A universe tiled with points

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Abstract. When absurdities are removed from Euclid's description of the properties of space, space acquires a physical reality rather than just being a mathematical abstraction. Supplemented with an equally self-evident postulate, that points have a lifetime and can emerge and disappear from nothing, the full power of a universe tiled with such points is presented. Our description is qualitative and not a fully mathematical one. Apart from confronting arguments and paradoxes against finite geometry, we are able to deduce speculative models for mass, charge, action at a distance, motion resulting from action and reaction, energy propagation and cosmogony utilizing the most elementary of constituents, space and time alone.

Key words: geometry; space; time; point; tiling.

1. Introduction

> "…however endlessly infinite the Universe may be, yet the smallest things will equally consist of an infinite number of parts. Since true reason cries out against this and denies that the mind can believe it, you must needs give in and admit that there are least parts which themselves are partless"
> – Lucretius

Euclid (ca 325-270 B.C.E.), using ideas from various other ingenious philosophers, wrote his famous book, *Elements* [1] which was for centuries to come the reference in geometry, the science and study of space. From very simple axioms, he described what were supposed to be 'self-evident' properties of space. Among the definitions used were (in our own words for ease of discussion): a *point* is that which has no part and is the fundamental unit of space; a *line* is a length but without width, and the extremities of a line are points; a straight line is a line which lies evenly with the points on itself; a *surface* is a collection of lines, having length and width but no thickness (and a *body* is a collection of surfaces).

As a line is defined as not having width, the common view is that the Euclidean point has no dimension, making points, lines and surfaces abstractions, merely useful as mathematical tools without any direct bearing on physical reality. As a consequence, it is not thought necessary to delve further into the inconsistencies in the definitions. Proceeding by *reductio ad absurdum*, if a point has no dimension, a collection of it cannot confer a line with dimension, similarly a line without width cannot confer a surface with 2-dimensions, and a surface with length and width but no thickness cannot confer a body with 3-dimensions.

If these absurdities in defining the properties of space are to be cured then the point must have dimension, conferring same to lines, surfaces and bodies. The point thus becomes a physically real, discrete unit of space and would no longer be just a mathematically abstract object. If this is the real property of space, what are we to expect as a consequence? This essentially is what we will be discussing in this paper.

In keeping with current theoretical ideas, we assume the point to be of Planck length ~ 10^{-35}metres in 3-dimensions. From this, we redefine lines as consisting a variable number of points thus having variable length but having the width and thickness of a point, and a surface as having length and width with the thickness of a point.

The debate whether space is discrete and made up of points or is continuous has a long history, see [2] for an accessible reference. Such debates usually emanate from the perspective of other discrete objects of nature, such as matter. However, space is special. Unlike matter, even if space is discrete in the form of points, since "nothing", "no space" and "nowhere" can lie between two contiguous points, both points must then still be continuous! Part of this difficulty is captured in Zeno's Paradoxes of Plurality, particularly his Argument from Denseness, see [3],[4]. Therefore, finite geometry without some additional understanding cannot be differentiated from continuous space.

The concept of a continuous space on the other hand is closely tied to ideas about motion so that objects can always be somewhere and move smoothly through space instead of 'jumping' from one point to another and be nowhere in the interval between one point and the next. The continuous space concept however faces its own difficulties as objects would have to traverse an infinite number of points from origin to destination with the consequence of never reaching there. This is well depicted by Zeno in his Paradoxes of Achilles and the tortoise as well as in his Dichotomy Argument [3][4]. Infinite divisibility would thus bring up its own absurdities.

Assuming the supertask of traversing an infinite number of points could be accomplished, Zeno goes further again to show in his Arrow Paradox [3],[4] that our concept of motion in space is still far from satisfactory. Since the moving body must occupy some place during its transit and at that instant it will be motionless, even the supertask cannot be started talk less of being accomplished based on current concepts. We will be confronting these issues.

