The wonder of intellectual conversations

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Part 1

Discussions on Quantum Grouping and interactions below the Planck Scales

Paper 1: Definition and interpretation of grouping

The path correction potential

Reference: Virtual particles in the Feynman Integral paths

The time and space between two real nodes on Feynman diagrams have been given some value that has to be "some real value" for the Energy and Momentum to be described; although they have been described to be "unmeasurable". Concerning to the fact that any conceivable path is subjected to a certain measure of probability amplitude, every path except the path of least action, has somewhere within itself symmetrical interactions- that cancel out in the calculations of the path integral; so in an electron pair scattering- a photon emitted by an electron could produce an electron-positron pair which could annihilate together to give out a photon before it interacts with the other electron. The symmetry accounts for the fact that- for any deviation from the path of least action-the path correction can be described as-"a potential energy is created". For the electron pair scattering that involves virtual electron-positron pair; for the intermediates to be described and distinguished as electron-positron pair, the electron and the positron should move away in space-time for a definable time before annihilating, even though the defined time may be immeasurable. If they do separate in space and time, as soon as they do, a potential is created that decelerates their relative separation that allows them to curve their paths in space time to aim towards each other again. The curved movement is clearly visible as curved line in Feynman diagrams.

Defining the meaning of group reconfiguration

A non-random behavior of a particle in a system is described as “when its interaction agrees with the behavior of the system”. When a particle inside a system interacts or behaves in such a way that it does not agree on the properties of the system, the behavior of the particle can be called random. Example: A series of 4 particles; in a one-dimensional system, are such that their kinetic energy configurations are expressed in Temperature as 10 degrees Celsius, 20 degrees, 30 degrees and 40 degrees (the particles are in one dimensional arrangement according to their order of listing). Considering the 20 degrees particle, its energy flows towards it from the 30 degree particle through it towards the ten degrees Celsius. But if the 20 degree particle acts as if it were isolated from the 3 other particles; rather as a separate system relative to the system consisting of the other 3 particles (which to the system of 20 degree particle acts as a system with energy configuration of 27 degrees (plausible approximation), energy will now flow from the system of three particles toward the isolated system of 20 degree particle. Similar description would apply for the particle at 30 degree particle. But energy would always flow towards the particle at 10 degrees and away from the particle at 50 degrees. But for different permutation of positions in the array, the agreement between the interactions not involving grouping and those involving grouping may vary.

The path correction potential as group splitting

If such a definition of group reconfiguration is applied to the energy potential involved in the path correction of virtual particles in the Feynman path integrals, it could be said that when the positron-electron pair separate in space-time, a system of photon splits into two systems of electron and positron that exert a potential excitement in the Higgs field-giving them mass. The idea that a photon gives rise to positron-electron pair could be rephrased as the system of a photon splits into two systems-one of an electron, and one of a positron; the two systems develop a potential-which is conveyed by the associated Higgs field. This explanation does not clearly explain the splitting of a quantum system but it does form the basics of the discussion on quantum splitting.

A new definition for space time and randomness

If we described the collision of two spheres in space, we know the time they took to collide, to be close at a certain distance or any time from a reference time. In other words, we can describe the change of their states. But let's say that a sphere instantaneously (taking no time) just split into two (this kind of interactions could very well be all around in our universe) . So if that took no time, can such phenomenon never happen? We do know quantum information can be in a superposition of states-which could be easier to describe as two things happening at the same times or better as “the change in states taking no time”. And if that's true what about our definition of quantitation of time (the Planck time). It seems that both could not be true at the same time.

But I think it can be described in this way. Let's say that every element has a 4 dimensional property and hence a 4 dimensional interpretation. How could it be that some object can move in quantized space. Let's describe the quantum leap (or like the quantum length). The time below the Planck time is very well not defined. So how can something (an object, interaction, energy) move “less than Planck length” amount of length in no time and still move a certain length after a certain time? Well we know that's how things move.

Time for answer-Think of the quanta of space-time as an inherent 4 dimensional system that can evolve on its own without any reference to outside. So the movement happens "on its own" like the sphere splitting into two spheres in no time at all. Such self-evolving system have time as inherently defined into their property and do not require time to be measured as compared to something happening outside. This idea has an enormous consequence.

Randomness- Since the systems below the Planck scales are self-evolving (I discussed it as at the Planck scales), we do not define interactions below the Planck scales because they do not depend on anything outside. That is to say everything below the Planck scales is absolutely random and hence not definable. So, that's what random means- self evolving, and independent of the system outside. But at the Planck scale things are not self-evolving and hence depend on the potential due to every other quantum system in the universe. The measure for the dynamics of space and time would be the vacuum energy field fluctuation. The vacuum energy field fluctuation accounts for the randomness-the information inside each quantum system below the Planck scale whose property is not completely dictated by the total information outside the Planck time.

But why would such a transition happen (as that happens at the Planck scales)? Discreetness is the property of our universe and discreetness would be the property of a group of quantum systems-to have many systems inside a group of systems that can change between interacting or not interacting with each other.

Space and time- That property of group formation is defined as space and the dynamic property of group reconfiguration as time- hereon through this discussion. It is often counter-intuitive to imagine describing other dimensions based on the extension of the definition of space and time as four dimensions. Maybe other dimensions describe the geometry of the group configurations and space and time describe the group reconfiguration property itself.

From algebra to geometry- a more intuitive discussion on the definitions

Let’s imagine each quantum system as a sphere to start with and then we will perform operations on the sphere .There would be two ways to describe the size of the spheres.

One would be where a group of spheres would interact and there would be many such groups in space. And as the spheres move around groups change which define which spheres are in a group-that is which spheres can interact. This model describes such quantum systems in space (this idea acknowledges space and time as not extremely different from the definitions that are currently well established).

Another model (the definition that we discussed in the previous topic) is to abandon the notion of space and say that instead of such groups of spheres lying in space, they're not in space but rather space is a consequence of interaction between the spheres.

Let me describe what I just said. The idea is that the shape and "sizes" of the spheres change and based on that-some spheres overlap while some don't. One kind of such an overlap-lets imagine it as a type of knot to tie a camping rope. There would be different types of knots giving rise to different notions of neighborhood. We know that gravity of a mass affects all of space-time but the strong nuclear force affects only the things in the range of the nucleus. So maybe gravity is such an interaction where all the systems we have been measuring-overlap. But maybe the strong force is an interaction with a geometry where only certain neighbors interact. In this model dimensional links give rise to interactions but space and time are the inherent property that describe the geometry of the quantum systems. Maybe the reason we can't efficiently describe space-time and other dimensions is because they're different things. Maybe dimensions are the type of grouping if the quantum systems while space-time are the complex fundamental geometry of quantum systems.

The splitting of a system

This might have to do with an assumption that there is more energy in the universe than the total amount that can be contained in all of the dimensional quanta for un-random events to happen. And when certain quantum have more energy than allowed, random events take place. This can be attributed to the relationship between continuity and quantization. During its evolution when the universe could be described with a single type of interaction, it could be treated as continuous and random events could not happen because the energy potential or pressure everywhere would be in the same vector direction. But as the universe evolved, and information was transferred, discontinuous interactions could take place (like teleporting) causing the continuous property to breakdown into separate quantized properties and interactions.

Imagine that our universe was a self-evolving structure- it split into many quantum systems-allowing them to interact in different kinds of ways. Of the systems that result as a product of splits- some are continuous and some are quantized. Continuous systems stay frozen preserving all the information as they are uniform throughout due to their continuity; until some quantized system bumps into them-introducing them to quantization and non-uniformity and they'd self-evolve into splitting into many systems-some of which are continuous while others are quantized. The quantized systems have interactions and non-uniformity and are interesting. They can split into systems that can form dynamic groups- giving rise to new properties, some properties can disappear too.

A continuous system split into many systems. One of them was continuous. After a quantized system bumped into it-it split into many systems-some if it were continuous while some were quantized. The group of the resulting systems is our universe. Some continuous systems have been preserving information, revealing them every now and then. Some discreet quantized systems as per the dynamics of their group configuration (evolution of space-time), give rise to new properties. We now believe that a long time ago, the strong and the weak nuclear force were the same thing; longer before that electromagnetic interactions were unified with the nuclear interaction and even before that everything was unified as gravity. One prediction of this model is that the fundamental constants should be dynamic. But it is very difficult to distinguish between human progress and the change in the fundamental property of our universe.

The reason that we observe the universe to be expanding as the space is being created or stretched is because the possible geometries for possible interactions of quantum systems is increasing-which we have defined as space-time in our discussion.

The quantization of speed, length and time

I would think that the Planck units describe energy potential of the universe and random interactions in the quantized space-time. All the fundamental constants are interpretations of the energy potential in dimensional interactions. Something could either travel one Planck length in one Planck time at the speed of light or just not travel any. The next Planck time, the energy potential under consideration would change and the "something" could travel yet another Planck time or not any. The absolute integral of the quantum speeds would describe the motion of the "something" jumping from one Planck length to the next like electrons jumping from an orbit to another "without traveling from between". But "something" traveling less than a Planck length would not make sense because we "something" can only jump from one Planck length of space to another without going through in between. Traveling 2 Planck lengths in a second would mean skipping a Planck length and hence "teleporting". Why the values for Planck length and time? The value of the Planck length can be interpreted as, inside one Planck length some non-random interaction-as per the definition we discussed for randomness-determined by the total information outside the Planck length, interaction cannot take place. The value of Planck time can be interpreted as the duration between two consecutive non-random interactions in a Planck length. If something happened in less than a Planck length-it would be described as a self-evolving system.

Volume as a single entity and length as a projection rather than volume described by 3 mutually related lengths

Let's start from the Banach-Tarski theorem. The step that I think would not be logical according to the following discussion is this: The points on the surface that can be represented as a projection of lines from the center cannot be taken together to define the volume of the sphere- because one cannot construct volume taking together the lines. But we have been using the idea that volume equals length*breadth*height all the time. And what about distance and speed?

Let's start with cubes. We define the volume of cubes with length, breadth and height. I like to believe that at the fundamental scales of reality, every shape has a symmetry as a sphere would in three dimensions. So, if it were in 11 dimensions- 11 dimensional symmetry as in a sphere. Notice that the volume of a sphere is just the manifestation of it's radius- already as per our definition that volume of a sphere equals (4/3)*Pi*R^3. But it is clever to notice that even if volume is just the manifestation of radius, or radius is just the manifestation of volume; as I would state in this discussion, Pi- which is circumference/diameter, contains circumference- an information that is not radius. Now this point follows from my discussion about the interpretation of vacuum energy field fluctuation as a property of quantum to interact with a certain number and identity of other quanta at a certain state and different number and identity at a different state. The Planck scale quanta acting as closed systems would mean that interactions outside could not always get in. So, in that perspective-circumference is the path information outside the system of interacting quanta would travel and diameter is the path information within the interacting quanta would travel. And very interestingly I would consider all motion as the sum of quantized discreet motions at the Planck scales all-either at the speed of light-while passing through closed quanta in a system or none at all-between interacting systems. Considering that I would be interested to search for Pi in the interpretation of the speed of light.

Let's imagine traveling on the surface of a sphere- or on Earth. Moving along the surface we can go left or right and forwards or backwards. We can leave the surface of the Earth by jumping and going further away from the center of the Earth or dig a hole to get closer to the center of the Earth. But at the Planck scale quanta following the discussion, systems could either be closed or interacting with one another. According to that interpretation, the information traveling on the surface of the quanta would mean nothing- if the quanta was interacting with another quanta, interaction would take place between the spheres and hence along the radii or one could visualize this as two water bubbles joining at a moment and when they separate the next moment their volumes have changed as per the exchange of the volume. If the quantum was not interacting with another quantum, or acting as a closed system, the information would pass through it through the circumference at the speed of light. But the information would not travel along the surface of the quantum- because if it were the case no quantum could act as a closed system to another quantum.

That was the definition. Let's briefly discuss the consequences of such an interpretation. But the speed contains length or at least the speed of light would considering the discussion. Very simply, speed is the sum of discreet light-speed or zero motion and the speed of light is the manifestation of the circumference of the quantum. Now let's see the idea if we can end up- right if we just went up. According to the closed system discussion, we would have to interpret the quanta of universe not as spheres spread across three dimensions but rather as fluctuating quanta contained in a single sphere- the fluctuation to be interpreted as the interactions in an instant- like all the quantum intertwined in a many-dimensional shape. So, at the Planck scales I would reason that it is not only possible to go up and end up right from where we started but virtually anywhere as according to the quantum interaction fluctuations.

But why does it still make sense to use length, breadth and height and why does three space dimensions seem so obvious? I would think that because information passes over non-interacting quanta at the speed of light- traversing through the circumference, we observe that light travels in a straight line- through the curved circumference. But as we project that motion to the center of the sphere- which would be the idea that we would observe the information as coming through that non-interacting quanta, we would observe the three dimensions.

But what would being near and being away mean? Explaining this idea, I would like to separate location in space from volume or the manifestation of radius. Usually, we define both length and distance in a similar way. But according to the discussion on closed system interactions, the relative location of the quantum would have to be defined based on the identity of the quanta the quanta it would be interacting with. And in that way location would be a dynamic quality.

Oh! and one more thing:

Volume + time is not equivalent to space-time. Volume is a one configuration of a group-a dimension whereas space-time is the geometry that describes the relationship between these configurations or dimensions.

Now to the more interesting part:

Black holes without singularity and systems below the Planck scales

Reference: An observer falling into a black hole observing something that is also falling into a black hole just before it:

If an outside observer never observes an in-falling observer ever fall into the black hole, any particle entering the black hole should feel nothing else to be inside the black hole but only itself; because just before it entered the black hole, everything that was about to enter the black before it froze at the event horizon, so there is nothing inside the black hole but just that particle. This would mean that there would be no singularity.

Second option-Now let's say that it would feel everything to be normal-that is see its predecessors fall into the black hole and that only those outside observers accelerating away from the black hole see things freezing on the surface of the black hole. For that to happen, when the same observer is moving towards the black hole, observes things going in; but when accelerating away observes things clumping up on the horizon. If that were to happen, every time the observer went back and forth the clumping would freeze and unfreeze.

Third-Or if an outside observer maintaining a constant distance from the black hole is the one that observes the clumping. When the observer moved away, if the things unfroze, entering the black hole; relativistic predictions would be incorrect.

Inside the black hole:

I like to talk about the first interpretation-the violation of the extrapolation of the geometry inside the black hole-that there is no singularity. If we add some definitions to the idea, it looks familiar to a question, we've been asking and the incomprehensible answer we've been getting.

First, the observer sees no non-virtual particles. However, high energy virtual particles pop into and out of existence frequently. When one of such particle deforms space-time, it forms temporary gravitational influence on the "only one" non-virtual particle-"observer" before shortly ceasing to exist and no more influencing the non-virtual particle. Another virtual particle comes into existence somewhere inside the black hole and temporarily pulls the non-virtual particle in a different direction (could be the same) with different intensity depending on their relative positions. As many virtual particles pop into existence, the particle is pulled around and pulled in some other direction while some virtual particles cease to exist and some other new virtual particles come into existence. The non-virtual particle is pulled around inside the black hole in this field of virtual particles; never quite achieving the influence to escape the black hole. It could be helpful to imagine the idea as a yo-yo being pulled back and forth, allowing the movement in all directions and the intensities to be different. Since, the observation is the same for all particles, the non-virtual particle is only non-virtual to itself, and virtual to every other particle and any observation from the view of the space-time inside the black hole.

