PROJECTIVE GEOMETRY THEORETICAL INTERPRETATIONS OF THE HOLOGRAPHIC PRINCIPLE AND AdS / CFT CORRESPONDENCE, WITH INSIGHTS INTO "SPOOKY ACTION AT A DISTANCE", THE STANDARD PARTICLE MODEL OF PHYSICS, THE STANDARD COSMOLOGICAL MODEL, AND FRACTAL DIMENSION BASIS FOR INFORMATION, DARK MATTER, AND DARK ENERGY

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PRIOR WORK, AND ISSUES:

The **holographic principle** concept of physics theory traces its origins to the study of black holes. In the 1970's Hawking and Bekenstein showed that black holes carry entropy, i.e. **information**, that is proportional not to black hole volume (i.e. 3-Dimensions), but to the area of the black hole horizon (i.e. 2-Dimensions). Subsequently Hooft and Susskind developed the holographic principle which pairs quantum gravity (3D) with quantum field theory (2D), making the black hole horizon "**contoured 2D**" and enabling **entanglement** information across the black hole horizon. More recently (1997 arXiv:9711200) Maldacena's Anti-de Sitter/Conformal Field Theory correspondence, provided the holographic principle with a more **explicit geometric** (bulk, gravity, 3D, AdS) boundary correspondence with quantum field theory (2D, CFT), where the 2D is actually related to a dual boundary and the varying **entanglement** of two subsystems, A and its complement B.

The most interesting part of all the foregoing is that the holographic principle, which pertains to geometry and information, brings string theory adjacent to loop quantum gravity (LQG), which also pertains to **geometry** and **information**. More recently in LQG (1994 arXiv:9411005) Rovelli and Smolin related quantization to area / volume (**geometry**), and graphs (**information**). If "conservation" of information is a law, geometry is a more malleable topological property, (i.e. networked inter-connectedness is unaffected by changes in geometry).

There are two major issues that need to be addressed for further holographic principle progress.

Issue 1: The AdS, or bulk, gravity, 3D side, needs to be **more topologically explicit and generalized**. Gravity in 3D is a purely topological theory. **In a topological theory geometric properties and spatial relations, i.e. networked inter-connectedness, are unaffected by the continuous change of shape or size of an object. Topological consistency is a very important aspect for systems of information, being akin to adiabatic consistency for systems of energy, thus providing stability.**

Issue 2: Holographic principle entanglement needs to be put in a larger context that **generalizes entanglement , and development of complexity. This includes CPT symmetry breaking, Lorentz covariant bound states (spooky action at a distance), neutrino oscillation involving electron, muon, and tau neutrinos, and gluon color charge oscillation.**

Holography involves **projection** of an **image** from an **object** as perceived by an **observer**. This paper expounds on projection of an image from an object as perceived by an observer. In particular this paper looks at **Pascal's Projection Ellipse**, and in a larger sense **General Projective Relativit y (GPR), as models** for projection of an image from an object as perceived by an observer, and in so doing addresses the prior holographic principle issues.

INTRODUCTION:

The obvious question is what is the big picture theoretical basis for this 2D to 3D holographic information connection? Information pertains to an **observer** of that information. If I am an ant observer in the lawn the grass looks 3D (lots of local curvature or not flat) because there is a lot of grass dimension z. If I am a human observer in my house looking out the window at the lawn the grass looks 2D (little curvature or flat) because there is less grass dimension z. If I am yet another human observer in an airplane flying above all the foregoing the house and grass both look 2D, though the house may exhibit some contours. In this context observers at the large scale see information as contoured 2D, with contours being somewhat flattened. Observers at the small scale see less flattened contouring until at the extreme contours are z quantized and either up or down. So there has been a **projective crossover in observer perspective** in going from 2D to 3D. This is in fact embodied in projection art such as depicted in the following diagram of a skyscraper drawn with what are called "3" perspectives x. Notice that "2" of the x's define what is called a vanishing line, or **"horizon"**, meaning that as the third x is moved to the line as well the 3D skyscraper vanishes, or loses contouring, though the information of the skyscraper is still there in flattened form. So the third x at the bottom represents being in the **"black hole"** of the skyscraper, and the "3" x's are **"entangled"**. In the diagram I have labels B, A, and B which will take on more meaning in a subsequent discussion of AdS/CFT subsystems.

SKYSCRAPER DRAWN USING 3 PERSPECTIVE POINTS X

PROJECTION ART
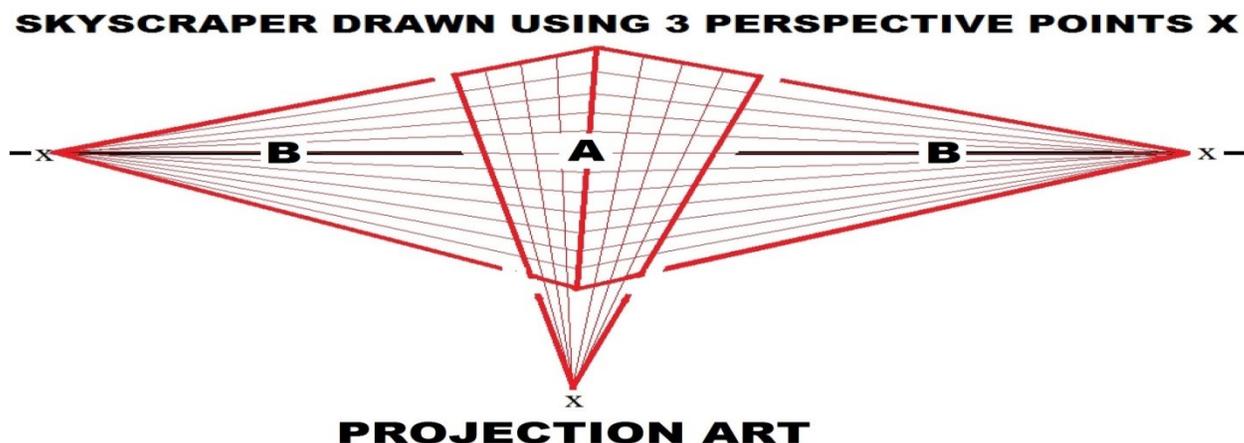
> What is the nuanced significance of "contoured 2D"? The nuanced significance is that, like a contoured 2D terrain map, the contours get bigger or smaller depending on what scale you as an observer of information are interested in, i.e. contours on a small "ant in grass" scale map disappear at the **relatively** larger "looking at grass from house window" scale map. Similarly, contours on a "looking at grass from house window" scale map disappear on an "airplane view of house and grass" scale map, because it is at yet another **relatively** larger scale. The main reason smaller scale contours disappear at larger scales is that there is a space limit to the amount of information that a geographic projection map can contain, though contours themselves are self-similar at all scales. Self-similarity at all scales, and contouring, is of course a **fractal dimensionality** concept.

Another nuanced significance of "contoured 2D" is that it has classical "you are here" geographic projection map aspects, i.e. measured **position**. Trails on a map also infer a potential for going somewhere on the map, i.e. **momentum**, and those trails are probably shaped by contours of least spent energy. So "contoured 2D" has measured **momentum** and **probabilistic** aspects that the contours represent.

➢ Medieval art had a major problem, and that was trying to present a 3D picture as an image on a 2D surface. In "art speak" medieval art was flat and lacked perspective. More technically the new art used "3" perspectives which essentially incorporate horizons where vanishing points are used to represent **infinity**. Thus "3" observer perspectives represent "3" dimensions, x, y, and z. Dimensions also imply observer measurement perspectives, or observer computation of information. Thus to visually get three dimensions one needs computation of information from three perspectives. This is what the Renaissance artists figured out, and it was all based on the principles of "projective geometry" and mathematics. **Projective Geometry"** is the study of geometric properties, some aspects of which are invariant under spatial projective transformations. The aspects which are invariant, involve the relative networked "entangled" connectedness of points in a given geometry, i.e. the points remain stably connected despite changes in distance, angle and orientation of networked connection. These are topological concepts. Such topological stability is an important aspect of information, inclusive of GPS systems of information. **Thus Projective Geometry, and in particular Pascal's Projection Ellipse, addresses issue one concerning making the 3D side of the holographic principle topologically explicit. Expanded discussion of these concepts follows:**

Recent studies of Cosmic Microwave Background (CMB) radiation, which emanates from the big bang in an expanding sphere, seem to confirm a **projective crossover in observer perspective** between flat 2-D at the large scale (airplane observer view) and gravitationally curved 3-D at the small scale (ant in grass observer view). This is in fact embodied in the Standard Model of Cosmology, which is a **"3-manifold"** model.

Geometric concepts provide yet another theoretical basis for this projective crossover. Consider the ratio of an expanding sphere's surface area to the expanding sphere's volume:

Formula for sphere surface   Area   = $4 * pi * (sphere\ radius)^2$

Ratio, unitary increase radius ——————   ————————————————   =   **"3"**

Formula for sphere volume   Volume = $4/3 * pi * (sphere\ radius)^3$

Thus for a unitary (i.e., "1"unit) increase in sphere radius, sphere surface area increases "3" times faster than sphere volume. **Thus if information during this volume expansion is totally recorded on that surface, it occurs computationally "3" units at a time.** The "3" units at a time translates into "3" dimensions using 3 perspectives "x" in a fractal dimensionality involving 2D and 3D. Are there any other **projection** related supporting concepts in addition to Cosmic Microwave Background (CMB) and expanding sphere geometry?