To end this introduction, we take cognisance of the fact that tiling of surfaces with geometric objects is also an area of interest to pure mathematicians but we will not be making use of many equations. In discussing a universe tiled with points, it is useful to note that no two points or tiles can occupy the same locus, i.e. NO OVERLAP (reason for the emphasis will be obvious later when we discuss motion and in our closing arguments). Also, although a point has dimension, it can have no shape! Shape is derived from lines and curves, but by definition you cannot mark out a line or a curve or even a boundary on a point. When points rather than shapes are used for tiling, this shapeless characteristic may resolve the anisotropy problem of finite geometry highlighted in [2].

2. An additional self-evident property of geometry

In both Euclidean and current non-Euclidean geometry, whether or not points exist eternally is not a consideration. This understandably would be irrelevant for a mathematically abstract construct. The question however becomes relevant when the point has dimension and is thus physically real.

If space is currently expanding, or may have emerged from nothing, or can collapse to same as contemporary cosmological theory suggests, then an additional property of space becomes self-evident: *a point has a lifetime, i.e. it can emerge from nothing and disappear into nothing*.

Emergence of points from nothing based on this property should be a spontaneous activity, very much analogous to the spontaneous appearance of "virtual particles" in quantum physics. Virtual particles can also be induced to temporarily emerge in high energy physics experiments. We speculate that analogously points can also be induced to emerge and disappear by certain phenomena.

If a point can appear and disappear, how long does it exist? We propose that the minimum lifetime of a point is the Planck time ~ 10^{-43}seconds, again to conform to current theoretical ideas. There is however no maximum lifetime.

This additional property of each point having a lifetime immediately declares part of its potency in answering the question of whether space is continuous or discrete space. Although "nothing" and "no space" lies between two contiguous points making them still technically continuous, their continuity is broken by their unshared lifetimes. The discrete nature of space then becomes meaningful by all definitions, including Zeno's Argument from Denseness.

In the diagram below, we have a line with five points. If one of the unshaded points exhausts its lifetime, the line joining the shaded points shortens, even though the shade has not left its own point. Similarly, if a point emerges from nothing on the unshaded portion of that line, the line lengthens and the shaded points appear to move apart, while not leaving their points.

Fig.1. Showing points in a line with points given a square shape for illustration only.

The lifetime of points in a collection could vary in a statistical and random way. As earlier mentioned, emergence and disappearance of points may also be induced by agencies which we will propose from the next section. In doing this, we hope to show how such induced emergence and disappearance of points not only helps resolve existing paradoxes of plurality and motion but furthermore provide us a glimpse how some of the phenomena observed in nature seem to have come to acquire their seemingly elaborate structure, confounding the simplicity that points and their lifetimes underlie it all.

3. What is mass? What is matter?

The circular way mass is defined and the problem of what matter is fundamentally made of, are well known. When we ask for instance, what is matter? We answer, 'anything that has mass'. When we then ask, what then is mass? The answer comes out as 'the quantity of matter'. Various lines of thought exist indicating that mass is not a fundamental property of geometry, i.e. a point by itself has no mass. If universal space is then made up of points, where then does mass come from? If mass is not ultimately conserved and substance can change to disturbance, i.e. energy, in view of Einstein's famous equation, $E = mc^2$, what then is substance?

We here propose mass as arising from a peculiar pattern of variation in the lifetimes of points in the tiling. For ease of description, let us assume the pattern has at least a point of relatively long lifetime surrounded by others with varying lifetimes to give a peculiar rhythm in the tiling labelled G.

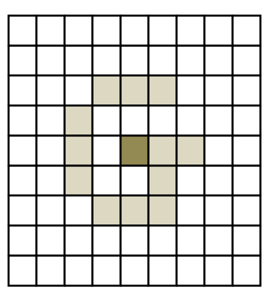


Fig.2. Showing a G-pattern in the tiling.