The same idea can be described in a different way. The space-time inside the black hole is a high energy deformation in the portion of space-time where, as virtual particles pop into and out of existence, powerful gravitational waves move the non-virtual particle around, inside the black hole. The gravitational waves are the result of virtual particles coming into and out of existence, producing different patterns of gravitational strong fields.

Explaining a very similar answer; and amazing consequences

Length below the Planck length leads to answers that there should be black holes everywhere below the Planck length. While that might tell us that we don't understand it so well, it could very well be telling us a different story this whole time. Maybe the reason systems below the Planck scales give rise to black hole scenarios is because what happens inside a black hole is very similar to what happens inside a Planck length-what happens to space-time.

Below the Planck scale, space-time is not empty and virtual particles coming into existence and going out of existence make up the vacuum energy field, as well accepted. Every point in space-time is stretched, as virtual particles come into existence as the vacuum energy field fluctuation. This is exactly like the first definition we established about what happens inside the black hole. The high energy virtual particles coming into and out of existence inside the black hole, cause gravitational influence because the gravitational waves are localized. Similarly, the virtual particles coming into an out of existence in vacuum field, stretch space-time at a lot of points (theoretically all points) and in a lot of all directions (theoretically all directions), creating the effect observed as Dark Energy. As the black hole shrinks, the mass that is consumed is spread out into creating more vacuum energy-stretching space-time; which according to our idea would describe the hawking radiation to be the same as dark energy-mass of a black hole is lost in creating vacuum energy-greater amount of agitation in the space-time. A very interesting question there- Is spacetime an emergent property of some fundamental vibration? – That leads us to String theory and M theory. We shall discuss more of that in part 2.

There is one more definition we need to add here. As, the virtual particles inside the black holes come into and out of the existence, the virtual particles coming into and out of existence that make up the vacuum energy field-do so at inside the Planck-scales, let's say inside the Planck volume. Since, the two phenomenon are extremely similar, that is why we get an answer that there should be black holes below the Planck scales, when we compute the prediction of our theories. But more than being similar, the two phenomena could be two observations of a single phenomenon.

The Hawking Radiation and conservation of information

It could very well be the case that the matter eaten by black holes in our universe appear as virtual particles in space-time outside the black holes; and that explaining why "inside the Planck scale phenomenon" and "inside the black hole phenomenon" are the same thing. Now the way this model can elegantly describe the hawking radiation or quantum tunneling as the property of the particles inside the black holes to appear outside the black holes as quantum vacuum field fluctuations-(the reason such systems are described as quantized at the Planck scales can be better discussed by explaining the Schwarzschild radius); hawking radiation as the dark energy itself. And this does not violate information conservation. And black holes turn out to be converting matter into vacuum energy diluting the energy in our universe.

An unanswered question: revisiting group splitting

All along this time, we did not answer why the particle inside the black hole observes no other non-virtual particle. This idea is described using the splitting of a group; the central idea in this discussion. A black hole has the following property. Before entering the black hole, some matter can interact with each other in space and are described as being in the same system in the "volume neighborhood" or less seriously-space. A black hole can split this system into many systems that cannot interact in the "volume neighborhood"-so that each particle when observed by some other particle is just a virtual particle. According to the idea of group reconfiguration, space-time is the geometry of group configurations while volume neighborhood or dimension is one such configuration. However, the particles may interact in "other dimensions or neighborhoods", and hence appear as virtual particles to each other in the volume neighborhood, and are able to convey gravitational influence as they continue to have defined geometries of group configurations- or less seriously interactions with space-time. According to the evolving dynamics of group reconfiguration, the virtual particles come into existence and cease to exist.

A more elegant description to the Hawking radiation with an anticipated link-entanglement:

We discussed that a virtual particle that ceases to exist inside a black hole, instantly appears somewhere in space-time outside the black hole as a virtual particle in the vacuum energy field and vice versa. It is not difficult to notice that entanglement is beautifully written into that idea-the opposite state is observed instantaneously-a virtual particle coming into existence and a virtual particle ceasing to exist. The idea that's even more fascinating is that not the particles but rather the "space-time inside the black hole and the space-time outside the black hole" is entangled-and that the entanglement is dynamic.

While exploring the entanglement as connections in higher dimension would be interesting, our discussion-owing to the fact that volume; a dimension, is not the same as space-time-which is not a dimension, seeks to describe that as entanglement of space-time and something fundamental to the property of space-time. So, let's see more to that.

If a virtual particle can pop into existence anywhere in space-time, all of the space-time outside the black hole should be entangled with all of the space-time inside the black hole. And that's okay. The more the entangled entities, the noisier it gets and the states get more and more indistinguishable. So, if all of the space-time inside the black hole is entangled with all of space-time outside the black hole, the virtual particles pop in and out of existence are really noisy and totally indistinguishable. That goes along well with the idea that any virtual particle can pop into existence anywhere in space-time and it would not be possible to determine which particle popped up where-the symmetry in energy states. But really, how does all of space-time outside the black hole get entangled with all of space-time inside the black hole?

When a particle is in the space-time outside the black hole, it has an influence on the curvature of space-time outside the black hole and not inside the black hole. When it moves into the black hole, it sort of disappears from the system outside the black hole sending out relaxation waves through space-time outside the black hole, and appearing into the black hole system it sends out distortion waves through space-time inside the black hole. But how could this be? The outside observer never observes the particle fall into the black hole, and hence should never observe this wave through space-time. But this wave carries information about entanglement and entanglement identifies entangled entities as discontinuous and separate and so is the information carried by this wave-which is just a fancy way of saying a part of a continuous element cannot be entangled with some other part of itself. And hence the need for quantization of space-time, and let's see how such a wave of entanglement information travels in quantized space-time, how the entanglement occurs, and how we can still appreciate general relativity.

The quantization of space-time

We have discussed previously that volume is quantized at the Planck scales and that volume + time is not equivalent to space-time. And now we are going to assign a proper definition to some construction that we have already used in the discussion. How can the gravitational waves inside the black hole be localized? How can the space-time deformation be different inside and outside a black hole? Yes, because space-time is quantized. The discreet chunks of space-time can have different energies. How can we reconcile that with the fact that gravitational waves propagate in a continuous stretch of space-time?

There's a video on YouTube from Mashable Deals "Revolutionary Orange Goo used to protect Football Players from Head Traumas" –about the D30 goo. And this goo has an interesting property; when stretched slowly, it stretches behaving like plastic materials, but under sudden stress the goo acts like a non-stretchy solid-which is why it's used in football helmets.

The way I like to discuss the quantization of space-time is by believing that it is continuous and smooth to convey the smooth curvature of gravity and propagate gravitational waves. But at the boundary of black hole-the event horizon and the boundary of Planck scale volumes, space-time behaves like a non-stretchy fabric, giving a non –continuous curvature. So when a gravitational wave is propagating outside a black hole since the boundary is stiff, the entire black hole behaves like one discrete particle in the wave-because its ends are stiff. The gravitational waves inside the black holes bounce off of this stiff walls and are contained inside the black hole. The same description applied to the Planck scale volume. But what creates gives space-time this stiff property?

Anything falling into the black hole is frozen at the surface of the black hole to any outside observer. The mass of the black hole is observed spread out at the horizon. So, what would be described as infinitely dense singularity is discussed in this discussion as the stiff boundary. The boundary-horizon, is in this constant rush to pack more information; like the singularity, to an outside observer observing the start of infinite inward curvature or the hole-like a sudden fall into a pit. Hence an observer outside the horizon never observes the propagation of gravitational wave outside the horizon to pass through the horizon. As for the particle inside the black hole, as it is constantly pushed and pulled around, it never reaches the horizon and every other particle it observes is virtual, so the gravitational waves inside the horizon never goes through the horizon.

The same idea goes for the Planck Scale volumes. **And so, quantization of space-time does not really require space-time to be composed of granular sub particles but allowing stiff boundaries in the continuous fabric-like knots in a rubber band, could better describe quantization of a smooth continuous space-time.**

The quantization of space-time in the group configuration interpretation

If the geometry of the group configuration-space-time; is quantized, not all imaginable configuration is possible-hence the configurations are not infinite in number; and therefore a sense of relief-there are only finitely many dimensions. So, trying to define the properties of dimensions makes sense.

How the entanglement information is conveyed between all of the space-time inside the black hole and all of the space-time outside the black hole

Back to where we needed the space-time to be quantized, entanglement. As a particle falls into the black hole, according to the observation-rather reasoning of the particle, it observes that the space-time outside the black hole must not have the particle. And so there's this sudden relaxation throughout space-time; or rather sudden uphill –which is another description of the idea "it's like the sudden fall just at the event horizon of the black hole". And following our discussion on the quantization of space-time, it is when-rather from that perspective where such sudden pits or uphill happen; that the space-time behaves quantized. And this gravitational wave of relaxation through space-time is different than the usually known kind through continuous space. Like we discussed, gravitational waves do no go through the stiff boundary; when all of the space-time is quantized-this happens: If space-time were a rope and usual gravitational waves would be transverse waves in the string, when all of the space-time is quantized and stiff, the wave would be such that the entire rope would move up and down without any element in the rope moving relative to each other-that is from the perspective of space-time ousted the black hole.

And so the relaxation gravitational wave is sent through all of space without any observation of gravitational wave inside anywhere in space-time. The gravitational wave of sudden distortion is conveyed through all of space-time inside the black hole. And the fact that the relaxation wave traveling outside the black hole and the distortion wave traveling inside the black hole carry the exact opposite information entails that the two waves are entangled. And as the information about entanglement of space-time outside the black hole and space-time inside the black hole travels as the waves, all of the space-time inside the black hole is entangled with space-time outside the black hole.

But how does this idea appreciate the expansion of the universe? If the rope is growing in length, how does all of it move up and down-without some of the elements going out of phase with one another?

According to our discussion, the expansion of our universe is due to the virtual particles inside the black holes disappearing from inside the black holes and reappearing somewhere outside the black hole, and that idea appreciates the quantization of space-time, so when the universe expands- the space-time outside the black hole observes that the expansion is smooth and continuous, whereas the space-time inside the black hole and below the Planck scale observe that the expansion is quantized. And so the rope moving up and down could grow maintaining the phase in oscillations, while moving up and down and no inconsistent observations happen.

Nothing about entropy?

It's time for the revelation. The entire discussion of group configuration, is actually a discussion about the patterns of group configuration. That means entropy is the central idea of this discussion.

But what happens when all black holes run out of food to eat?

The universe could be left with just vacuum energy field fluctuations with virtual particles popping into and out of existence. Our universe's geometry to interact in volume-neighborhood could be gone while the energy of our universe (as particles) may continue to interact in other configurations and neighborhoods. Virtual particles may form real particles. The universe could split into different systems or combine with some other system. The universe could lose its quantization as black holes disappear taking away with them the vacuum energy fluctuation making the system continuous. The continuity could be disturbed when something else interacts with our system in a big bang.

Where's the math, buddy? We need some good math.

I do not have confidence and understanding in powerful tools in mathematics but with my intuition, I believe we start with differential geometry. The Null spaces of the subspaces would represent the randomness associated with each system below the Planck scales-while representing the splitting in volume neighborhood. The order of could subspaces would represent the configurations of the groups and vector calculus would define the energy configuration.

-End of paper 1

Paper 2 of the discussion on Group Dynamics

The Emergence of our universe from virtual particles

-with more interesting ideas

-“We can not make measurements at or below the Planck scales but we can describe the effect of the phenomenon below the Planck scales at scales much bigger.”

-“Random is just too active.”

Virtual particles and the emergence of mass

Postulate 1: All real particles are made up of virtual particles; that is when we get better at measuring the scales-probably discovering smaller fundamental particles-we'll see that. –this is the group reconfiguration definition of the Higgs Field.

This is the beautiful understanding of subtle consequences of the particle wave duality-a possibility of infinite continuation of fractal symmetry. The wave description of a particle describes the uncertainty in its position and momentum. If a particle is described as a wave, it can very well be described as the fluctuation of a particle in the wave-this is the quantization of a wave. That particle also has an uncertainty associated with it which is described as its wave description, and so on. This alludes to the idea that we can reduce a particle description to a 'much smaller particle' description. But can we use this reductionalist idea for ever? How far can we go? And what is the mathematical description for such a phenomenon? We can go on as long as a particle in the wave correctly represents the wave- that is to say that the wave is symmetrical, non-interacting and space-time invariant. We already have a mathematical language for such a description.

But we do need to appreciate yet another very important question. Isn't everything interacting with a lot of things and that nothing is isolated? And the fractal symmetry would be true if things were not interacting. So, how does that fit into the model? We need to appreciate that factor with our understanding of the quantization of space-time at the Planck scales from our discussions in part 1; where Planck scale quanta can be isolated from every other quanta from our understanding of the group dynamics. So that would mean, such a symmetry could be a plausible description for wave-particle duality below the Planck scales. But there's a huge gap between the standard model and the Planck scales right? Yes, and that could mean it could take a long time to test if such a description would be true. But if we should ever near the Planck scales, the relationship between large uncertainty in momentum with a better certainty in the position would be clear.

Corollary 1: If that is so, the mass of a particle is not an inherent property.

When virtual particles interact with each other in space-time, that is if the frequency of virtual particles appearing in one place is high enough, or that more virtual particles appear in a certain quantum location in spacetime, the fluctuation on space seems to observed as not-fluctuating geometry, the fluctuation is so fast that it is observed as a permanent curvature in the spacetime-the emergence of gravity. The mass of a particle-describes the frequency of a virtual particle that would cause-'real particle like' deformation in the spacetime. But what it spacetime really if it's not just the virtual particles- that answer could be explored trying to understand what the frequency of the virtual particle oscillations would mean.

The frequency of the oscillations are characterized by the group dynamics of the virtual particles as per our discussion on part 1. That is to say that some virtual particles interact with only some other virtual particles in some dimension at one point in their dynamics and some other particles maybe including some previous ones, others new and losing interaction with some other particles. The interactive groups are dynamic. And spacetime is exactly that group dynamics-so a picture of the virtual particles field fluctuating in space makes sense-but what is really happening is that the virtual particles' ability to interact is evolving –and that evolution is space-time.

Entropy, Complexity and Conservation on energy- The kinetic and potential energy in the universe

Let's discuss about the evolution of mass in the universe-with interesting discussion on complexity and entropy.

Does the idea also go along well with the universe being symmetric when it was hot, and as it cooled down there was this symmetry breaking giving rise to the Higgs field, hence particles getting mass? That would have to mean that when the universe was hot and there was no mass, the frequency of the oscillations would have to be less-which means less energy of the field, which means low temperature? Wait, that seems to be contradicting itself, doesn't it? Actually, no. Let's be a bit more careful this time. When the universe was hot-most of the energy was contained as kinetic energy and appreciating the conservation of energy-there was low potential energy. And we know that the vacuum field fluctuation is the scalar potential field in the universe. So when the universe was hotter more of its energy was in kinetic form-which is the energy exchanges between the Planck scale quanta in a group; that means, since the potential energy was less and hence the dynamics of the group reconfiguration was less, at the big bang almost all of the universe was the same system in just one dimension-which happens to be volume. And so the big bang- is really the splitting of this one big system with every particle into many systems that would be dynamically interacting and reconfiguring. As the universe cooled down the group dynamics increased, and hence more dimensions were created, also destroyed; but the number of possible dimensions being created grows (dimensions are being created and destroyed all the time at the Planck scales). So maybe in a long cosmic timescale some dimensions could be observed as being created while some being lost- but as most of the energy of the universe turns into dark energy, more dimensions could be created (also destroyed) as the from the part 1 of the discussion we know that black holes delocalize the vacuum field fluctuation. But as the dynamics of the group configuration grows, there would be more and more incomplete interactions between the Planck scale quanta interacting together as the kinetic relaxation time-or the energy diffusion time would be less; and that **is the increase in entropy and complexity in the universe.** The increase in entropy, is the phenomenon of more interactions being observed as random due to the shortening of the energy diffusion time-which is linearly dependent on the number of Planck scale quanta in a group-the more number of Planck scale quanta a group has the greater the incompleteness and hence the greater hidden unexpressed information which is entropy. The increase in complexity, is the phenomenon of more interactions being possible due to the increase in the number of dimensions being created (and destroyed) which is exponentially related to the number of Planck scale quanta-where the number of and the quanta in a group keeps changing- which gives rise to interesting instantaneous interactions even when the entropy is so large that any interaction is extremely short lived. That is to say-quantum mechanically as the complexity increases the universe will never be dull even when the entropy is very large.

