His balanced static universe was not a success. The way Λ was used turned out to be a formula for instability. If Einstein, however, had fashioned Λ and gravity into a simple cellular pattern he could very well have modeled a truly stable and quasistatic universe. The result would have been a dynamic-space (i.e., his general relativity curved space) and equilibrium-state universe. In short, he would have "discovered" a *dynamic steady state universe*.

### B. Cohesion and symmetry of galaxy clusters

The harmony of opposites manifests in the cohesion and symmetry of galaxy clusters. See Fig. 6. The relationship of the "forces" that bind a galaxy cluster can now be fully understood. Figure 6 reveals the key pattern of the two "forces" that shape, hold, and confine a rich cluster of galaxies. The symbolic shape is that of a trefoil, the actual shape is a

tetrahedron.[3] Notice how the lines, representing comoving trajectories, behave in conformity to the respective dynamics. Follow the lines as a test particle freefalls from the trefoil's extremities. In the Λ-region—the space expanding region—trajectories *diverge*. In the central gravitating region—the space contracting region—trajectories *converge*. Following the course of a freefall represents a distance of about $160\times10^6$ lightyears (the radius of the trefoil) and a staggering $150\times10^9$ years of time.

The presence of matter and the dual dynamics of space, as shown in the diagram, is what holds clusters together. Nothing else does. Moreover, and fundamentally significant, nothing—nothing whatsoever—can freefall *into* the cluster's domain as represented by the trefoil. Outside the trefoil all freefall is *away* from the cluster's space! This understanding leads to the climax in the story of gravity and Lambda. The space region that contains the dense aggregation of galaxies, the domain of the cluster, forms (more properly *is*) what can only be described as a cosmic gravitation cell.

### C. Suborder of cellular structure

Our universe is cellular, not on one, but on two levels.

Just as the universe is structured into physical cells, the ones that have long been observed by astronomers, it is also structured into distinct gravitation cells—or *gravitational fields* to use the mathematical term. There is, of course, a definite relationship between the structured cells of the universe and the gravitation cells. In terms of the schematic representations of the above drawings, Fig. 6 is a single *gravitation* cell and Fig. 5 is a single *structured* cell; the latter contains portions of six individual gravitation cells.[4] Our universe consists of an ordered arrangement of the two types. Of the structural units, only their filamentous skeleton and vertices are visible. Of the gravitation units, only their core concentrations are visible.

There is an obvious implication with respect to the applicability of general relativity theory. General relativity cannot be applied to the structural unit as a whole for it is *not* a proper gravitational field. However, it should be possible to apply it to the *gravitation cell* for it *is* a proper gravitational field. Another consideration is that the shape is notably nonspherical. The largest individual gravitational fields in our universe are *not spherical*; which means that the usual inverse-square law does not apply. No doubt, this will make the mathematics more challenging.

### D. Range of gravity is strictly limited

The trefoil cell of Fig. 6 is a self-contained gravitational field. And as noted earlier, nothing can freefall *into* the Lambda-gravity region represented by the trefoil. Outside the trefoil domain all freefall is *away* from its boundaries.

Revisiting a claim made near the beginning of the discussion: The range of gravity is indeed limited.

### E. Unified Gravity

Although it has not been expressed explicitly up to this point, the application of the harmony of opposites means that we have created a unified gravity. Gravity and Λ together form a *unified gravity*. The gravity cell of Fig. 6 is that of a *unified gravitation cell* (field). The term "unified" refers to the union of contractile gravity and expansionary Lambda; a cosmic scale "unified" field has contracting quantum-foam at its center and expanding quantum-foam at its midregions and extremities. The infinite universe is a polyhedral assembly of such *unified gravitational fields*.

If we define the effect of gravity at any point in space as the mass of a test particle multiplied by its comoving acceleration (realizing that the comoving acceleration is curved toward the center of the galaxy cluster), then the acceleration proceeds along a freefall trajectory—slowly, but relentlessly, increasing all the while—regardless of the region the particle happens to occupy. Whether the particle is in the Λ region or the gravity region the acceleration proceeds, the direction does not waiver. Therefore, despite the fact that gravity and Λ are truly opposite processes with different causes, combining normal gravity and repulsive Λ under one umbrella called *unified gravity* is in agreement with the above definition and justified. Treating the amalgamation of a region dominated by gravity and the adjacent regions dominated by Lambda as a *unified gravitational field* is fully justified.

In the context of the DSSU theory, gravitation is defined in the following terms. Gravity is the measure of the rate of change of the velocity of the quantum-foam (which is a quasi-absolute space) that induces a dynamic effect (motion) on any entity of or in the quantum-foam. The direction of the gravitational effect is the direction of increasing gradient of the rate of change of the velocity of space flow. It is not a geometric effect as claimed by Einstein's general relativity, but rather it is a disturbance, a change, in the fluid movement of quantum-foam space. These fluid movements include expansion, contraction, and translation. The causal mechanisms are expansion and contraction.