This G-pattern in the tiling, we call matter, quantified as mass. When such a pattern comes into proximity of a similar pattern in the tiling, e.g. by the spontaneous disappearance of points separating them, a further disappearance of points this time non-spontaneous is induced in the line joining their central point resulting in an even shorter line with the points therein becoming induced to have a relatively high temporal stability. This line we call a bond, see zebra shaded area in Fig.3.

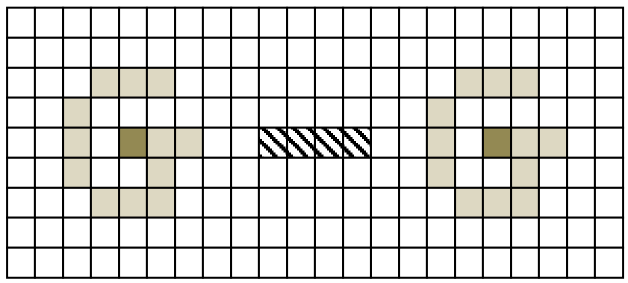


Fig.3. Illustrating interaction between two G-patterns.

Some alternating increase and disappearance of points on this bond length can occur about its stable mean length, analogous to the compression and extension of a vibrating spring. This will confer an alternating moving towards and apart about a mean distance behaviour on the G-G pattern. An elliptical shape is describable if one G-pattern of much smaller mass orbits the other.

The induced, non-spontaneous disappearance of points in the line joining one G-pattern to another results in a non-random relationship between the two G-patterns. We label this "action-at-a-distance", in this case due to gravity, as it occurs without any direct physical contact between the two patterns representative of mass.

Various alternative hypotheses have been described to explain the 'what' and 'why' of action-at-a-distance. Newton himself gave us the 'how' but refrained from proffering any other explanation, captured by his famous statement, 'hypotheses non fingo' [5]. Einstein's proposal involved mass inducing curvature in its surrounding space. Particle theorists on their part propose various force particles like photons and gravitons as the mediators of attraction or repulsion at a distance by way of momentum transfer. The last hypothesis is unsatisfactory in many respects, especially as an attraction mechanism. For instance, electromagnetic attraction and repulsion still take place across opaque barriers through which we know photons cannot pass.

In our proposal, motion of bodies away from or towards (repulsion or attraction) each other due to 'action at a distance' is due to an induced change (lengthening or shortening respectively) in the number of points in the line joining the two bodies.

4. What is charge?

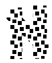
Nature can further elaborate the artwork in the tiling beyond what we described in the previous section. For example,  and  patterns of emergence and annihilation of points can be added on to the basic G-pattern. For illustration, let us call these patterns GN and GP.

Fig.4. Illustrating GN and GP patterns in the tiling.

Like the G-G interaction, spontaneous reduction in the number of points can cause one GN pattern to come in proximity to another GN pattern. However, when this occurs, unlike the G-G case, a non-random emergence and increase in the number of points in the line joining both GN patterns is induced, lengthening the line between them, interpretable as repulsion. A similar thing may be observed between two GP patterns in the tiling. Between a GP pattern and a GN pattern what is observed is however similar to that described between two G-patterns in section 2.

While we have interpreted the G-pattern as mass and the interaction between two such patterns as gravitational, we label the GN-pattern as "negative charge" and the GP-pattern as "positive charge", and the interactions between them as electromagnetic. A point itself has neither mass nor charge. Mass and charge are therefore not fundamental properties of geometry but they can be acquired and also lost following spontaneous or induced processes that can disrupt the tiling pattern. From our modelling, N and P patterns do not occur independently but always with G. In other words, charge cannot exist independently without matter.

When shortening or lengthening of lines occur in G-G, GN-GN, GP-GP, GN-GP interactions, the patterns themselves retain their points in the tiling, but can be macroscopically observed to move nearer to and away from each other. In the following section, we discuss more about "force", which is also used in this type of circumstances.

