

# Cosmos 2014 - Bruno - Llull - E8 Physics

viXra 1403.0178

Frank Dodd (Tony) Smith, Jr. - 2014

Cosmos (2014) with Neil deGrasse Tyson discusses Giordano Bruno's MultiVerse. David Deutch defines the MultiVerse in terms of SnapShots that are equivalent to  $Cl(16)$  E8 Local Lagrangian Regions that can be combined by completing the union of all tensor products of all copies of  $Cl(16)$  for such E8 Local Lagrangian SnapShot Regions to produce a generalization of the Hyperfinite II1 von Neumann factor that is a realistic Algebraic Quantum Field Theory for E8 Physics. Ramon Llull's 13th Century Quaternary Phase Art gives a remarkably detailed picture of the Structure of E8 Physics. In the 16th Century Giordano Bruno had access only to Llull's Ternary Art which was far less detailed than the earlier Quaternary Art, but even so was able to see that Llull's Art was, as Anthony Bonner said, "... a way to explore the connections among his infinity of worlds ...", a way that can now in the 21st Century be seen to be consistent with the realistic E8 Physics model. Bruno also influenced Giambattista Vico and Joyce's Finnegans Wake.

**"Cosmos: A SpaceTime Odyssey" (2014) with Neil deGrasse Tyson said:**

"... **Giordano Bruno** ... dared to read the books banned by the Church ...



... [and declared]

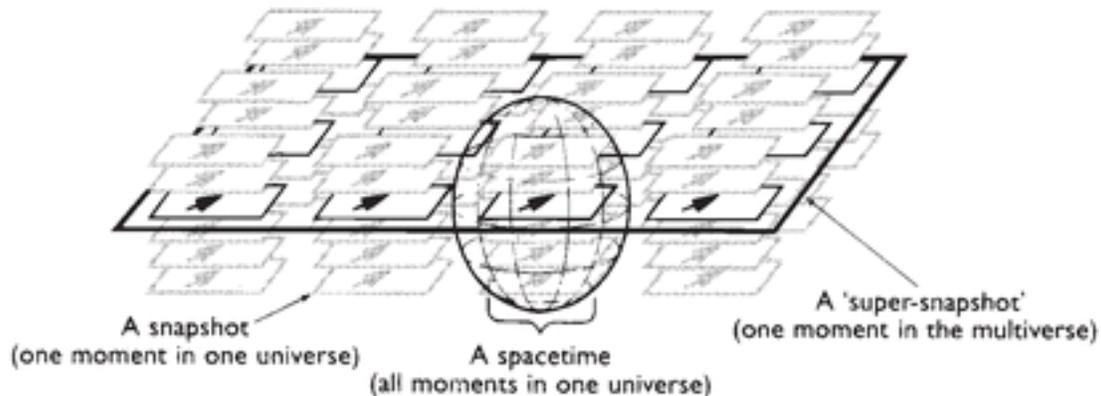
**"... our infinite God has created a boundless universe  
with an infinite number of worlds ..."**

... many of us suspect that all of this ...  
is but one tiny bubble in an infinite ocean of other universes ...

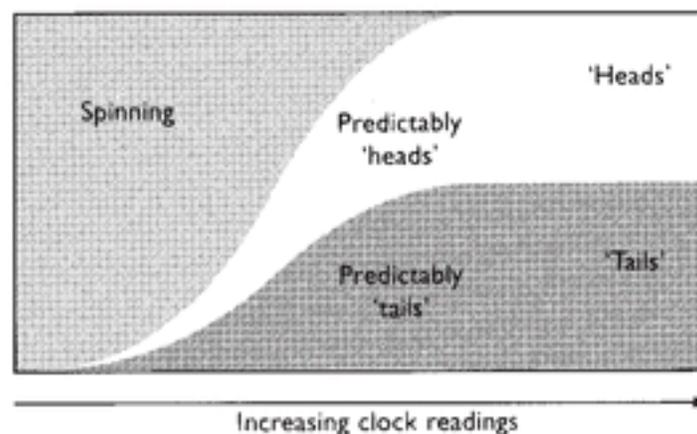
**a MultiVerse ...".**

"The Fabric of Reality" (1997) by David Deutsch said:

"... If the **multiverse** were literally a collection of spacetimes, the quantum concept of time would be the same as the classical one ...