Consider today's Global Positioning System, or GPS technology and theory. GPS requires "4" networked satellites to calculate a GPS user's position in a dimensionality, "3" satellites to calculate position, in "3" dimensions, and "1" satellite to get a time synchronizing correction. **If the GPS system had perfect elliptical orbital periodicity or ongoing intrinsic atomic clock synchronization only "3" GPS-satellite-analogous observer connections would be required, in "3" dimensions, which is an important simplifying factor.** Now consider "entangling" a second GPS user's position with the first user's position. Connecting two entities, they could be electrons or photons at the quantum level, requires a **second set of "3" GPS-satellite-analogous observer connections bringing the total number of connections to "6" (i.e. complexity dimensions) – is there a simple model for this?**

➢ The concept of changing dimensionality in computing information is new to most people. The following diagram shows that changing dimensionality is a two-step computational information process. The first step is to **reflect** a mirror image of the original dimension. The second step is to **rotate** the mirror image 90 degrees, or perpendicular, to the original dimension. This involves what is called "angular momentum", which in a nuanced view can be either positional spin angular momentum or 2-body entangled orbital angular momentum. **Thus changing dimensionality is a reflect/rotate process, with rotational mixing of spin and orbital angular momentum in nuanced ways supporting projection and fractal or contoured dimensionality, i.e. not pure 3D or 2D but a fractal dimension in between, which represents complexity, information, and probabilistic correlation.**

reflect   **rotate**

1 D to 2 D

reflect   **rotate**

2 D to 3 D
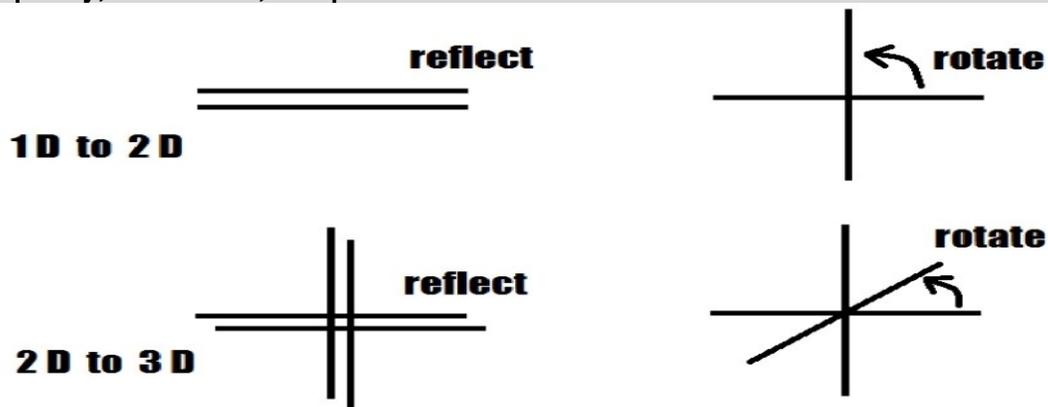
**CHANGING DIMENSIONALITY
REFLECT / ROTATE PROCESS**

By definition a fractal dimension is given by:

$$\text{Fractal Dimension} = \frac{\text{Log (complexity dimensions)}}{\text{Log (scale dimensions)}}$$

In this definition for fractal dimension, complexity dimensions relate more to variable dimensions above and beyond the usual xyz dimensions of a symmetric space. Scale dimensions relate more to the usual xyz dimensions of a symmetric space. In this context scale is the "positional" base geometry whereas complexity is the variable but always connected "momentum" geometry. Nuanced formulas for fractal dimension include information dimension and correlation dimension. These are all concepts relating to **projection**.

Photons have a unique capability for connecting to and operating in a dimensionality. This capability comes from the duality of a **reflective** electric field (Charge) and **rotational** magnetic field (Parity). In effect this makes a **dual aspect (two step) dimensional (CP) field for the photon**. In laser light beam holography this **dimensional (CP) field** is altered when the light beam strikes an object. This encodes holographic, and dimensional, information. In the strictest sense Holographic **"projection"** is limited to single wavelength coherent laser light. In a broader sense **generalized "projection"** is not limited to single wavelength coherent laser light, and the **dual aspect (two step) dimensional (CP) field for the photon** becomes a very important factor in nuanced ways.

This brings us back to the prior GPS discussion, and yes there is a simple **model for entangling two entities** ("6" GPS-satellite-analogous observer connections) which is **Pascal's Projection Ellipse** as shown in the following diagram. First, a1, a2, and a3 are analogous to GPS satellites for the first entangled entity. Second, b1, b2, b3 are analogous to GPS satellites for the second entangled entity. Third, b1b2b3 is a reflection of a1a2a3 whereas "computational and contoured" c3c2c1 is a rotation of both a1a2a3 and b1b2b3. Thus in net this is a two-step **reflect/rotate** computational information process that changes **dimensionality from 3D (GPS, ellipse) to contoured 2D (c3c2c1)**. The nuance is that a1a2a3 is a reflected **entangled image** of b1b2b3 and visa versa such that we have "2" reflections. Similarly the rotation of c3c2c1 is 180 degrees such that it represents "2" **(di)** 90 degree rotations or 180 degrees **(spin ½)**, and **chirality**, to be discussed later.
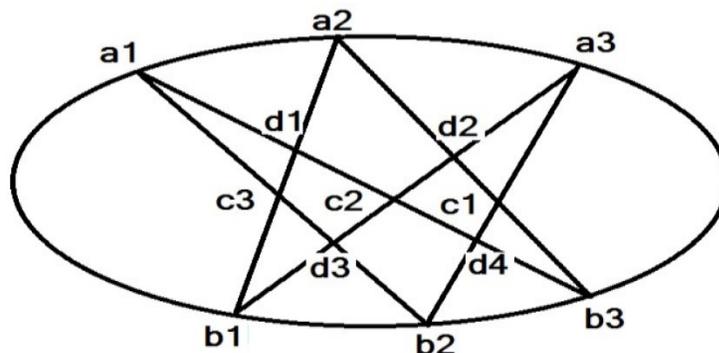

PASCAL'S PROJECTION FROM CONICAL SECTION - ELLIPSE TO COLLINEAR   c3 c2 c2   FROM 6 POINTS ON ELLIPSE

In the Pascal Projection Ellipse Model we do not need an analogous satellite "4" for time because the ellipse represents a relative angular momentum timing mechanism. In the model "b1" represents a projection **"positional"** image of "a1" whereas b2b3 represents a projection **"momentum"** image of a2a3 relative to a1. Corresponding relationships hold for a2 and a3. In the Pascal Projection Ellipse Model **reflect/rotate** c3c2c1 represents computational information about entangled position/momentum information. This c3c2c1 information is derived using "2" projective lines (**dual aspect (two step) dimensional (CP) field for the photon**) off of each of a1, a2, a3, b1, b2, and b3 into new **dimensionality** (3D physical to 2D and paired informational) in a **reflect/rotate** process. Thus one projective line off of "a1" represents a reflection, sometimes called "charge" in physics speak, and one projective line off of "a2" represents a rotation, sometimes called parity in physics speak. **Thus Pascal's Projection Ellipse model addresses the CPT symmetry breaking larger generalizing entanglement context part of issue two.**

➢ The following diagram depicts current AdS/CFT concepts which will be enhanced via Pascal's Projection Ellipse. On the left each stacked (i.e reflect) disk represents a time increment in 3D AdS black hole core / outer horizon 2D CFT evolution, thus time is one part of the dual system. Angular quantity "r" (i.e. rotate) is the second part of the dual system which can be divided into two subsystems A and B (which conceptually relate to B A B in the prior skyscraper projection diagram). Entanglement entropy between A and B can be measured holographically by calculating geodesic length A as illustrated in red on the left. Alternatively quantum field theory methods can be used as illustrated on the right (graph). **In pure AdS/CFT physics speak Pascal Projection Ellipse's a1a2a3 and b1b2b3 are two subsystem projections on the horizon whereas c3c2c1 represents the BAB entanglement of the two subsystems and related entanglement entropy, i.e. chiral information.**