For those who may want to retain an analogy with current theoretical speculations on the origin of structure in the universe, the pattern in the tiling we label G- can be substituted with a vibrating "string" that lengthens and shortens, in a peculiar rhythmic fashion. What is essential is that the peculiarity in the pattern is attributable to points and their variable individual lifetimes.

5. What is motion? What is force?

Intuitively, everyone thinks they know what motion is, characterizing it by velocity, acceleration, displacement and time. Physicists and philosophers however appreciate that our concept of motion is plagued by difficulties of definition from which have arisen a number of paradoxes, notable among which are those of Zeno (mentioned earlier). There is also the question whether motion can be said to occur without reference to some other body's motion. That is, whether motion can be an absolute concept as described by Newton using an absolute space [5], or whether the concept is a relative one depending always on reference to other bodies, as advocated by Ernst Mach [6].

Not to take things for granted, the commonly held notion about motion should be stated. It is one in which a body traverses a series of points in a line beginning with a point of origin and ending at a destination point. A body being any of different combinations of mass, positive and negative charge. In this notion, most physicists hold the view that the space traversed is smooth and continuous, having an infinite number of points. A significant number differ, holding that space is discrete with a given line having a finite number of points. A notable number of the former, however harbour the suspicion that as a consequence of a possible quantum gravity theory space may no longer be continuous at infinitesimal scales.

In both the former and the latter concepts of motion certain fundamental assumptions are made. One, the points marking the route are taken to remain where they are during motion. Two, though moving bodies are also geometric entities, they are separate and independent from the space in which they move. Three, the space in which bodies move is a passive backdrop, and is not a participant in the motion itself. We will show that these assumptions may be false and lie at the heart of our current difficulties in conceptualizing motion.

For the concept of a body *running* through a line with an infinite number of points, the concept of motion is confronted by the paradoxes described by Zeno, notably that of Achilles and the tortoise and his Dichotomy Argument. To summarize the paradox for this scenario, *motion would be possible but destination cannot be reached*.

For the concept of a body *hopping* from one point to the next in a line with a finite number of points, the motion also faces its own difficulties. First is that the motion would be jerky with stops and starts; second is that between one landing and the next, the body would be 'nowhere'; thirdly, at each landing the instantaneous velocity would be zero and as Zeno tried to illustrate with his Arrow paradox, motion would be impossible. Thus although, *destination can be reached in a discrete space, motion would seem to be impossible*.

Since space is either discrete or continuous, this state of affairs has led many to believe that the paradoxes and conceptual difficulties suggest that the current concept of how a body moves needs to be revisited. Others are disillusioned outrightly dismissing motion as an illusion! [7].

Points possessing dimension and a physical reality of their own provide a means to redefine our concept of motion. In our proposal, what happens and what do we mean when a body (e.g. having the pattern G-GP-GN) is said to be moving? We have earlier mentioned an induced change in the number of points in a line, e.g. when two G-patterns in the tiling interact, which has the effect of bodies on that line displaying motion in a particular direction.

When two bodies **A** and **B** in the tiling come to abut each other either by a spontaneous or induced disappearance of the points in the line joining them, we now propose another example of non-random, induced emergence and disappearance of points. When the bodies collide in this manner, there can be no overlapping of points of bodies **A** and **B** and a substantial number of points in the bodies would have long lifetimes and cannot therefore spontaneously disappear. In the line joining them, appearance of points occurs while simultaneously in the line contra-lateral to the G-GN-GP pattern, disappearance of points happens, see Fig.5.

