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Natural Cosmic-Scale Geometry of Our Universe

How the Cosmos is Partitioned into Tetrahedral, Octahedral, and Dodecahedral Cells

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Article Info

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Abstract

The Universe exists as a cellular tessellation —structurally as rhombic dodecahedra and gravitationally as octahedra and tetrahedra. Supported by validated laws of physics and a comprehensive (unified) theory of gravity, and an abundance of irrefutable observational evidence, the Cosmos is revealed to be an interlocking geometry of dodecahedra, octahedra, and tetrahedra. Based on the DSSU aether theory of gravity and the mass-and-radiation recycling system, the cosmic structural units are predicted to have a rhombic dodecahedral shape. Significantly, this structural shape has two distinct types of vertices, minor nodes and major nodes. They provide the explanation for the astronomical observations that galaxy clusters come in basically TWO SIZES — something that would otherwise be inexplicable. Presented is the revolutionary advancement in the understanding of cosmic geometry, namely, that the cosmic cells (the structural units and the unified gravity domains) are perpetually SUSTAINED (meaning there was no initial formation origin). The mechanism responsible for this sustainment of the grand cellularity consists of two parts: 1) A self-regulating balance between the ongoing emergence of new aether (within great Voids), on the one hand, and its loss via the *direct action of mass* (acting as a sink) and via the *stress inducing processes of contractile gravity*, on the other. 2) A self-adjusting balance between the *regeneration* of matter, on the one hand, and its *entropic degradation* (in accordance with thermodynamic law) and outright *negation* (mass Extinction via aether deprivation), on the other. In the concluding section, some profound implications of steady-state gravity domains are briefly discussed.

Keywords: Cosmic Cells, Gravity Cells, Gravity, Unified Gravity, Cosmic Structure, Cosmic Web, Mass Extinction, Mass Annihilation, Aether Deprivation, DSSU

Introduction

... this grand book of the universe which stands continually open to our gaze ... is written in the language of mathematics, and its characters are triangles, circles and other geometric figures, without which it is impossible to understand a single word of it; without these, one wanders in a dark labyrinth. —Galileo Galilei, 1623, The Assayer

1. The Universe is Cellularly Structured

1.1. Observations

Observations have long made it clear that matter in the universe is distributed in a more or less orderly manner. Thanks to the work of people like Gérard De Vaucouleurs (French cosmologist), Jaan Einasto (Estonian astronomer/astrophysicist), Anthony Fairall

(South African astronomer), and many others we know that the universe is cellularly structured. There is an appreciable abundance of evidence that the visible matter of the universe is distributed as a vast tessellation —a network of great voids and rich clusters and filamentous links.

It is generally acknowledged that Jaan Einasto and M. Joeveer, back in the 1970s, were the first to describe the universe as being *cellular*. Astronomical observations left no doubt, the Universe is a labyrinth of large-scale structures and voids [1].

Others confirmed the cellularity; and the term *the Cosmic Web* became popular.

Quoting from the work of an international collaboration of astronomers describing the cosmic structure: "The Cosmic Web is the salient and pervasive foam-like pattern in which matter has organized itself on scales of … a hundred Megaparsec. The web-like spatial arrangement of galaxies and mass into elongated filaments, sheet-like walls, dense compact clusters, and the existence of large near-empty void regions are major characteristics of the cosmic matter distribution."[2]

But it wasn't some tangled labyrinth or chaotic web. There was unexpected order; there were remarkable features hinting of some systematic pattern.

It was called the Great Wall. It stood out as the most remarkable feature of the famous galaxy-distribution survey produced by V. De Lapparent, M. Geller, and J. Huchra. Here was a wall of galaxies stretching across the entire 3-dimensional map dividing up adjacent giant voids. The universe was supposed to be clumpy on small scales, then it was supposed to become smoother and smother as one examines larger and larger scales. The experts were truly baffled. Richard Gott, in his book on the Cosmic Web, had this to say. "So what was going on? Also, why was it a linear feature anyway? If individual [cosmic-scale] bubbles were forming and hitting each other to produce a froth, then why did the walls of a number of separate independent bubbles line up and strengthen along a single line to form a Great wall? Could that happen by chance? Speculations abounded …"[3]

Most remarkable were the findings of Anthony Fairall and his colleagues: Galaxy surveys revealing parallel walls as well as perpendicular walls of galaxies. Their report, for 1990, concluded that the right-angled bends are indeed real. The report also, perspicaciously, noted that these distinct features could serve as critical tests for any theoretical model [4] [5].

Essentially then, galaxies are not uniformly distributed spatially. On large scales the Universe displays coherent cellular structure with galaxies residing in dense clusters, and along joining filaments, and spread within sheet-like walls separating great near-empty regions.

1.2. Review of large-scale structure theories

What was the contemporary theoretical thinking on cellularity? Apart from unsound speculations, there were basically two rival theories: the "pancake" model promoted by Russian Astrophysicist Yakov B. Zeldovich [6], and the "hierarchical clustering" model advanced by Canadian-American James Peebles [7]. According to the Zeldovich scenario (a top-down approach) matter first collects into giant cosmic pancakes and then fragments into smaller structural components. Peebles' hierarchical-clustering scenario reverses the sequence (and was called the bottom-up approach). Small-scale systems (star-cluster sized objects) form first. Then by further clustering, larger size systems like galaxies and clusters of galaxies form [8].

In the Zeldovich model, the matter-containing pancakes were the flat walls between his mostly-empty cosmic bubbles. As Freeman J. Dyson, in his book *A Many-Colored Glass*, summed it up: "The interiors of the bubbles are the voids containing mostly radiation and little matter. The flat walls between the bubbles are the pancakes containing most of the matter."

The Peebles hierarchical idea went like this: A galaxy would form, then it would tend to bond gravitationally with the galaxy nearest to it and form a binary galaxy. The binary galaxy would bond with another binary galaxy to form a quadruple. Two quadruples would be pulled together to form an octuple, and then two of the octuples would form a cluster of 16 galaxies. The scenario extended to the clustering of great clusters and ultimately to superclusters of galaxies.[9]

The theoretical constructions of cosmic cells were failures. The models of Zeldovich and Peebles were plagued by the same problem shared by all theories based on gravity of extreme scale or of great intensity. The construction of any sound theory of large scale structure demands a deep understanding of gravity —namely, its *causal mechanism*. Unfortunately, this *cause* is something missing in both Newton's and Einstein's versions of gravity.

The pancake and hierarchical models were conceived within the framework of conventional gravity theory, a functionally incomplete theory.[1] Neither the 'pancake Voronoi' cells nor the 'hierarchical fractal' cells could be made to work properly. Think about it. Using the same underlying gravity theory the experts harnessed different modes of gravitational aggregation and predicted radically different outcomes.

Not surprisingly, both theoretical camps conducted much of their research on the basis of a mathematical statistical approach rather than on fundamental intrinsic grounds. Supporters of both models treated cosmic cell structure as mainly random statistical phenomena rather than as fundamentally innate in nature. In an effort to reconcile theory with actual observations, the cognoscenti focused their attention on *density waves*. Considerable research went into matter waves analysis. The conclusion was that the distribution of mass in the universe can be explained by the interference pattern of *density waves* of different wavelengths. For example, galaxies tend to cluster where large-scale density waves intersect and combine their intensity maxima. Superclusters form in regions where the largest density waves combine to produce constructive interference. Voids are manifestations of destructive interference, as they form in

[1] A proper theory of gravity, including its causal mechanism, was not discovered until the year 2002. See the extensive work of R. T. Cahill http://www.mountainman.com.au/process_physics/index_of_papers.htm

regions where large-scale density waves combine in similar locations of minima. That was how Jaan Einasto summed up his 2009 conference paper on the *Large scale structure of the Universe* [8]. But no one was able to explain what maintains the synchronization of the waves or the stability of the interference pattern. One is left wondering: What produced the various density waves, what caused the different wavelengths? —Or was this just a mathematical exercise? … Indeed, if, on the one hand, the theories themselves were not very compelling and, on the other hand, the highly-flexible statistical methods were able to generate expectation-fulfilling results, then at least theorists could agree that the distribution patterns were *phenomenological*.

There was, however, a far more serious problem. It was uncompromisingly fundamental. Cosmic structure did not evolve. Cellularity did not come about from some prior non-cellular state of existence. It was a realization that emerged with a new insight into gravity.

The twenty-first century witnessed the advent and rise of DSSU theory —a surprisingly natural cosmology that combines Hubble's great discovery, Einstein's "nonponderable" aether, Penzias and Wilson's distant starlight, Heraclitus's harmony-of-opposites principle, and incorporates more recent developments including the powerful particle theory of Williamson and a unifying concept of gravitation. With the addition of a two-faceted Primary-Cause process and a *sui generis* mode of vacuum excitation, the entire construction becomes fully functional. [10]

The DSSU model[2] of cosmic structure is radically different:

- DSSU cell structure has a definite shape —a pattern with verifiable systematic features. In contrast, the Zeldovich model is a random Voronoi tessellation; while the Peebles hierarchical model is a random scale-variant tessellation.
- DSSU cell structure never evolved, never formed. The cellularity has always existed. In contrast, all theories constructed under the framework of the expanding-universe paradigm insist on cosmic scale evolution, in particular cosmic cellular structure.
- Predicts certain features in the tessellation pattern — features that no other model can explain [11].
- DSSU cell-structure theory incorporates several newly discovered laws of physics [12].

The theoretical analysis of structure was given new life in 2014. In that year, the expanding universe hypothesis was proven to be invalid as a scientific exercise. The Big Bang lost its main supporting pillar and could no longer stand as a representation of the real World. See the Press Release, posted at CellularUniverse.org and the published article "*Cosmic Redshift in the Nonexpanding Cellular Universe: Velocity-Differential Theory of Cosmic Redshift*."[13]

[2] DSSU is the acronym for *the Dynamic Steady State Universe* —the cosmology theory that holds that the space medium is the ultimate bedrock of Nature, and further, that the space medium expands and contracts ***regionally and equally*** resulting in a cosmic-scale cellularly-structured universe. It is a model based on the premise that all things are processes.

The point is this: The real Universe does not expand. This greatly simplifies our understanding of cosmic structure. One does not need to ponder how cosmic structure came about, how grand-scale cellularity evolved. One only needs to focus on the factors / forces / processes that sustain the cellular pattern.

So, what caused this major shift in structure theory? And what motivated the rejection of whole-universe expansion? … The discovery that changed everything was the *velocity-differential theory of Cosmic Redshift*. It was in the year 2014 that the cautionary prediction made by Edwin Hubble, famed astronomer of the Mount Wilson Observatory, was fulfilled.

Hubble (in the 1930s) proposed the existence of some yet-unknown mechanism to explain the *cosmic redshift*, the measurable effect that made far-away galaxies appear to be receding. Quoting from his book *The Observational Approach to Cosmology*:

"We may state with some confidence that red-shifts are the familiar velocity-shifts [i.e., Doppler shifts], or else they represent some unrecognized principle of nature."[14]

"[L]ight *may* lose energy during its journey through space, but if so, we do not yet know how the energy loss can be explained."[14] … "If the nebulae [galaxies] are not rapidly receding, red-shifts are probably introduced between the nebulae and the observer; they represent *some unknown reaction* between the light and the medium through which it travels."[15, emphasis added]

In the book's conclusion Edwin Hubble wrote: "But the essential clue, **the interpretation of redshifts, must still be unraveled**. The former sense of certainty has faded and the clue stands forth as a problem for investigation. … We seem to face … a new principle of nature."