Let's add another major nuance to the this AdS/CFT versus Pascal's Projection Ellipse discussion. How does one get an ellipse out of AdS, which is essentially a stacked cylinder of time incremented disks (i.e. time runs perpendicular to BAB)? This is done by entangling two adjacent disks in time. This represents an inclined plane cutting through a cylinder which gives an ellipse. **Entangling in time also enables probabilistic aspects.**
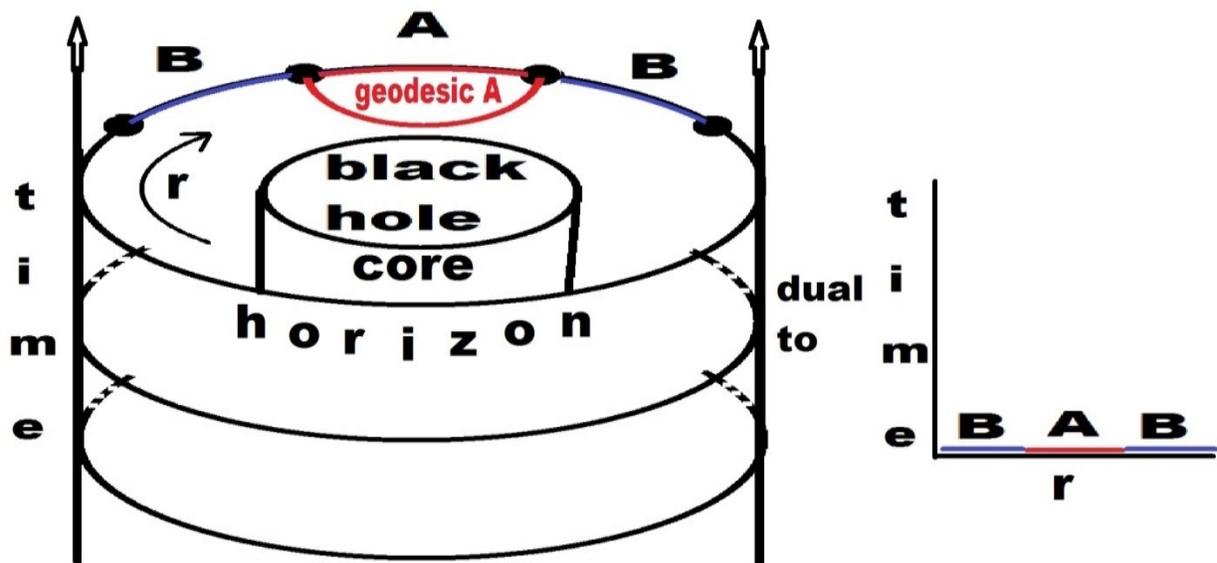
CONCEPTUAL AdS / CFT

So with Pascal's Projection Ellipse we have a model that measures entangled position, and via Kepler's laws of planetary motion (elliptical orbital periodicity), entangled momentum. Moreover this information is two-step and fractal **reflect/rotate entangled image**, which means we have projected 3D physical to 2D contoured holographic at c3c2c1. When this is done, we have, much like a topographical map, information containing contours, or in the context of a gravitational field space-time curvature. In a nuanced sense, this could also be termed a "dimensional field" since it is **reflect/rotate** and photon based as previously discussed.

➤ Kepler's laws of planetary motion, restated for entangled information in AdS/CFT and Pascal's Projection Ellipse, are:

1. The orbit of a1a2a3 or b1b2b3 is an ellipse with "2" bounding subsystem foci, one foci at c3 and another foci at c1, and a center of (informational) mass c2 (positional stability).
2. Periodicity and timing comes from connections to a1, a2, a3, b1, b2, b3 from c3 and c1 sweeping out equal areas over equal intervals of time, i.e. oscillation (momentum stability).
3. The square of the orbital period of a1a2a3 or b1b2b3 is proportional to the cube of the semi-major axis, which is a straight line passing thru c3c2c1 to the ellipse from c2.

This last point has nuances of great significance, since it infers going from 3D to contoured 2D in computation of entangled information, which involves time. **The squared to cubed differential can be viewed as an energy density differential, i.e. contouring, representing the energy going into information represented by the gravitationally "entangled" elliptical orbit.** For the holographic difference pattern this translates into the holographic stored 2D image (squared) which looks like the original 3D object (cubed).

➤ The term **Projection** has several definitions:

1. An estimate or forecast of a future situation based on a study of the present.
2. The presentation of an image on a 2D surface.
3. A thing that extends outward from something else.

Pascal's Projection Ellipse meets all these definitions. The first Projection definition is met by observer measurement of the position and momentum of two entangled entities, which enables a probabilistic forecast using information i.e., c3c2c1. The second Projection definition is met by c3c2c1. The third Projection is also met by c3c2c1. All these points will be elaborated on subsequently.

WHIRLWIND TOUR OF PROJECTION CONCEPTS:

In the following sections I do a whirlwind tour of Projection concepts that have far-reaching implications.


SKYSCRAPER DRAWN USING 3 PERSPECTIVE POINTS X

OBJECT

REFLECTED AND ROTATED 180°

IMAGE

PROJECTION ART - OBJECT IMAGE
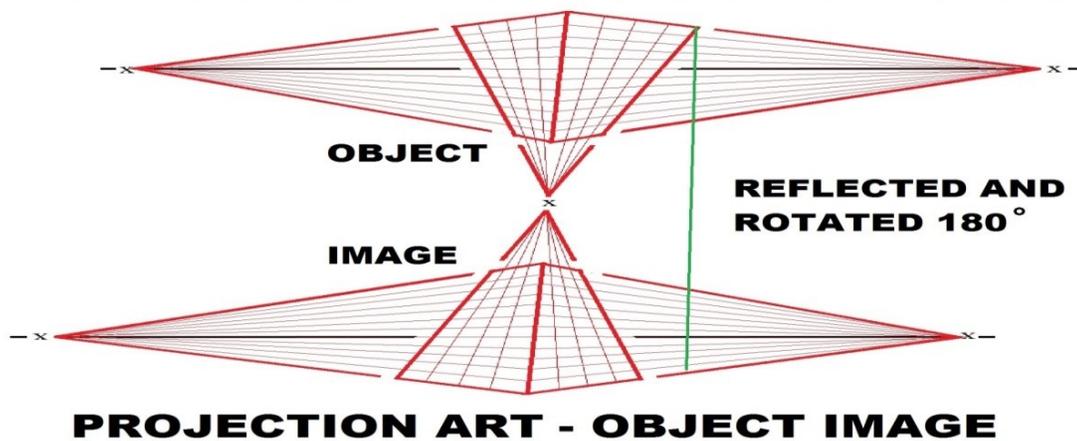
In the prior diagram the skyscraper projection used earlier in this paper is reflected and rotated 180 degrees, as is c3c2c1 in the Pascal's Projection Ellipse. If the skyscraper was just reflected the right edge of the bottom skyscraper would be aligned with the top skyscraper on the vertical green line. With the 180 degree rotation the image becomes real, as in if you were a person looking at your mirror image you could not shake right hands with the non-rotated mirror image since you would be shaking the image's left hand, which is impossible unless the opposing left hand was twisted 180 degrees somehow. The only way you could shake hands with the image's right hand is if the mirror image were rotated 180 degrees as in the diagram above. This is all made possible with the projective lines passing through vanishing point x in the middle to two projective horizons, one at the top and one at the bottom. This is called **chirality** and it is an important physics concept. Pascal's projection ellipse is an extension of these concepts with the major nuance being that the vanishing lines represent the top and bottom of the ellipse and the vanishing point x represents c3c2c1 where **chirality** occurs. **Chirality makes images of objects real, and this involves projection.**

> ➢ The single vanishing point in the middle where chirality occurs is actually a vanishing line of minimal length in what is a 3-manifold system. In pin-hole camera fashion this also enables Object-Image (O-I) capability. If the vanishing point is somewhat larger than an actual point (aperture) Images have relatively more momentum content and are fuzzy. If the vanishing point is an actual minimal size point (aperture) Images have relatively more position content and are sharper, though more exposure time may be required to attain this quality.

Thus Pascal's Projection Ellipse model in physics speak, embeds reflect/rotate CPT symmetry breaking which explains why matter and antimatter have not totally annihilated each other, thereby leaving an excess of matter. In particular a1a2a3, and b1b2b3, represent orbital angular momentum over half an ellipse, leaving an allocation for non-orbital angular momentum of **spin 1/2**. In the interior line c3c2c1 represents **charge allocations of 1/3 and 2/3** between two subsystems. Nonsymmetrical reflection and rotation lead to fractal contoured dimensionality in a **dimensional (CP) field** with stability coming from shedding mass to lowest energy states and entangled oscillation at both the quantum and cosmic level.