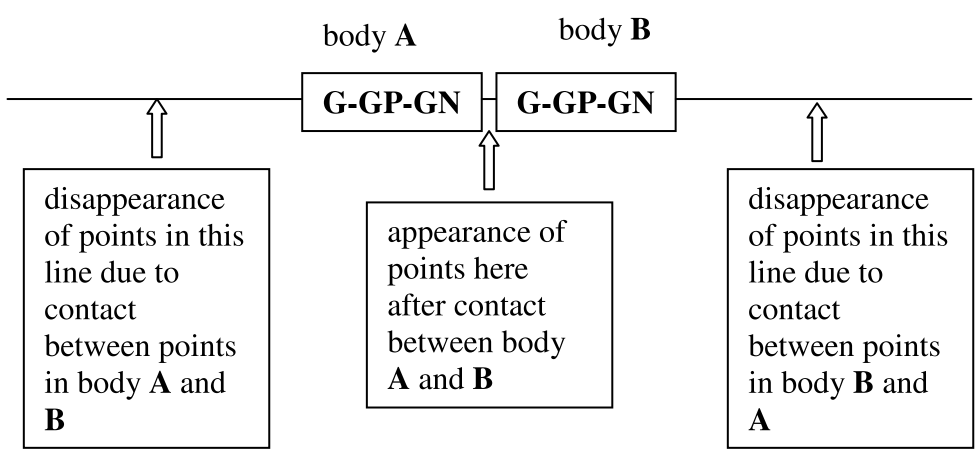


Fig.5. Illustrating changes in different line segments when two bodies collide.

The outcome of this ordered emergence and disappearance of points in the lines passing through both bodies is that both bodies subsequently move apart. The rate of disappearance and appearance of points determines how quickly the bodies move apart along their lines. We imagine that this rate depends on the initial rate of shortening of the line separating bodies **A** and **B** as they came together and on the individual mass of each body.

The rate of shortening of a line we call *velocity*. Sometimes this rate may not be constant, the rate of change in the rate of shortening we call *acceleration* and the change in length itself we call *displacement*. The way in which the mass of the bodies subsequently influence the rate of disappearance of points in a given line defines *force*. In the scenario depicted in Fig.5, the rate of disappearance of points in the lines through which body **A** and **B** eventually traverse after collision is peculiarly ordered and follows the *principle of conservation of linear momentum*. The great Sir Newton in his legacy to us, the *Principia* has adequately captured what is described. We merely work towards an answer already prepared by him and stated in his laws of motion. In doing this, we have followed his admonition to us his inheritors

> "...derive the rest of the phenomena of nature by the same kind of reasoning for mechanical principles, for I am induced by many reasons to suspect that they may all depend on certain forces" – Isaac Newton

There would be no gain if our currently proposed concept of motion cannot resolve some of the problems associated with older concepts, where abstract points eternally exist on a line and bodies are to be treated as distinct geometric entities from the space they occupy. Firstly, Achilles can overtake the tortoise if the rate of disappearance of points in the line to his destination is faster than that of the tortoise. Secondly, motion will be possible and destinations can be reached since points in the line of a body's motion disappear in that direction though appearing in the opposite, thus resolving the Dichotomy Argument. Thirdly, since the points describing the body are relatively stable, while those on the route can be made to disappear, Zeno's famous Arrow (an example of a G-GP-GN pattern in the tiling) would not have to leave its own place, i.e. the points which it occupies and of which it is also made, and yet it would hit its target.

> "What is in motion moves neither in the place it is nor in one in which it is not" – Zeno of Elea

Therefore, contrary to the assumptions in today's concepts of motion, the points marking the route do not remain where they are during motion and all points whether of the body moving or on the route participate in their own way to make motion describable by Newtonian dynamics.

To summarize, while random spontaneous appearance or disappearance of points can cause the motion of a body in a corresponding random way since a body is a member of many lines in different directions, motion with velocity in a direction requires action and reaction between bodies or an action-at-a distance and is characterized by ordered appearance and disappearance of points in the line of motion.

6. Energy propagation in space

Various definitions exist for what we call *energy*. Among these are, 'the capacity to do work', 'disturbance', 'the product of mass, acceleration and displacement', etc. We do not wish to add to the list of definitions. Here, we wish to merely illustrate how energy can be transmitted in a universe tiled with the physically real points that we have suggested.