Another way to understand entropy and complexity is this: almost when thermal equilibrium is achieved, that is when more parts(portion-appreciating the classical continuity) of the system have values closer to the mean, (in classical systems, the difference between the mean value and the value at each point which goes on decreasing), less interesting changes can happen in the system. This is the quantum mechanical description of entropy, which also very similar to the quantum mechanical entropy of the system.

But in quantum systems, as the energies are quantized, it's not the difference between the mean value and value at a certain point that carries the information or the possibility that something interesting happens (entropy), but rather the number of quanta of information that a certain quantum in location can represent(complexity). Before the thermal equilibrium some quantum locations had more quanta of information to be represented , others had less quanta of information to be represented; and there was more information concentrated in one region in spacetime and less somewhere else. But as the system approach thermal equilibrium, every quantum of location has almost the same number of quanta of information they can represent-hence some quantum information can more efficiently travel through or interact with more regions of the quantized system. So as entropy increases as the universe evolves and parts of the universe move towards thermal equilibrium, complexity also increases increasing the possibility of spontaneous interesting events. It's sort of also like: when entropy is low parts of the universe are like matrices with incompatible number of rows and columns that represent properties and information-there are more matrices that are incompatible. As entropy increases, these matrices break into more matrices and recombine with others such that more matrices are compatible with others (incompatible matrices are also formed but due to more split and recombination both compatible and incompatible matrices are more giving rise to more interaction)-maybe rectangular matrices become square matrices. So as the complexity increases-that is the activity of splitting and recombination of matrices increases so does the interaction and hence the possibility of something interesting happening instantaneously. However, any such event like any other event would be shorter-lived as complexity and entropy increase because of the increased 'rate' of recombination and splitting.

Corollary 2: According to the idea-the universe has energy in two forms-kinetic and potential; the kinetic energy being the diffusion of energy or interaction between the Planck scale quanta in a group-which is observed as energy exchanges; the potential energy being the dynamics of the group reconfiguration- the dimensional neighborhood, and the mass and motion (yes motion is potential energy which is why momentum is so fundamental) which is also mass being lost in one location and being created in other location at the small scales-which is the localization of the vacuum field fluctuation or the frequency and amplitude of the vacuum field fluctuation. And the total energy is conserved.

Higgs Field and Dark Energy

One more question on this very idea before moving on. Why is dark energy density constant and hence why is space growing? Is it the volume that's growing or is it space? If it's the space that growing why do we observe the volume to be growing?

The constant density of dark energy is better described as because of the quantization of space-time at the Planck scales-not the volume but the spacetime; there can only be a certain amount of energy localized inside a Planck scale quanta which is because like inside a black hole all the particles are virtual and indistinguishable relative to one another. It is the dynamics of the grouping of the Planck scale quanta that changes and as it changes the amount of energy localized in a group of Planck scale quanta changes because the number of Planck scale quanta interacting with each other in different dimensions keep changing. Due to the high activity of group dynamics near the Planck scales-it is plausible to think that other dimensions are small and coiled together as suggested by the String Theory. So as the universe gets cooler that is more dark energy is being created (note: emergence of dark energy is actually very similar to emergence of mass), since the preexisting number of Planck scale quanta can not store more potential energy than before-these Planck scale quanta break into more Planck scale quanta (reminder: Our discussion on part 1 included instantaneous group splitting or seemingly self evolving systems) , so the space grows. As the space grows (not just space –time grows too-which could possibly suggest that in the large cosmic scales time could get slower and perhaps the age of the universe could be less than our projected guess), the potential energy of the universe increases-which can also be described as the increase in the energy of the Planck scale quanta-but since the Planck scale quanta can only have certain energy, they split into more Planck scale quanta(the number of Planck scale quanta defines the volume whereas the group dynamics defines spacetime) –thereby increasing the Volume of the universe.

What is so similar between the Higgs field and dark energy? Are they the same?

Higgs field and dark energy both describe the fluctuation of virtual particles, according to our discussion. Both permeate all of spacetime as the vacuum energy field fluctuations. They are indeed similar. The difference as we see it as that the Higgs field describes the frequency of the fluctuation of virtual particles required to give mass to different kinds of fluctuations, and their properties. Dark energy is more like an explanation to how as more kinetic energy of the universe is converted to potential energy-and as Planck scale quanta can only have certain energy-more spacetime is created as the Planck scale quanta split.

Double slit experiment, Wave phenomenon and quantum tunneling

It might be a good idea, to start off by probing an explanation to the double slit experiment and hence the Feynman path integrals. If an electron is made up of fluctuations of virtual particles that sendoff gravitational waves of tension(in the next quantum of spacetime that the electron's part (this follows from the idea that electron is not a fundamental particle) is observed to appear) and relaxation(in the quantum where the part of the electron is observed to disappear) due to the mobility of the localization of 'more virtual particles' increasing the frequency in the local region creating observable mass, in the quantum of spacetime at the Planck scale as they propagate; the gravitational waves form interference pattern that gives rise to the uncertainty in the position of the electron. But since the interference pattern should have bright and dark fringes, (and the gravitational waves are localized-sent off to two adjacent quantum of spacetime- on one as tension and on the other as relaxation-and the waves are entangled), the uncertainty in position also has gaps inside the range-of where the particle can not be. If a particle can be here and there but not in between-that is exactly the description of quantum uncertainty in momentum; that is the electron can go across the barrier (not through) in no time. Hence, the discussion of the uncertainty principle in the group configuration interpretation is discussed as uncertainty in position being constructive interference of localized gravitational waves, and the uncertainty in momentum being the destructive interference of the localized gravitational waves. We do have to appreciate the idea that one fringe is observed as one Planck scale quantum as interactions inside the Planck scale quanta are localized only to the interacting groups.

Superposition-the indefinite interference of the uncertainty in position and the uncertainty in momentum; the barrier and quantum tunneling

When an electron passes through empty space-the interference pattern of the localized gravitational waves describes the uncertainty in the position and momentum of the constituents of the electron (following from the idea that electron is not fundamental particle). When the electron touches the barrier-that is when the fluctuating virtual particles enter the quantum of spacetime influenced by a lot of other virtual particles with significant frequency that they become the real (non-virtual) barrier, the interference pattern between more gravitational waves (higgs field excitations) increases and is so high that the uncertainty in position is the entire region of barrier. But as our discussion describes the uncertainty in position and momentum as the constructive and destructive interference of gravitational wave, the interference pattern form a series of extremely tiny (because of the large number of gravitational waves due to greater frequency and number at any instant at the barrier), constructive and destructive fringes extending across the barrier. The uncertainty in momentum also extends across the barrier. But at the edge of the barrier is there a Planck scale quantum with a destructive interference or a constructive interference? At the edge of the barrier due to constant interaction with the quanta of spacetime closely on the side to the edge of the barrier, the edge sometimes has the constructive interference while sometimes has the destructive interference. But since the interaction between the Planck scale quanta in a group happens below the Planck scales; to the outside observer it is observed that there is indeed no time difference between the constructive and the destructive interference.
Corollary 3: Both of them exist at the same time-and that is superposition. So this picture of the fringes is like ‘it’s alternate but it is both ways’ at the same time. At the local scale in the barrier the alternate fringe phenomenon is observed. It is important to appreciate the idea that the state of all the quanta concerning the barrier can not be made at the same time-which is before many of them have already changed their states following the uncertainty principle. But since measurements at the Planck scale is not possible, it is impossible to determine the exact edge of the barrier and hence the superposition between constructive and destructive interference exists. The consequences of this idea is that: the particle is here and there at the same time without being somewhere in between but it can also go from one place to the same place in no time (superposition of uncertainty in position and uncertainty in momentum)-which seems to say that the particle can be stationary, which can not be true. So, if we appreciate the superposition(of interference pattern) of the uncertainty in position and uncertainty in momentum, as sort of like when a ball is squeezed one way, it stretches out in the other way (the way

gravitational waves propagate), when the uncertainty in position stretches across the barrier, the uncertainty in momentum stretches perpendicular to the barrier and hence goes through the barrier, when the uncertainty in momentum stretches across the barrier, the uncertainty in position stretches perpendicular to the barrier and hence goes through the barrier. And since these states are in superposition due to the 'indefiniteness' of the boundary, an electron can go through the barrier at the edge-also described as diffraction. This is very well known to be 'quantum tunneling' and is used in tunneling microscopes among other areas.

Infinite slits and the empty space- infinite Feynman path integrals

Now that the electron has passed the barrier, is the space without the barrier like a barrier with no slits or a barrier with infinite slits? We know that the answer is the latter from Feynmen's infinite path integrals. Before we get to that, let's understand one slit and double slit electron diffraction.

When there are slits, there are indefinite boundaries at the edge of slits, and hence quantum tunneling also occurs at the edge of slits. But some localized propagation of vacuum field fluctuations can go through the slit-undisturbed because it's like there is no barrier. But what if there are two or more slits? The important question here is that on the Planck scale how does the gravitational wave propagation of virtual particles on one slit at the local level interfere with the gravitational wave propagation of virtual particles on the other slit, which is at that local scale infinitely far away (which means that we can not observe the alternate pattern of the interference fringes continuously from one slit to another-because we can not measure all of that at the same time); because that is what describes the electron interference pattern observed in the double slit experiment. It is just that we can't observe the alternate pattern-but it holds. But still how do the wave propagation of virtual particles through two slits interfere? Planck scale quanta interacting in Volume dimension send of gravitational waves in Volume dimension(3 dimensions as we think of it otherwise), and it does take some Planck scale quanta for the waves to propagate before they interfere. So if we can get the barrier so close enough that the gravitational wave propagation of the electron have yet not interfered, we will not observe the interference pattern. Which brings us to the question will we observe the electron split into many or will we observe nothing? And that is to be answered with was the electron one or split before it went through the barrier? And to the question how is the space before the slit different from space not before the slit, which we answer by revisiting what it means for an electron to propagate in space?

Does the electron split- Yes, Can we measure it? –We need better detectors.

Space is like a barrier with infinite slits(as described by the infinite Feynman path integrals)- of what?-of fluctuating virtual particles. The constituents of electrons are sending off virtual particles in all neighborhood of volume (and also other dimensions), but due to the dynamics of the group formation-it is conveyed as propagation of the localization of virtual particles. When the electron goes through the barrier with slits-the uncertainty in position and momentum in the neighborhood is so high and hence indefinite that the localization cease to exist due to the high interference of the concerned gravitational waves at the Planck scale quanta. But the uncertainty is definite in the slits and hence the gravitational waves propagate through the slits to recombine on the other side.

The answer is-yes the electron splits in its constituents at the barrier and recombines into an electron after the barrier**. And if we can make such measurements-with the detectors being so close to the barrier that it's before the interference of gravitational waves passing through the slit (of course without the detectors interacting with the barrier which is an enormous challenge), we will observe parts of the electron.** One more question-how is the interference of the gravitational waves passing through the slit localized when they interfere? For that we need to better appreciate the group dynamics of the spacetime in volume neighborhood.

How to collapse stuff into a black hole?

Can electron sized black holes eat quarks(can black holes eat stuff bigger than themselves, how small can a black hole really be?) by ripping them apart into smaller constituents?-or do they just bounce off?

-Putting the postulate to a test

Charge diffuses on the surface of a black hole, when a black hole is perturbed with a charge. If we throw in some electrons, does the charge split? How does it diffuse along the surface of the black hole if charge is quantized? How do we describe that phenomenon? Are the electrons are changed into something else, and separated from the charge?, but what does the charge live on now? Can charge exist independently or do they have to be associated with mass? The charge uniformly diffuses along the surface? But how can we describe the uniform surface charge density-sort of like a layer diffused on the surface, maybe? But charge is supposed to be quantized how does that become uniformly distributed through the surface if we just throw in an electron? Well, we have some very interesting answers to explore. But first let's explore a much more fundamental question of how charge is emergent.

Is charge emergent? How is certain charge assigned to certain masses?

If mass is characterized by the frequency of the virtual particles appearing in a quantum of spacetime, maybe charge characterizes the direction which they into the quantum of spacetime through their motion in that quantum of spacetime , but not exactly the direction from which they come(as in which quantum of spacetime they disappear before appearing in the current one) because that would distinguish some virtual particles from the other and that should not be the case for the these virtual particles to be able to pop into existence into any other quantum of spacetime in the universe and for all of the spacetime to be entangled as the information of entanglement between the gravitational wave of stress due to appearance of a virtual particle in one quantum of spacetime localized to that quantum of spacetime and the gravitational wave of relaxation in the quantum of spacetime that it disappeared from localized to that quantum of spacetime, as such waves carry information to dynamically entangle all of spcacetime. But rather charge is emergent phenomenon that describe the interaction of these virtual particles that are at one instant inside the same quantum of spacetime (in some dimensional neighborhood). Let's get it clear what that means. If a virtual particle while it is appearing in a quantum of spacetime hits another virtual particle in the same quantum of spacetime-that is to say when the second is influenced by the first particle's gravitational wave of tension, the particle influenced by this interaction-the second particle, is observed to bear one of the charges (either positive or negative). The first particle is observed as carrying the opposite charge. If a virtual particle hits another virtual particle when the first one is disappearing from the same quantum of spacetime-that is the second one is influenced by the waves of relaxation of the first one, the charges observed are opposite to those in the previous scenario. And so a neutral charge would be observed if a particle does not interact with another particle during its appearance and disappearance in a quantum of spacetime. That interaction in the same quantum of spacetime between virtual particles is described by the group dynamics of the quanta of spacetime as in some are interacting in some dimensional neighborhood while others are interacting in other dimensional neighborhoods.

But a quantum of space could have many interactions at once meaning a virtual particle in a quantum of spacetime could be interacting with many other virtual particles while it is appearing and many others while it is disappearing, so the charge of a particle is fluctuating.

Corollary 4: Not only is charge emergent but also fluctuating. This is how charges are assigned to masses-which are the localization of virtual particle and so charges are the interactions between the localized virtual particles. Charge is quantized down at the level where spacetime-or virtual particles are quantized; that is to say one interaction of one virtual particle of another virtual particle in the same quantum of spacetime when they are fluctuating out of phase, one such interaction is equivalent to one quantum of charge. This is almost the unification of gravity and electromagnetic forces.

So an electron's charge is just this dynamic interaction between virtual particles in a quantum of space that have been localized to be observed as an electron. So what happens inside an electron is something like more of particles influence others either when disappearing or when appearing in a quantum of space. So let's say if one virtual particle influences others when it appears in that quantum of space-it gives the negative charge, but now that particle disappears together with the other particles it influenced when appearing, but such that when they disappear no other particle appears. So there's this asymmetry that virtual particles appear one by one or some by some but disappear together, and other particles appear after they disappear-and their net gravitational wave of relaxation influences the first particle of the new batch. But we have appreciated the idea that the charge of an electron or anything is fluctuating, so this is not exactly what happens but rather what happens in net most of the time.