The Pascal Projection Ellipse also has **Object Image** projection aspects as shown in the following diagram. First notice the top and bottom of the ellipse each have 3 points a1a2a3 and b1b2b3 which are the left top/bottom right of the analogous skyscrapers. The c3c2c1 in the middle is the analogous skyscraper's two vanishing lines / vanishing point complex. The red projective lines represent the entanglement of top and bottom in Object "O" and Image "I" fashion as shown. What is the nature of this entanglement? Quite simply it is a 3D oscillating entanglement with oscillation embodied in the elliptical "orbit" analogous to an earth, center of mass, moon system. **The nuance is that the elliptical and projective complex also represents a quantum level model, and infers O/I pairs and the prefix "di".**
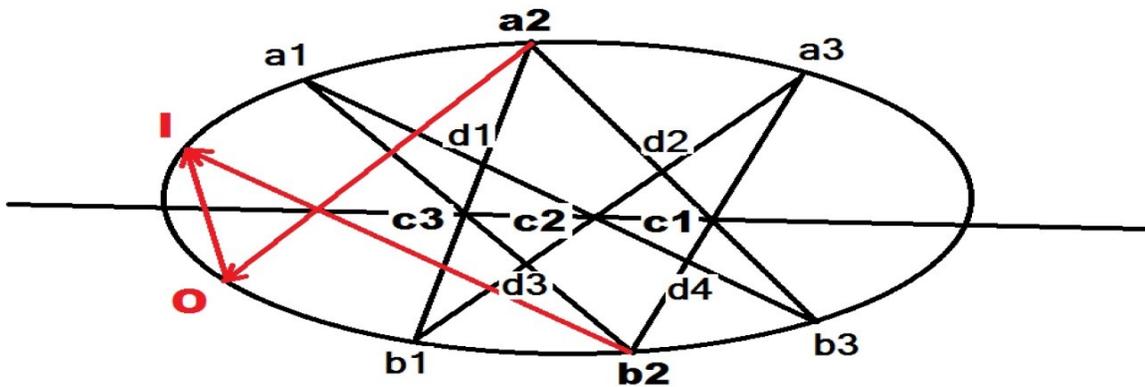
PASCAL'S PROJECTION OF OBJECT "O" AND IMAGE "I" TO COLLINEAR c3 c2 c1 HORIZON FROM a2 and b2

Might Object / Image projections also come from a1 and a3? Yes, as shown in green, off of a1b1, and blue, off of a3 and b3. Thus there are "3" generations of Object Image with the I/O connecting line getting smaller between successive generations. **Thus Pascal's Projection Ellipse addresses the neutrino oscillation and gluon color charge oscillation larger generalizing entanglement context part of issue two.**
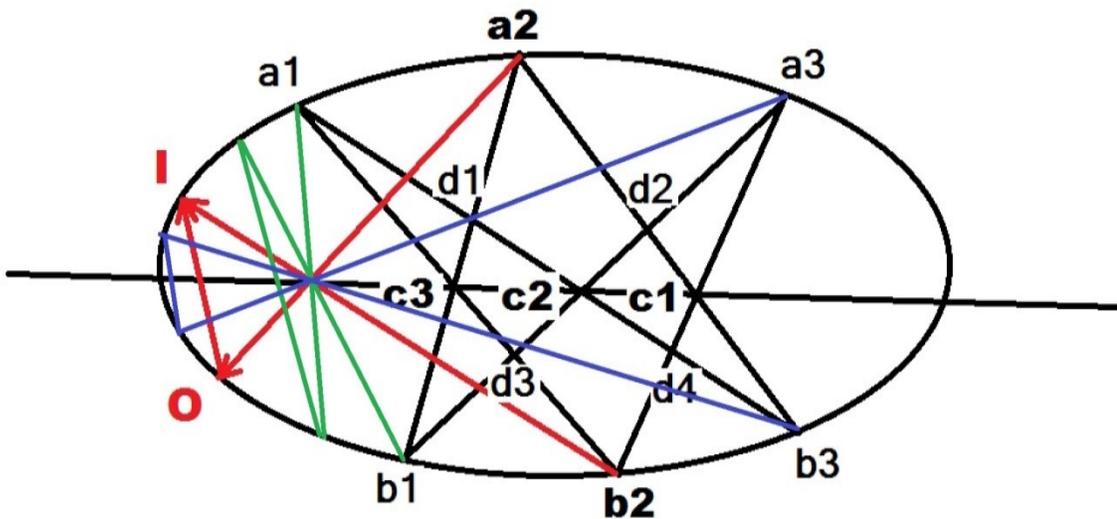
**PASCAL'S PROJECTION OF OBJECT "O" AND IMAGE "I" TO COLLINEAR c3 c2 c1 HORIZON FROM a2 and b2**

In the following diagram Object/Image projections have moved outside the 3D oriented ellipse to the 2D oriented c3c2c1 horizon. Notice that in the process "O" and "I" have flipped polarity, with "O" now being on top instead of bottom. Moreover, this is an asymptotic environment that goes to infinity as shown in second following diagram.
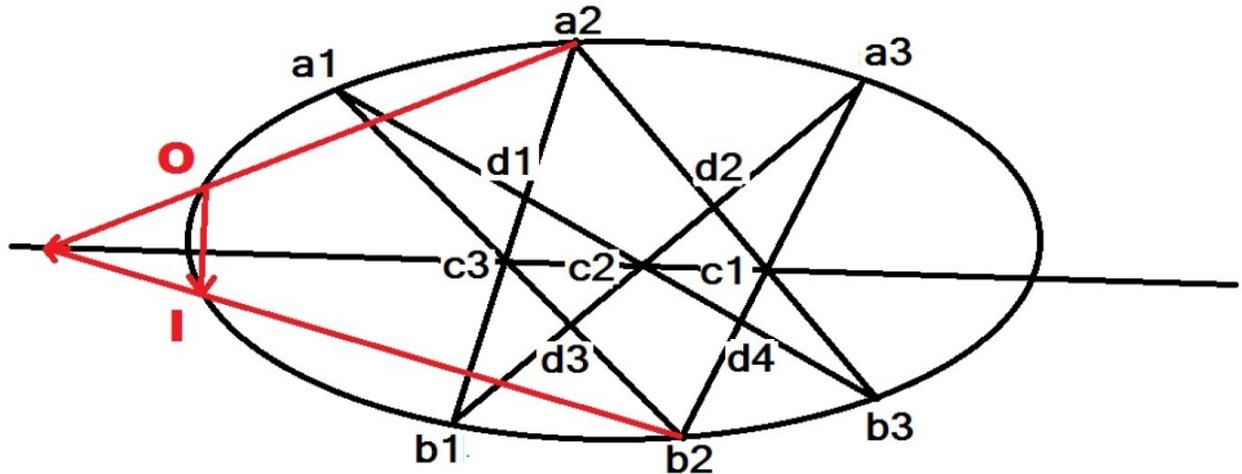
**PASCAL'S PROJECTION OF OBJECT "O" AND IMAGE "I"
INTERSECTION WITH c3 c2 c1 SHIFTED OUTSIDE ELLIPSE
OBJECT "O" CROSSES OVER IMAGE "I", ARROW FLIPS**
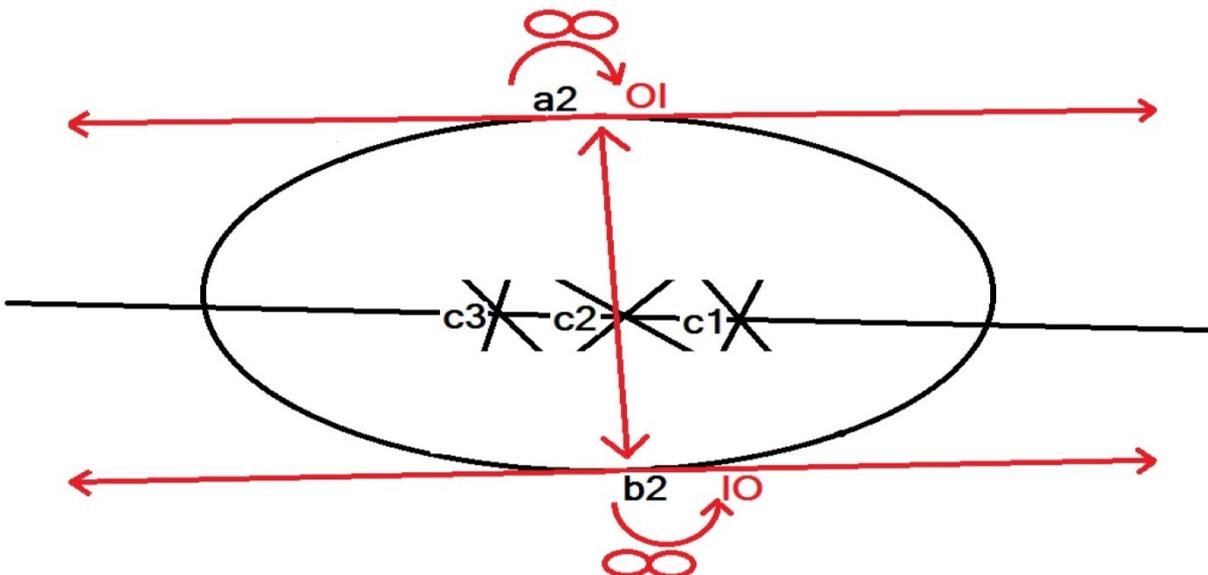
PASCAL'S PROJECTION - INFINITY CROSSOVER

In this last diagram the crossover has progressed out to infinity. In a nuanced sense **reflect/rotate** dimensional field entanglement processes internal to Pascal's Projection Ellipse have moved out to a **"2" aspect reflect/rotate infinity**, with the c3c2c1 2D surface in between. In a cosmic sense this is "spooky action at a distance" involving electrons (reflection), photons (rotation) and "dual cosmic strings". **Thus Pascal's Projection Ellipse addresses the Lorentz Covariant Bound States larger generalizing entanglement context part of issue two.**

➢ Instantaneous correlation (i.e. spooky) at a distance (i.e. non-locality) has been a very active area of new experimental research. Essentially this new experimental research shows entanglement over space, and time, is "loophole free" certain, and more generally pervasive

than previously thought, and spooky has gotten even spookier. There has been experimental evidence of polarization correlation of photons that never coexisted in time, i.e. non-locality not only in space but also in time. This is of course consistent with holographic information that has a probabilistic correlation function, past to future as well as future to past. There has been experimental evidence that projective entanglement of photons enables "taking pictures" of an object with photons that never interacted with the object, i.e. their only interaction was with the photons that interacted with the object in the first place. There has been theory (Wheeler-DeWitt) and experimental evidence (INRIM) that time itself only emerges from pervasive entanglement correlation processes, processes which General Projective Relativity (GPR) embeds.