Hubble's mysterious redshift mechanism, his "new principle of nature," has turned out to be the *velocity differential redshift*. Briefly, it works like this: The combination of (i) the fact that aether is the conducting medium of light and (ii) the fact that aether is not static but is involved in a dynamic flow, in accordance with the aether theory of gravity, leads directly to a new mechanism of cosmic redshift. Research has shown that contraction of aether *can* cause spectral redshifting. What this means, and this is crucial, is that lightwaves stretch not only in expanding 'space,' as has long been known, *but they also stretch in inhomogeneously contracting 'space.'*[13] In other words, wavelength increases within the great voids (where aether expands) as well as within gravity wells. But most amazingly the redshift occurs (as an intrinsic effect) during the entire transit across a gravity well —it occurs for both the inbound *and* outbound journey. Needless to say, the implications for cosmology are profound. [13]

In summary, distant galaxies are not receding, Hubble's redshifts were *not* Doppler shifts, the Universe is not expanding, the cosmic tessellation is not the result of cosmic evolution. Cosmic cells structure has always existed and is forever sustained by on-going processes, as discussed in Section 3.

1.3. Cell size

According to Jaan Einasto, "The web has a characteristic cellular pattern, the diameter of one cell – a void surrounded by superclusters – is fairly constant, about 100 h^{-1}Mpc."[8] The symbol *h* is known as the dimensionless Hubble parameter. Since Einasto assigned to *h* the value of 0.8, the cell diameter works out to 125 Mpc or about *400 million lightyears*.

Some refer to it as the End of Greatness. According to Wikipedia (2023-7-31), "the *End of Greatness* is an observational scale discovered at roughly 100 Mpc (roughly 330 million lightyears) where the lumpiness seen in the large-scale structure of the universe is homogenized and isotropized in accordance with the Cosmological Principle."

The results of an extensive mapping of galaxies were published in 2012. Called the WiggleZ survey [16], it contained more than 200,000 galaxies, and probed a cosmic volume of about 3 billion lightyears cubed. As ScienceDaily (Aug. 21, 2012) reported, "This makes it the largest survey ever used for this type of measurement of the large scale Universe." Using the Anglo-Australian Telescope, it was found that "on distance scales larger than 350 million lightyears, matter is distributed extremely evenly, with little sign of fractal-like patterns."

1.4. Cell shape

From the observational perspective, there is much cell-shape ambiguity with considerable uncertainty stemming from the challenge of obtaining reasonably accurate distance measurements. Much of the cosmic web appears as a chaotic froth-like tessellation. However, conclusive evidence has been found. From the theoretical perspective, the shape depends on the dynamic aspects of the cosmic environment —the forces, processes, and their temporal nature. The discussion will expand on these in a moment.

Since cellularity did not make sense under the contemporary paradigm of whole-universe expansion, the question of cell shape never arose (except possibly as a statistical tool). But there were three game-changing developments spanning three centuries. One was the realization that Michelson and Morley really had measured the motion of the space medium back in 1887. This fresh awareness was brought about by Australian Professor Reginald T. Cahill following an extensive reexamination of the 1887 Michelson and Morley experiment and also the vastly more detailed 1925-26 Dayton Miller experiments. Second, the causal mechanism of gravity was discovered [17] [18]. And third, the true nature of the cosmic redshift was discovered making the recession of galaxies an obsolete notion and thus overturning the big-bang hypothesis. As discussed above, Edwin Hubble was proved right after all, when he predicted the probable existence of "some unrecognized principle of nature." Hubble considered it entirely plausible "that redshifts are not primarily velocity-shifts." … "that redshifts result from some unknown principle that does not involve actual motion."[14] These developments removed a major theoretical block; and so, what was formerly the phenomenological features of cosmic cellularity could now be interpreted as the landscape of inherent cellular structure.

If cell structure is not something transient but fundamentally innate, it stands to reason that we are dealing with repeating, self-same units. Think of this as a space-filling exercise. Consider the ways that the volume of the universe could be divided-up into more or less identical cells (tightly packed polyhedra). From a purely geometric point of view, it turns out there are only three ways. Only the cube, the rhombic dodecahedron, and the truncated octahedron can be packed together without leaving gaps between adjacent cells. See **Figure 1**.

The cube is an obvious space filler. But having an unfavorable volume-to-surface-area ratio and poor stability (as can be shown with a wire-frame unit), it is immediately rejected as a cosmic cell model.

The rhombic dodecahedron and truncated octahedron (also known as *tetrakaidekahedron*) are associated with the packing of spheres and their subsequent deformation under extreme compression. The two simple and homogeneous configurations—the rhombic-dodecahedral and tetrakaidekahedral assemblages —are easily and commonly produced; the one by the compression of deformable 'solid' spheres in ordinary closest-packing, the other when a liquid system of spheres or bubbles is free to slide and glide into a packing which is closer still. Between these two configurations there is no other symmetrical or homogeneous arrangement possible [19, p555].

Compressed lead shot example: In an experiment conducted many years ago, lead shot was compressed within a steel cylinder with the plunger capable of exerting up to 35,000 pounds per square inch. When the spherical pellets were introduced carefully, so as to lie in closest-packing arrangement, and the pressure applied, the result was an assemblage of regular rhombic dodecahedra [20].

The rhombic dodecahedron and the truncated octahedron exhibit similar geometric characteristics when they are viewed in cellular arrays. As structure expert Peter Pearce described them, "With both systems there are always three shared faces (partitions) meeting on an edge. For the rhombic dodecahedron these shared faces meet at angles of 120°, while for the truncated octahedron they meet at 125°16′, 109°28′, and 125°16′. In space filling arrays, the rhombic dodecahedron has two classes of vertices: four edges meeting at a vertex at 109°28′ angles and eight edges meeting at angles of 70°32′, in the ratio of two 4-edge-connected vertices for every 8-edge-connected vertex. The space filling truncated octahedron has only one type of vertex, which is 4-connected, with alternating angles of 90° and 120°. Looking at the individual polyhedra, we find that the rhombic dodecahedron has eight 3-connected vertices (that is to say, eight with three edges surrounding each vertex) and six 4-connected vertices, for a total of 14; and the truncated octahedron has 24 3-connected vertices."[21, p5]

Another interesting point of comparison is the **volume-area relationship**. Which of the two shapes has the least surface area per unit of volume? "Lord Kelvin, in 1887, made the remarkable discovery that the fourteen-sided tetrakaidekahedron truncated octahedron homogeneously partitions space —into equal, similar and similarly situated cells— with an economy of surface in relation to volume even greater than in an assemblage of rhombic dodecahedra." [19, p551]. In other words and purely in terms of the geometry, the plane-surfaced truncated octahedra will uniformly partition space with less surface area than rhombic dodecahedra [21, p5]. The difference, however, is quite small. The surface-to-volume ratio in terms of the geometric invariant *I* (which is equal to *SurfaceArea / Volume*$^{2/3}$) for the rhombic dodecahedron is 5.34539; while for the truncated octahedron it is 5.31474 [21, p155]. The difference appears only with the third significant digit.

This suggests that truncated octahedra are involved in minimum energy arrangements. It is probably the reason why the truncated octahedron is most commonly found in a homogeneous system of fluid films such as the interior of a froth of soap-bubbles [19, p552]. (But because of the interplay between surface tension and gravity on the soap films, there is considerable variance in shape and number of faces. Nevertheless, among the cells, the *average number of faces* is close to 14, the number of faces of the truncated octahedron.)

Comparing the geometry of facets. The rhombic dodecahedron (idealized) has 12 identical rhombic faces; or six pairs of *opposite and parallel* and equal faces. (Because its vertices do not all lie on a circumscribing sphere, the rhombic dodecahedron is not considered a Platonic shape.) The truncated octahedron (basic tetrakaidekahedron) is bounded by seven pairs of parallel planes —three pairs of equal and opposite *square faces*, and four pairs of equal and opposite *hexagonal faces*. (It is one of the thirteen semi-regular and isogonal polyhedra *Archimedean shapes*.) [19, p551]

Evidently (based on the economy of surface in relation to volume as mentioned earlier), an assemblage of space filling truncated octahedra is a minimum energy system. As such, it must be considered to be the generalization within three spatial dimensions of the hexagonal array (the recognized minimum energy system in two dimensions). Nevertheless, *the rhombic dodecahedron, as well as the truncated octahedron, appears as the basis of the solution to certain minimal problems in nature; and thus it is not easy to identify one or the other as the most general solution, or even in a particular situation.* [21, p5].

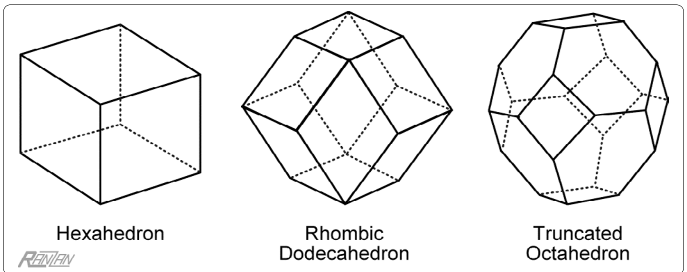

Figure 1. The three basic polyhedral shapes capable of being *closest* packed —capable of partitioning space with no in-between gaps. The truncated octahedron is also known as a tetrakaidekahedron or "orthotetrakaidekahedron" to emphasis that all its facets are planar. Note that the vertices of the cube are all identical and so are the vertices of the tetrakaidekahedron; significantly, this is not the case for the rhombic dodecahedron.

So the question then is which shape is the one that Nature actually employs? More specifically, which tessellation works better in the cosmic environment ruled by gravity?

Knowing that the vertices represent the locations of rich galaxy clusters and that the links joining them trace the filamentary galaxy clusters serves as an obvious starting point. But deeper insight comes in recognizing and applying the main drivers behind cosmic cellularity —the driving forces or processes that actually sustain the structure. This is remarkably straightforward.

Most relevant are two fundamental properties of what is loosely called *space*, but more properly called the *universal space medium*. The space medium is involved in two foundational processes:

- The axiomatic nature of the universal space medium is to expand. This ethereal-medium growth involves the spontaneous emergence of new ethereal units (the discrete entities of a non-physical aether).
- The mechanism of gravity involves the contraction, in the sense of *self-dissipation*, of the universal medium, a vanishment of those discrete entities of the non-physical aether.[3]

Knowing those two fundamentals, that the axiomatic nature of the space medium is to expand (particularly when it is under tension as it is across the cosmic voids) and that gravity involves the dynamic contraction (self-vanishment) of the space medium around mass-aggregation regions, represents a major step towards determining which of the three shapes best fits Nature's design.

Essentially, cosmic cells are perpetual dynamic systems —ruled and driven by dynamic gravity processes.

It should be mentioned that the Voronoi argument/ principle is of limited use**:** The dynamic processes that sustain fluid (or fluid-like fine particulates) cells invariably produce hexagons (in the case of surface-type cells), in accordance with the principle of Voronoi cells. But in the case of 3-dimensional spatial cells the Voronoi principle is less predictive —it allows for both the rhombic dodecahedron and the truncated octahedron. Moreover, the experimental result (described earlier) of compressing spherical lead pellets or of just imagining the outcome of compressing a collection of balloons so that the interstitial spaces/gaps become greatly reduced so that those in-between gaps are eliminated, those experiments can give mixed results. If initially the spheres are systematically closest-packed, the results favor the dodecahedron. But real cosmic cells were never spheres and so a deformational transition to a polyhedron never arises.

[3] **Essential points of the mechanism of gravity:** Mass objects/particles (as well as energy particles) are aether consumers and consequently act as aether sinks. ● This *direct absorption* or *assimilation* of aether by all mass and all radiation is the **primary cause of contractile gravitation**. ● The associated converging flow of aether causes ongoing self-extinction of a proportion of the space medium. In other words, there is a stress-induced vanishment of aether within contractile gravitation 'fields.' ● This vanishment process accelerates the aether flow and is the secondary cause of gravity. ● (These processes also produce the property of mass and its inertial aspect.)