Now to black holes with charges

-No hair theorems say that only mass, electric charge and angular momentum of a black hole are observable to an exterior observer

Let's try to bring that relativistic idea in agreement with quantum mechanical reasoning.

According to part 1 of the discussion, black holes change the group dynamics of the matter entering it- making every particle as virtual to every other particle and hence allowing the virtual particles to appear anywhere outside the black hole as hawking radiation. Taking that together with our discussion on the emergence of mass and charge, the mass and charge falling into a black hole is preserved as the fluctuation of virtual particles and hence delocalized to quantum of spacetime outside the black hole. And that is how the mass and charge of the black hole is conveyed to an outside observer. But there's one other interesting thing.

Remember that we talked about when a particle is about to disappear to appear influencing another particle which gives rise to charge- that time delay or the phase difference of the frequency of oscillation of virtual particle in quanta of spacetime is the property of angular momentum. Hence by the above discussion angular momentum of a black hole is observed by an outside observer. Angular momentum describes the interaction between two virtual particles in a quantum of spactime as in the effect of one as the influence of other. Linear momentum describes half of the interaction which is just the influence of such an interaction on a particle and not the complete interaction itself.

So if particles with one type of charge-let's say electrons are thrown into a black hole, the asymmetry of the virtual particles appearing one by one or some by some but disappearing together (in general, but what happens is more active and not as much structured) is conserved as that defines the structure and propagation of the gravitational waves of tension and relaxation, which is conveyed across the horizon as hawking radiation.

We discussed about quantum tunneling in our discussion about the electron diffraction so now let's get that together with discussing the discussion of the hawking radiation as the delocalization of virtual particles to the space outside the black hole from inside the black hole from our discussions from part 1. Quantum tunneling happens due to the indefinite fringe pattern on the edge of the barrier leading which is better described as the interference of the uncertainty in position and the uncertainty in momentum causing the uncertainty of position to stretch in through the barrier as the uncertainty in momentum stretches across the barrier, and vice versa. In the event horizon of the black hole the same phenomenon can be described. Due to the indefinite fringe at the event horizon, quantum tunneling occurs and hawking radiation happens in the same manner. There is one thing special about this comparison. It says that black holes bigger than or at least equal to one quantum of spacetime as projected in dimensions, can still have hawking radiation, which could mean that such small black holes could exist, as hawking radiation alludes to the property that black holes make particles virtual relative to one another and allow them to delocalize as vacuum energy field over all quantum of spacetime. That would lead us to the question of how small can a black hole be? How small of particle be collapsed into a black hole and really what does it mean to collapse matter into black hole?

What does it mean to collapse something into a black hole? And how does black hole separate particles in groups in spacetime that make them virtual?

When we probe the idea of collapsing something into a black hole, Do all of them have to be collapsed at the same time?, that doesn't seem so plausible because we can always add more stuff in the black hole. So do you collapse each particle into different black holes and then merge the black hole together or collapse one particle into a black hole that would eat the other particles? This may not seem as much a big question in itself but it has beautifully designed two more interesting questions in it:

1. If we collapse one particle into a black hole, how small a particle can we collapse into a black hole? Say if we collapse an electron into a black hole, it could still have the atom undergo an attempt for radioactive decay –which is that if we can collapse some electrons of a highly radioactive nuclei, one of them could be pulled to the nucleus as black holes preserve their charge. Since the black hole formed from the electron is much smaller- if it's smaller than a quark, what happens when it hits a quark?

If the quark is in itself not a fundamental particle, it will be ripped apart into smaller particles that the 'much smaller' black hole formed form electron can swallow. But if quarks are really the fundamental particles, and the black hole formed from electron before it gets big enough to swallow quarks if is hit by a quarks do they just bounce off each other? Let's say that we find more fundamental particles in the future, and we put those to the same scenario. How small can a black hole be and more importantly how can it swallow a bigger fundamental particle(electron black holes could also swallow electrons which would still be much bigger since the first one is now a black hole but considering their electrostatic repulsion let's consider opposite charges for now). This could say that with our current understanding that 'everything at the Planck scales should have been black holes', those black holes are unable to eat anything if everything else is a bit bigger than them. So the truly fundamental particles are bigger than the Planck scales, the Planck scale black holes are really just isolated systems that can either eat each other(because of the inherent uncertainty in their size) or evaporate away- **and that is another logical way to the 'group reconfiguration' interpretation.**

Now let's take a path similar to the first one. Say that we need to have at least some fundamental particles to collapse them into a black hole and we can't just collapse one of them into a black hole. This could avoid the 'bouncing off' idea from the second idea we just discussed. And that now leads us to another important question.

2. What does it really mean to collapse something into a black hole? What happens?

To answer that question we will seek the group configuration interpretation. If it requires at least two or some non-virtual particles(which already are a lot of virtual particles) to form a black hole, then when black holes form the virtual particles mess up with each other's frequency of the localization of vacuum energy field, such that the virtual particles can now come into existence anywhere else without following that localization. This could be thought of as the neighborhood in another dimension could have been lost. But how does this happen according to the virtual particles idea? Remember we talked about emergence of charge and momentum from the interactions between virtual particles in the same quantum of spacetime with 'some virtual particles appearing one by one but disappearing together in a quantum of spacetime giving rise to one -say negative charge, while the opposite giving the opposite charge. We did not discuss what happens when one virtual particle is appearing and another is disappearing in a perfect synchrony-but did say that such interaction are much more complex and as a result they can happen. If such a synchrony creates a perfectly destructive interference of the gravitational waves between the appearing particle's gravitational wave of tension and the disappearing particle's gravitational wave of relaxation, the appearing particle even though it's there in that quantum of spacetime appears as virtual to that quantum of spacetime as it apparently has no gravitational influence until it disappears leaving its own gravitational wave of relaxation. Since the appearance and disappearance of the particles and especially the frequency follow the group dynamics which is described by the potential energy dynamics of the universe, due to that quantum of spacetime appearing empty to the quantum of spacetime, the frequency of the appearance and disappearance of virtual particles in those quantum of spacetime where such interference happens. So when some particles are collapsed into a black hole, they influence each other as the above description; increasing the gravitational fluctuation inside the black hole and hence the delocalization throughout all of spacetime. If a single particle can also be collapsed into a black hole, then such interference takes place between the virtual particles that have been localized as a single particle. Our discussion on the group reconfiguration suggests than any particle however small can form a black hole and can eat anything else.

Tiny black holes evaporate away quickly. So such an interference is not uncommon at all, but what happens is such an interference does not just happen continuously on the same quantum of spacetime and increasing the frequency of virtual particles appearing and disappearing in a few quantum of spacetime alone. Such interferences are usually spread out evenly. Another interpretation that since such phenomenon is happening all the time at the Planck scales, maybe that's the reason we get black hole in our equations at the Planck scale-because there exists such a property. But when black holes form such interference is localized increasing the local frequency of appearance and disappearance of the virtual particles, giving rise to what becomes a black hole.

To better understand how group dynamics leads to such interactions, it might be a good idea to revisit what dimensions really are. Then we can build up some understanding about entangled black holes.

What are dimensions really?

We have discussed dimensions as neighborhood in groups as group configurations change as per the group dynamics, and that spacetime are not dimensions themselves but rather the geometry of these dimensions that describe what quantum of spacetime can belong to which groups as groups keep changing. We also discussed that a quantum of spacetime can be belong to a group in a certain dimensional interaction and interact with other quanta of spacetime in another dimensions and that these groups are dynamics. Let's just briefly understand what we mean by the quantum of spacetime. As spacetime is the geometry that describe the group dynamics, a quantum of spacetime is the simplest group in a dimensional neighborhood at one instant in its evolution. Using the idea that virtual particles appearing in a quantum of spacetime (the simplest group not the smallest volume) are indistinguishable (they are all the same and it is only the interaction between them that gives the emergence of properties) we can determine all information on the quantum of spacetime at a single instant (because it's just the interactions that determine properties and not the particles' inherent properties themselves being unique-which is not the case. But remember we did talk about time differences between particles appearing and disappearing in a quantum of spacetime. It was then that all virtual particles were not exactly the same as in they were different in this new parametric property of phase difference. With a bit of uncertainty in time as the property of phase difference we can be a bit more certain about the energy of the particles that became virtual even to the quantum of spacetime-they were not interacting with the quantum of spacetime. This can be better understood with a one dimensional series of particles at different temperatures kept in a system where some had no local flow of energy due to the net flow from the system of that one to the rest of the system being zero; from part 1 of the discussion. The beauty of this idea is that since only interactions between virtual particles define a quantum of spacetime, linear algebra can be beautifully designed to describe the idea. The virtual particle that appears virtual even to the quantum of spacetime it's in can be described as now having a zero real contribution but a non zero imaginary contribution to the interaction because the existence of the particle has a pattern (it is just virtual to the quantum of spacetime (includes at that instant in the definition)). We also need to appreciate that volume is a single dimension and is not the same as space. We also need to appreciate the idea that one type of group or one geometry of group is one dimension and that there may be many localized groups with the same geometry-there will be many systems in a dimension.

So how can we bring the group dynamics together with collapsing black holes in an understanding of dimensions? Persisting imaginary contribution to the group dynamics can define a new geometry of spacetime and hence a new dimension. Through the new dimension, virtual particles inside the black holes can now interact with or appear in the volume neighborhood outside the black holes in a new way. This is the projection of one dimension on the other.

Does entanglement create dimensions? How do things get entangled? With a discussion on that question, we will probe entangled black holes.

Entangled black holes

We discussed that since a virtual particle disappearing in a quantum of spacetime creates a gravitational wave of relaxation in that quantum of spacetime and a gravitational wave of tension in the quantum of spacetime that it appears in. The two waves are exactly the opposite because they carry the exact opposite information and are delocalized throughout all quanta of spacetime; those two waves are said to be entangled. Entanglement is like storing opposite information or same in magnitude information in two different systems. So it is not that entanglement creates a dimension for the transfer of information but rather that the information is identical in magnitude and evolve the same way as long as they are entangled. But since entanglement can happen between real big particles like electrons (even bucky balls), it needs to define a new geometry for entanglements to stay together as a group-defining a new geometry of spacetime- a new dimension. If the group geometry is the same for all group of such virtual particles, entanglement may create just one dimension which may be difficult to achieve in bigger particles. But if geometries of the groups created by entanglement can be different, many dimensions can be created by entanglement and hence different entanglements would have different properties but also bigger particles could be entangled using different geometries.

Inside the three way Einstein Rosen bridge.

The current understanding of entanglement grouping is described by the Einstein Rosen bridge, but at times three way Einstein Rosen bridges or GHG systems seem interesting to define. While this could be described as a new geometry created by entanglement it leads us to a much interesting observation that entanglement can create groups inside a group-which mean that dimensions inside a dimension could exist rather than just two dimensions being independent. The overlap of dimensions could be described using the zero real but imaginary contribution by a virtual particle in a quantum of space-the system contains the virtual particle but everything else inside that quantum of spacetime can act as an independent sub-system and the particle as another independent sub-system (this is only for an analogy with one such particle; there could be a lot of such particles).

What happens when black holes merge?

This might be a really interesting question to probe the understanding of singularity of a black hole. If black holes (more than one) with the same mass merge in a symmetrical motion (which happens when the surrounding gravitational influence on both stays same through their collision), how will the singularities merge. Every singularity pulls on every other singularity with the same gravitational influence. It sounds really cool to state that once inside the event horizon, even another black hole can’t escape another black hole; so there’s no bouncing motion once they collide. Will singularities continue to stay static relative to each other until the symmetry is broken, when the now bigger black hole eats something? Suppose if there’s nothing to eat until it evaporates, will the black hole continue to have multiple singularities until it evaporates? How can we better understand the black hole dynamics at that instant of symmetry Is that hawking radiation different from one from a black hole with single singularity? More interestingly what happens to the stuff inside the black hole?

Theoretical condensed matter physics describes the idea that not even light can escape a black hole as the manifestation of entropy being so large that it is extremely likely that something inside a black hole remains inside the black hole and not escape and the unlikely escape is described as the Hawking radiation. That goes along well with the description from group dynamics interpretation that there is no singularity and just virtual particles inside a black hole, and that is the main reason that this whole description is about entropy but not to miss complexity. According to the group dynamics description, since everything inside a black hole is high activity of virtual particles and hence massive gravitational waves localized within the horizon, when two or more black hole collide the gravitational waves inside the merger becomes stronger and so does the virtual particles' activity (the frequency and energy of appearing and disappearing increase), but there isn't really anything unusual.

And so since theoretical condensed matter physics really appreciates the notions of entropy and complexity, is there anything from group dynamics interpretation that can be sensibly related to theoretical condensed matter physics, and as in: Quantum Chromodynamics analysis of the waves between the flux tube between the force between quarks, and gluons being the change of variables, is there an analogous idea that can be modeled into an experiment?-something like studying black holes as quantum liquids that can be studied in experimental condensed matter physics? The group dynamics interpretation for that would that-the flux tube is not between the quarks but rather quarks are a part of the same tube-since every particle is made up of virtual particles.

Can we see something in the predictions, any reference to condensed matter physics?

As we cool a group of atoms down to Bose Einstein condensate, how does that respond to the vacuum field fluctuations? Superfluid Vacuum theory studies the vacuum of spacetime as Bose Einstien condensate-which is to say that 'superconducting property is a Higgs mechanism'. Superconductors give mass to photons violating gauss' law- and hence there's current without potential difference in the superconducting region. Massive photons can't get into superconducting and hence region superconductors expel magnetic fields.

When photons get mass, they start influencing each other (photons between electric charges forming the electromagnetic field), but ordinarily photons would not interact with each other except when swinger pairs are produced by photon-photon interaction. The electrodynamics between current carrying electrons becomes more like chromodynamics and the electromagnetic field can be explained as wave in the flux tube that carries the force between quarks. The flux tube shields them from their own changing electromagnetic field (due to their motion), hence there is no electromagnetic propagation of the field produced by the photons shielded by their flux tubes. The faraday's law is no more applicable and so is the Lenz's law and hence there is no electromagnetic resistance in a superconductor.

The idea that vacuum is described as a quantum liquid or Bose Einstein condensate does agree with the group dynamics interpretation. The virtual particles are delocalized in a sense that they are virtual and can appear and disappear anywhere defined by the group dynamics, but also localized in a sense that that property is defined by the group reconfiguration. The idea that the virtual phenomenon is describing the Higgs field is in complete agreement that empty space is in fact quantum liquid, and so are black holes. The relationship to experimental super fluidity and super conductivity is promising to make some analogous testable ideas that may appreciate something observable. We will be back with more of that in the part 3 of the discussion.

Postulate 2: The laws of physics are dynamic as the universe evolves

The group dynamics interpretation would suggest that the laws of physics are changing. At what scale? Are they too tiny to be observed? Or do they happen at vast cosmic time scales that no civilization can keep track of them changing? And more puzzling how can we distinguish the changing of the laws of physics from the advancement in our understanding of the universe?