In the following two diagrams entanglement involving two different scales, large scale at top and small scale at bottom, is depicted using Pascal's Projection Ellipse. Notice in the top diagram that straight projective lines cannot effectively connect up, and the projection loses "collapsible" focus. Thus **curvature** of projective lines as shown in the bottom diagram are required to effectively connect up and maintain a "collapsible" projection focus. These "collapsible" and "curvature" phenomenon are of course embodied in the Heisenberg Uncertainty Principle as well as the Standard Model of Cosmology.
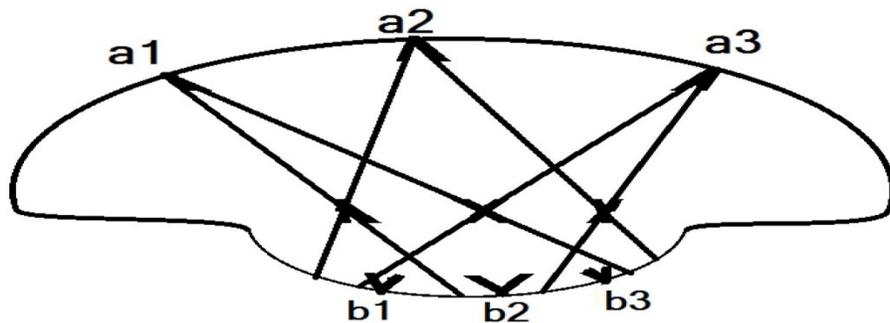
PASCAL'S PROJECTION FROM CONICAL SECTION - ELLIPSE
TO COLLINEAR c3 c2 c1 FROM 6 POINTS ON ELLIPSE
CHANGE OF SCALE / PHASE TRANSITION
UNCERTAINTY b1 b2 b3
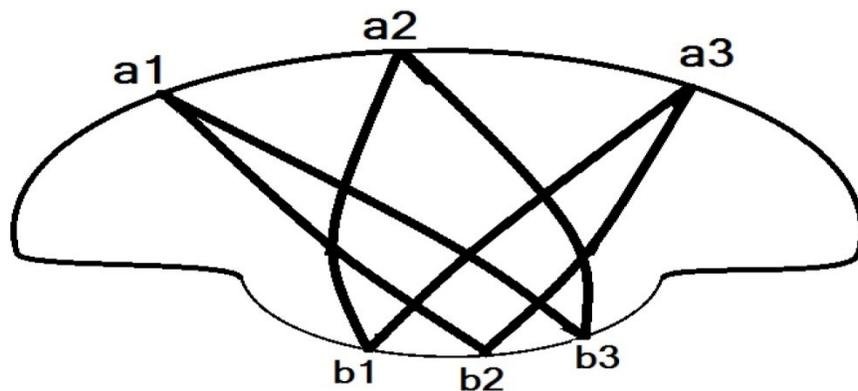
PASCAL'S PROJECTION FROM CONICAL SECTION - ELLIPSE
TO COLLINEAR c3 c2 c1 FROM 6 POINTS ON ELLIPSE
CHANGE OF SCALE / PHASE TRANSITION

➤ **In a mathematical sense problem infinities infer projection.** In a quantum subatomic particle sense projection also infers Object/Image **"pair"** and **"di"** phenomenon will be encountered, starting with the bottom quark with a mass of 4.18 GeV/c^2 or 4.65 GeV/c^2 depending on the mathematics used to deal with problem infinities. For the Large Hadron Collider (LHC) this means "smashed atom" collisions that spread out entanglements into **"pair"** and **"di"** phenomenon. Overall Pascal's Projection Ellipse gives a new **networked context** with which to view and understand the universe.

Leonhard Euler, 18th century physicist, developed what is called the Euler Characteristic which originally pertained to 3D geometric solids but has since been extended to topology, curvature, network, and graph studies. In the Euler Characteristic formula shown below "v" are vertices, "e" are edges, and "f" are flat faces.

$$\text{"v" - "e" + "f" = Euler Characteristic}$$

For the arrangement of projective lines of the Pascal Projection Ellipse, counting the ellipse itself as an edge, the Euler Characteristic is:

$$13 - 21 + 8 = 0$$

Thus an Euler Characteristic depends on geometric curvature with "0" representing flat topological curvature ("2" is spherical curvature). In fact because the curved ellipse itself was counted as an edge the actual curvature is fractally somewhat more than flat "0", or contoured 2D. An Euler Characteristic of "0" enables a networking paradise of flexible connectivity where causal direct connection circuits can evolve to be probabilistically functional without cross-connection or gaps that break arrow of time computational processes.

What about d1, d2, d3, and d4 in the Pascal Projection Ellipse Model? Quite simply these are the "4" topological forces shaping the projection. Einstein's 10 coupled nonlinear hyperbolic-elliptic partial differential field equations for calculating gravitationally induced curvature to space-time simplify to "6" equations and "4" gauge fixing degrees of freedom. The "6" equations are represented by a1, a2, a3, b1, b2, b3 whereas the "4" gauge fixing degrees of freedom are represented by d1, d2, d3, d4. Thus c3c2c1, and the ellipse, represent the curvature of space-time. In the quantum world, as in Dirac's relativistic Schrodinger equations, d1, d2, d3, and d4 show up as "4" components of the Schrodinger wave function. The amplitude of the Schrodinger wave function of course, when squared, represents the space-time probabilistic function of a subatomic particle. The nuance when dealing with "2" entangled particles in space-time, as in a1a2a3 entangled with b1b2b3, is that the space-time probabilistic function is a joint function, or the amplitude of one Schrodinger wave function times the amplitude of the second Schrodinger wave function. With this in mind let's look at some more effects of topological forces.

In the following diagram a1 has been moved to the left along the ellipse, as shown in red, while a2, a3, b1, b2, and b3 remain fixed. This results in angular movements in d1, d3, and d4 while d2 remains unaffected. Changes to d1, d3, and d4 cause angular movements in c3 and c2, as shown in red, while c1 remains unaffected, and c3c2c1 remains collinear, thought rotated and lengthened. Thus c1c2c3 has both reflective (electron) and rotational (photon) aspects to it.
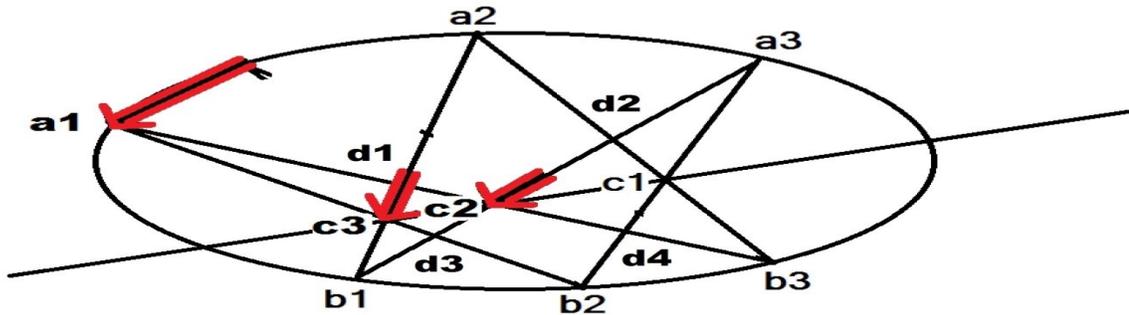
PASCAL'S PROJECTION FROM CONICAL SECTION - ELLIPSE TO COLLINEAR c3 c2 c1 FROM 6 POINTS ON ELLIPSE SHIFTED a1 CAUSING SHIFTED c2 and c3

In the following diagram a1, a2, and a3 on top and b1, b2, b3 on bottom have been brought together in a singularity. This results in a d1-d2 "pairing" on top and a d3-d4 "pairing" on bottom. In the middle c3, c2, and c1 remain linearly connected though moving to a single point.