... time would ... be a sequence of moments. The only difference would be that at a particular moment in the multiverse, many universes would exist instead of one. ... The whole of reality for the whole of time would be the stack of all the super-snapshots ... Because of quantum interference, each snapshot would no longer be determined entirely by previous snapshots of the same spacetime ... But the super-snapshots beginning with a particular moment would be entirely and exactly determined by the previous super-snapshots ... though the laws of quantum physics are perfectly deterministic at the multiverse level, they do not partition the multiverse ... into separate spacetimes, or into super-snapshots each of which entirely determines the others ... there is no fundamental demarcation between snapshots of other times and snapshots of other universes ... Other times are just special cases of other universes ... Suppose ... we toss a coin ... Each point in the diagram represents one snapshot



... in the multiverse there are far too many snapshots for clock readings alone to locate a snapshot relative to the others. To do that, we need to consider the intricate detail of which snapshots determine which others. ...

in the multiverse ... the state of one group of identical snapshots (... 'spinning')... determines the state of an equal number of differing snapshots (... 'heads' and 'tails') ... Because of the time-reversibility ... of ... the laws of quantum physics, the overall, multi-valued state of the latter group also determines the state of the former. However, in some regions of the multiverse, and in some places in space, the snapshots of some physical objects to fall, for a period, into chains, each of whose members determines all the others to a good approximation. Successive snapshots of the solar system would be the standard example. ... We do not expect that approximation to break down in any foreseeable terrestrial experiment, but ... it must break down badly in certain types of physical process. The first is the ... Big Bang ... the earliest moments which are, to a good approximation, sequential occur roughly when classical physics would extrapolate that the Big Bang had happened  $10^{(-43)}$  seconds (the Planck time) earlier. A second and similar sort of breakdown ... is thought to occur in the interiors of black holes ... Thirdly ... on a sub-microscopic scale quantum effects again warp and tear the fabric of spacetime, and ... closed loops of time ... exist ... this ... is also ... possible on a large scale ... near ... rotating black holes ... in our vicinity in the multiverse ... the number of distinct types of snapshot tends to increase rapidly with time, and hardly ever decreases ... related to the second law of thermodynamics ..."

### **Deutsch MultiVerse SnapShot Region = Cl(16) E8 Local Lagrangian Region**

E8 Physics ( viXra 1312.0036 and 1310.0182 and 1311.0094 ) is based on the structure of the Lie Algebra E8 embedded in the Real Clifford Algebra Cl(16) by  

$$248\text{-dim E8} = 120\text{-dim Bivectors of Cl(16)} + 128\text{-dim Half-Spinors of Cl(16)}$$

In each MultiVerse SnapShot Region E8 Physics is described by a Local Lagrangian constructed by integration over 8-dim Spacetime from D8 / D4xD4 in E8 of Gravity and the Standard Model terms from the two D4 subalgebras in E8 and a Dirac Fermion Particle-AntiParticle term from the D8 half-spinors in E8. Details about (4+4) M4 x CP2 Klauza-Klein SpaceTime, Fermion Generations 2 and 3, Higgs, Truth Quark Condensate, Dark Energy, Coleman-Mandula, etc are given in viXra 1310.0182 and 1311.0094 .

The Deutsch MultiVerse Quantum Theory comes from taking all tensor products of all copies of Cl(16) MultiVerse Snapshots and then completing the union of all those tensor products to produce a generalization of the Hyperfinite II1 von Neumann factor that constitutes a realistic Algebraic Quantum Field Theory (AQFT) for E8 Physics.

Consistency of the AQFT structure is ensured by Real Clifford Algebra 8-periodicity  $Cl(16) = Cl(8) \times Cl(8)$  whereby any Real Clifford Algebra, no matter how large, can be embedded in a tensor product of factors of Cl(8), and therefore of  $Cl(8) \times Cl(8) = Cl(16)$ .

## Ramon Llull described the Structure of E8 Physics

( for details see viXra 1305.0060 )

( images in this section from "The Art and Logic of Ramon Llull" (2007) by Anthony Bonner  
and for Universal Figure from quise8tullus.narpan.net )

**Correspondences of the initial Quarternary Phase of Llull's Art with E8 Physics**  
are:

Figures Y and Z  are a Binary Pair - the basis of Real Clifford Algebras.



Figure A has 16 vertices and 120 connecting lines corresponding to  $Cl(16)$  and its 120 D8 BiVectors.

$$248\text{-dim } E8 = 120\text{-dim D8 Bivectors of } Cl(16) + 128\text{-dim D8 Half-Spinors of } Cl(16)$$



Figure X divides the 16 vertices into two groups of 8 vertices thus dividing the 120 connecting lines into 3 sets:

28 that connect vertices of one group of 8 with each other

28 that connect vertices of the other group of 8 with each other

64 that connect vertices of one group of 8 with vertices of the other group of 8



Elemental Figure  has  $4 \times 4 \times 4 = 64$  elements corresponding to 64-dim D8 /  $D4 \times D4$  contained in the 120-dim D8 BiVectors and to the 64 Figure X lines that connect vertices of one group of 8 with vertices of the other which physically represent 8-dim SpaceTime Position x Momentum and therefore by Triality also to

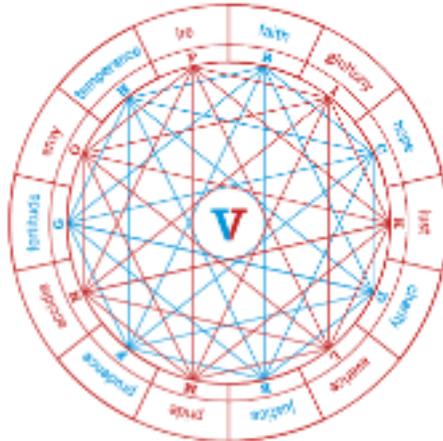
64-dim +half of 128-dim D8 Half-Spinors of  $Cl(16)$

which physically represent 8 components of 8 First-Generation Fermion Particles and to

64-dim -half of 128-dim D8 Half-Spinors of  $Cl(16)$

which physically represent 8 components of 8 First-Generation Fermion AntiParticles.

Figure V describes the two 28-dim D4 of the 120-dim D8 of 248-dim E8 by which 64-dim D8 / D4xD4 is formed. Figure V has 14 vertices divided into two groups of 7 vertices



each with 21 lines connecting vertices of one group of 7 with each other.

Each set of 7 vertices + 21 lines corresponds to one of the 28-dim D4.

Mathematically, each set of 7 vertices represents 7 Imaginary Octonions = 7-sphere S7. The Non-Associativity of Octonions prevents the 7-sphere S7 from forming a Lie Group. If you try to make a Lie Algebra out of the 7 generators of S7 you find that the products do NOT form a closed 7-dim Lie Algebra but they generate: a 14-dim G2 Lie Algebra of the Automorphisms of the Octonions and a second 7-sphere S7 so if you combine the initial 7 with the newly generated 14 + 7 you get a 28-dim D4 Lie Algebra.

Each of the 7-vertex 21-line systems is related to the 168-element group  $PSL(2,7) = SL(2,3)$  and to the 480 Octonion Multiplications.



Figure S contains 4 squares:

The 4 vertices of the central square correspond to the 4-dim Quaternionic subspaces that emerge below the Planck energy to break Octonionic 8-dim Spacetime into (4+4)-dim Kaluza-Klein spacetime with 4-dim Minkowski Physical Spacetime plus 4-dim Internal Symmetry Space  $CP^2 = SU(3) / SU(2) \times U(1)$

The remaining  $3 \times 4 = 12$  vertices correspond to 12 of the 28 Figure X lines that connect vertices of one group of 8 with each other and represent the 12 Standard Model gauge group generators of  $SU(3) \times SU(2) \times U(1)$