Math Update:

https://m.youtube.com/watch?v=yhtcJPI6AtY

I watched this video that builds the Riemann hypothesis from Mobius function and Von Mangoldt function. Could that make sense here in Feynman's quantization of gravity? The 'non renormalization divergence' corresponding to the analytic continuation of the Riemann Zeta function. The Von Mangoldt function corresponding to the idea of the quantum of gravity. The Mobius function corresponding along with the analytic continuation of Zeta function to the real part of less than or equal to 1, the symmetry accounting for the scalar property of the Higgs field and hence this 'imaginary contribution from negative mass-the asymmetry of the theory of gravity'. But there is a singularity at the pole of Zeta function which could in a way correspond to the idea that the quantum of gravity can not exist as a single entity and hence should be spread across some other set of interactions-corresponding to the non locality of quantum information and preserving the quantum error correcting code. However the Riemann hypothesis is known for the 'non trivial solutions whether entirely being on the half real value or not'. This idea could correspond to the idea of graviton with the spin of two which can be described as sort of the least energy states of the expression of the quantum of gravity in a system of quantum interactions; which would be as much as gravity can be understood as quantum. Does the Riemann Hypothesis describe the Higgs field asymmetry, that gravity can be quantized in distinguishable set of interaction in a system and not as a single interaction, and whether all of the quantum of gravity encode different quantum information even though they are observed as indistinguishable? If this interpretation is correct, it tells us that gravity can be quantized not as interaction between the smallest of masses but rather as localization of gravitational waves. The quantum of gravitational waves encode different information but are indistinguishable to outside observer, which describes the emergence of spacetime from quantum entanglement between localized gravitational waves. The analytic continuation and the asymmetry of the Higgs field would require the quantum of gravity to be fluctuating meaning gravitational waves of tension and relaxation, which account for the negative mass being imaginary as the fundamental distortions of gravitational waves on spacetime as fluctuating and hence that the fundamental particles are such that they appear and disappear in the quantum of spacetime forming gravity waves of tension and relaxation. The minimum energy states of the quantum of gravity, or the non trivial zeroes of Riemann Zeta function correspondingly, describes the Planck scales at which the quantization of spacetime can be described and hence the localization of gravity waves. The singularity at 1 of the Riemann Zeta function would describe that at the fundamental level mass is an emergent phenomenon and so it does not make sense to ask whether there is any smaller particle than that or not. If that makes some sense, more of that in the emergence of spacetime and other interesting ideas.

Proving the Riemann hypothesis to be correct hints at the idea that it is not all of a black hole that localizes gravitational fields, but rather just the Planck scale quanta at the event horizon that do so. If the Riemann hypothesis is proved to be incorrect, this would mean that gravitational waves can not only be localized at the Planck scales but possibly at other scales (as from the least possible energy states of the quantum of gravitational waves are not all the same if any non-trivial zeroes of the Reimann zeta function is found outside the line with real part one half).

With these distinctions in describing black holes, we will be back in paper 3 to build up some more exciting ideas on group dynamics.

-End of paper 2.

We will get back with **Paper 3** of the discussion which will have more ideas on Condensed Matter Physics and experimental modern physics so that we can better appreciate logical consistency in the group dynamics interpretation; to exploring many other such interesting questions and discovering fascinating answers that would lead us to a mind bending journey of intellectual discussion about reality. We will better appreciate the design of experiments that lead to breakthroughs in our understanding of the universe, with more of group dynamics.

Thank You very much!

A perspective on a unified theory of physics

There's chaos at some scale, then there's order at scales larger and smaller. Then there's chaos at scales larger and smaller than that one. And there's order at scales larger and smaller than that one, and so on. A unified theory would I believe appreciate this cyclic behavior, and hence be able to understand the scales that we explore in different contexts, put that into the mathematical construction and be able to predict where in that curve of chaotic-ordered behavior would the scenario of context be described as. Such a mathematical construction would probably require foundations from different ideas in mathematics from geometry and topology, to calculus, to combinatorics and just all the way around really. This fractal symmetry, but also the cyclic property and everything just describing emergence and self-coupling in emergence that leads to disappearance of emergence, or de-emergence of existing properties, and understanding the transition between these states and behavior in systems. Chaos, symmetry and transition-a theory of structures and behavior.

We start off questioning the uniformity of the expansion of the universe, to appreciate and explore how electromagnetic and gravitational interactions could be expressed in terms of each other, and then discover other interesting ideas from Electromagnetic interactions.

Part 3 Questioning the Uniform Expansion of the Universe and trapping bosons in loops in the fabric of spacetime

On the part 2 of our discussion, we discussed that The Hawking Radiation is observed as the fluctuation of vacuum energy field; which is the manifestation of gravitational waves of virtual particles localized at the Planck scale. These gravitational waves are entangled with each other (multi-way entanglement), and hence the virtual particles are indistinguishable and so that is why black holes seem to destroy information from the current perspective in Physics. We discussed that the information is preserved in the randomness of the virtual particle fluctuations, but it would be inaccessible to us-which is kind of a hypocritical way of saying that information is preserved. It says that information is preserved but our access to the information decreases which apparently seems like the microscopic version of "The second law of thermodynamics." But in this discussion, we are going to discuss how our access to information could be preserved-going the other way round. We are going ask some crazy answers, discover and find some really fascinating answers.

The Non-Uniform Expansion of the Universe

From our last discussion: Hawking radiation is what manifests itself as dark energy. Black holes convert matter into Hawking Radiation, which are virtual particles in vacuum energy field, and so as the number (rather the frequency of oscillation of coming into existence and ceasing to exist) of these particles increase, so does the energy of space; but as black holes eat up more objects, the localization of gravitational wave inside and outside the gravitational wave creates more entangled gravitational waves that propagate through all of spacetime producing more virtual particles which is the same as producing more spacetime, because they (their appearance) delocalize even more to maintain the 'undistinguishable' property. In summary: Virtual particles make up spacetime, they are not distinguishable from each other and hence can delocalize over all of spacetime (group splitting), and hence the spacetime expands as black holes turn matter into hawking radiation-which is virtual particles with associated gravitational waves localized and entangled at the Planck scale.

We also discussed that real particles are observed (particles with mass) when the frequency of appearance of virtual particles is high enough they appear as real particles (because their appearance and disappearance is not observed, we also discussed that if we can look deeper mass would be described as an emergent phenomenon and the fundamental particles are all virtual particles). (Incredibly this happens to be another example where energy is proportional (may not be but certainly correlated) to the frequency.) This would also describe pair creation and annihilation, together with the idea of momentum (which we described as virtual particles bumping into each other while they appear in the same quantum of spacetime **(I am really sorry about the confusion, the Particles are spacetime that appear in the quantum of group dynamics, as we discussed that spacetime is the geometry of these group dynamics that take place across different dimensions and interactions. From hereon, whenever I say 'quantum of spacetime' or spacetime let's assume I mean virtual particles in the quantum (rather describing the interactions between quanta) of group dynamics, unless we talk about group dynamics in which case I will state it otherwise. It's a habit to talk about spacetime when you're talking about something so fundamental, but it is not spacetime according to our discussions. That is crazy and that's why we enjoy the idea.)**

Continued… to describe why momentum is another incredible emergent phenomenon.

Let's get to the point. If virtual particles can localize in a quantum of spacetime (**again, I am sorry please excuse me, hereonwards. We are talking about the quantum of group dynamics)** to manifest themselves as real particles.(which is also how we described quantum tunneling, which was pretty cool), virtual particles can localize so much that they do not form real particles at a certain observed scale but the energy of the quantum of spacetime(**Apologies continue)** can be slightly higher than in some other quantum of spacetime-just random clumping somewhere and not as much somewhere else. In that case, since the virtual particle field is described as Dark Energy, the dark energy field would also have random fluctuations, and hence the expansion of the universe would not be uniform. This is against the belief that the expansion of the universe is not uniform, which is a real big deal, but is a really fascinating question to ask (Suppose that if not in our universe, but some other universe such were the case. How would it be like to be there?) And from these un-uniformities, we could actually extract the information encoded in the Hawking radiation and hence the information swallowed by the black holes. That is to say the information becomes more accessible, the more we get better at observing the emergence of mass by virtual particle fluctuation.

A quantized loop

Just a quick interruption, If we could go around a circle, we would just keep going; but we would know that because we repeat after certain time. But if the walk around the circle is quantized-meaning we could take discreet jumps from one point to another, since pi is irrational and hence the circumference of the circle is irrational, we would never end up at the same place again even though we were just going around the circle. This idea could actually be portrayed by the nature of complex numbers which could represent the same phenomenon-you take discreet steps around a circle (especially when we are talking about nth roots and the 2pi has to be divided into n arguments for each root, but that's just like taking discreet jump right except that here we take pi to be rational-because we could end up at the same point after n roots.) and have a tremendous explanation to the Riemann hypothesis as this periodic nature of random walks as portrayed by the Riemann sum, and so if you have a zero sum-you end up where you started (here pi would be rational), but not end up at the same point for non-zero sums (here pi would not be rational) and so this transition between rational behavior and irrational behavior of going around a circle, would be described by the complex numbers. If our universe were closed (or maybe some other universe, or a system) but also quantized at the fundamental level, would pi be rational or irrational? Would we end up at the same place where we started? Could there be a sphere with such properties? Would that have anything to reveal about the nature of surfaces and interiors. (This could actually be another good way to talk about other dimensions). If we can tease answers out of this questions, they will be incredible but also very practical as in understanding the Riemann hypothesis and the nature of complex numbers.

I'm sorry let's continue with the non-uniform expansion of the universe.

Such clumping of virtual particles, would cause slight differences in the expansion of the universe. We'll definitely come to the difference in the Cosmic Microwave Background but first let's describe the nature impact of such an expansion.

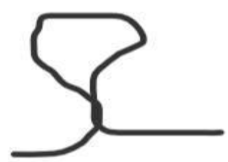
If a portion of spacetime is expanding (stretching) at a different rate than another portion in its immediate neighborhood (the idea of portion and not a single quantum would also be consistent with General Relativity, if no definition exists between the number of quanta required for this idea, which could mean that this non-uniformity is ubiquitous.), the fabric of spacetime can bend over to touch itself to form a loop. If according to the changing group dynamics, if the two portions of spacetime can ghost each other-meaning the loop could pass through itself, and someway of that passing the portions would unghost themselves and get stuck as a loop in the fabric of spacetime-incredible things can happen. The stability of either kind of loop would depend on the diffusion of the difference in the rate of expansion of the universe in the two portions. Since we're talking General Relativity here-above the scale of individual quanta, this phenomenon could likely be observed at scales greater than the Planck scales, and a theory of strings could actually work at scales bigger than the Planck scales.

Photon decomposition and dark matter in the loops of spacetime

Figure 1

If a photon (a lot of mixing between quantum ideas and relativistic ideas, could be confusing and maybe even very inconsistent), happens to be around in the region where this pass through looping happens (assuming that there is many of these events), the photon has two paths to travel going one path would look like going back in time, but the two paths would come together at the point of intersection to become the photon. (**Right- One loops crossing**) <u>**Fabric of spacetime- could it be anti matter described by the loops in the fabric of spacetime due to the un-uniform expansion of the universe?**</u> If the photon has these choices, and the diffusion of the un-uniform expansion breaks the loop, the photon can not go back to being photon. And so what happens is two identical entities-one going backward in time with reference to the other leave the spacetime-**"This is how a photon turns into particle-antiparticle pair". The unification of gravity and electromagnetism lies in this incredible phenomenon, where a photon is caught in a loop in the fabric of spacetime.** We'll shortly come back to if there can be loops that self-intersect more than once, and more on the story of antimatter; but let's first talk about loops that just touch.

Figure 2



If a loop just touches itself, it does not have two paths to go but it is observed to have been delayed or and hence bent greatly as they travel through the un-uniformly stretched fabric of spacetime. We have not discussed actively about dark matter in our previous discussions (I just noticed that I have mis-written dark energy as dark matter somewhere in the article. Please excuse me, that should have been dark energy). (**Left- One loop touching**) **Fabric of spacetime- could it be dark matter delaying the light causing an apparent curvature in the fabric of spacetime?** Now, this touching loop in the fabric of spacetime could be described as dark matter. So, now let's try to explain why dark energy and dark matter are observed at the cosmic scales and not the ordinary scales. They're much weaker than gravity and hence un-observable, but our discussion might lead us in another interesting discussion.

I watched a video, "Hot water freezes faster than warm water." (I can really appreciate the term "water seems to have memory of …" that was in the video, now that I am describing a similar scenario. The difference in the Cosmic Microwave Background, which is light (EM wave) traveling through spacetime. Where there's more active matter-inside galaxies, there's a large difference the photon density (temperature) across the spacetime in that region. In the voids of the cosmos where there's little activity, there's little difference in the photon density (temperature). If the diffusion rate of non-uniformity of the expansion of the universe (the time it takes for the neighboring regions to go back to having the same rate, which again is short lived, and could be the same or highly correlated with the time for the reverse phenomenon), is inversely proportional to the extent of non-uniformity, those regions with greater uniformity will have greater effects, and those with greater un-uniformity would have lesser effects. This idea is the same as saying "Hot water freezes faster than warm water" (which I believe could have a great impact in the ocean-atmospheric dynamics, climate and evolution; and so I submitted a proposal of a project to study this effect (Majorly accounted to Mpemba effect, but also to other interesting ideas), could exist and have impact in the global freezing and melting of water. This idea (coming back to the dark matter and dark energy), would be described as: The loops would live much longer in less active regions because the spacetime is less dynamic there than where there's active cosmic phenomenon like galaxies. If the loops can last much longer, light can go around a lot of times when the loop touches itself(dark matter) misinforming us about the observed masses of the galaxies, and can form virtual particle pairs and annihilate back a lot of time where loops intersect (dark energy). And that's why dark energy and dark matter dominate the large cosmic scales. But as, the scales get larger and there are greater regions of less activity, since the stability time of loops increases-they'd more likely intersect than just touch, and so at the much larger scales Dark energy dominates dark matter, which would describe our current understanding of galaxies clustering, but clusters moving away from each other.

Note: Light can go around in touching loops causing apparent effects of dark matter on the fabric of spacetime curving the path of light. Light breaks down into matter-antimatter pair when loops cross through each other as now there's two directions in time itself.

The Cosmic Microwave Background is very uniform, but at the small fluctuations, they are believed to describe the acoustic waves during before the recombination era when the universe became transparent. However, these fluctuations could also be carrying the information that the expansion of the universe it not as smooth. They certainly hint at structures being formed from quantum fluctuations in the past when the universe was much smaller, which grew into bigger structures as the universe expanded exponentially. But maybe these random fluctuations still have an effect at the large scale of the universe and the information is encoded in the Cosmic Microwave Background field.

Figure 3

Now let's get back to the idea, if there were more than two paths intersecting at the same point. A photon at the junction of several loops (4 loops shown in the figure in the right), has 8 possible paths in the fabric of spacetime. The light would have to go around longer, so a greater effect of dark matter would be observed. If there can be different numbers of loops, there would be different densities of dark matter observed on the fabric of spacetime, and that effect would leave signatures in the dark matter spectrum. And according to the current understanding there are different kinds (degrees of interactions, perhaps) of dark matter: cold, warm and hot.

Why do we have dark matter theories? To explain the extra curvature of spacetime that does not interact with electromagnetic waves, but influence the curvature of spacetime which influences the light that we observes here on earth. It's all about explaining light being bent and delayed(if you will), and even though this conversation sounds crazy, it's a great way to understand how light could get bent and delayed in the fabric of spacetime and could give an apparent gravitational influence. This is just a great conversation to have, a great story, and an interesting question to ask that perhaps has more to offer.

More with loops

Electroweak unification

If a photon trapped in a self-crossing loop in the fabric of spacetime, can produce particle anti-particle pair, a Z boson can also do the same and a W boson could decay into an up type quark and a down type quark when its trapped in a self-crossing loop in the fabric of spacetime. A gluon stuck in a loop in the fabric of spacetime could decay into quark-antiquark pairs or because a gluon can interact with itself, produce two gluons. Each time it seems, a new symmetry is broken in the hierarchy-and is indeed the case. Notice that we're describing these decays as the bosons trapped in a self-crossing and having to go two ways causes the decay. Now let's do some unification.

Figure 4

Left- A case when a boson is caught in two self-crossing loops in the fabric of spacetime. Let's use that to explore the electroweak unification with a labeled diagram on the right. The loop self crossing as shown forms when the universe expands non-uniformly. During electroweak unification: An electroweak boson (before the symmetry breaking), is trapped in such a loop. The boson produces 4 fermions which are all anti to each other in a sense, that four of them would be produced during the boson decay and four of them would be required for annihilation.

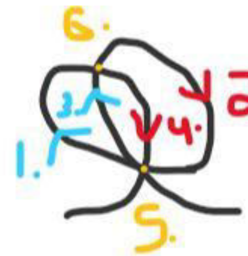
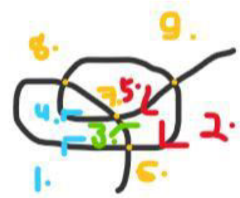


Figure 5

Figure 6

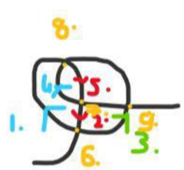
Note: This is different from the case as shown in the diagram to the left, in which case 2 of the bosons could independently annihilate. This case is related to the scenario when the electroweak symmetry breaking happened.

Figure 7



Now let's consider the case to the right, where the two loop vertices do not end at the same points. 1, 2=fermion anti-fermion pair is emitted by the electroweak boson at 6. 3= Since only one fermion anti-fermion pair has been emitted, a part of the boson is left. 4,5=the left boson decays into fermion anti-fermion pair at 7. Recombination happens in geometrical order in 8,9.

Figure 8



On the left is a different looking but the same diagram as the one above. Note: since 3 is a boson, points 7 and 6 are the same location. And so this picture is the same as the one before the symmetry breaking. The only difference is that the electroweak boson can decay in two steps giving rise to two independent boson during the symmetry breaking. During the symmetry breaking, the case figure 5 evolved into figure 6, when two bosons became localized in a loop different than the loop where the other two were localized. Figure 6 evolved in figure 7, as a sort of fluctuation between states 5 and 6. Figure 7 evolved into figure 9-to the right. It's easier to see how figure 8 evolved into figure 9 so, let's see that but since 8 and 7 are identical states, they should be the same. When 3, acquired the properties of what are now weak bosons, since the weak bosons are massive and couple with space, the 3 pushes the second loop away(sort of untangling the knot), to result in state 9, where the double knot is just two independent knots, and the electroweak boson decayed into photon and weak boson.

Figure 9

And so since the weak boson formed in such a loop would push the loops away, at present observable energies, two loops in the fabric of spacetime whenever cross produce two photons-by pair production, but the electroweak bosons do not couple. However, under higher energies that can cause these loops to form, coupling could be observed.

Electrostrong unification

A similar loop untying could describe the symmetry breaking between electroweak and strong force.

But the gluon couples with itself. So, when the electroweak and gluon were set to combine, the gluon decayed into other gluons and so was not compatible with the electroweak boson.

Yet another difference

We discussed fermion anti-fermion production. How was the fermion anti-fermion pair from a photon different from the one from a gluon or weak boson(either of the Ws and the Z)? Before the symmetry breaking, they would be the same. After the symmetry breaking, there are anti color charges and negative hypercharges. The question here is, why are these (almost seemingly particle anti-particle relation) properties of bosons for strong and weak interactions and why is the property of fermions for the electromagnetic interactions? That might get us exploring the shortage of anti matter in the universe but first let's go bigger, and understand why we have not been able to gravity in the unification.

Particle-anti particle states in bosons and fermions, and the story of antimatter

Since the photon has not yet decayed into two bosons, the electromagnetic force has not decomposed into more forced. And maybe the reason behind that is the fact that anti matter (due to charge), can couple with the fabric of spacetime, by which we mean that when anti-particle is trapped in such a loop in the fabric of spacetime, it breaks down into something else. A boson would decouple into a boson, so an anti fermion would decouple into more fermions.

The unification of gravity

Since a gravity boson trapped in the fabric of spacetime would also have to produce pair, we have something to relate from the way it does that. From our previous discussion, we explored that mass is just virtual particle popping into and out of existence in the quantum of group dynamics (**got it right this time**) whose geometries are described by spacetime. A gravity boson trapped in such a loop in the fabric of spacetime, would create some mass but would remove some mass away (in the virtual particle fluctuation), this would tear (sort of puncture) the loop that it's in, tearing apart the fabric of spacetime. Our understanding of the unification and loops in the fabric of spacetime is based on a dynamic but not tearing fabric of spacetime. Disconnected fabrics of spacetime are disconnected in time frames: there's no way to describe the relationship between their relative space and time properties from the perspective of being somewhere in the fabric.

Relativity describes spacetime coordinates related by a continuous fabric, and so does not explain the breaking of spacetime, due to gravity self-coupling. But these kinds of phenomenon could be happening inside black holes and at the planck scales, where the group dynamics idea describes the relationship between torn fabric of spacetime.

And so since gravity self-couples, the expansion of the universe would be un-uniform, as the fabric of spacetime is constantly torn apart. During the era of gravitational unification, gravity self-coupled to rip the fabric of spacetime apart.

What's so special about strings

Strings are loops or open connections that create new couplings. These are the central construction of our discussion about the unification of forces with the perspective of loops in the fabric of spacetime. Strings can describe inherent properties of pieces of torn fabric of spacetime because of their geometry and how entanglement could build the fabric of spacetime. But to bring together the pieces something about the phenomenon of gravity self-coupling could be essential. The interesting feature of group dynamics is that it describes these gravity self-coupling oscillations as entangled virtual particles coming into and out of existence. The idea that entanglement describes the ripped fabric of spacetime is essential in understanding the emergence and quantization of spacetime.

The Higgs in the unification and symmetry breaking: distinction between vector and scalar bosons and supersymmetry

Vector bosons when caught in the fabric of spacetime could decays into a fermion-anti fermion-like property, because vector bosons can be described as collisions. Scalar bosons; the Higgs boson, would not be described the same way when caught in a loop in the fabric of spacetime. With an understanding of this geometry- vectors=collisions, scalars=self-interference, a scalar boson caught in the loop would behave as a wave spreading out, evenly distributing the mass. So when a Higgs boson and a photon are caught in the same loop, the Higgs splits like a wave into more particles. If the higgs and the photon are coupled, which is the case in superconducting systems, the higgs wave spreads out and gives the particles from photon decay- their masses. Since there are two particles, the mass evenly distributed between them causes a particle and an anti-particle to have the same mass.

Earlier we asked a question, why the boson decays into bosonic particle-anti particle property for does strong and weak interactions but fermion pairs for electromagnetic interaction (photon decay). Now if we are able to describe the photon decay as resulting into boson-anti boson pair property, with a supersymmetric adjustment (not SUSY cousin particles but just the idea), the idea might be described as: the boson-anti boson property being assigned to particles by the photon, and masses by the higgs boson; this fits the bigger picture: why does matter-anti matter are oppositely charged but same in all other regards? Because like other bosons photon also decays into matter anti-matter property bosons with positive and negative charges and the higgs trapped with the photon splits into giving the particles their masses.

But what happens when a non-massive photon decays? Remember that we said anti-matter could couple with the fabric of spacetime to discuss why there's a shortage of anti-matter in the universe. Let's apparently change that around for a starter but we'll come back to the idea. Let's say that fermions (matter) couple with the fabric of spacetime. So if a fermion produced from non-massive photon decay coupled with the higgs outside the loop where matter and anti-matter separated, all of the higgs's mass was acquired by the matter, and perhaps anti matter could not couple with the higgs. And so the anti matter would have to decay like a photon whenever trapped in the loops. So, the anti matter would instead couple with the fabric of spacetime as the weak bosons, pushing the loops away. This idea suggests that there could be anti matter or products of anti matter decay out there that do not annihilate with matter. Or maybe, this is a much better answer, when the antimatter not coupled with the Higgs, collided with matter that couped with the Higgs by itself, annihilated the charge but not the mass and hence led to the creation of chargeless particles such as the neutrino. **The antimatter went into producing chargeless property. That is incredible because there is no such thing as flavor-less particle or colourless (not to be confused as white) particles while there is an electrically neutral particle. The case with gravity is as we have discussed, more subtle as the coupling dictates the ripping of spacetime.**

There are two incredible things about this idea. One, how do you produce mass from massless bosons? You don't. You produce particle-anti particle property of charge from a photon, which when coupled with Higgs in the same loop in the fabric of spacetime, the Higgs gives evenly distributed mass to the particle anti-particle properties. Particle anti-particles are properties of interaction, the mass arises from interaction with the Higgs. The idea also explains the shortage of anti-matter (the latter one is incredible). Two, the phenomenon for the shortage of anti-matter and mechanism of decay of non-massive photon (only photon and not a Higgs trapped in the same loop), can describe the fine tuning cancellation associated with the Higgs's mass in the hierarchy problem.

Riemann hypothesis, discreet walks, and the loops in the fabric of spacetime

Previously in this discussion we discussed about discreet walks around a circle. In an article about complex numbers, Riemann hypothesis and discreet periodic walks with uncertain transitions, we discussed about the inherent discreet periodicities. If we can use a similar idea to describe these quantized loops in the fabric of spacetime. We can describe the idea in relation to the group dynamics. The uncertain transition here is the distinction between separated and non-separated bosons in the loops. This could help us answer, how close do matter and anti-matter have to get to annihilate each other? Is there a vertex in the loop, or is a different geometry better at describing the idea. And since inside the loop, the description of time(evolution) would be very different and so the idea of uncertain transition from the complex numbers could be analogous to: a loop or a quantum in the fabric of spacetime describing a system within itself, as complex number described a distribution of uncertain transition from a state to an imaginary state and back to itself, from the discussion about complex number and the Riemann hypothesis. As for the Riemann hypothesis, there probably is more to describing the weird world around us.

I watched a talk from Jordan Ellenberg at the Royal Institute: How not to be wrong: The power of mathematical thinking (https://www.youtube.com/watch?v=kZTKuMBJP7Y) in which he talked about a state lottery ticket with a positive expectation for the buyer, which was pretty weird in the beginning but had a unique story. Out of the three parties who bought tickets, one of them wrote the tickets by hand to minimize the risk. And that strategy to have the lest risky tickets were written using projective geometry. And this geometric notion describes combinatorics in a way that is very clear and allows for complex constructions. The geometry of the loop in spacetime is subtle yet intriguing. Even it is doubtful the later part of the discussion could be formulated in mathematical ideas describing Hamiltonians in spacetime and, algebra and geometries in quantum mechanics, the description of dark matter and photon decays seems really interesting to follow and ask more questions to. There will be more questions to answer and more answers to questions.

That is exactly how I have been writing these conversations by asking questions to myself, understanding what those questions mean, exploring the wild possibilities of answers, asking questions to the answers to understand what they describe and discussing even more questions and answers.

When I'm discussing ideas with myself, no question is a bad question, no answer is too weak. The conversation is what takes the progress of education forward, and with these conversations with myself I enjoy learning the way I love it most-through conversations. And so when I find a community where I can have intellectual conversations across ideas that fascinate me, with people who are excited to learn together and explore intriguing insights, and become a part of the educational experience, I believe I will be able to compliment and contribute to the conversations in these communities, do the awesome researches I've always wanted to do and enjoy learning and discovering more incredible ideas with a community passionate about learning together.

Cheers! To intellectual conversations, the freedom to learn and the amazing communities that inspire learning together.

Explaining the Photon coupling experiment

Experiments by the team, led by Vladan Vuletic, the Lester Wolfe Professor of Physics at MIT, and Professor Mikhail Lukin from Harvard University recently discovered photons coupling in triplets to be strongly correlated than those previously discovered to be coupling in pairs exiting ultracold rubidium atoms. Remember, we discussed that loops are stable in less dense regions and hence dark matter has greater impact in the larger structures than in scales with higher density and activity-the galactic medium. If we can create less active medium, ultracold condensed matter systems, loops could be stable. What happens if the loops were quite stable and a photon coupled with Higgs in a loop never decayed? The particle anti particle polarity could be conveyed to a neighboring portion in the fabric of sapcetime creating loops in the neighborhood. This could be true not because of the charge, but because going forward in time and going backward in time inside the loop-the vertex in the loop allows for more loops to be added to form like a chain of loops. When two or more photons in neighboring loops interact because of the loops, they become correlated and also-massive. More photons could correlate better because of the boundary conditions, and the stability-they couldn't decay and would have to follow a uniform pattern-phase.

Eternal inflation, big bang and the dynamic scale of the universe

The stability of these loops could help us understand the large scale structures in the universe and a possibility for eternal inflation. As the universe expands, dominated by dark energy; cosmic horizons become smaller and smaller. The clusters inside a horizon collapse into a high density states, dominated by dark matter and normal matter gravity. The collapse bounces of creating the new big bang-creating a new universe that is now a piece of fractal like many other such fractals in the universe that existed before this one. The universe grows governed by similar physical laws and end up producing the next generation of fractals, or could evolve to give out new laws of physics and still end up the same way, or these new laws of physics would detach the universe from the sea of island universes, into a bubble of multiverses beyond the fabric of space and time.

If anything could be understood about the fate and history of the cosmic evolution far beyond the big bang describing the stability of these loops, there should be signatures of unstable and stabilizing structures in the universe. If we are to describe the un-uniform expansion of the universe, there should have been slight evidences of changing scales of mass, length, time etc. over large cosmic scales.

Explaining the uniformity in the mass of hydrogen across the universe

Local structures in a non-uniformly expanding universe could produce different time scales, among other things, not considering the influence of regular and dark matter gravity. I watched a talk from Harvard Smithsonian CFA colloquium, which included an experiment to measure the uniformity in the mass of Hydrogen across the universe, and the results concluded that it was uniform with an uncertainty of 1 in 100 million. Based on the experiment, it could be inferred that the expansion of the universe was smooth and time variation across the universe was uniform.

To describe the observations, let's try to describe what happens when the loops break down (untie really, not ripping the fabric of spacetime apart).

What happens when the loops break?

When a loop forms, it would have to localize gravitational waves and when it breaks it would release the tiny gravity waves. This is how diffusion of the non-uniform expansion keeps the non uniformity from growing and brings it back to a steady state. But what happens to the particles trapped and formed, because they carry the signature of a deformation in time and space.

And that requires some more conversation, more findings, more intriguing questions and more fascinating answers. We will return with Part 4 of the discussion: Particles lost in space and time, and structures in the universe

Part 1 was about exploring a new idea called group dynamics to describe the universe at its extreme: below the Planck scales and around black holes. In Part 2, we explored the entanglement and emergence of spacetime, and in Part 3, we probed loops in the fabric of

spacetime to tease the possibility of un-uniform expansion of the universe. We will keep exploring more fascinating ideas about the universe, and soon in Part 4, we will describe particles lost in space and time, and the structures in the universe.

In part 4, we will probe ideas like: If time is just an evolution of one state to the other, how are the past, present and the future different from each other; what-if any, emergent properties accompany the evolution of systems? Does present even exist? Can we go back in the past? And what is future? What does going slower, forward or backward mean?