Dynamic space medium argument: The space medium's expansion property tends to favor maximizing the cosmic cell's volume. While on the other hand, the gravity effect dominating at the cell interfaces tends to favor minimizing the cell's surface area. The great Voids 'strive' to expand; the surrounding boundaries 'strive' to contract. Nature, in effect, seeks the lowest possible surface-area-to-volume ratio (expressed in terms of the geometric invariant, $I = (surface\ area)/(volume)^{2/3}$). In descending order these ratios are 6.0000 for the cube, 5.34539 for the rhombic dodecahedron, and 5.31474 for the truncated octahedron [21, p155]. This obviously eliminates the hexahedron; but the values of the other two shapes are just too close to be conclusive.

Strong argument against truncated octahedron: The truncated octahedron is excluded by a simple gravity argument. Its square faces (of which there are 6) are much smaller than its hexagonal faces (of which there are 8). A typical square face would shrink as the clusters at the 4 corners/vertices 'pull' together to become one large cluster. The result would then be an octahedron. But this, of course, cannot stand as the final shape, since octahedra by themselves do not close pack and form a gap-free space-filling assembly.

Vertices hold the key. The pivotal difference between the two candidates is this: The dodecahedral tessellation (**Figure 2a**) has two types of vertices (4-linked nodes and 8-linked nodes). The truncated octahedron has only one type —all its vertices have 4 links. It means that if the Universe is tessellated in dodecahedral fashion, then there needs to be two sizes of nodal galaxy clusters. On the other hand if it is a truncated octahedral tessellation, then ALL nodal clusters would be expected to be the same size.

It turns out that observational evidence clearly shows two classes in cluster size. Astronomers have found that real galaxy clusters come in basically TWO SIZES.

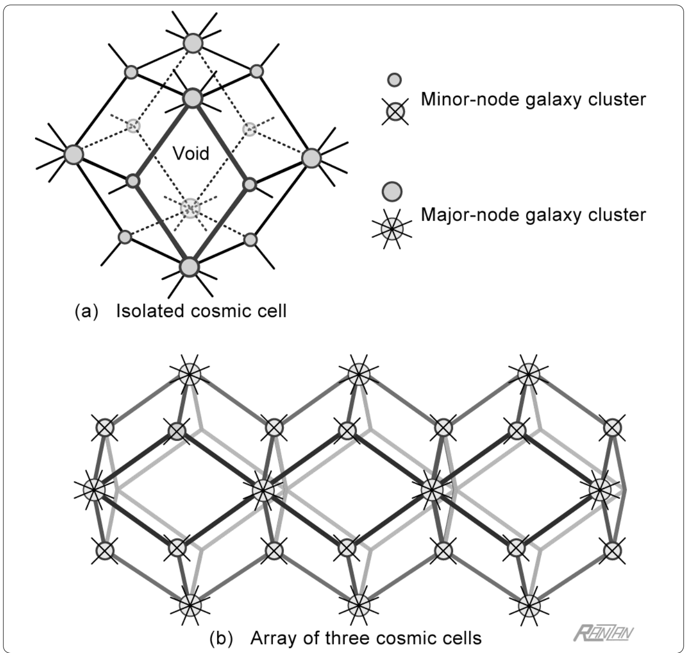

Figure 2. Typical cosmic structural cell, schematic (a), has two distinctly patterned vertices or nodes. Within an extended tessellation these nodes are configured as four-armed and eight-armed nodes. Schematic (b) shows a portion of a multiple 'packing.' Interestingly, although an individual cosmic cell has 8 minor and 6 major nodes, within an extended tessellation there are actually *twice* as many Minor nodes as Major nodes.

Galaxy clusters come in two sizes. In perfect agreement with the close-packed dodecahedron (**Figure 2**), clusters fall into two categorical sizes. Back in 2002, following a study of 79 distant clusters of galaxies (redshift range $0.1 < z < 1$), astronomers Naomi Ota and Kazuhisa Mitsuda announced the "discovery of two classes of cluster size." The distribution graph they presented was based on the measured core size of each cluster and revealed a distinct double-peaked distribution. The pattern could not be explained by any selection bias or instrument effects; they, therefore, concluded that it reflects the real nature of the clusters.

The evidence was clear "the histogram of the core radius shows two peaks at 60 and 220 kpc." Cluster core diameters could be classed as either 390,000 lightyears or 1,430,000 lightyears. The enormity of the size difference made this a significant discovery. However, Naomi Ota and Kazuhisa Mitsuda were baffled by the underlying cause. They failed to apprehend "through which physical processes such discrete cluster structures are formed."[22] The notion that these clusters never formed but are forever sustained, assuredly, never entered their consciousness.

This agreement between observed cluster sizes (in terms of nominal diameter and the number of galaxies) and two distinct vertex sizes (in terms of the number of 'arms') in the tessellation geometry, as well as agreement with several other significant features that have been astronomically observed (**Table 1**), effectively proves the rhombic dodecahedron as being the structural building block of the Universe.[4]

Table 1. Comparison of the two candidate shapes as they relate to cosmic-scale observations. When it comes to explaining cosmic structural features, a network of dodecahedra trumps a network of truncated octahedra.

Structural feature: Observed	Rhombic dodecahedron: Explanation	Truncated octahedron: Explanation
TWO sizes of galaxy clusters	Major and Minor nodes (4-arm and 8-arm vertices)	None
Filamentary galaxy clusters	Links between nodes	Links between nodes
Right-angled walls of galaxies	A plane cross-section through 4 Major nodes has the shape of a perfect square	No right angles
Extended linear walls	Rhombic faces run linearly along any axis (lying in the faces) running through Major nodes	No adjacent faces in the same plane
Extended parallel walls	Explained by combining the above two properties	None
"Ribbon-like" structure*	Manifest within the tessellation (**Figure 2b**)	None
TWO extraordinary sequences of galaxy clusters	Two characteristic patterns provide a decisive fingerprint match (See reference [23])	None

[4] It is quite probable that the closest packing configuration of dodecahedra also includes rhombic-trapezoidal dodecahedra.

Reciprocal network. A *reciprocal network* is the tessellation formed by joining together the geometric centers of close-packed structures. The reciprocal net resulting from the linking of dodecahedra centers is a dual-shape packing of tetrahedra and octahedra. Quoting from Peter Pearce's monograph on structure, "The reciprocal net of the rhombic-dodecahedral array contains both tetrahedra and octahedra."[21, p8] "Octahedra and tetrahedra will fill space when packed in the ratio of 1:2."[21, p42]

The significance of this dual-shaped reciprocal net will become crystal clear in the following section.

2. Cosmic-Scale Gravity Cells

Each and every node of a dodecahedral structural cell is the site of a significant galaxy cluster. Each and every node, thus, acts as a center of gravity of some definable cosmic-scale region.

Since there two types of nodes (Major and Minor), there should be two corresponding types of gravity domains. It can be shown that there are two basic shapes of gravity cells.

2.1. Tetrahedral cell

Consider first a typical Minor node. It is surrounding 4 structural units —four close-packed dodecahedra (**Figure 3**). In simple terms, this node is shared by 4 dodecahedral cells. The gravitational influence of the node's galaxy cluster extends as far as the surrounding void centers, of which there are four. (Any objects located beyond these void centers are outside the subject domain. Any such distant objects would come under the gravitational influence of other nodal galaxy clusters.) In terms of the physical cosmic tessellation, a 4-armed galaxy cluster is always surrounded by 4 Voids.

The gravity domain is then defined by the cluster at the center and by four surrounding void centers (ideally symmetrically positioned). Joining the void centers, as shown in **Figure 4**, reveals a tetrahedral-shaped gravity domain.

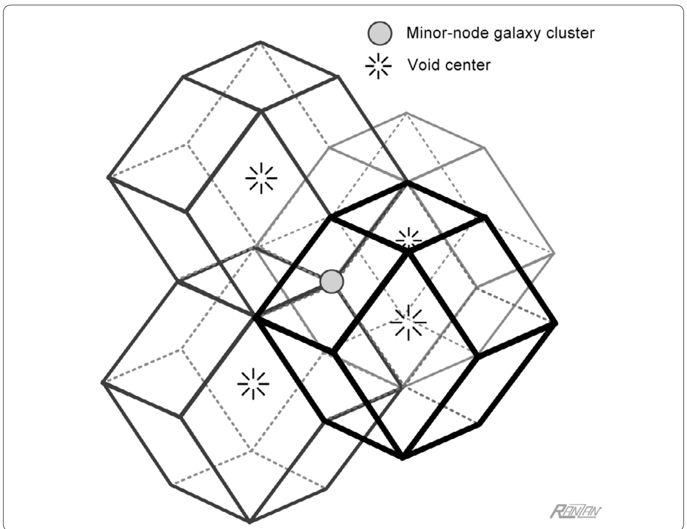

Figure 3. Minor node galaxy cluster is always surrounded by four dodecahedral structures. It means this type of aggregation of galaxies is always surrounded by four Voids, whose centers are clearly shown in this schematic array of cosmic structures. Those 4 locations define a tetrahedron which marks the limiting extent of the indicated nodal cluster's gravitational influence.

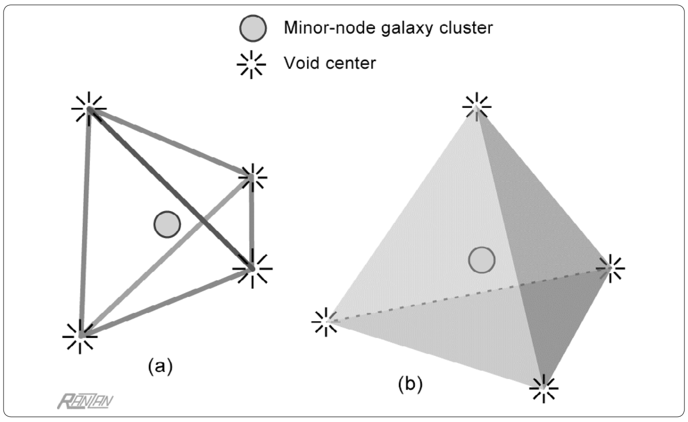

Figure 4. *Autonomous tetrahedral gravitating region* associated with the galaxy cluster located at any 4-armed node of the rhombic dodecahedral tessellation. Part (a) shows the edges of the tetrahedral gravity cell (oriented as found in **Figure 3**). Part (b) shows the tetrahedral gravity cell (reoriented for the sake of clarity) as a 3-dimensional semi-transparent shape. The galaxy cluster lies at the geometric center, equal distance from each of the four indicated Void centers (as well as equal distance from each of the four faces).

2.2. Octahedral cell

Next, consider a typical Major node. It is surrounded by 6 structural units —six close-packed dodecahedra. **Figure 5** shows a 'touching' pair, one above the other, surrounded by the pair's four closest neighbors (but detached for the sake of clarity). Again, the gravitational influence of the node's galaxy cluster extends as far as the surrounding void centers, of which this time there are six. In terms of the physical cosmic tessellation, an 8-armed galaxy cluster is always surrounded by 6 Voids, similarly arranged.

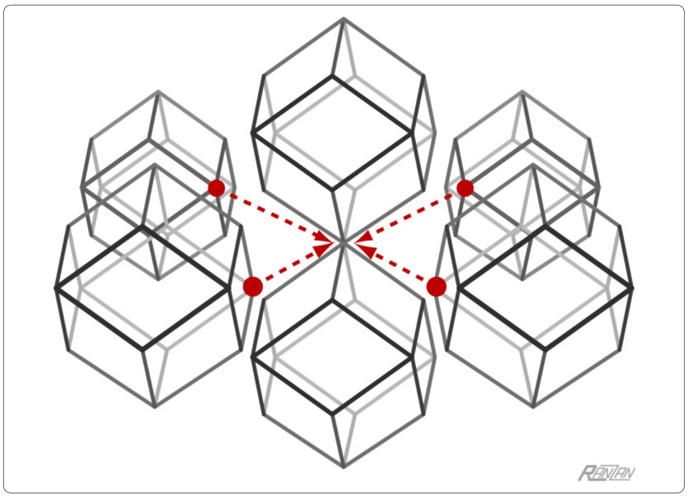

Figure 5. Schematic of a cosmic-structural-cell grouping as a guide in determining the shape of the gravity domain for a typical Major node galaxy cluster. In terms of the geometry, the Major node is surrounded by six close-packed dodecahedral cells. In terms of the astronomically observable structures, the associated nodal galaxy cluster is surrounded by 6 Voids. Shown here is a 'touching' pair of structural cells, one above the other, surrounded by the pair's four closest neighbors (but detached for the clarity).