### F. Trajectory interaction and the cause of galaxy rotation

The patterns shown in Figs. 5 and 6 are essentially representations of the fluid flow of *space* itself. But what about the trajectories of objects moving in this space flow? What about the trajectories of objects such as galaxies? Galaxies, which are simply the aggregation of comoving matter that "forms" in the void, follow the radial fluid-flow pattern in the Λ-region. Here there are no forces to cause a deviation from pure comovement.

The exponential nature of the expansion in the Λ-region produces an accelerated flow; consequently, the comoving galaxies gain speed and momentum. When galaxies reach the extremities of the void and enter the interface region, their radial speed may be as great as 3000 km/s. Their momenta are significant. The requirements of the law of inertia will cause most galaxies to cross the interface and temporarily escape their originating unit-universe. Galaxies are, in effect, flung through the interface and into the adjacent cosmic cell.

[3]The tetrahedron is the simplest idealized shape of the trajectory region. The other symmetrical shape, which so divides gravity and Λ regions, is the octahedron.

[4]An actual dodecahedral cosmic cell contains portions of 14 different gravitation cells.

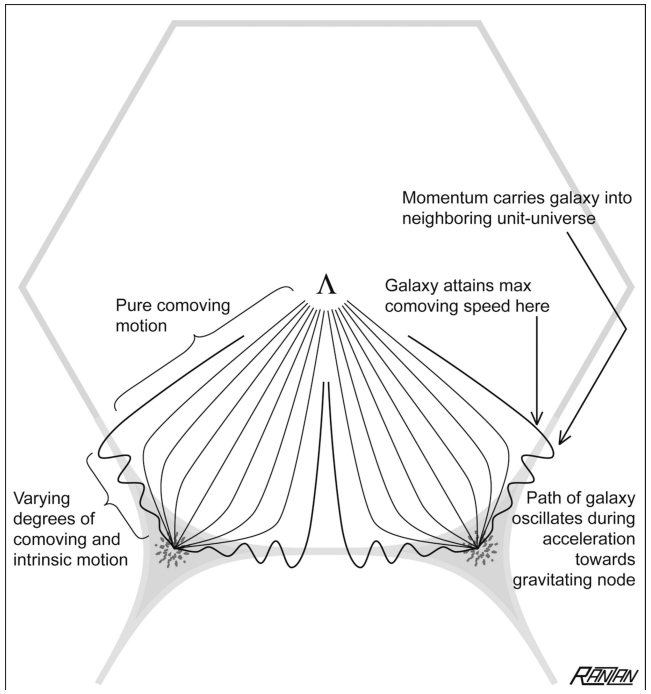


FIG. 7. *Some trajectories deviate from pure comovement.* In the Lambda region, galaxies (not shown) will accelerate toward the interface while gaining momentum. Since the motion of galaxies are subject to the law of inertia (Newton's first law of motion), those at, or near, the perimeter of the unified field will deviate considerably from comovement. A galaxy's inertia—its reluctance to change its motion—propels it across the interface and into the neighboring cell. Gravity and Λ, however, are relentless; they dampen its wayward motion, guiding it toward the core of the node structure.

For an "escaping" galaxy the process may be repeated several times as it is buffeted back and forth on a time scale of many hundreds of millions of years. See Fig. 7.

Throughout the interface region, the pattern of trajectories becomes a maze of criss-crossing curves. With numerous intersecting trajectories, galaxies will often find themselves on conflicting paths; collisions will inevitably occur. And it is these interface collisions that are absolutely essential to the formation of spiral galaxies and fundamental to the initiation of *all* major rotation in all astronomical objects.

The story of gravity and Lambda has led to the source of galactic rotation. It has led to the mechanism that causes galaxies to collide, to orbit each other, to merge, and some to partner in a spiral dance.

It started with a compelling idea; followed by phenomena of unimaginable grandness yet of utter inevitability. The concept of *gravity and Lambda in harmony* demands a grand cosmic-cell structure, which leads to the highly interactive interface between cells; and the interactivity manifests in the wide variety of collisions of galaxies including spectacular spirals, which majestically advertise their enormous rotational momentum. A simple and elegant explanation. BB cosmology has nothing comparable.

Keep in mind that the BB concept of *universal expansion* demands that there *not* be any major interactions. When everything in the universe is supposedly involved in a great Hubble expansion, there is simply no opportunity for such collisions. With no collisions, expect no rotations. And for this reason, there are no plausible rival theories for the cause of galaxy rotation.

The cellular configuration of gravity and Λ holds the key to the cause of galaxy rotation.