SINGULARITY
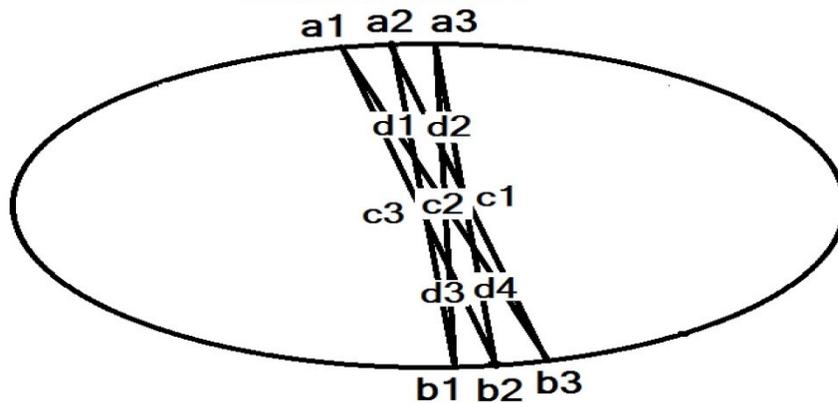
PASCAL'S PROJECTION FROM CONICAL SECTION - ELLIPSE TO COLLINEAR c3 c2 c1 FROM 6 POINTS ON ELLIPSE

In the following diagram a1, a2, and a3 on top and b1, b2, b3 on bottom have been spread out in a linearity. This results in a d1-d3 "pairing" at left and a d3-d4 "pairing" at right. In the middle c3, c2, and c1 remain linearly connected though moving to an elongated line.


LINEARITY
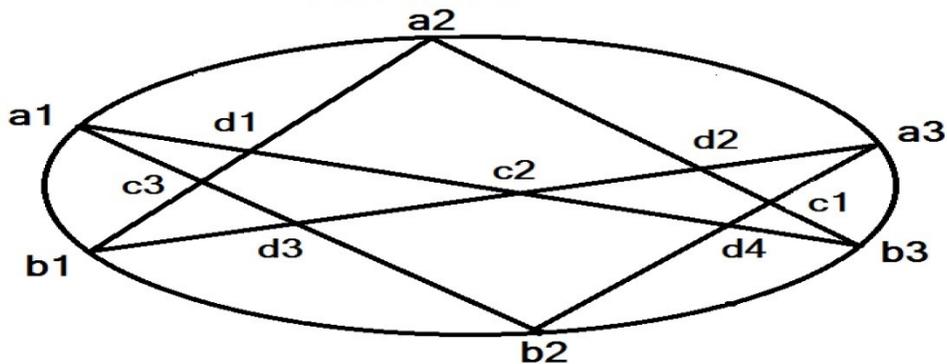
PASCAL'S PROJECTION FROM CONICAL SECTION - ELLIPSE TO COLLINEAR c3 c2 c2 FROM 6 POINTS ON ELLIPSE

In the following two diagrams the bottom ellipse is shifed to the right, as if given a momentum boost to escape velocity. This results in a rotation and "sqeezing" of c3c2c1 (first diagram) until c3c2c1 is completely up-down perpendicular to the original horizontal orientation and point-like (second diagram). In addition the "6" projective lines merge down to "3" projective lines. **At the extreme topological forces d1, d2, d3, and d4 disappear and we have essentially a photon**.
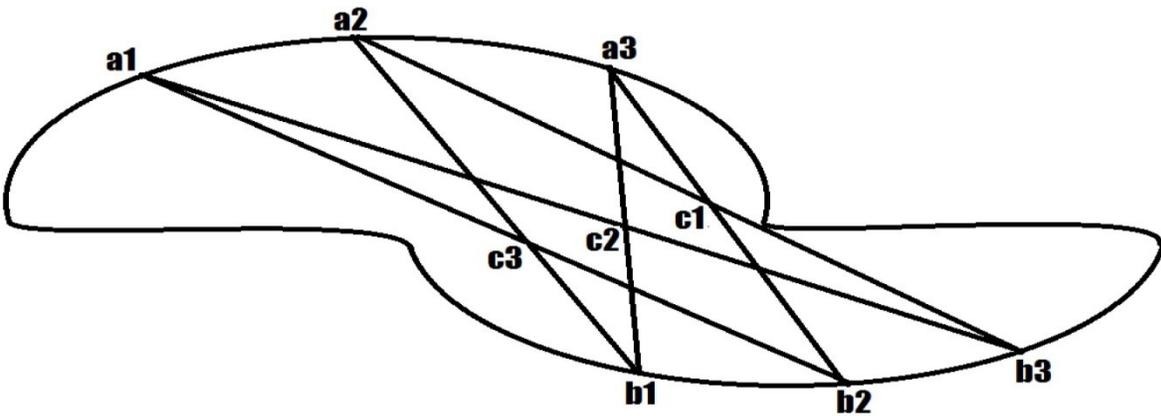
PASCAL'S PROJECTION FROM CONICAL SECTION - SHIFTED ELLIPSE DILATION AND COUNTERCLOCKWISE ROTATION OF c3 c2 c1 COUPLING
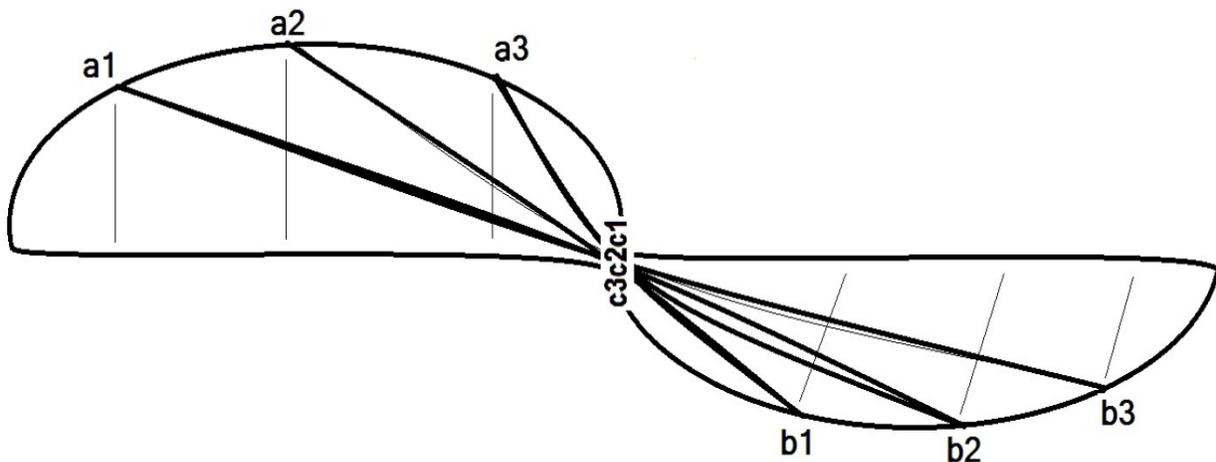
PASCAL'S PROJECTION FROM CONICAL SECTION - FULLY SHIFTED ELLIPSE FULL DILATION AND PERPENDICULAR CCWISE ROTATION OF COUPLING c3c2c1

In the following diagram a2 has gone to the leftmost part of the ellipse while b2 has gone to the rightmost part of the ellipse. In between a2 and b2 are b3, b1, a1, and a3, This forces the c3c2c1 projection totally out of the ellipse and perpendicular to the usual horizontal orientation. At the same time topological force d1 seems to disappear as the d1 defining projective lines a1b3 and b1a2 go parallel, and topological force d3 also seems to disappear as the d3 defining projective lines a2b3 and b1a3 go parallel. This phenomenon can have many implications. One that comes to mind involves black holes, where the core seems to be gravity (G) and strong nuclear force (SNF) dominated and the horizon seems to be light electromagnetic (EMF) and

hawking radiation weak nuclear force (WNF) dominated. This brings us back to AdS/CFT. If c3c2c1 on the right represents entropy on the black hole horizon the elliptical structure on the left represents structure interior to the black hole itself.