The gravity domain of a Major node is then defined by the galaxies at the center and the six surrounding void centers (again, ideally symmetrically positioned). Joining the void centers, as shown in **Figure 6**, reveals an octahedral-shaped gravity cell.

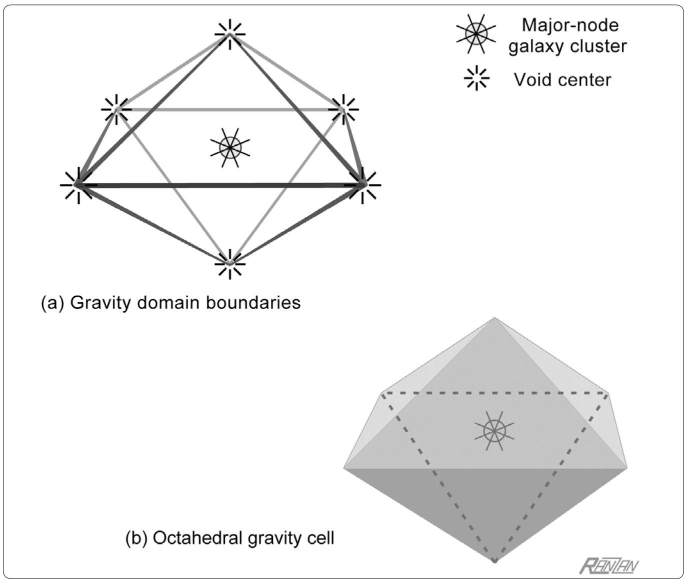

Figure 6. *Autonomous octahedral gravitating region* associated with the galaxy cluster located at any 8-armed node of the rhombic dodecahedral tessellation. Part (a) shows the edges of the octahedral gravity cell (oriented, more or less, as indicated in **Figure 5**). Part (b) presents the octahedral gravity cell as a semi-transparent shape. In this idealized situation, the cluster lies at the geometric center, equal distance from each of the four indicated Void centers (as well as equal distance from each of the four faces).

2.3. Super-octahedron

Next to be examined is how the two types of gravity domains fit together. The easiest way to do this is to make cardboard models (see the cutout templates in the Appendix) and join them together so that they properly correspond with the nodes of the rhombic dodecahedron. This can best be accomplished by first orienting the dodecahedron, as shown in **Figure 7** (upper part), and using it as a reference for the step-by-step placement of the gravity cells grouped into three layers. The three layers will be referred to as bottom, middle, and top. **Figure 7** (lower part) shows the 2 tetrahedra and 2 octahedra of the first layer.

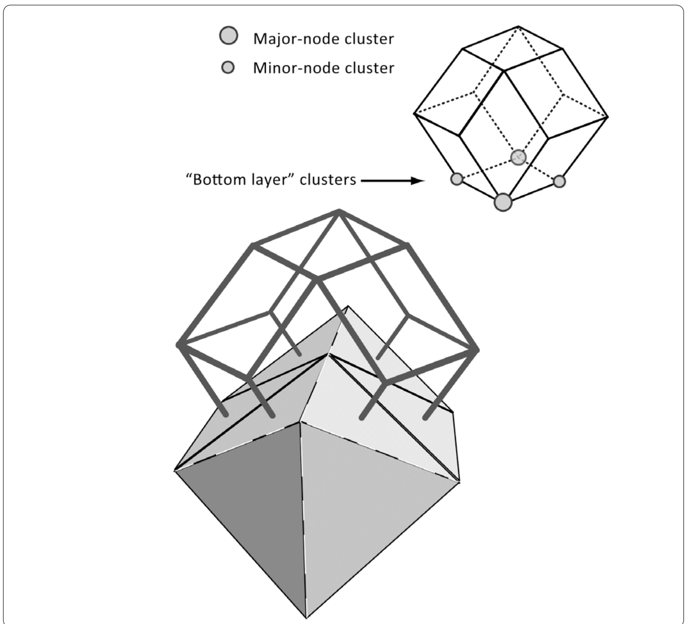

Figure 7. A pair of tetrahedra and a pair of octahedra are joined together for the 'Bottom layer' of the model construction.

In **Figure 8** the 4 tetrahedra and 2 octahedra of the Middle layer have been added. It is interesting to note that faces are all identical (in size and shape) but are never joined to the same type of polyhedron. Tetrahedra, for instance, are never joined face to face (they only join edge to edge).

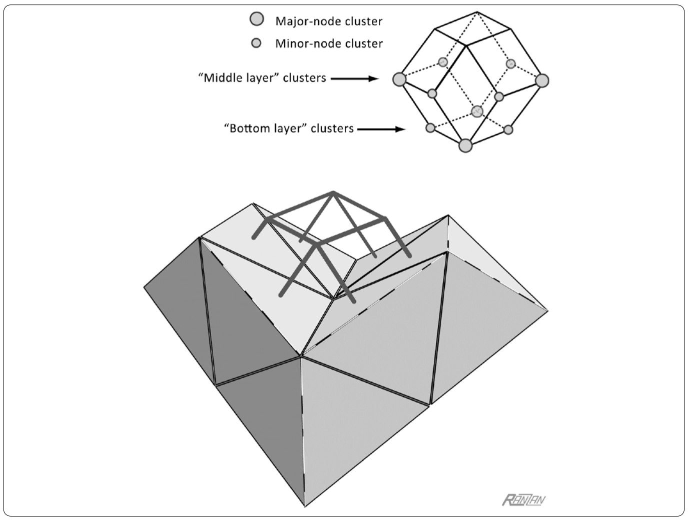

Figure 8. Middle layer, consisting of 4 tetrahedral cells and 2 octahedral cells, has here been added atop the Bottom layer.

The completed model assembly of the 14 autonomous gravity cells is shown in **Figure 9**. Each cell is centered on a node of the concealed rhombic dodecahedron —eight tetrahedra are centered on respective Minor nodes and six octahedra on respective Major nodes. Together they comprise a 'super-octahedron'. It nicely illustrates a linking property of cosmic geometry. Even though there are only 14 gravity domains associated with the central Void, they actually extend into 18 other Voids. There are 18 Voids surrounding the enclosed dodecahedron —6 are located at the super-octahedron's vertices and 12 at its boundary midpoints. The super-octahedron links up the centers of those 18 Voids.

An exploded view of the super-octahedron (**Figure 10**) reveals the embedded rhombic dodecahedron surrounded by its 14 autonomous gravity cells.

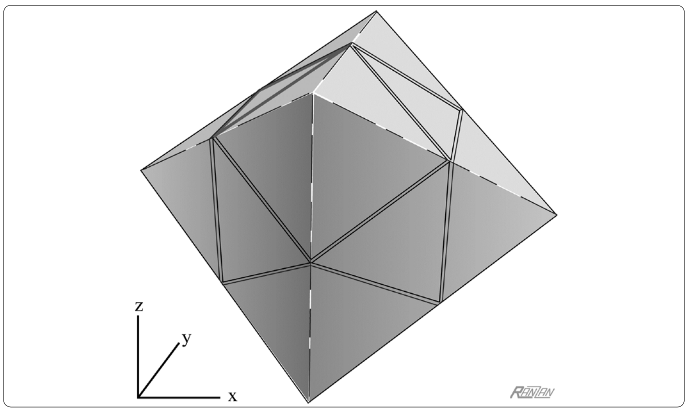

Figure 9. Model assembly of the 14 autonomous gravity cells each centered on a node of the rhombic dodecahedron (hidden inside). Eight tetrahedra (for the 8 Minor nodes) are combined with six octahedra (for the 6 Major nodes) into a 'super-octahedron'. The model reveals a linking property of cosmic geometry. There are 18 Voids surrounding the core dodecahedron —6 are located at the super-octahedron's vertices and 12 at its boundary midpoints. The super-octahedron connects to the centers of those 18 Voids.

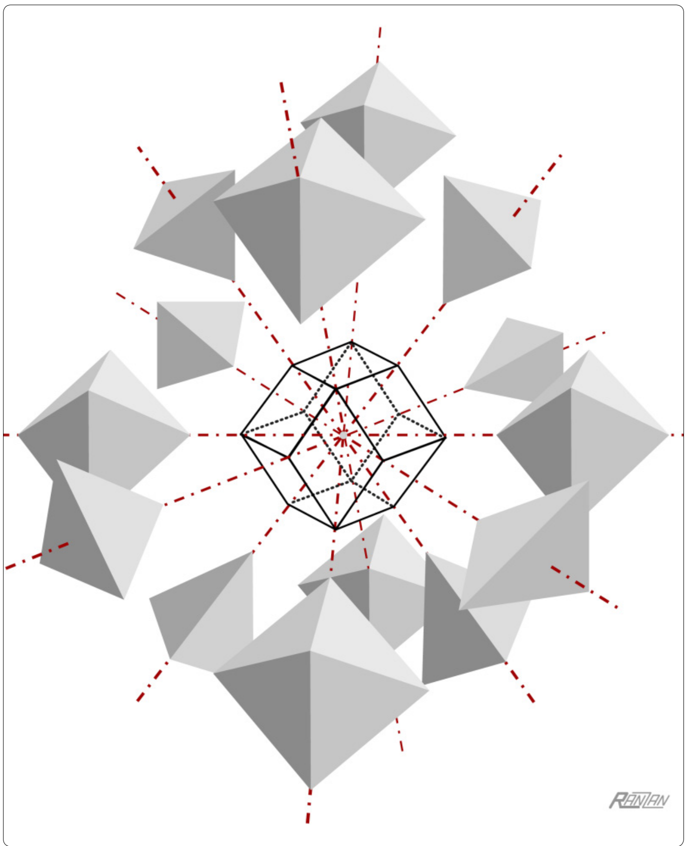

Figure 10. Exploded view of the super-octahedron that was shown in the previous schematic (Figure 9) reveals the embedded rhombic dodecahedron. Each of the 14 autonomous gravity cells is associated with a particular node of the dodecahedral structure. The axes radiate out from the common center-point and pass through each of the 14 nodes and extend through the geometric centers of the gravity cells (8 tetrahedral and 6 octahedral cells).

The ratio of tetrahedra to octahedra. Consider an extended array of gravity cells. At first glance it would seem that there are 4 tetrahedral cells for every 3 octahedral cells. However, it has been determined the ratio is actually two to one. The 2:1 ratio is somewhat surprising, since we do have a linkage of 8 Minor nodes and 6 Major nodes comprising a single dodecahedral structure (i.e., an arrangement of 8 Minor clusters and 6 Major clusters). So, whence the two-to-one relationship? The solution lies in the fact that within an extended tessellation each Major node is shared by 6 dodecahedral units, while each Minor node is shared by only 4 dodecahedral units. Also understand this geometric fact: tetrahedra and octahedra are 3-dimentional duals. Tetrahedra and octahedra are space-filling shapes when close-packed in the 2 to 1 ratio [21, p5 & p42]

3. Discussion of Sustaining Processes, Validating Evidence, and Something Strange

3.1. Cell sustaining processes

Earlier it was mentioned how certain properties of the universal space medium and its role in the mechanism of gravitation were primarily the causal factors in sustaining cosmic structure.

Here we delve deeper into what sustains the cellular structure. Three key factors are involved: the dynamic universal medium, aether-based gravity, and a recently discovered matter regenerative process.