The concept that has been put forth, of *gravity and Lambda in harmony*, opens the door to the resolution of many other mysteries of the universe. Resolutions that are simpler, more elegant, and better rooted in reality than has previously been possible. There can be no doubt of the profound and far-reaching implications in the discovery that gravity and Lambda act in harmony. Those described herein are some of the highlights.

If ever there was a theory that embodied beauty, elegance, simplicity, and explanatory power, then the *theory of gravity and Lambda as opposites in harmony* must surely qualify. Its geometric manifestation rivals the beauty of the exquisite pattern of the double-helix DNA molecule. Its power is that of *process physics*. Its elegance is self-evident. Its simplicity, and its spirit, is reflected in the words of the American physicist John A. Wheeler.

> "To my mind there must be, at the bottom of it all, not an equation, but an utterly simple idea. And to me that idea, when we finally discover it, will be so compelling, so inevitable, that we will say to one another, 'Oh, how beautiful. How could it have been otherwise?'"[21]

## VII. THE DEEPER IMPLICATIONS

Gravity and Λ, as we have seen, are processes that act in harmony. On the cosmic scale, gravity "pulls" in a certain direction and Λ "pushes" in the *same* direction. Quantitatively the gravitational contraction of space is equal to the Λ expansion of space. We have also seen how gravity and Λ are united in a unified gravitational theory involving unified gravitational cells (or fields). With the two effects united in this way, we are precluded from asking the conventional question, "Which phenomenon rules the universe?"—gravity or Λ?… As a question in physics, the answer is that they equally rule the universe. Neither one dominates. They prevail *in harmony*.

But there is a deeper question: Which *effect* is the more fundamental one? And the answer seems straightforward. Lambda is selected as being more fundamental; surely, space must be expanded *before* it undergoes gravitational contraction. But then we might ask, Is gravity not the cause of the tension across the void that results in the expansion of space? Yes, but then again gravity needs the prior formation of matter—where matter, in the DSSU theory, is the secondary level of formation that accompanies the primary formation (and expansion) of space. It seems we are trapped in a causal cycle. And it is a fundamental requirement in physics that traps us.

In the realm of physics, everything that *is*, and everything that *happens*, is so, and does so, because of some *cause* (even if merely probabilistic). All of science is a detailed analysis of cause and effect. In a succession of processes of

causes and effects, one notices that every effect becomes itself the cause for the next effect. The pursuit of a theory of everything is simply the unraveling of a regressive succession of causes and effects of processes down to the most fundamental level of existence.

What traps us is this: If every process (regardless of how fundamental) must have a cause, then we are led into an infinite regression of processes never to arrive at the *true* fundamental process.

Let us again question the fundamental nature of space expansion.

Any phenomenon has both a cause and an effect; then if space expansion is the phenomenon, the effect is obvious, but what about its cause. "Lambda" is not the cause; it is nothing more than the symbol for the phenomenon. We define $\Lambda$ as the phenomenon of space expansion, and ask, "What is the cause?" A good answer would be the energy of "the vacuum." Fine. Now the question is, what causes the vacuum energy to be there and to have a certain intensity? The DSSU theory does provide an answer: The *cosmic tension* across the void (i.e., across the diameter of a unit-universe). And again, we seek the cause, this time for the cosmic tension. The cosmic tension, as stated above, is caused by the presence of gravitating mass in the "shell" of the unit-universe. For example, there is gravitational tension between the Virgo galaxy cluster and the more distant Coma cluster located at opposite ends of a typical cosmic void. Finally, we ponder, what is it that caused the matter to be there? And we are back where we started; for the mass surrounding the voids is there because of space expansion. It seems we are trapped in a logical regression.

There is a way out.

There is an escape clause in the form of a metaphysical argument. The foundation of all the laws of physics depends, at some primitive level, on at least one noncausal mechanism. The noncausal mechanism, whatever it may be, sits at the vertex of an inverted pyramid of increasing complexity of processes and their manifestations—the pyramid of physics. And so, in a regressive sequence of cause and effect there is one process, strange as it may seem, that requires no cause. It serves as the most fundamental process of the universe. It is the natural process of the very essence of the universe. *Space*, as defined, is the essence of the universe. And *space expansion* is the one and only process that proceeds without a cause!

Now consider an even deeper implication: If space expansion proceeds without a cause, then our metaphysical argument has but one conclusion. If a process is without a cause, then there is no reason for it to ever come to an end; it proceeds in perpetuity. *Space expansion* then ranks as the Universe's one and only causeless and perpetual process![5] [22]

Appropriately, the concept of space expansion as the primary process of the universe serves as *postulate No. 1* in the DSSU theory. There is recognition of the fact that *the* primary process of the universe is *sans a priori*, as well as being perfect in the sense of the *perfect cosmological principle*.

The deep and profound implication of this story is that generic $\Lambda$—the expansion of space—is the *perfect primary process* of our universe.