PASCAL'S PROJECTION GEOMETRY ELLIPSE

d1 = a1b3 | b1a2
d2 = a2b3 | b1a3
LINES GO PARALLEL & NO INTERSECTION

PASCAL'S PROJECTION INTERIOR HEXAGON & COLLINEAR c3 c1 c2 OUTSIDE ELLIPSE
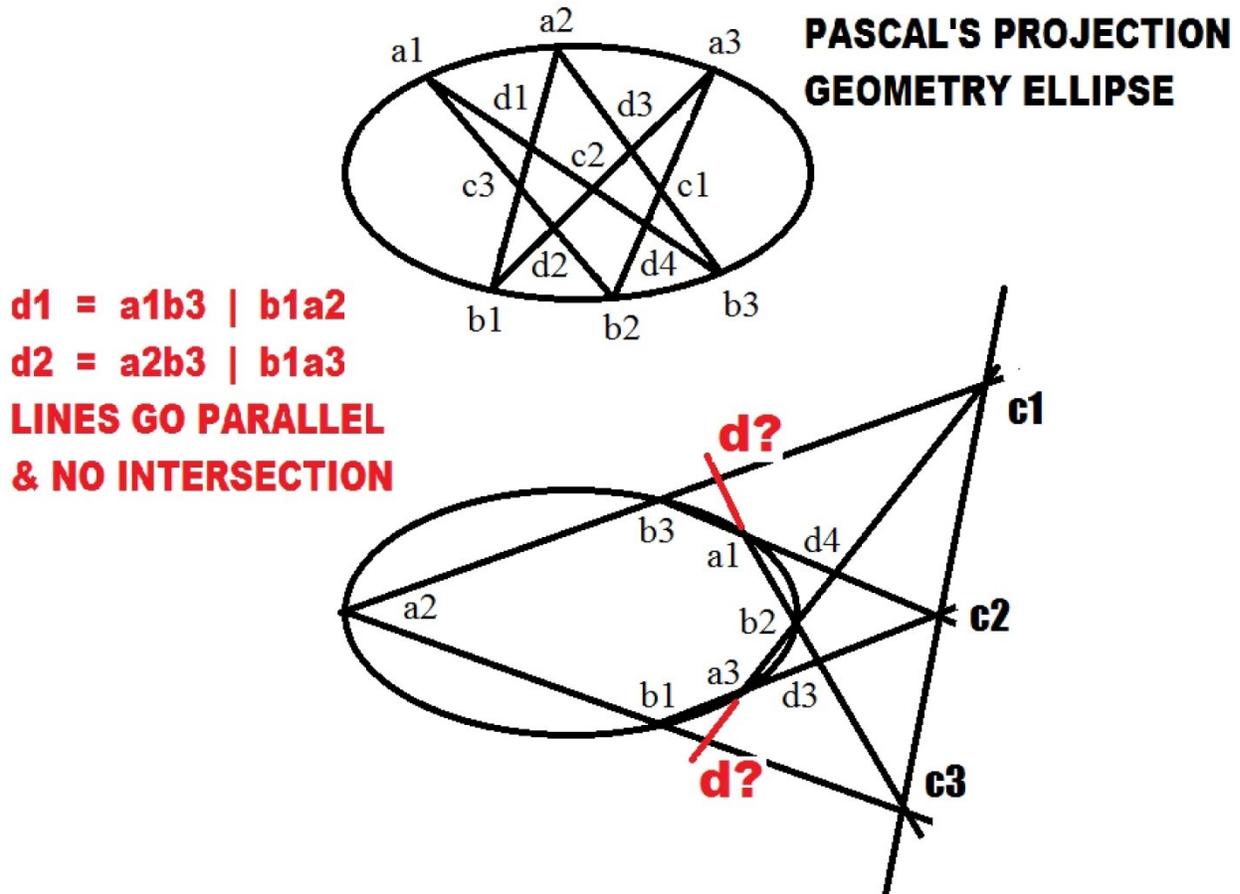
What does this correspondence tell us about the interior of black holes? One interior aspect is "a2". Recall that "a2" represents the top of a projection, or z aspect. This corresponds with c3c2c1 which to AdS/CFT is BAB entropy or holographic information. At the extreme a2 can go out to infinity which means entropy, or holographic information can go to infinity as well. Moreover the area of the ellipse allocated to "a2" can go to infinity, which means via Kepler's laws as previously discussed that time (past time) can go to infinity as well. So at the extreme the black hole represents infinite space, infinite information, and infinite past time, akin to a perfect recording machine for the universe.

The prior discussion also holds on the obverse side if b2 and a2 traded relative geometric places in the structure, putting c3c2c1 out on the left side of the ellipse. In oscillating past-future, future-past manner then, we would have two 2D holographic structures with a 3D elliptical structure in between. This is classic 3D sandwiched between 2D "wormhole" structure with negative energy holding the "wormhole" open.

CONCLUSION:

We have seen how Pascal's projection ellipse provides a **fixed geometric background (for String theorists)** that also supports, in topological manner, **variable geometry (for Loop Quantum Gravity theorists)**. Concerning M String Theory, Pascal's Projection Ellipse provides "6" dimensions represented by a1, a2, a3, b1, b2, b3, and another "4" dimensions represented by c3, c2, c1, and time. **The elliptical complex itself represents dimension "11" (super gravity).** Concerning Loop Quantum Gravity (LQG), as shown in the following diagram we have unit circle loops (3 at top, 3 at bottom and opposite in rotation) transforming and **quantizing geometry** (gravity). **At the extreme unit circle level a1a2a3b1b2b3 angular momentum is confined and spin dominated, while at the other extreme orbital angular momentum dominates with corresponding changes in the mixing angles at topological forces d1d2d3d4.**
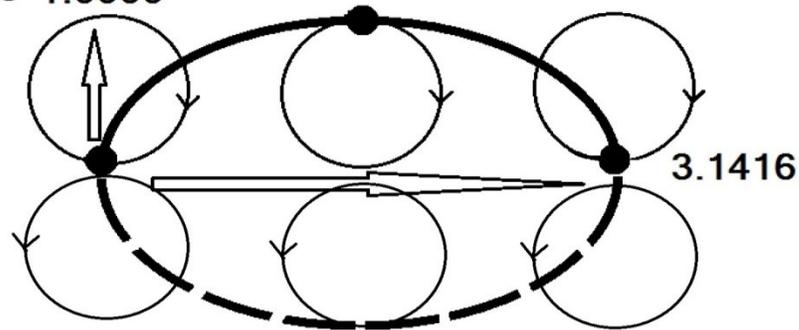
TRANSFORMATION

This also happens to be representative of the up-down-up quark structure of the proton juxtaposed to the down-up-down structure of the neutron and confined by gluons with color charge (red, blue, green), i.e. molecular structure as shown in the following diagram. In this context projective lines of the Pascal Projection Ellipse are related to gluon color/anti-color charge. There are "8" working combinations of gluon color/anti-color charge, with "6" of those working combinations being analogous to Pascal Projection Ellipse projective lines off of a1a2a3b1b2b3 (AdS, bulk 3D). The remaining "2" working combinations (CFT, 2D) are analogous to c3c2c1 where one of c3, c2, or c1 exhibits positional stability while complementary c2c1, c3c1, or c2c3 exhibits momentum stability.
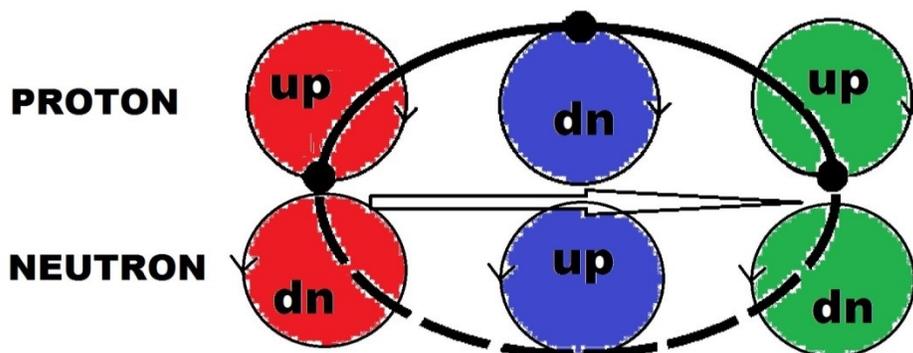
MOLECULE - QUARKS/GLUON COLOR CHARGE

➤ AdS/CFT is all about correspondence between two theories to aid further research. The following discussion is about a correspondence between quantum chromodynamics (QCD) theory and General Projective Relativity (GPR) as presented in this paper. The following are the "8" gluon independent color states from the Gel-Mann matrices where "r" = red, "g" = green, "b" = blue, and the same letters with the bar over the top are the anti-color

$$(r\bar{b} + b\bar{r})/\sqrt{2}$$

$$(r\bar{g} + g\bar{r})/\sqrt{2}$$

$$(b\bar{g} + g\bar{b})/\sqrt{2}$$

$$-i(r\bar{b} - b\bar{r})/\sqrt{2}$$

$$-i(r\bar{g} - g\bar{r})/\sqrt{2}$$

$$-i(b\bar{g} - g\bar{b})/\sqrt{2}$$

$$(r\bar{r} - b\bar{b})/\sqrt{2}$$

$$(r\bar{r} + b\bar{b} - 2g\bar{g})/\sqrt{6}.$$

The top "6" states can be related to the Pascal Projection Ellipse projective lines coming off of a1a2a3b1b2b3 in a paired (√2) manner. The bottom "2" states can be related to the top/bottom and c3c2c1 elliptical complex itself.

The following diagram, together with the prior discussions, depicts how the Pascal Projection Ellipse Model parallels the Standard Particle Model while also explaining why we have "3" generations of particles and "di" photon events. At the top left we "3" generations of electron, as well as the concept of a spin up / spin down orbital state as O/I flip flops between top and bottom. At the top right we have "3" generations of neutrinos, related to "3" generations of electrons, which exhibit oscillation between the "3" generations as they travel through space. At the bottom center we model "di" photon phenomenon as well as Lorentz Covariant Bound States (spooky action at a distance) for electrons and photons as discussed previously. The "4" force carrying bosons of the Standard Particle are represented by topological forces d1d2d3d4 in conjunction with c3c2c1. The "2" aspect Higgs is represented by the "2" halves of the ellipse. This is all relative to projection, or General Projective Relativity (GPR).