Dynamic universal medium. The dynamic universal medium has been described as the subquantum medium that permeates all space. It is the *nonmaterial essence* of the Universe; it consists of discrete units —fundamental essence fluctuators, or essence oscillators. As a basic space medium, it serves as the propagator of electromagnetic waves [12, Glossary].

To be absolutely clear, it is a nonphysical (has no mass, no energy), mechanical (discrete entities, not a continuum), aether-like ethereal fluid. It has an essential axiomatic property: In the absence of compressive and shear stresses, it will expand. Moreover, when subjected to cosmic tension, the universal medium will expand. We are dealing here with one of the most fundamental facts of astrophysics and cosmology —the fact of cosmic space-medium expansion.

What this means for the cosmic cell structure is that aether expands within the great Voids —there is a real emergence (a quantitative growth) of the universal medium.

But *expansion* is only one dynamic attribute of the ethereal medium.

The other side of the 'dynamic' coin —the attribute that brings harmony to the system— involves the quantitative loss of aether.

Gravitation. It is with the active loss of aether where the mechanism of gravitation plays a key role. According to the most successful cosmology theory within the scientific literature, gravitation is defined as *the effect produced by the acceleration of the universal space medium (aether)*. This aether theory of gravity can be summarized as follows:

(1) ***Gravitation, is foremost the effect produced by the acceleration of aether itself*** towards the center of mass. (2) It is caused primarily by the direct assimilation of the space medium by matter. By this process of assimilation, matter acts upon the medium —pulling in the surrounding aether. This *direct assimilation* process, it turns out, also produces the property of mass and its inertial aspect. (3) A secondary gravity effect involves the *contraction of aether* within a surrounding *contraction field* —a region where the medium self-dissipates and literally disappears. The intensity of *contraction* has an inverse relationship to radial distance. (4) A tertiary gravity effect involves the *emergence/expansion of aether* in each cosmic Void and produces a radial acceleration of the medium (directed away from the Void center). It is a *cosmic-gravity* effect often likened to antigravity; generically, it is called the positive Lambda force/effect (comparable to the DeSitter effect). (5) By combine the normal *contractile-gravity* (described by (1), (2) & (3) above) with the *cosmic-gravity* (the tertiary gravity effect), the *DSSU theory of gravity* becomes a ***unified theory of gravity***. [24]

Here is the big picture: there is an accelerated flow, outward from the Void (the expansion region within the dodecahedral cosmic cell), of the space medium along with any comoving mass/matter. The flow continues its acceleration as it heads towards the nearest center of mass/matter aggregation (towards some node of the dodecahedral cosmic cell). As the flow converges on a nodal galaxy cluster, ONE, the stress of convergence causes the aether to contract (and, thus, further accelerate the flow); and TWO, the comoving material is conveyed (becomes deposited) into the cluster. Finally, the flow accelerates into the cluster's stars, etc., where it is 'consumed' —and totally vanishes from the Universe.

Significantly, there is a harmonious balance between the two dynamic processes. A quantitative balance exists between, on the one hand, expansion/growth of aether in the Voids and, on the other hand, the stress-induced contraction/consumption loss of aether in the galaxy cluster regions. The consequence of this dynamic equilibrium is that the cell size is sustained; the cosmic cells remain perpetually stable. (Such is the case when the matter regeneration cycle is included.) They neither grow nor collapse.

In a very real sense, what we have with the tetrahedral and octahedral domains are individual unified gravity regions/fields. The domains do not interact, they are more or less autonomous. The "unified" label refers to the fact that parts of the region have accelerated aether flow caused by expansion/growth and other parts have accelerated aether flow caused by contraction/consumption.

The Universe consists entirely of cosmic-scale gravity cells —domains of *unified gravity*.

Matter regenerative process. The matter regenerative process is actually a three-operation mechanism. It clearly and completely explains (except for the particle-antiparticle imbalance) how the material of the Universe is continuously replenished:

The key component is the **Terminal neutron star:** a gravitationally collapsed structure that exists simultaneously in the *critical state* and the *end state*. It is a neutron star that has acquired a lightspeed surface-boundary (the critical state). It stands as the Universe's most unusual type of star. Once such a star forms, it can neither grow larger nor smaller. Its volume and mass content remain forever fixed (as the terminal/end state); its density is Nature's ultimate. Most relevant to the matter regenerative operation is that Terminal stars have —and necessarily so (as a requirement of Special relativity)— a surface layer consisting of pure energy. Think of it as a photonic and neutrinoic layer. Energy regeneration takes place within this layer. See **Figure 11**.

The key process is the *Blueshifting* of the surface-trapped photons and neutrinos, this is the process of energy generation by the proven mechanism of *velocity differential propagation* of radiation [25] [26]. For as long as photons and neutrinos are trapped within the energy layer, they undergo energy amplification (wavelength contraction).

The Terminal star has a *Primary radiation* component —its polar jets emanating *directly* from within the energy layer. Without violating any laws of physics, this is the polar ejection of amplified energy, including the energy derived from mass that has fallen onto/into the Terminal star's surface. This Primary radiation is the Universe's ultimate energy source [26] [27].

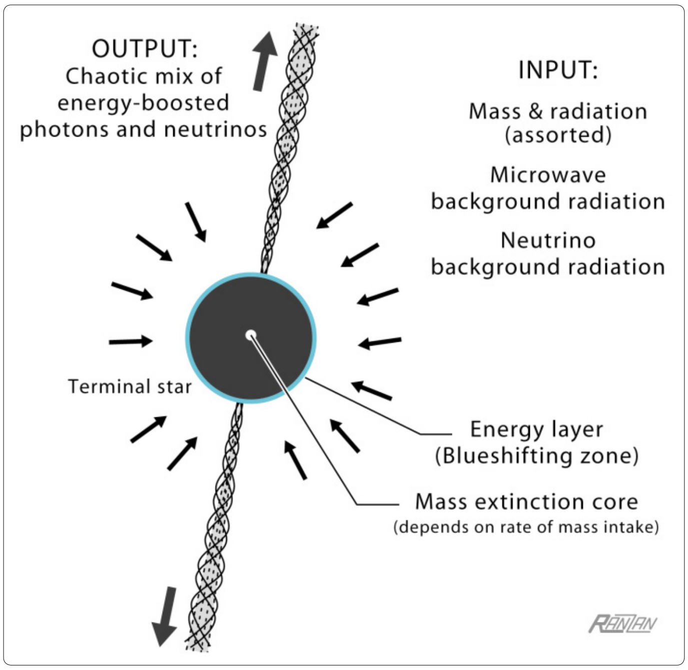

Figure 11. Terminal star is the end result of total gravitational collapse. It represents nature's ultimate concentration of contiguous mass (presumed to be of neutron density). Its surface has an energy layer in which trapped radiation (photons and neutrinos) undergo energy amplification (*Blueshifting*). Size and density are unalterable (see text), only rotation can vary. Amplified energy escapes through the polar emission beams. Any excess mass acquired leads to the extinction of mass at the core —a process of mass destruction by *aether deprivation*.

The final component of the matter regeneration cycle is the conversion of the emitted radiation into mass. As it happens, the Terminal stars' beamed emissions (much of which is extremely energetic and, in fact, includes the most energetic photons and neutrinos ever detected) sooner or later undergo collision with already existing matter (particles, objects, stars) and so produce prodigious amounts of new matter. It is a production by energy transformation as occurs routinely in laboratory particle accelerators. Energy is converted to mass. The new mass, in turn, regenerates the stars —stars that in the course of cosmic time continually collapse into the Terminal state, or stars that may simply end up being absorbed into an already existing Terminal star.

Lastly, the sustaining system includes a unique way of negating any excess build-up of mass. The system has a heretofore unrecognized component —a *balancing opposite* to mass formation. Any excess mass acquired by the Terminal body leads to *mass extinction* at the core —a process of mass destruction by *aether deprivation*. Mass quite literally disappears from the universe. Such vanishment follows logically from the defined *principle of physicality*, which states that all matter (all mass, all radiation) is entirely dependent on the existence (the proximate presence) of aether. Any and all matter deprived of this essence simply cannot continue to exist [28].

When additional mass joins a Terminal star: (i) The star's density cannot increase; this is because, by definition, its density is already at nature's ultimate concentration. (ii) The star's 2-dimensional size cannot increase; this is because the expected increase in surface area would be insufficient to supply the required volumetric flow of aether (since the star's volume is proportional to 3rd power of the radius while the surface area is proportional to only the 2nd power). (iii) The surface inflow of aether cannot increase; this is because the structure possesses the ultimate electromagnetic barrier, aether is already entering at the speed of light. These three constraints ensure that only a limited quantity of concentrated mass can be supplied with sustaining aether flow. And so it is, when additional mass joins a Terminal star, the mass at the core suffers aether deprivation extinction [27].

The grand picture then has cosmic cells being sustained by two self-equilibrating mechanisms —streaming of aether and streaming of mass (which includes the streaming of radiation energy).

- The emergence of aether is balanced by its consumption and self-dissipation.
- The formation of mass is balanced by its extinction within countless Terminal stars.

3.2. Theory validating evidence

Proof of validity rests on the correspondence between prediction and empirical evidence —between what the theory specifies and what has actually been observed.

The prediction is that the Cosmos is cellularly structured as a 'packed' arrangement of rhombic dodecahedra. This packing arrangement is based on (i) sound theory of a dynamic fluid substrate (the essential component of a comprehensive *aether theory of gravity*) and (ii) a continually operating mass-and-radiation recycling system.

What proof is there that the theoretical geometry —the rhombic-dodecahedral tessellation— matches the actual structure of our Universe?

Most importantly there is the evidence of two characteristic sequences of galaxy clusters. Although radically different, both sequences can be explained (simultaneously) only with the dodecahedral arrangement. They serve as the definitive observational evidence.

The first is an alternating repeating sequence of clusters and Voids, as shown in **Figure 12**. Compare the schematic sequence with what has actually been observed, namely, the periodic galaxy clusters known as the Abell-85 sequence and including the background clusters Abell 87 and Abell 89. They are undoubtedly the most unusual arrangement of galaxy clusters ever observed. The near regular spatial periodicity of the clusters is completely inexplicable with any other theory or hypothesis. No other universe model can explain a cluster-and-void sequence of this nature (a sequence that actually extends for over 10 repetitions)! [11] [23]

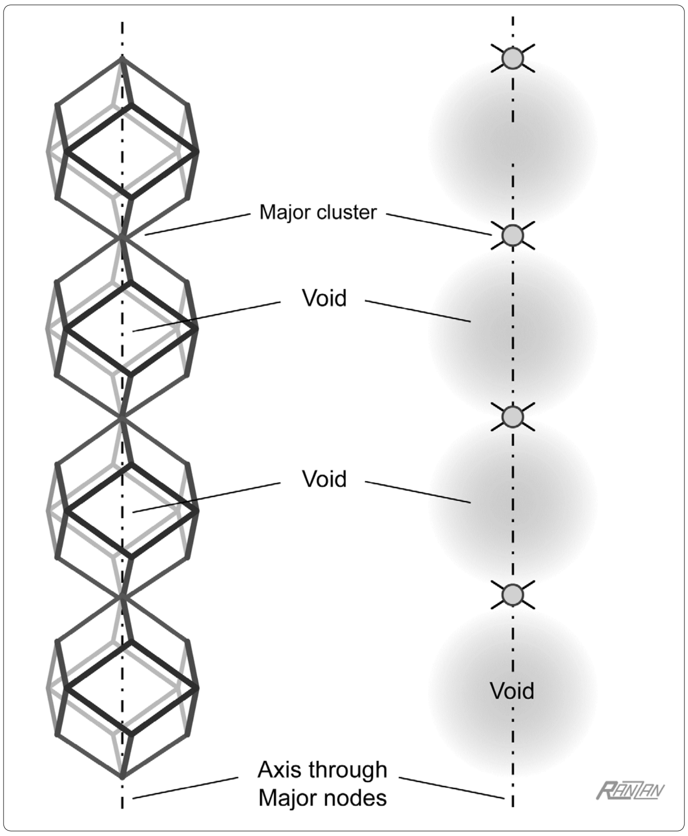

Figure 12. Characteristic pattern found in a close-packing of dodecahedral cosmic cells. The line of sight through opposite Major nodes, as shown here schematically, encounters an alternating sequence of Major galaxy clusters and great Voids. (For the sake of clarity, the surrounding units of the packing have been omitted.) The evidence for this kind of pattern can be found in the Abell-85 system of galaxy clusters.