Current theory suggests energy can be transmitted by particles or by waves, the latter requiring a medium with vibrational properties. Only discrete media can vibrate. For a continuous matter-free space, energy transmission would be by particles, e.g. photons. However, such particles cannot escape Zeno's Dichotomy Argument and energy may not be able to reach a receptor in a finite time, as all points on the route must be impacted and these are infinite.

For a discrete matter-free space, the Dichotomy Argument can be overcome as the points are finite. However, an energy particle moving from one point to the next could be "nowhere" in between. On the other hand, transmission of energy by waves requires action and reaction between the discrete units of the medium according to Newton's third law, but as the units have no mass this would be inexplicable in matter-free space, without some additional consideration.

It is proposed that energy is transmitted in matter-free space by successive and alternating shortening followed by lengthening, occurring in segments of a line from an energy source to a receptor at some destination. Take a sample line, as in Fig.6 with each segment on the undisturbed line having six points, i.e. each half segment has three points.

undisturbed

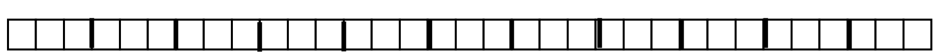


Fig.6. Showing an undisturbed line.

When disturbed, a half segment loses a point to become two, then this is restored back to three, then the next half segment gains a point to become four, then this is restored back to three, then the next half segment loses a point again to become two, etc till the orderly pattern of disappearance and appearance of points reaches the destination. The pattern is akin to an alternating puckering and stretching of the fabric, and can also be likened to an alternating attraction and repulsion pattern.

It is interesting that gravitational waves proposed by General relativity are described as also propagating through vacuum in essentially the same manner, causing oscillations in the structure of space-time, with alternating increase and shortening of the separation of points as the gravitational wave passes [8].

Further analogies with a waveform and a compression-rarefaction diagram are illustrated under the corresponding parts of a disturbed line in Fig.7.

disturbed

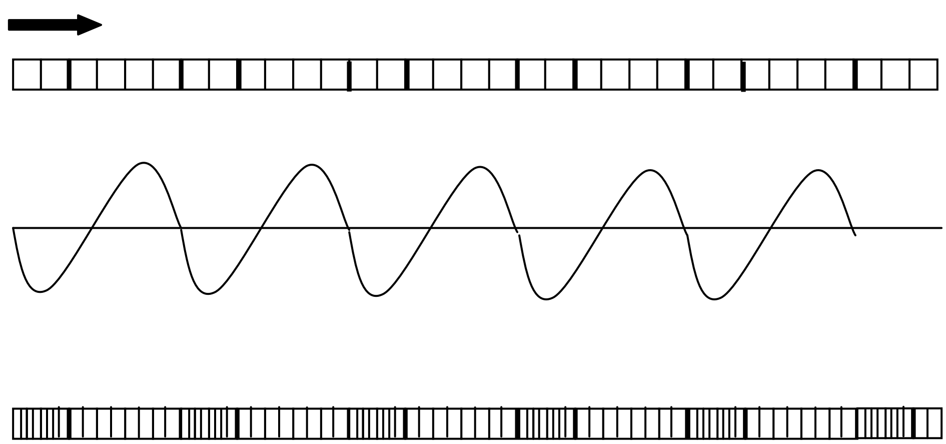


Fig.7. Showing a disturbed line and analogy with other types of wave transmission.

We can liken each segment to the wavelength of the transmission. Obstacles on the route of wave transmission, e.g. from highly stable points in matter can result in diffraction, reflection or other change in transmission properties. It is clear from what is described and the illustration that the waves can also interfere with each other if their lines cross. Doppler phenomena due to motion of source or receptor can also be described, taking into consideration the shortening and lengthening of lines caused by motion of bodies discussed in section 5. In this way, we demonstrate that propagation of energy in matter-free space may not require any particle to travel from source to receptor neither would it require the discrete units of the medium to have mass.

> "One of the most fundamental questions raised by recent advances in science is how to reconcile the two contradictory views of matter and wave. It is one of those fundamental difficulties which, once formulated, must lead, in the long run, to scientific progress" – Albert Einstein

7. What is time?

Even though we can only deduce the lifetime of a point and cannot observe it, changes in the system derived from it can make time observable. Such observable changes will include emission and reception of transmitted signals, motion of mechanical parts, the number of swings of a pendulum or increasing entropy. These make portions of time measurable and useable in dynamics but cannot occur if something more fundamental was not having a duration or a lifetime as we have hypothesized.

Measurable space arises from the existence of unmeasurable but deducible points. In the same way, observable and measurable time can arise from unobservable but deducible durations of physical existence. In other words, we view both space and time as real and not mere mathematical abstractions.

8. Cosmogony

The hypothesis of a point emerging and collapsing back to nothing has been the subject of earlier sections. The focus here is a consideration what the scenario would be when the first point in our universe emerged. Also, why does our universe have to be tiled with so many points? If the universe is still expanding with more tiling still taking place, what physical principle or law could be at play? We speculate.

If energy is a disturbance, i.e. a change in the spatial and temporal arrangement of points, emergence of a point with a lifetime represents a disturbance to the tranquillity of nothingness. If we quantify this point disturbance as ΔE, and if nothingness cannot have a temperature, i.e. $T = 0$, then if the second law of thermodynamics holds for all time, i.e. $\Delta S = \Delta E / T$, an astronomical increase in the number of different possible arrangements or patterns must follow this point disturbance.

Entropy, S is the number of different possible patterns in the tiling and will statistically depend on the number of points available as well as the amount of variation in their lifetimes. The thermodynamic equation is the best we have been able to employ in our speculation as to how an astronomical number of things can result unforced from an infinitesimal event.

If the disturbance, E, has a wavelength, λ, ~ the Planck length and if it exists as radiation, from $E = hc/\lambda$, we can calculate the energy value. On this basis, knowing the volume of this early universe, we have calculated an initial temperature ~10^{32}K and a temperature timeline as the universe further increases in size during the radiation era [9]. Our speculation agrees 'pretty nearly' with what is described in the big bang theory.

For completeness of this section, we crave the indulgence of the reader to finally speculate that while the G-patterns in the tiling may represent non-baryonic or dark matter, the more elaborate G-P, G-N, G-P-N patterns may constitute the baryonic matter in the universe.

9. Closing arguments

We start our closing arguments with brief comments on some of the problems usually highlighted as posing an obstacle against proposals suggesting that space is discrete and not infinitely divisible. These are usually stated to be: the distance function or Pythagoras' problem (also known as 'Wyel tile' argument [11]); the dimension problem; the anisotropy problem and the identification problem (see [2]). In earlier sections, we have made suggestions that can help resolve the latter three.

Where a and b are the lengths of the sides of a right angled triangle and c is the hypotenuse, the Pythagorean theorem says $a^2 + b^2 = c^2$. For the Pythagorean theorem to give correct results, Definitions 1-4 in Euclid's geometry (see [1]) must hold. In particular, space must be infinitely divisible.

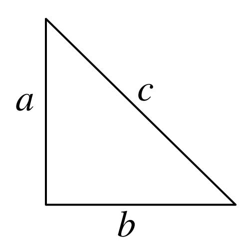


Fig.8. Showing a right sided triangle with sides *a* and *b* and hypotenuse *c*.

However, for certain non-Euclidean geometries where space is also infinitely divisible like in the Euclidean case, the relation is known to take a non-Pythagorean form, i.e. $a^2 + b^2 \neq c^2$ [10]. The theorem may similarly give non-Pythagorean answers to questions posed to it when space takes on a discrete form and is not infinitely divisible as envisaged, with points having dimension and lines having width, as the geometry will no longer be exactly Euclidean.

To see why this would be so, one merely needs to look at the underlying Euclidean assumptions that serve as proof for the Pythagorean theorem. In measuring a, b or c there is no overlap. That is, no part of the measure of a will be added to or removed from the measure of b. In Euclidean geometry this is easy, since the point has no dimension. However, in a discrete geometry, where lines have width as pointed out by Van Bendegem [12] in his own counter-argument to Wyel's, the width of side a contributes to the length of side b, and the width of b contributes to the length of a. This is not envisaged in the Pythagorean theorem and is contrary to its underlying assumptions.

To borrow an illustrative example from Forrest [13], if we use people to represent the points, afterall people are finite, the person at the corner between lines a and b, is he or she to be counted as part of line a or b? Or to employ the square tiling, Wyel used in formulating his argument, on which line, a or b will the corner square be counted?

If we arrange 16 people in a 4x4 square formation, we know for certain by counting that in the diagonal there will be 4 people, but if we use Pythagoras' theorem to determine the number, it will tell us there are $4\sqrt{2}$ people on that diagonal. Similarly, if we measure the sides a and b as a whole number of points, and we try to measure the hypotenuse as a whole number of points by posing the question "how long is the hypotenuse?", the Pythagorean theorem will not be giving us the correct answer to the question.

When the Pythagorean theorem therefore sometimes gives irrational results like $\sqrt{2}$ to simple questions that have a finite answer, we should be alerted that perhaps in measuring lines a and b, the point common to both partakes in the length determination of a and b, indicating that the corner point is not dimensionless!

To close our comment on the Wyel tile argument, no right-angled triangle whose sides have a finite number of points can have the finite number of points in its hypotenuse determined using Pythagoras' theorem!

In this essay, we have by removing absurdities in definitions and using deductive reasoning been able to tentatively model a universe tiled with physically real, instead of abstract points. Our speculation is economical, being founded on space and time alone, yet powerful enough to discuss many physically observed natural phenomena without seriously contravening many of our cherished dynamical beliefs.

In our model, Euclid's point assumes more relevance and we also satisfy many of Zeno's concerns. Achilles can outrun the tortoise and the Arrow would not have to leave its place in order to reach its destination. Points disappear in the direction of

motion while emerging in the opposite direction, with the rate of line lengthening or shortening depicted by Newton's laws of motion. To recap, some of the agencies that may induce a patterned appearance and disappearance of points include:
- action and reaction between bodies according to Newton's third law
- wave propagation in matter-free space
- action at a distance
- in obedience to thermodynamic laws

Although resolving many puzzles, the hypothesis that any time we make a movement, points are being caused to simultaneously disappear and emerge in the line of motion and against it respectively, appears almost incredulous even to the author. But when viewed against the backdrop that after all we ourselves are geometric objects made of points, surrounded everywhere by points of space, all of which points cannot overlap, neither can the points of space yield to those of a body in motion by way of Newton's action and reaction law, since in their rudimentary form there is no mass, the only mechanism for motion to be feasible is by the induced disappearance and appearance of points in space as outlined. We therefore take solace in the words of Lucretius

> "Give your mind now to the true reasoning I have to unfold. A new fact is battling strenuously for access to your ears. A new aspect of the universe is striving to reveal itself. But no fact is so simple that it is not harder to believe than to doubt at the first presentation." - Lucretius

Behold then a glimpse of how nature could have manipulated points and their lifetimes to give rise to complex things like mass, charge and motion.

> "The supreme task of the physicist is to arrive at those universal elementary laws from which the cosmos can be built up by pure deduction" – Albert Einstein

Acknowledgement
Comments will be welcome and acknowledged at taojo@hotmail.com, while journal publication is being explored.

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