"Time is what a clock measures." –Einstein. Does time need to be measured, or does it enforces measurement on systems? What resonates from the different timekeeping by different systems? Why do some things resonate and others don't? What can we infer about time, from our measurements of time in different kinds of systems, including condensed matter systems; and how can we understand the dynamics of the structures (patterns) in the universe.

Thank you very much!

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1) The factoring of a^2-b^2 and the associated area.

| described for $a>b$

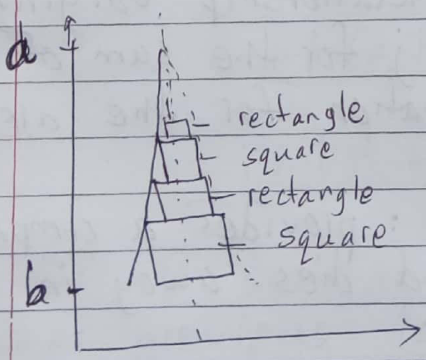
a^2-b^2
$=(a+b)(a-b)$
$=\{(a-b)+b+b\}(a-b)$
$=(a-b)^2+2b(a-b)$

which can be understood as area of square of side $(a-b)$; the difference of the two numbers a and $\to a>b$, and the area of the rectangle with sides $2b$ and $(a-b)$.

$F' = \sum_j (a^2-b^2).f(j)$ is defines

as the sum of areas of squares and rectangles with sides varied over a parameter j, describing the factoring of a^2-b^2.

Graph 1)



(i) Note that squares and rectangles are placed alternately

(ii) The sides of the rectangles and squares vary as with the parameter j, but the predefined relationship is maintained.

(iii) The side $2b(a-b)$ of the rectangle rests on the square.

(iv) The area under this imaginary curve represents the sum.

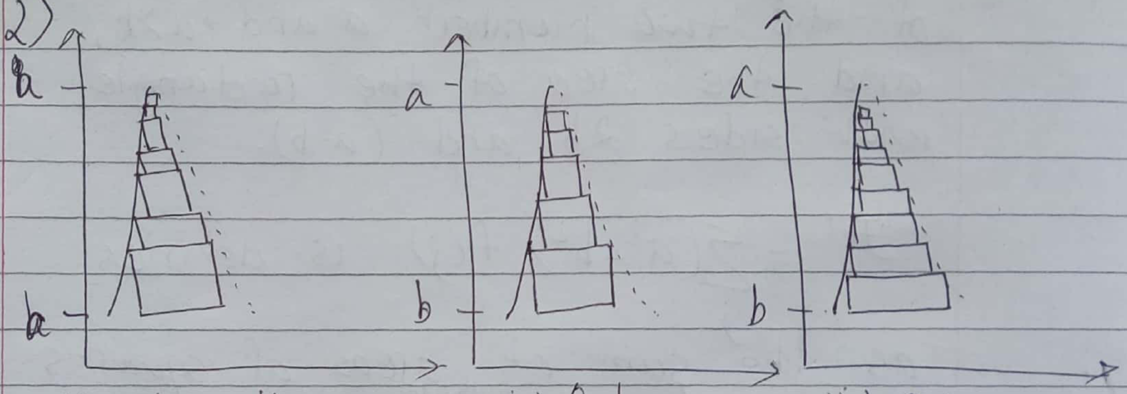
TNPL

DATE / /

(v) The number of rectangles and square and the length of their successive side lengths as described by the parameter j allow for a wide range of controllable area pieces and sort of a decomposition of a^2-b^2.

- The case for alternating squares and rectangles.

Graph 2)



(i) Alternating squares and rectangles (ii) Only squares (iii) Only rectangles

For the predefined relationship varying over the parameter j for the sum of a^2-b^2, the approximation for the area under the curve

(ii) For only squares: provides a comparably bad approximation and dies away in fewer no. of terms.

(iii) For only rectangles: proves a better approximation but persists for greater number of terms.

(iii) For alternating squares and rectangles:

TNPL
DATE / /

the no. of terms can be controlled with the parameter j, with a balance tradeoff with the approximation.

Note:
(a) Only Rectangles could have done the role of alternating squares and rectangles better if the predefined relationship was ignored, but we'll see the meaning of the construction in a while.

(b) This is not for a limit as squares and rectangles going to 0; alothough it does work better in that case, but to study such defined ~~disc~~ appoximation for discreet sums.

2) Sum of the integers between a and b
Sum is given by the formula:

$$Sum = \frac{(a+b+1)(a-b)}{2} \quad \Big| \; a > b.$$

$$= \frac{\{b+(a-b)+b+1\}(a-b)}{2}$$

$$= \frac{(a-b)^2 + 2b(a-b)}{2} + \frac{a-b}{2}.$$

For a similar description ~~between~~ as the previous topic.

the sum varied over the parameter

$$S = \sum_j \frac{(a-b)^2 + 2b(a-b)}{2} + \frac{a-b}{2}.$$

TNPL

DATE / /

If $\sum_{j} \frac{(a-b)f(j)}{2} = 0$;

$$S = \frac{F}{2}.$$

but keeping the predefined relationship, this would only happen when $a=b$, but at that condition S and F both would be equal to zero.

So, we need a construction of such analogy wher $S = \frac{F}{2}$.

3) Factoring a^2+b^2; the case for complex numbers:

$$a^2+b^2$$
$$=(a+bi)(a-bi) \qquad \text{where } i=\sqrt{-1}$$
$$=(a-bi)(a-bi+2bi)$$
$$=(a-bi)^2+2bi(a-bi)$$

Let F' varied over the parameter j represent the sum

$$F' = \sum_{j} (a-bi)^2 + 2bi(a-bi)$$

As in part (2), let $S' = \frac{F'}{2}$ represent a corresponding sum

$$S' = \sum_{j} \frac{(a-bi)^2}{2} + \frac{2bi(a-bi)}{2}$$

and $S'' = \sum_{j} \frac{(a-bi)^2}{2} + \frac{2bi(a-bi)}{2} + \frac{a-bi}{2}$

$$= \frac{F'}{2} + \frac{a-bi}{2}$$

represent a sum (corresponding analogous) to S.

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$$s'' = \frac{F'}{2} + \frac{a-bi}{2}$$

- Note: We have initially described a and b as real numbers.

But if we were to use $a = bi$ and $b = ia$ in the same framework, for the following term $\left(\frac{a-bi}{2}\right)$.

$$F' = \sum_j \frac{a^2+b^2-2abi+2abi-2b^2i^2}{2} f(j)$$

$$= \sum_j \frac{a^2\cancel{+}-b^2}{2} f(j) = F = \frac{S}{2} \text{ for the case } a=b.$$

4) The meaning of $a^2+b^2 \to a^2-b^2$ correspondence.

a^2-b^2 varied over a parameter j was an approximation of the area under the corresponding graph.

a^2+b^2 varied over a parameter j could be understood as the similar apporoximating value if $a = bi$ or, $b = -ia$ in the same construction but violating the preconceived notion that a and b are real numbers.

$a^2+b^2 = r^2$ in complex description $a+bi$ and $a-bi$. We are trying to deconstruct r^2 in a distribution represented by a^2+b^2, sort of unfolding the circle in some way.

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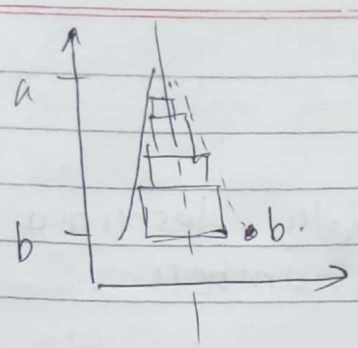
Graph3.



Graph 3, the same as graph 1, depitcs the idea that, if a value stayed at but ; but a construction is to be defined for ~~time~~ states between the two successive times it was b; a is defined. A value was b, after some states during its change it came back to the value b.

Since the sum a^2-b^2 describes the discreet sum of intermediate states betweer a and b, the sum would be 0 for the sum of intermediate states between b and b.

So we define that b changed to state a and then to b; where a is an intermediate state which gives us the description of this cycle. But describing a as an imaginary value informs us of a cycle with 2 steps.

As described by $S'' = \frac{F'}{2}$ for the condition, the symmetry normalization would describe the 1 step equivalent of the evolution.

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TNPL
DATE / /

5) Question: Why describe b as a cycle of 1step than just a step of no cycle?

If we repeat b for some number of times, even though there is no change in b, there is a relationship between the intermediate stages (which are imaginary).

$2+3i$, $2+5i$, $2+0.5i$

this series of complex numbers represents a constant value but an evolution and relationship between the imaginary intermediate stages.
So, even if the real value 2 does not change; it is a part of repeated cycles as characterized by the imaginary values.

- Concluding argument:
Complex numbers represent values that are part of a cycle; here $2+3i$, $2+5i$, $2+0.5i$ are part of a cycle with combination smaller periods characterized by the changing imaginary parts, whose real observation remains constant.

Fourier argument: This is sort of like creating a combination of waves for single and discreet values.

DATE / /

6) Euler's formula to the rescue:

$e^{i\theta} = \cos\theta + i\sin\theta$;

$e^{i\theta} \cdot e^{-i\theta}$, where $e^{-i\theta}$ is the complex conjugate of $e^{i\theta}$

$= 1$. while on the right,

$\cos^2\theta + \sin^2\theta = 1$

for a similar corresponding analogy

$$\sum_j (a^2+b^2) f(j) \sim \sum_j f(j) \cdot k$$

where

$\sum_k (a^2+b^2) = k$; k depends on the correspondence of $a, b \to \sin\theta, \cos\theta$.

in this case sines and cosines represent a continuous spectrum of values.

However for an analogous discreet spectrum of values, the argument would not be correct because the approximation could be of shapes other than a circle as per the parameter j.

However, the transformation

$a \to ka$; $b \to kb$ [$\because$ ellipse to circle]

would get it back to the relation.

- $\sum a^2+b^2$ could represent periodic property of sines and cosines if our elliptic approximations are transformable to circular ones.
- A sine, cosine, periodic desription is described for the elliptic approximatio

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TNPL DATE / /

- Also, $re^{i\theta}$ described a point on the circle r, so in the complex form, a random complex number $a+bi$ should inherit the property.

7) Let's remind ourselves what we did.

1) Described area under an elliptic distribution with $\sum(a^2-b^2)f(j)=F$

2) Described the sum of the integers between a and b, S, in a relation to the F. $S=\frac{F}{2}$ for $a=b$.

3) Described a similar factoring for $\sum(a^2+b^2)f(j)=F'$ and a made up corresponding S' of the form S with parameters corresponding from $F \to F'$.

4) If $a=bi$, or $b=-ia$ for the term $\frac{a-bi}{2}$ in $S''=\frac{F'}{2}+\frac{a-bi}{2}$,

$F'=F-\frac{S}{2}$. The factoring of a^2+b^2 using complex numbers to describe that Area approximation under the curve would be almost equal to the sum of the integers between a and b.

The preconceived notion of both a and $b \in \mathbb{R}$ is violated so that ~~at least~~ exactly one of them is complex with (just imaginary part)(real part $=0$).

This is done to described the kind of discreet walk with ~~undefina~~ transitions that are not properly defined as in $(1+1+\ldots)+(\ldots-1-1)$ to establish that sum of the steps is the total area under a curve that represents the sum of the integers.

Note: The factor of 2 describes the symmetry of rectangle and squares and the area described.

TNPL
DATE / /

This is intended to describe the transition from a to b and back to a.
The idea that b is imaginary (real part = 0), implies of a cyclic distribution of transitions for a steady value of a real part of a complex number, thus implying the complex numbers inherently describe a distribution of cycles.
The imaginary part carries the information regarding the characteristics of the cycle (periodicity) associated with the real part.
This could describe the root of $x^2+1=0$ as; crossing $y=0$ at 2 undefined states as ~~part~~ conveyed by the complex ~~imaginary~~ roots;

Note: This part is quite unsatisfyingly described, even though it is the central part of the argument described mathematically.

5) $2+3i$, $2+5i$, $2+0.5i$, $2+0i$, 2 are ~~understood~~ described as per the argument where the first four represent values of same quatity corresponding to different cycles, while 2 to be a value described with any periodic affiliation.

6) $e^{i\theta} = \cos\theta + i\sin\theta$ is used to describe the periodicity of complex

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numbers described previously.
A transformation of elliptic → circular as of discreet → continuous is discussed for affirmations to $\cos^2\theta + \sin^2\theta = 1$ and ~~a possibilit~~ the relation of the discussed mathematical construction to these two ideas.

The description involves the relationship between discreet values summed over a changing parameter, which is studied as a cycle with a property that all of the steps are not properly definable.

Complex numbers describe a distribution (a periodic cycle) associated with them, which defines a^2+b^2 ; which as per the discussed construction are described as a^2-b^2; the construction which relates a^2-b^2 to the discreet sum between a and b. The discreet sum between a and b describe of the of the symettric distribution from a to b and back to a. If b is not properly defined and considered complex, the phenomenon a to a. described as an associated cyclic distribution is described by the sum a^2+b^2; which defines the complex period of discreet states of a walk.

Asymptotics and Periodicity in Riemann Hypothesis

The wave perspective at Riemann sums

Zeta function at 1.

The Grande series 1+1-1+1-1+1….. is descried as ½ by Cesàro sum. But if written as (1+1+1+….)+(…..-1-1-1) is equivalent to the description of someone going northwards relavite to a point on the earth's surface and eventually approaching the point from the south without actually passing through the point, which we described earlier as imaginary transition as captured by the idea of complex solution. As for the purposes of this discussion we consider that the value on the right side is a finite quantity, but the value itself is not important to the discussion.

The Zeta function at 1 is 1+2+3+4+5+…… which is described as -1/12. The idea that the right hand side is a finite value represents the idea that even though I kept going north for an infinitely long time, I ended up south than the 'northmost point'. Of course, if I keep going north for an infinitely long time, I will end up where I started infinitely many times.

The idea is to use the fact that the Riemann sum at real part=0.5 with a similar analogy, implying of a wave perspective at the Riemann hypothesis.

So, what's the perspective?

The zeroes of the Riemann sum being equal to zero is described as the imaginary transition through the state of a walk analogous to walking around the earth, as ending up at the same point. Negative values would imply of eventually ending up at a point southwards relative to where we started (in our analogy), and positive values would imply ending up at a point northwards than where we started, but southwards than where we continued (we continued walking north indefinitely).

Note:

1. This is only described for analytic continuation of the function. For those sums with defined real values, an analogy of going north, stopping and returning southwards in a properly defined evolution of states is an appropriate analogy for this discussion.
2. The idea of ending up 1 unit northwards from where we started, and the idea of ending up 5 units southwards from where we started; as described by the values on the right of the

Riemann's sum, inherently contains the idea that we can not define the fact that if we have ended up at 5 units south of where we started, we will be able to reach 1 unit north of where we started in the same walk. This may be understood as an analogy that if we move northeast, but maintain the angle (as described by some other parameter) of the cross section of the circular path around the earth, the length of the path could either increase or decrease as the radius would do, and we may not may not be able to end up at another value of northness relative to where we started. So, ending up at a point does not imply that we should have ended up at another point south of that point, this is inherent in the definition that we define tge cycle as 'not properly defined returning'. The east and west value could be described as imaginary values of the path, with sums defined at complex values.

Riemann Hypothesis

"The non trivial zeroes all have real part of 0.5"

The idea is that a feature of this periodic walk as something like number of steps (as given by the real part), if is 0, whatever the length, or size of the wave maybe or some feature that determine the shift we could adjust in our walk which would bring us back to the same point as without the shift (as described by the fact that imaginary part could be any value), we always end up where we started (the zeroes of the function), but not necessarily at some point south of that point too.

How do we describe the walk?

We have describe the walk based on some defined parameters. How do we define the parameters?-we construct them using the trivial zeroes. If for other paths where only with the feature of something like these many number of steps (the fixed real parts), and the shift feature being only= 0(the complex part), do we end up where we started. Is it true for a defined feature of walk evolution like the number of steps of 0.5(real part), any value of shift feature (the imaginary part), of a cyclic walk or evolution based on defined parameters, we end up where we started; with an inherent description that we end up somewhere does not imply that we must also visit a point nearby.- That would be the perspective on the Riemann hypothesis.

Random walks, complex numbers and Riemann hypothesis

Transient random walks corresponding to infinite Cayley graphs describe the Banach Tarski theorem. The walk, or the feature depicted by the real part and the periodic property depicted by the imaginary part to understand the Riemann sums, can be described with random walks, and Cayley graph transformations; also both the walks are described as discreet walks. The Riemann sums, can be described as recurring random walks; zeroes as recurring ones, but the directional recurrence or transience would depend on slight modifications to the Riemann walk(seems exciting to call it that too) and probably have something more to define about the walk, and shift of the state of transiency could describe some interesting sums such as the Riemann sum at 1.

Mobius function, Von Mongoldt function

https://www.youtube.com/watch?v=yhtcJPI6AtY This is the talk "The Riemann Hypothesis: How to make $1 Million Without Getting Out of Bed" on Yale Math Mornings by Professor Alex Kontorovich. I had not learned about the relationship of the Mobius and Von-Mangoldt functions with the Riemann zeta function. The idea about co primes, and prime ratios was really fascinating, however it the fluctuating 'periodic' description laid out by the Mobius and Von Mangoldt functions, that are of interest in this understanding of the Riemann sum as periodic walks. In that case a relationship between understanding the Primes numbers could also be described with the essence of complex numbers, and their inherent periodic property.

Asymptotics

The function y=1/x is a hyperbolic phenomenon, with its asymptotes x=0, and y=0. As we walk towards x approaching 0, y approaches positive infinity. We keep approaching x=0, y keeps getting large. But approaching x=0 from the negative side, y goes to negative infinity. The idea of when "we stop moving up in y and appear somewhere low in y", happens, is not properly defined. This is almost like the idea the Riemann sums. These two ideas can be described with proper mathematical description, if the 'switch in direction happens somewhere in a finite value that we cannot properly define'; it should be finite but we will not be able to pinpoint the value. Since, the walk is discreet few steps can greatly influence compatibility (especially when we're talking about returning to a defined position), as in (1+1-1+1-1…) where an extra term flips the result. In the case of the earth, we ended up south of where we started even though we headed north was because the circumference of the earth is finite. This is important, the property of the walk should be finite for this analogy. This can be done with transform functions, with defined features of the walk(maybe something like the area between the curve 1/x and two of it's asymptotes equals a finite value and so that the graphs can be inferred as Riemann sums, and these properties would be dictated by the nature of walks. If it is so, the properties of the walk can be studied in asymptotic analyses.

Fun fact: At the heart of this idea, is the assumption that Complex numbers inherently describe discreet quantities that are part of a period.

Thank You very much!

Part 4 Self-interaction, Time and Least Action

Feeling one's own field

In classical theories like classical electromagnetism, a force is defined for two charges, and so charge is defined as the property due to which a charge feels the electric field created by another charge. If there was just a single charge, the charge would not feel its own electric field, and indeed any electric field. But in quantum field theories like the Quantum Electrodynamics, interesting things can happen.

Let's assume that there's only one fermion particle in the universe currently and its an electron. Let's say that the electron vibrates and emits photons. However, since a photon can decay into particle anti particle pair, let's say that some of these photons (would probably have to be a lot of emissions) decay into particle-anti particle pairs, and that some of the particle-anti particle pairs happen to be an electron and a positron. Let's assume that some of these pairs manage to have such a momentum configuration that the positron comes back to annihilate with the initial electron. Boom! The electron just felt its own field. Although such a condition is extremely highly unlikely, (we just isolated the electron to remove other effects, but this could happen with everything buzzing around, too; just way bit tiny probability), this is an exciting phenomenon. So, if a particle could feel its own field, then the force better be described for every particle-that is one important feature of Quantum Field Theories-they describe all particles as excitations in corresponding fields, and particles can decay.

There's another interesting phenomenon here, the positron annihilated the initial electron, but the one that was produced during the decay moved on, and so the charge of the electron travelled, the information about its field was conveyed. Wait a second! That sounds familiar. How does an electron talks to another electron?-by exchanging virtual photons. Let's say an electron is essentially at rest (other than the uncertainty principle), if it can produce a virtual photon that decays into an electron and an anti-electron such that the anti-electron annihilates the initial electron and the new electron moves on, what would happen? Of course, we don't want the initial electron to be annihilated, but intermediate electrons of such a chain to be annihilated and the charge of the electron to be carried away. In essence, a virtual photon consists of virtual electron and positron pairs in that configuration where one annihilates with the previous one and the new one lives on to carry the information. But what about the electrostatic interactions between an electron and a proton. It wouldn't work would it? It could work if the virtual particle-anti particle pairs could have gravitational adjustments corresponding to frames of reference in special relativity, and the property of the virtual particle-anti particle pairs is that they only represent annihilate-able charge property.

So, the natural question is why is this any better than a photon mediating the interaction, right? Because this idea describes how a particle can feel its own gravitational field. The virtual photon emitted by an electron is an electron-anti electron pair from its gravitational frame of reference while it is a proton-anti proton pair from the gravitational frame of reference of the proton, which are correspondingly renormalize-able. If a vibrating charge produces photon that is capable of particle anti particle decay with associated probabilities, a charge at rest-since it is moving as per the uncertainty principle, produces a virtual photon that is capable of producing particle-anti particle pairs which convey the electric field. The reason everybody is virtual is because they started in the same frame of reference as the charge that produced it. Particles are radiated in all directions, as is the electric field, unless the particles are absorbed by electromagnetic shielding. Because anybody who made measurements of the electron would account for the uncertainty in its momentum and hence not observe the virtual particles. Those who did not measure the electron's motion would not be in the same gravitational frame of reference and be unable to observe the virtual particles. And this sounds pretty sloppy, but were are now going to discuss the gravitational frame of reference, which is a pretty interesting idea.

A particle can feel its own gravitational field, like the electric field. We discussed in part 2 of our discussion that real particles are localization of virtual particles or better increase frequency of virtual particles appearing and disappearing in the vacuum excitation field. When the frequency of appearance increases and decreases; fluctuates a little bit by the uncertainty principle, slight changes in the tension and relaxation of the fabric of spacetime sends out ripples of gravitational waves, which when localized can convey the gravity of a mass to itself. This is a specific case of renormalization of the gravitational frame of reference, and hence describes the virtual bosons of Coulomb force. But the fact that a mass can feel its own gravitational force has profound consequences.

"Time is what a clock measures."

Measurements are interactions. Everything that interacts, keeps track of time and evolves; which is to say that everything keep their own time. But what if there was only one particle in the universe? Will there be time? Will there be evolution? If a mass can feel its own gravitational field, its own electric field and maybe all of its properties, it can detect fluctuations in its properties and hence time is fundamental-because it defines how particles feel their presence. Now, I know where this is getting-Is there something to consciousness from this? We'll keep that for some other time when we will ask great questions about neuroscience.

And so since time is fundamental because particles can feel their own field, I find it interesting to imply the inverse-evolution of time allows particles to feel their own fields (we'll eventually get there to interaction with others in a while). So what would happen if everything was still and time did not evolve? (I find it weird to call time evolving, because time is itself the evolution of a system but in geometrical description as in earlier discussions it could imply of other ideas). If a universe (meaning no influence from anything other than what we are talking about), started out in such a state, it would not evolve because the particles would not be able to feel themselves. Everything would be deterministic and static. So our universe could not have evolved from a state where particles would not feel their own properties, but it could have evolved from a state where particles only felt their own fields and not anybody else's. Let's check that out.

A universe where things only felt themselves

During the Planck era, the four forces were unified into a single force. The electro-strong force became distinct from gravity shortly afterwards, which allowed for interactions to form clumps of particles using the almost-uniform gravity. But during the unification, gravity was so much more different than as we know it today. During the Planck era, particles were so energetic they would not feel anybody other than themselves-"virtual particles of a collection formed as a real particle would go through the collection of virtual particles forming their neighbor real particle, even before they were fluctuating and so they wouldn't even interact. The way gravity and the other three forces were the same was that none of them would not be used for particle-particle interactions. We discussed in part three how a boson trapped in a loop in the fabric of spacetime could decay into bosons that would not recombine as the universe cooled (but would recombine at higher energies) giving rise to new interactions.

But gravity itself could not decompose into other fields. The fabric of spacetime would have to create its own boson and since it would self-couple, decay into other types of bosons. A gravity boson would be a localized gravitational wave. Gravitational waves can be localized when quantum of spacetime are isolated. But during the early Planck area, before gravity part ways with the other three, there was no gravity bosons and hence the universe was continuous and not quantized. We did discuss how a group could split into more groups which initially could have continuous properties but could self-evolve to become quantized-in part 1, when we discussed the ideas of group dynamics.

So our universe was continuous during the early Planck era. This would mean that more than one point was also a single point (from understanding continuum properties and from group dynamics). And so the energy density of every point was higher than the energy density of the universe. And that is why nobody felt the presence of anybody other than themselves. That is also why every point in the universe at present is the center of the universe, because of evolution from such a state. That is also why the universe was expanding non-uniformly and hence loops in the fabric of spacetime could cross each other (from part 3 of our discussion). And so when the universe was quantized, particles could feel each other's fields, as discussed by splitting of groups in group dynamics idea.

Observation and Time

The quantum Zeno effect has been observed in experiments where observation influence the rate of interactions like the random radioactive decay. If we could continuously observe a system or a particle (breaking the uncertainty principle), would there be no time? What does measurement mean for the evolution of quantum systems? We shortly get back to this but let's take a quick detour to exploring the Principle of Least Action.

The Principle of Least Action

The principle of least action states that the path with the least action is what happens. Action is the integral of the Lagrangian over the time (evolution of the system), where Lagrangian is the total energy of a system bound in a field with a certain potential-it's kinetic and potential energies can be interchanged at the expense of no extra total energy from outside. During the flight of a ball thrown in the air-Kinetic and Potential energies are exchanged. When light is propagating, energy stored in Electric field and Magnetic field are exchanged. The action is least would mean that conversion between Kinetic and Potential energy for the ball and Electric Field energy and Magnetic Field Energy for light is maximized (for vector fields), (For a scalar field minimizing the action would mean minimizing the modulus of the Lagrangian).

So for the ball, the path that requires the most interchange of Kinetic and Potential energy, would happen. According to Lenz's law, electromagnetic induction opposes the cause that produces it. But what light is doing is trying to maximize the conversion and this is how it works. The speed of light is proportional to the inverse of the root of the product of the permittivity and permeability of the medium. If the permittivity is high, it is easier to polarize the medium, electric field lasts longer and hence more energy is stored in the electric field. As electric field is more stable, the medium magnetizes little or the magnetic flux change is less, and hence less energy is stored in the magnetic field. And vice versa from Lenz's law. So, why is light trying to do by taking the least action path is maximize the conversion of electric and magnetic fields instead of minimizing it? Because Lenz's law + Least Action principle=0 , and they are the opposites of each other. This is also consistent with explaining the increasing entropy as described by the second law of thermodynamics. Probably the uncertainty principle also has a similar structure: if the change is maximized, there would be more uncertainty in the measurement. Why does that happen? Well let's see what that has to do with particles interacting with their own fields and back to the question we asked a while ago about time.

Earlier, we described how virtual particle annihilation (a form of self-interaction) conveys the electromagnetic field of a charge, as charge feels its own field. The idea was much more concrete for the vibrating charge. But for both models, information would be conveyed more efficiently if more conversion and annihilation happened. And that would be the most efficient if a particle interacted with only itself. That is to say, least action path is that path where a particle interacts only with its own field. And before we get to answering: But everything is interacting with all other things all the time, we have to understand the thing with time, observation and evolution.

Another way to understand this is, a particle by self-interaction has an inherent oscillation of conversion of its energy. This is why the vacuum energy field fluctuates and why nothing can be at absolute rest- because every particle keeps its own time. When interacting with other particles, sometimes more energy is added, so the time period of oscillation increases as it takes more time for complete conversion. When energy is taken out, the time period of oscillation-of the conversion between energy form as described by self-interactions, the time period of oscillation decreases. This can be understood as dynamic frames of references.

But during the Planck era, particles only interacted with themselves, and so the frames of reference were constant. Measurements could not be made, as particles were not interacting, and hence time appeared frozen from one's perspective of the other particle.

https://arxiv.org/abs/1711.03323 Reversing the thermodynamic arrow of time using quantum correlations, 2017-presented that when Carbon and Hydrogen nucleus in trichloromethane molecule were correlated, the Cooler Carbon nucleus lost heat to the Hotter Hydrogen nucleus. During the changing proper times of particles, by addition or removal of energy, if a coherent multifrequency interference can be sustained, apparent time-reversal phenomenon can be observed. If a particle was losing its kinetic energy to potential energy, and some more kinetic energy was added, it would take longer to maximize the conversion. But when going the other way, if some kinetic energy was taken away when potential energy was being converted to kinetic energy, the oscillation would not go all the way and there would be an apparent observation in the shift of the time frame of the particle. And so the shift, which was an apparent 'miss to complete the oscillation as before', could make apparent time slow down, speed up of go back, depending on the interference of the frequencies-described by the correlation. These shift would be defined by the quantum complexity associated with the interactions.

And so measurements fluctuate the frames of reference and hence observe fluctuating time frames, making things uncertain. But what's the difference between observation of a particle by another particle and measurement by a human made machine?-the frame of reference.

So answering the quantum Zeno effect-can we make time stop if we keep looking at something? It would slow down according to the interference of frequencies or even appear to go back, but it would not stop. Because the end point of conversion between the forms of energy can not be properly defined. The particle can never have zero potential energy and all of its energy as kinetic energy, or likewise for different forms of energy, and this uncertain transition is described by our discussion on the inherent property of complex numbers to describe a distribution associated with discreet walks of uncertain transitions.

But how did the universe evolve when nobody felt everything other than themselves, into things that interact together?

After spacetime began to interact with itself, loops were formed in the fabric of spacetime, decaying spacetime into bosons and properties, and particles could interact with each other. Group dynamics would describe this as establishing new ways the group could interact. But before the spacetime interacted with itself, the vacuum field was not fluctuating, there were no particles-virtual or real, and it was an un-interesting continuum. How did that happen? The spontaneous symmetry breaking associated with the phenomenon, which is what we will discuss when we understand more about such phenomenon.

In part 5 of the discussion, we will try to relate time scales, structures, complexity and dynamics, symmetries and uncertainties, associated with the evolution of systems we have probed so far, and some others we have not yet.

Let's just see where we've gotten so far. The first discussion-we discussed about group dynamics and some preliminary ideas, the second discussion-we discussed about virtual particles, emergence and quantization of spacetime, the third discussion-we discussed about loops in spacetime, the fourth discussion-we discussed about interactions with one's own fields, and in a bonus discussion we discussed about uncertain transitions and associated distributions described by complex numbers.

Thank you very much!