Another example of this kind of cluster periodicity is the structure known as **DC1842-63** with three distinct clusters. A published histogram shows them located at 4,500km/s; 10,500km/s; and about 16,000km/s; evidently evenly spaced [29].

The second characteristic sequence is an alternating repeating sequence of linearly-linked clusters and Voids, as shown in **Figure 13**. Such a sequence arises when the line of sight runs through opposite Minor nodes of the dodecahedral tessellation. The order in this case is as follows: Void, triple cluster, Void, triple cluster, and so on. Each triple cluster falls along the same axis and consists, first, of a Minor cluster, then a filamentary cluster, a Major cluster, another filamentary cluster, and ends with another Minor cluster. The axis then passes across another Void. A good example of this can be found in the famous 1980s galaxy map prepared by M. Geller, J. Huchra, and V. Lapparent. The unmistakable "CFA stick man" includes such a void-and-triple-cluster sequence. The near Void in their galaxy plot is part of what is called the Northern Local Supervoid (just beyond the Virgo cluster) and the Major node corresponds to AGC1656 (aka Coma cluster); as for the far Void, it has not been identified and does not seem to have been given an official name. What makes the linear-clusters-and-Voids pattern a decisive factor is that such a sequence is simply not possible with any other candidate polyhedral structure.

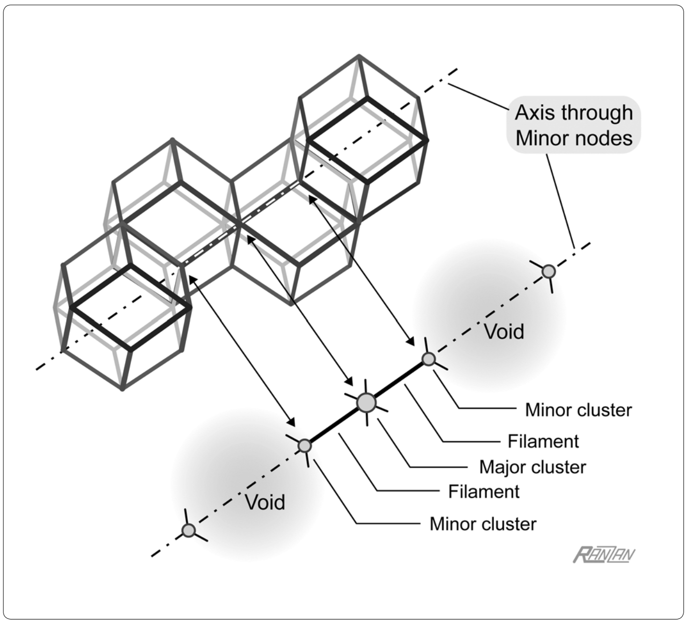

Figure 13. Characteristic pattern found along the line of sight through opposite Minor nodes of dodecahedral cosmic cells. The sequence along an idealized extended axis through Minor nodes always has Voids separated by triple clusters —so that the sequence alternates between Voids and triple-chain clusters. (Again, the surrounding cells of the close-packing have been omitted, to better reveal the pattern. In the perspective view, the end units are above the plane of the page; the middle two units lie below; and the dashed axis defines the plane of the page.)

Also embedded in the geometry (since opposite faces of dodecahedra are parallel) are lines-of-sight passing through multiple Voids *without* encountering any galaxy clusters (**Figure 14**). An observer may easily be led to believe that he has found a hole in the universe. Probably the most dramatic example of such a configuration is the "WMAP cold spot" located in the southern hemisphere of the celestial sphere in the direction of the constellation Eridanus. The finding was featured in Scientific American (August 2016) and headlined as The Emptiest Place in Space and described as "a supervoid extending 1.8 billion lightyears across aligned with the cold spot." … "A pocket of almost nothing [that] tells us something about the cosmos." It was admitted, "This 'cold spot' has perplexed scientists since it was first discovered in data from NASA's Wilkinson Anisotropy Probe (WMAP) in 2004." The initial idea proposed by the experts was that this cold region, this deep cosmic cavity, was some kind of a supervoid; but then more realistically suggested, "If several spherical voids are stacked next to one another in the direction of the cold spot (like a snowman), then the void could more easily explain its presence." … The hole seems to extend from about redshift 0.09 to redshift 0.22, corresponding to a significant penetration of 1.76 billion lightyears. It means, from the perspective of DSSU theory, if our cosmic cells have nominal diameter of 300 million lightyears, then the "hole" extends through 6 dodecahedral units.

Astronomer István Szapudi, the author of the Scientific American article, concluded with this perspicacious comment,

[I]f our supervoid has offered up a hint of [support for alternative gravity] theories, we may have an exciting opportunity to understand the universe on a deeper level than we currently know.

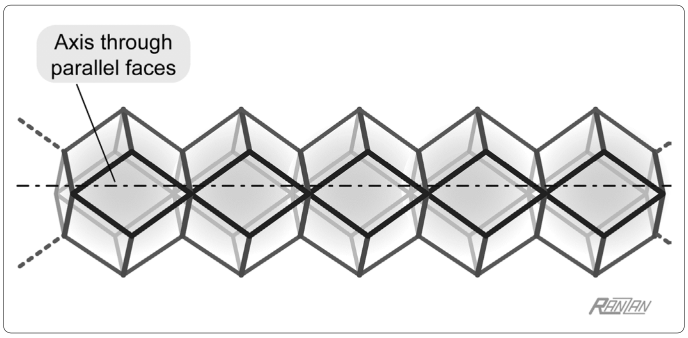

Figure 14. Geometry dictates that opposite faces are parallel. Therefore an idealized line-of-sight (one which pierces the centers of faces) may pass through multiple Voids *without* encountering any galaxy clusters.

And then there is the evidence provided by the established existence of two sizes of clusters.

Theory predicts two sizes of mass aggregations (galaxy clusters). And indeed, that is precisely what has been found; galaxy clusters come in basically two distinct sizes. As described earlier, this size classification corresponds to the two types of vertices present in the geometry. There are two distinct nodes (4-branched and 8-branched). This is extremely important —it is a feature not shared by the Cube, or by the Truncated Octahedron.

Convergence of the evidence. The validity of the theory of cosmic cellularity (the DSSU) is based on the soundness of the physics and on the convergence of the evidence. For a more extensive discussion of supporting evidence see reference [23].

3.3. Strange situation

The Universe is cellularly structured. Cosmic cells are an intrinsic aspect —integral to the nature of how the Universe operates. The evidence is overwhelming, the theory is compelling, the underlying physics is validating.

However, there are serious thinkers, physicists and philosophers who perceive the cosmic cells as being just random features. They see the Universe as merely phenomenologically cellular. In order to understand such contrary-to-evidence thinking, reflect on this. If one believes in an expanding/accelerating cosmos, then systematic cellularity makes no sense whatsoever. Moreover, if one believes that the *apparent* recession (of distant galaxies) is *actual* recession, and has failed to recognize Edwin Hubble's true sentiment, and has failed to heed his repeatedly published warning that maybe "they [the measured redshifts] represent some *unrecognized principle of nature* [14] … they represent *some unknown reaction* between the light and the medium through which it travels"[15]; and has failed to survey the scientific landscape beyond one's narrow tunnel, and so missed the *principle's* veritable discovery in 2014 [13]; then, predictably, invoking the structural chaos of an 'exploding' (Big Bang) universe becomes the only self-consistent option.

And so it was, speculative hypotheses rooted in randomness needed to be pursued —such as cosmic sponge and Swiss cheese models.[3, p103-105] Any unexpected regularity in the large-scale structure, we were told, might be attributed to cosmic strings! [3, p142]

Experts needed to declare, as did Princeton astrophysics professor J. Richard Gott, "We expect the universe to have a randomness in the shape of the cells."[3, p68]

In order to incentivize the theory-speculators and provide an aura of scientific legitimacy, awards had to be bestowed —such as the Nobel Prize (Physics 2019) granted to James Peebles (1935-) "for theoretical discoveries in physical cosmology." It was also "for contributions to our understanding of the evolution of the universe"[30] —meaning a universe of chaotic structure and how it purportedly changed over time from a dense spec of almost nothing.

Nevertheless, the orderly patterns were still out there, still had no meaningful explanation.

Richard Gott, in his book The Cosmic Web, Mysterious Architecture of the Universe, tackled the problem. In the course of developing his sponge models, he considered various cell shapes including the familiar five Platonic 'solids,' as well as various other polyhedrons. But he completely missed a critically important shape.

What Richard Gott missed (and remember this is the world expert on the subject), both in the book and in his on-line lectures, is the key space-filling polyhedron: the rhombic dodecahedron! His original idea was to use a truncated octahedron as his space-filling cellular unit.

Since he lacked a proper causal mechanism for matter density distribution, he focused on the randomness. This is why he favored the chaotic nature of sponge-like models and Swiss cheese simulations.

Ironically, if he had followed his own book's instructions —instructions on how to form a 3-dimensional Voronoi honeycomb [3, p68] — he would have arrived at the rhombic dodecahedral cell-shape. And *that* shape does have a fundamental causal mechanism associated with it.

Ignoring the rhombic dodecahedron is one thing, but seeming ignorance of its existence is another.

Max Tegmark is an MIT physics professor and author of a book detailing his "Quest for the Ultimate Nature of Reality." (Incidentally, the book presents a truly bizarre version of 'reality.') Therein, the professor states that there exist just five "3-dimensional shapes with only flat identical faces." And then to make his point quit clear, he adds, you "can't invent a sixth one —it simply doesn't exist."[31] Strange indeed.

4. Concluding Remarks

The following is a quick summary of the evidence clearly supporting the cosmic tessellation based on the rhombic dodecahedron:

- Two types of nodes correspond to the observed two sizes of galaxy clusters (as discussed above).
- Supergiant elliptical galaxies, cluster-dominating *cD* galaxies, are found only at nodes [12].
- Wall-like structures in galaxy distribution [32] of which the Great Wall (found by Lapparent, Geller, and Huchra) is a notable example.
- "Ribbon-like" bands of galaxies observed and documented by astronomer Anthony Fairall [4] [33].
- The remarkable "thin filamentary sine-wave-like structure that dominates the whole southern sky" documented by astronomer Kraan-Korteweg [34] —reminiscent of Fairall's ribbon-like-bands of galaxies— and beautifully explained by **Figure 2**.
- Parallel walls, as well as perpendicular walls of galaxies, ***features which Anthony Fairall considered critical for testing any theoretical model*** [4] [5].
- The feature known as the "WMAP cold spot" where the lines-of-sight passing through multiple Voids without encountering any galaxy clusters (**Figure 14**) readily supports a dodecahedral tessellation.
- Two extraordinary sequences of Voids and galaxy clusters. One lies in the direction of Abell 85, the other aligned with the Virgo and Coma clusters. These characteristic patterns provide a decisive fingerprint match for dodecahedral tessellation. (See **Figures 12** and **13**, and reference [23])
- The rhombic dodecahedron is predicted by the DSSU aether theory of gravity [11] [18].
- Additional supporting features may be found in [11] and the article, *Steady State Cosmic Structure (https://doi.org/10.4236/oalib.1107901)*

The evidence is indeed overwhelming. It clearly points to a dodecahedral cellular structure.

* * *

In summary, cosmic cellularity is sustained by:

- A self-regulating balance between the ongoing emergence of new aether (within great Voids), on the one hand, and its loss via the *direct action of mass* (acting as a sink) and via the *stress inducing processes of contractile gravity*, on the other. Details may be found in [35].
- A self-adjusting balance between the *regeneration* of matter, on the one hand, and its *entropic degradation* (in accordance with thermodynamic law) and outright *negation* (mass Extinction via aether deprivation), on the other. Details may be found in [26], [28] and [36].

The two underlying keys to a functional natural cosmology are:

- All space is permeated by a dynamic fluidic aether whose discrete 'particles' possess *no energy* and *no mass*. Aether's axiomatic emergence and stress-induced vanishment are, therefore, not subject to conservation laws. This ethereal medium expands and contracts regionally.

- The very existence of matter (mass and radiation particles) depends totally on the continuous excitation/absorption/consumption of aether.

The implications of autonomous gravity domains:

- The range of gravity is strictly limited.
- Since they manifest both divergent and convergent gravity effects, these cells function as domains of *unified gravity*.
- In their dynamic functionality, the cells hold the key to the cause of trajectory interaction (among galaxies) and the cause of galaxy rotation.

The implications of a universe of autonomous gravity domains; the consequences of having the cosmos intrinsically 'packed' by cosmic gravity cells:

- The Universe is stable, it neither expands nor contracts.
- Galaxy clusters maintain cohesion and symmetry.
- A deeply profound implication is that the Universe is infinite. Since the cell structure is sustained, not formed, it obviously means the Universe had no beginning (and, of course, can have no temporal end).
- The Universe is eternal —not in the sense that any object or particle exists forever. No. Rather, the *sustaining processes are perpetual*. The aether and matter cycles (cited above) are forever active.

The broader implication is the realization of something long anticipated —a revolution in cosmology. A change in Worldview has been the popular sentiment for several decades. In 1994, for instance, the Britannica Science and the Future yearbook featured an article entitled *The Revolution in Cosmology*, which concluded with the suggestion that the revolution may come about as a result of some "*unforeseen breakthroughs in theoretical physics*."

Near the turn of the last century, Scientific American announced on the cover of its 1999 January issue, "*New observations have smashed the old view of our universe*." It seems there is too much uniformity. Looking 10 billion years into the past looks very much the same as the present. As the feature article reported, "MAJOR PARADOX in cosmology is the near uniformity of the universe. In the normal big bang expansion, such regularity is impossible."[37] Indeed, the observed order is impossible in an expanding cosmos!

In recognition of the seriousness of the conundrum, the Scientific American headline opened with the prediction "**Revolution in Cosmology**."

The Revolution in Cosmology, it may be said, began in 2002 at the ESA/ESO/CERN Astrophysics Symposium in Munich, Germany[38] —the Dynamic Steady State Universe had been discovered.

* * *

APPENDIX

Proof confirming shapes of gravity domains

It has been established, within the text and various references, that the cosmic structural tessellation is patterned on the rhombic dodecahedron. Based on this framework *with its two types of nodes*, the shapes of the gravity domains can be easily derived. It is simply a matter of applying the Voronoi principle.

Consider a Minor node (see **Figures 2** and **3**): it is surrounded by four gravity concentrations (its four nearest neighboring galaxy clusters). The directions of these four are indicated by the dodecahedral geometry. (Idealized, the directions are symmetrical.) According to the Voronoi principle, located somewhere between each of the Minor node's four neighbors, there is an imaginary plane dividing/separating respective gravity domains. There are four such planes; they obviously form the boundary faces of a tetrahedron. And the vertices of the tetrahedron mark the locations of Void centers. It is simple, basic geometry.

The same argument applies to any Major node, but now with 8 neighboring galaxy clusters (located symmetrically in 8 directions). The resulting 8 boundary faces form an octahedron.

Tetrahedron, octahedron, and dodecahedron cutout templates

The most favorable scaling for representing the cosmic shapes is: 1 inch = 100 megalightyears.

Note, In order for the cardboard models to reflect a realistic scaling (that is, for them to correspond to the probable nominal diameter of 300 megalightyears of the Universe's structural dodecahedral cells), the images must be enlarged when printing so that the included one-inch-scale mark will actually measure 1 inch along a physical ruler. In other words, when printing the "cutout", adjust the printer using the "scaling" printing option with an appropriate setting. (This makes the functional scale 1 inch equals 100 megalightyears.)

Tetrahedron cutout template:

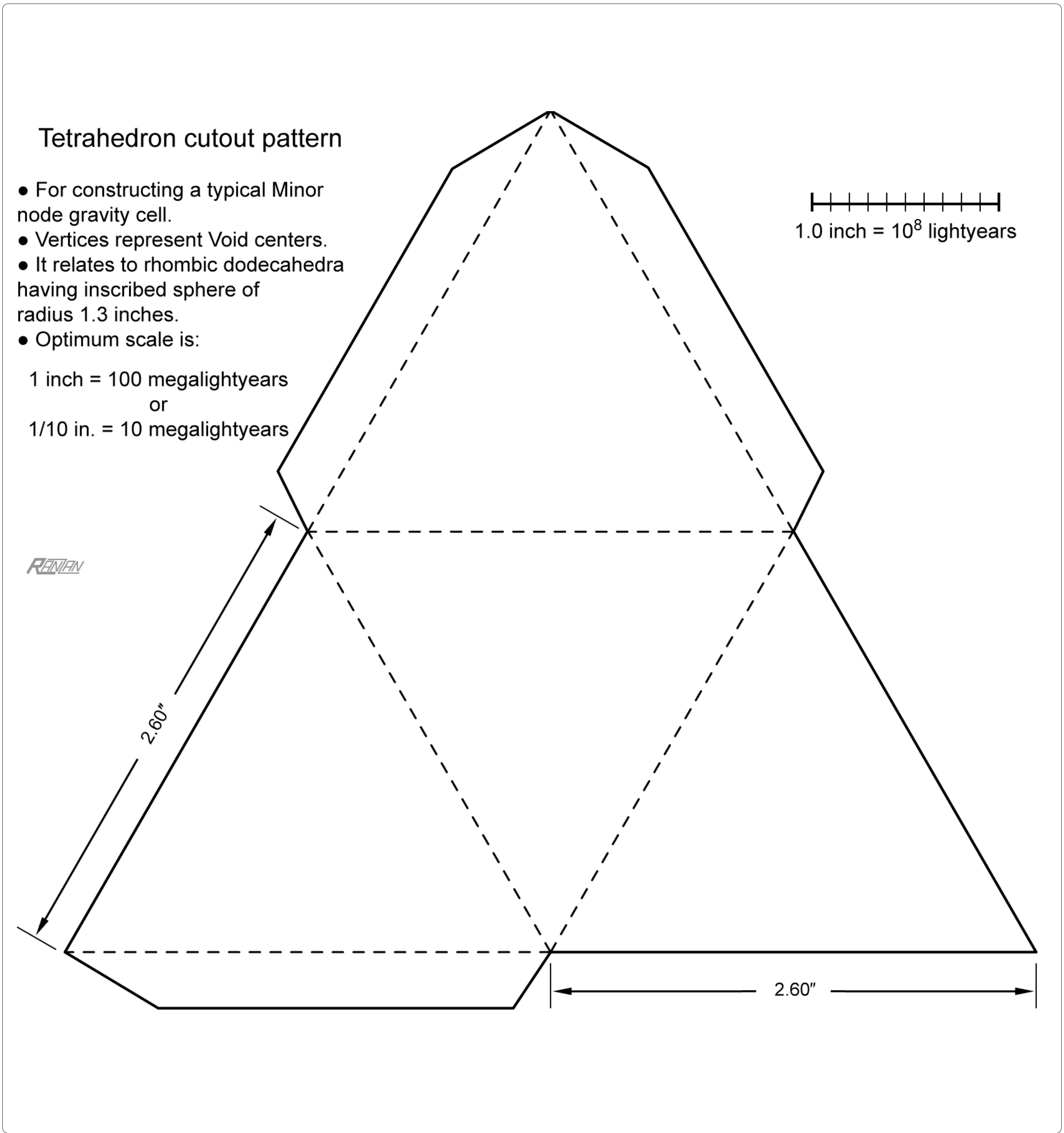

Figure 15. Tetrahedron cutout template. (Note: If one wishes to make use of the indicated scale, the image size must first be enlarged to width 5.6″ × height 4.9″.)

Octahedron cutout template:

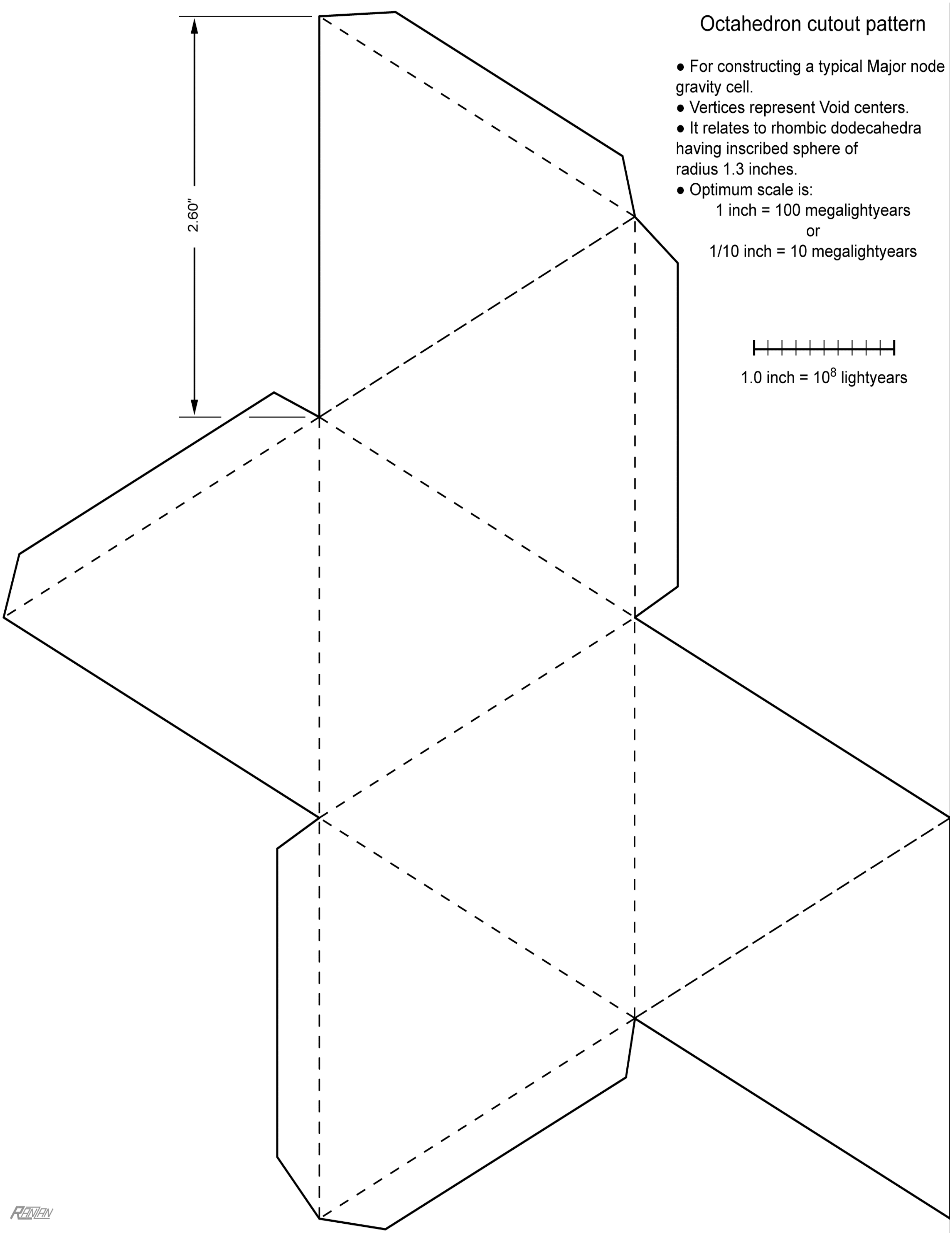

Figure 16. Octahedron cutout template. (Note: If one wishes to make use of the scale indicated in th e figure, the image size must first be enlarged to width 6.8″ × height 8.0″.)