## VIII. REFLECTIONS

On the cancellation of the cosmological constant: The harmony of opposites can also take the form of one factor canceling another. A medical disease, a harmful factor, may be negated by a cure, a beneficent agent. [loosely based on Heraclitus' Fragment No. 107][23] Synthesis is canceled by an opposing diathesis. Space contraction cancels space expansion. Gravity cancels Einstein's cosmological constant!

Reflecting on another version of the harmony of opposites: Immanuel Kant (1724–1804) argued that if repulsive forces alone existed, matter would be dispersed infinitely over space, while attractive forces alone would gather all matter together at one place. Hence, the universe, according to Kant, must be ordered by the interaction and balance of these two forces.[24] Describing a universe in this way; describing a universe as being "infinite" and "ordered" is a noncommittal way of saying that it is a cellular universe. (If the universe was *not* ordered, then it would manifest randomness instead of cellularity.)

On nonharmonious opposites: There are many cosmologists who favor the *oscillating universe* (Alexander Friedmann was probably the first). It expands and contracts in cosmic time cycles. This being the case, is there not harmony in the opposites of big expansion followed by a big crunch?—with the alternating domination of $\Lambda$ expansion and gravitational collapse?… No. Being cyclical rather than balanced, sequential rather than simultaneous, they represent nonharmonious opposites.

On the quest for dark matter: It would be naïve to think that with the elucidation of the true nature of $\Lambda$—its gravity enhancing nature—the fruitless search for *mysterious dark matter* and *dark energy* would cease. It is not easy to argue that there simply is no *dark matter*; there is a dilemma in trying to prove a negative. One can only assert, as does Reginald T. Cahill, of Flinders University, an expert in process physics and responsible for the discovery of the causal mechanism of gravity.

> "There is no 'dark matter', merely an exotic self-interaction and annihilation process [i.e., a space-contraction process] of the quantum cellular structure that is space."[4]

The quest for dark matter will continue. It will continue mainly for two reasons. First, the unexpected discovery will be ignored and even suppressed. Second, research into dark matter is funded by government and quasigovernment institutions; funding decisions are influenced by factors often far removed from truth and reality.

For the foreseeable future, expect more of the same—more speculative mysterious-matter theories.

My final reflection highlights the most disheartening as-

[5]A *perpetual process* does not necessarily violate physical law. According to Ref. 22: A perpetual motion machine of the third kind violates NO known laws.

pect of academic cosmology. Gravity and Λ are the keys to an ordered universe of perpetual existence; yet sadly, gravity and Λ are misapplied in the artificial construction of a *creationism cosmology*.

Consider, in the DSSU we see the ultimate in balance between gravity and Λ. We see this clearly in our minds because we grasp the underlying principle that Λ manifests as the expansion of space while normal gravity manifests as the contraction of space. It is a balance that maintains our universe's observed orderly structure. They are two sides of the same coin.

We see a harmony of opposites.

What does institutionalized cosmology see?… The view of the leaders of the Supernova research[6] teams is representative:

> "What [Saul] Perlmutter and [Brian] Schmidt see, instead, is the ultimate in unbalance…a runaway universe, in which galaxies race ever faster away from one another."
>
> —Corey S. Powell[25]

What Academic Cosmology sees must—of course—conform to the established BB orthodoxy. As Corey Powell effectively argues, its practitioners deify Lambda as the Angel of Dark Energy. First, the BB Cosmology provided its followers with a *creation story* in the form of an exploding singularity; the Angel of Dark Energy now provides followers with a doomsday scenario—a prolonged demise in which Perlmutter and Schmidt's accelerated expansion leads their universe toward increasing emptiness and death by dilution. Academic cosmologists envision a rather gloomy future.

> "The [Λ dominated] accelerating universe could create a spiritual crisis…"
>
> —Corey S. Powell[25]

All the while, the practical crisis is very real, for it must be that whatever has a beginning also has an ending. The adherents of the creationism cosmology, having failed in unraveling the mystery of their *creation event*, now ponder the meaning of their universe's demise.

[6]The research involved the use of supernovae type 1A to indirectly measure Lambda Λ.


[1]W. Harris, Prof. Emeritus Middlebury College, *HERACLITUS, The Complete Fragments* (Fragment No. 116), http://community.middlebury.edu/~harris/Philosophy/heraclitus.pdf.
[2]C. Ranzan, *The Large Scale Structure of the Dual-Dynamic Universe*, unpublished.
[3]E. Milne, Kinematic Relativity (1948), as in E. R. Harrison, *Cosmology, The Science of the Universe* (Cambridge University Press, Cambridge, UK, 1981), p. 316.
[4]R. T. Cahill, Space and Gravitation, published in *Magister Botanicus*, Vol. 2, www.mountainman.com.au/process_physics/HPS20.pdf (2004), pp. 13–22.
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