"3" generations electron

"3" generations neutrinos
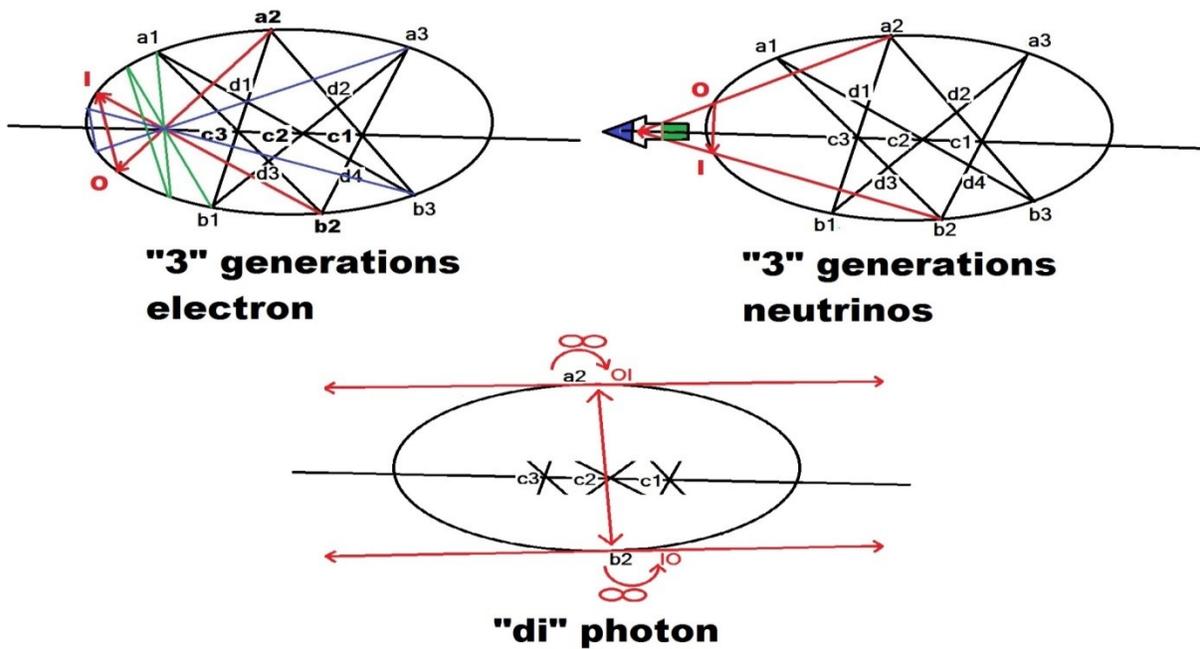
"di" photon

PASCAL'S PROJECTION ELLIPSE & STANDARD PARTICLE MODEL

The following diagram represents the most general pre-entangled case (i.e. circle) of the Pascal Projection Ellipse. A light photon is traveling through space in what is normally a pre-entangled wave-particle duality straight line. Suddenly the light photon encounters a small circular object. The light photon cannot pass through the circular object, and must go around the circular object which like a "2" slit experiment means probabilistically a top or bottom wave-like path. Thus there is an entangled change in energy flow (i.e. interference pattern) where one path is the circumference of the circle, or 2 * pi * radius (analogous to holographic object beam), and the other path is straight across the diameter of the circle, or 2 * radius (analogous to holographic reference beam). This gives a ratio of pi or 3.1416.
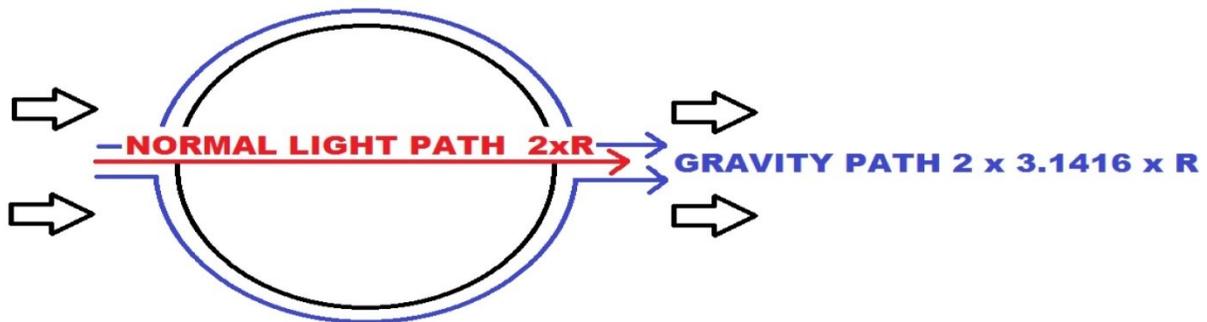

$$\text{GRAVITY / LIGHT DYNAMICS} \quad \frac{\text{GRAVITY PATH } 2 \times 3.1416 \times R}{\text{NORMAL LIGHT PATH } 2 \times R} = 3.1416$$

Current estimates are that the energy of the universe is allocated 4.9% to ordinary matter, 26.8% to dark matter, and 68.3% to dark energy. Thus we know very little about 95.1% of the universe. This brings us to the following calculations:

$$\frac{100.0\%}{(4.9\% + 26.8\%)} = 3.15 \qquad \text{versus } 3.1416$$

So since these energy allocations are at best, estimates, it appears that energy flow as it relates to entanglement in the prior diagram, is related to the proportions of ordinary matter, dark matter, and dark energy. Thus the proportions of ordinary matter, dark matter, and dark energy in the universe seems geometrically fixed by pi (п, or 3.1416) which is perhaps part of the reason why п shows up in so many equations, and is a key (i.e. unit circle) factor in Pascal's Projection Ellipse?
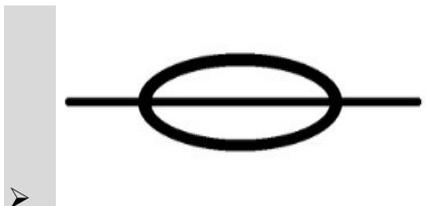
➢ Is it just a coincidence that the prior discussions fit our concept of how planetary/moon systems, solar systems, and galactic systems are structured? In fact a photon is always doing both paths, 2 * R via electro-field and 2 * pi * R via magnetic-field. Pascal's Projection Ellipse could be called a "6" photon model of entanglement, with each photon supporting CPT symmetry breaking relativity (i.e., 2 * R supporting v^2 and 2 * pi * R supporting c^2).

Information that has a probabilistic correlation function has most value, to an observer, when that information is truly probabilistic – what does this mean? Events that never occur, or events that occur all the time, are certain and not truly probabilistic. In the middle between these two extremes is where energy is well spent in probabilistic correlation functions. The Standard Particle Model is essentially built around this concept. At the certain yet still probabilistic end of the spectrum are the quarks (i.e. quarks like to cluster), of which there happen to be "6" in "3" generations (relating to a1a2a3b1b2b3), with the up quark having a low mass/energy ground state of 2.3 MeV/c^2. At the less certain and more probabilistic end of the spectrum are the leptons (i.e. leptons like to roam), of which there happen to be "6" in "3" generations (relating to a1a2a3b1b2b3), with the electron having a low mass/energy ground state of .511 MeV/c^2. Thus the relative ratio of **total probabilistic certainty + uncertainty** to **probabilistic uncertainty** is:

$$\frac{2.3 \text{MeV} /c^2 + .511 \text{MeV}/c^2}{.511 \text{MeV}/c^2} \qquad = \quad 5.50$$

Dark matter is dark because it does not interact strongly with electromagnetic light, i.e. the path of light with dark matter is straight (2 * R) versus a light path with ordinary matter which is circular (2 * 3.1416 * R). As mentioned previously the estimated allocations of dark matter and ordinary matter in the universe are 26.8% and 4.9% respectively. This gives us the following ratio:

$$\frac{26.8\% \text{ (dark matter estimate)}}{4.9\% \text{ (ordinary matter estimate)}} \qquad = \quad 5.47$$

Thus the estimated proportions of dark matter and ordinary matter, at the cosmological level, seem to be related to proportions at the quantum level embedded in the Standard Particle Model. More specifically the up quark and electron provide a basic framework on which to organize ordinary matter at the quantum level, with the electron being the main tool of organization (i.e. forming molecular covalent bonds). This suggests that the essential nature of dark matter is to provide a basic framework on which to organize ordinary matter at the cosmological level. **Thus, this is theoretical confirmation, and enhancement, of part of the Standard Cosmological Model.**

➢ Is there a fractal dimension for information? Recall that a fractal dimension is given by:

$$\text{Fractal Dimension} \quad = \quad \frac{\text{Log (complexity dimensions)}}{\text{Log (scale dimensions)}}$$

Suppose that based on the prior discussions the complexity dimensions (numerator) are holographic 2D, with one of those dimensions being probabilistic uncertainty and a second dimension probabilistic certainty (i.e. B A B). Further suppose that based on the prior discussions the scale dimensions (denominator) are straight line 1D, with that dimension being probabilistic uncertainty. This gives us the following calculation for information fractal dimension:

$$\text{Information Fractal Dimension} = \frac{\text{Log (uncertain D , certain D)}}{\text{Log (uncertain D)}} = \frac{\text{Log (2)}}{\text{Log (1)}} = \frac{.30}{.00} = \infty$$

Thus in the prior contexts the fractal dimension for information is infinite, and is based on the juxtaposition of probabilistic certainty with totally entropic (random) uncertainty.

ACKKNOWLEDGEMENTS: