CASSIOPEIA'S ToE

3

QUANTIZED SPACE & the "*NEW IDEA*"

Space itself can be thought of as having properties of topology, curvature, and differentiability. The topology and curvature will be addressed shortly, but let's begin by exploring the differential nature of space on Planck scales – a billion billion times smaller than a proton.

IN 1968, John Archibald Wheeler said of space, "At really small distances of the order of 10^{-33} cm, a Euclidean topological structure is quite unlikely. At such distances the fluctuation of quantum gravitation will be extremely violent and probably produce an ever-changing, dynamic topology."

And in their book *Gravitation and Spacetime,* Onanian and Ruffini say, "Perhaps spacetime at subnuclear level has a very pathological structure, is multiply connected, full of wormholes and bubbles; perhaps it is not even a continuum."

If we combine three physical constants -- the speed of light (c), the gravitational constant (G), and Heisenberg's constant (h) – in this manner…

$$\sqrt{\frac{\hbar G}{c^3}}$$

…then we can get a feel for the smallest piece of space that makes sense – a piece of space so small that if the wavelength of light were small enough to fit inside it, the energy in that light would collapse that chunk of space into a tiny black hole (at least according to General Relativity). That piece of space is the smallest possible piece of space that has physical meaning. And if there is a "smallest piece of space", then we can say…

SPACE IS COMPOSED OF QUANTA

These chunks of space (as noted by Wheeler) are about 10^{-33} cm long and have a volume of about 10^{-99} cm$^{3.}$.

The concepts of quantized space and non-commutative geometries are not new… But here is the fundamental new idea of this treatise…

THESE QUANTA ARE NOT INTRINSICALLY CONNECTED.

In order to form a mental picture of this, imagine a 3-dimensional matrix of unconnected dots.
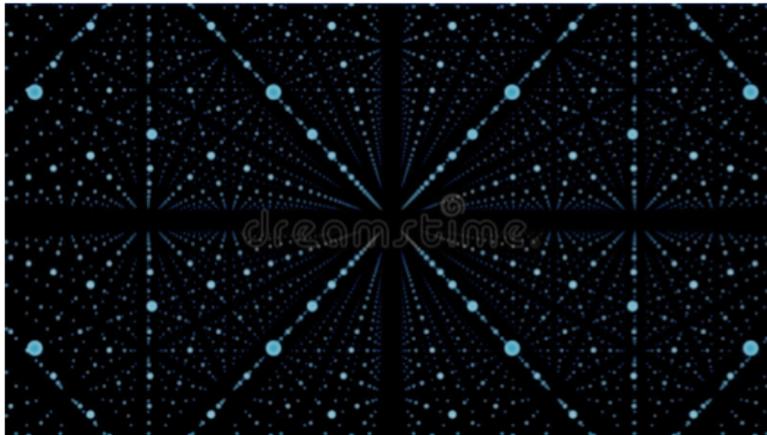
Each dot represents a space quantum. If space had a zero-energy fundamental state, and if there were no Uncertainty Principle, then this would be all there is – these space quanta would remain separate dots.

However, let's postulate that any type of particle or energy existing in this quantum space – be it a photon, an electron, or something else – forms bridges or connections – let's call them "wormholes" among and between the quanta.

And because of the uncertainty principle, emergent energy will constantly produce non-zero energy everywhere. This transient energy will produce transient wormholes, and these wormholes randomly connect space quanta near and far in every direction.   There are also virtual particle pairs coming into existence and then disappearing again as allowed by the Uncertainty Principle. And because things this tiny almost never sit still, let's imagine that all of these connections have typical quantum jitters and are dynamic and changing. New energy coming into existence and then disappearing again will randomly modify the wormhole connections in exciting ways we will explore in a little while.

Let's call this matrix of connected space quanta along with its set of wormholes a PLEXUS or a FIELD (our wormhole plexus will eventually be related to the fields of QFT, but they are not identical).   Each Plexus then is fundamentally a dynamic but random landscape of wormholes coming and going and constantly creating different connections among a set of space quanta. (add video clip)

And, it is convenient to postulate that these wormholes are directional… they have a preferred direction of transit… they are one-way-only under given conditions of CPT.   (We will revisit this idea further when we discuss Charge Conjugation, Parity, and Time Reversal.)

In FREE SPACE, the dynamic nature of the shifting wormholes, guarantees that wormholes point in all (random) directions. There are no non-local gradients in the density or directionality of the Field.

MULTIPLE FIELDS
We also recognize that there is no reason why a given set of dynamically connected wormholes should be unique. We can add a second set of wormhole connections that form a second field. And there need not be any intrinsic crossover wormhole connections between the first set of connected space quanta and the second set.