Dodecahedron cutout template:

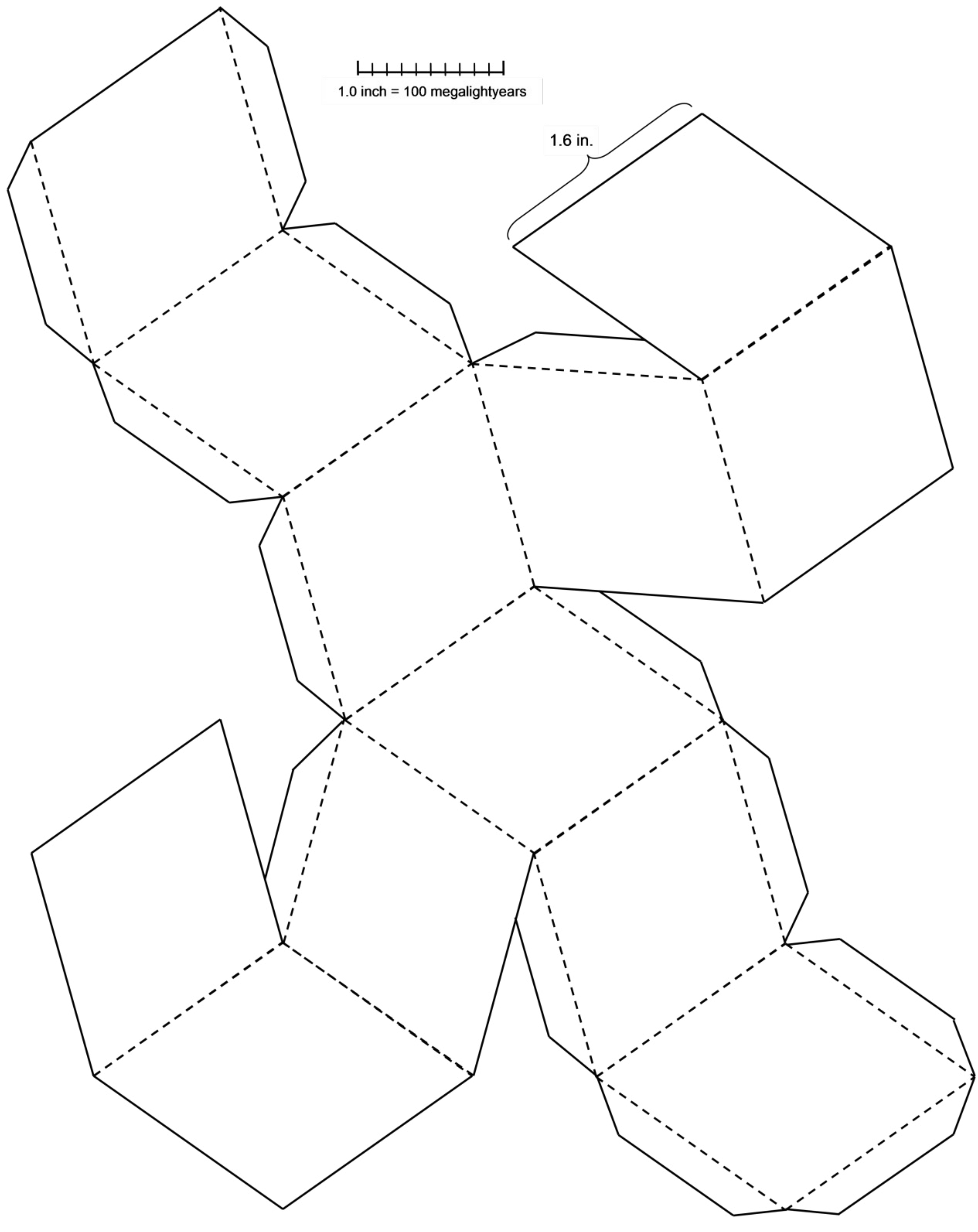

Figure 17. *Cutout pattern for a rhombic dodecahedron* whose folded size corresponds to an inscribed sphere of radius 1.3 inch. The scale shown means that the model represents an actual *cosmic structural cell* having an inscribed sphere of radius 130 Mly (or 260 Mly between its parallel sides). (Note: If one wishes to make use of the indicated scale, the image size must first be enlarged to width 6.7″ × height 8.5″.)

References

1. Joeveer M, Einasto J. The Large-Scale Structure of the Universe. IAU Symposium 79, (ed. M. Longair, & J. Einasto). 1978; P241.
2. Rien van de Weygaert, Bernard JT Jones, Erwin Platen, Miguel A Aragón-Calvo. Geometry and Morphology of the Cosmic Web: Analyzing Spatial Patterns in the Universe. Sixth International Symposium on Voronoi Diagrams. 2009.
3. Gott JR. The Cosmic Web, Mysterious Architecture of the Universe. Princeton University Press, Princeton, New Jersey. 2016. P141.
4. Fairall AP, Palumbo, GGC Vettolani, G Kauffmann, Jones A, Baiesi-Pillastrini G. Large-Scale Structure in the Universe: Plots from the Updated Catalogue of Radial Velocities of Galaxies and the Southern Redshift Catalogue. *Monthly Notices of the Royal Astronomical Society*. 1990; 247: 21-25.
5. Fairall AP, Paverd WR, Ashley RP. Visualization of Nearby Large-Scale Structures. *ASP Conference Series*. 1994; 67: 21-30.
6. Zeldovich YB. Gravitational instability: An approximate theory for large density perturbations. A&A. 1970; 5: 84-89.
7. Peebles PJE. Physical Cosmology. Princeton Series in Physics, Princeton, N.J.: Princeton University Press. 1971.
8. Einasto J. Large scale structure of the Universe, The Sun, The Stars, The Universe and General Relativity. International Conference in Honor of Ya. B. Zeldovich's 95th Anniversary. AIP Conference Proceedings. 2010; 1205: 72-81. doi: 10.1063/1.3382336
9. Gott JR. The Cosmic Web, Mysterious Architecture of the Universe. Princeton University Press, Princeton, New Jersey. 2016; 52-56. doi: 10.1515/9781400873289
10. Ranzan C. The Dynamic Steady State Universe. *Physics Essays*. 2014; 27(2): 286-315. doi: 10.4006/0836-1398-27.2.286
11. Ranzan C. DSSU Validated by Redshift Theory and Structural Evidence. *Physics Essays*. 2015. 28(4): 455-473. doi: 10.4006/0836-1398-28.4.455
12. Ranzan C. Laws of Physics Twentieth-Century Scientists Overlooked. DSSU Research, Niagara Falls, Canada. 2022.
13. Ranzan C. Cosmic Redshift in the Nonexpanding Cellular Universe: Velocity-Differential Theory of Cosmic Redshift. *American Journal of Astronomy and Astrophysics*. 2014. 2(5): 47-60. doi: 10.11648/j.ajaa.20140205.11
14. Hubble E. The Roll of Red-shifts, in The Observational Approach to Cosmology. Oxford University Press, Oxford. 1937.
15. Hubble E. Possible Worlds, in The Observational Approach to Cosmology. Oxford University Press, Oxford. 1937.
16. Scrimgeour MI, Davis T, Blake C, James BJ, Poole GB, Staveley-Smith L, et al. The WiggleZ Dark Energy Survey: the transition to large-scale cosmic homogeneity. *Monthly Notices of the Royal Astronomical Society*. 2012; 425 (1): 116. doi: 10.1111/j.1365-2966.2012.21402.x
17. Cahill RT. Absolute Motion and Gravitational Effects. CERN. 2003.
18. Ranzan C. The Processes of Gravitation –The Cause and Mechanism of Gravitation. *Journal of Modern Physics and Applications*. 2014; Article ID 3.
19. Thompson DW. On Growth and Form. Cambridge University Press, England. 1945.
20. Marvin JW. The Shape of Compressed Lead Shot. *Amer Journ of Botany*. 1939; 26: 280-288. doi: 10.2307/2436462
21. Pearce P. Structure in Nature Is a Strategy for Design. The MIT Press, Cambridge, Massachusetts. 1990.
22. Ota N, Mitsuda K. X-ray Study of Seventy-nine Distant Clusters of Galaxies: Discovery of Two Classes of Cluster Size. *The Astrophysical Journal.* 2002; 567(1). doi: 10.1086/339852
23. Ranzan C. Steady State Cosmic Structure. *Open Access Library Journal*. 2021; 8: 12. doi: 10.4236/oalib.1107901
24. DSSU Glossary.
25. Ranzan C. Law of Physics 20th-Century Scientists Overlooked (Part 1): The Velocity Differential Propagation of Light. *Physics Essays*. 2020; 33(2): 163-174. doi: 10.4006/0836-1398-33.2.163
26. Ranzan C. Law of Physics 20th-Century Scientists Overlooked (Part 2): Energy Generation via Velocity Differential Blueshift. *Physics Essays*. 2020; 33(3): 289-298. doi: 10.4006/0836-1398-33.3.289
27. Ranzan C. Mainspring of the Universe –The Mechanism Sustaining the Universe's Steady State. *Int J Cosmol Astron Astrophys*. 2021; 3(1): 130-142. doi: 10.18689/ijcaa-1000128
28. Ranzan C. Law of Physics 20th-Century Scientists Overlooked (Part 4): Mass Extinction by Aether Deprivation. *Journal of High Energy Physics, Gravitation and Cosmology*. 2021; 7(1): 191-209. doi: 10.4236/jhepgc.2021.71010
29. Malumuth EM, Kriss GA, Dixon WVD, Ferguson HC, Ritchie C. Dynamics of clusters of galaxies with central dominant galaxies. *Astronomical Journal*. 1992; 104(2): 495-530.
30. Nobel physics award for 2019: https://www.nobelprize.org/prizes/physics/2019/summary/
31. Tegmark M. Our Mathematical Universe: My Quest for the Ultimate Nature of Reality. Alfred A. Knopf, New York, 2014. P260. 2014.
32. Broadhurst R, Ellis RS, Koo DC, Szalay AS. Large-Scale Distribution of Galaxies at the Galactic Poles. *Nature*. 1990; 343: 726-728. doi: 10.1038/343726a0
33. Fairall AP, Turner D, Pretorius ML, Wiehahn M, McBride V. Vaux G de, Woudt, PA. Percolation Properties of Nearby Large-Scale Structures: Every Galaxy Has a Neighbour. *ASP Conference Series*. 2005; 329. doi: 10.48550/arXiv.astro-ph/0411437
34. Kraan-Korteweg RC. Galaxies Behind the Milky Way and the Great Attractor. *From the Sun to the Great Attractor*. 2000; 556: 301-344. doi:10.1007/3-540-45371-7_8
35. Ranzan C. The Nature of Gravity –How one factor unifies gravity's convergent, divergent, vortex, and wave effects. *International Journal of Astrophysics and Space Science*. 2018; 6(5): 73-92. doi:10.11648/j.ijass.20180605.11
36. Ranzan C. Law of Physics 20th-Century Scientists Overlooked (Part 6): Law of Cosmic-Scale Conservation of Energy. *Physics Essays*. 2021; 34(3): 331-339. doi:10.4006/0836-1398-34.3.331
37. Bucher MA, Spergel DN. Scientific American. 1999; p69.
38. ESA/ESO/CERN Symposium on Astronomy, Cosmology and Fundamental Physics. 2002.