Two of the remaining 3 squares of Lull's S-wheel form the vertices of a cube



Looking at the cube along a diagonal axis and projecting all 8 vertices onto a perpendicular plane shows the Root Vector Diagram of  $SU(3)$  and its 8 Gluons. Since each Gluon links 4-dim Physical SpaceTime to color Internal Symmetry Space the gauge group  $SU(3)$  acts globally on Internal Symmetry Space  $C^2 = SU(3) / U(2)$

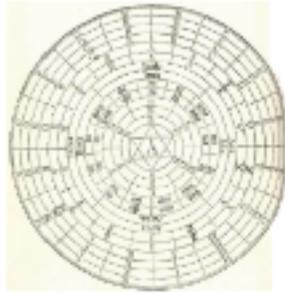
The third of the remaining squares, that is the final square, corresponds to the 3  $SU(2)$  weak bosons and the  $U(1)$  electromagnetic photon. Since  $SU(2) \times U(1) = U(2)$ , and since  $CP^2 = SU(3) / U(2)$ , they act locally on  $CP^2$  Internal Symmetry Space.



Figure T contains 5 triangles:

The  $5 \times 3 = 15$  vertices correspond to 15 of the 28 Figure X lines that connect vertices of the other group of 8 with each other and represent the 15-dimensional Conformal Group  $SU(2,2) = Spin(2,4)$  that describes Gravity and Dark Energy and lives in 16-dimensional  $U(2,2)$  as  $U(2,2) = U(1) \times SU(2,2)$ .

The  $U(1)$  of  $U(2,2)$  corresponds to the 16th of the 28 Figure X lines and represents the Complex Phase of Propagators.



Lull's Universal Figure shows how the parts fit together:

The outer 4 rings of 16 elements represent 64-Element-Things. There are 3 of these, related by Triality: 8 Position x 8 Momentum, 64 components of Fermion Particles, and 64 components of Fermion Antiparticles,

The next (going in toward the center) 2 rings of 14 elements each represent 28-dim  $D_4$  and its Lie subalgebras. There are two of these  $D_4$ , producing Gauge Groups of Gravity and the Standard Model, respectively.

The next 2 rings of 4 elements each represent the  $4+4 = 8$  dimensions of Spacetime.

The next 2 rings of 13 elements each represent the 26-dimensional String Theory with Strings seen as World-Lines of Fermions, producing a Bohm-type Quantum Theory.

At the center are 3 rings of 6 elements each surrounding a 6-vertex Star of David whose  $3 \times 6 + 6 = 24$  elements correspond to the 24-dim Leech Lattice whose Monster Group symmetry defines the size (about  $10^{-24}$  cm) of Physical Particles as Schwinger Source Kerr-Newman Black Hole clouds of virtual particle-antiparticle pairs.

( see viXra 1311.0088 )

Therefore:

**The correspondence of the Quaternary Phase of Lullian Art  
to E8 Physics  
is Very Clear and Detailed**

However,

in the time of Giordano Bruno the Lullian Quaternary Phase was not printed so that Giordano Bruno ( and others of the time such as Agrippa and Leibniz ) had access only to Lull's later Ternary Phase works.

**Giordano Bruno did not see the full Quaternary Phase of the Art of Ramon Llull  
but  
only saw the 16th century version of the Ternary Phase.  
Even so,  
Bruno saw that Lull's ideas were key to understanding Multiverse Physics.**

**Comparison of Quaternary and Ternary versions of Figure A indicates  
how severely Bruno's work was limited by his ignorance of the Quaternary Phase.**

**It is great credit to Bruno that he was able to see so much  
through the limited window of Llull's Ternary Phase.**

**"The Art and Logic of Ramon Llull" (2007) by Anthony Bonner said:**

"... With the introduction of printing and with the sixteenth-century search for a general method of science and learning, interest in Llull's Art increased ... the only works of the Art which saw their way into print were those of the ternary phase. This is clear from ... the commentaries on the Ars brevis by Agrippa von Nettesheim and Giordano Bruno ... Agrippa von Nettesheim's commentary on the Ars brevis was printed fifteen or sixteen times between 1531 and 1651 ... The complete absence of printed editions of works of the quaternary phase was not remedied until Salzinger's great anthology of the early eighteenth century ...

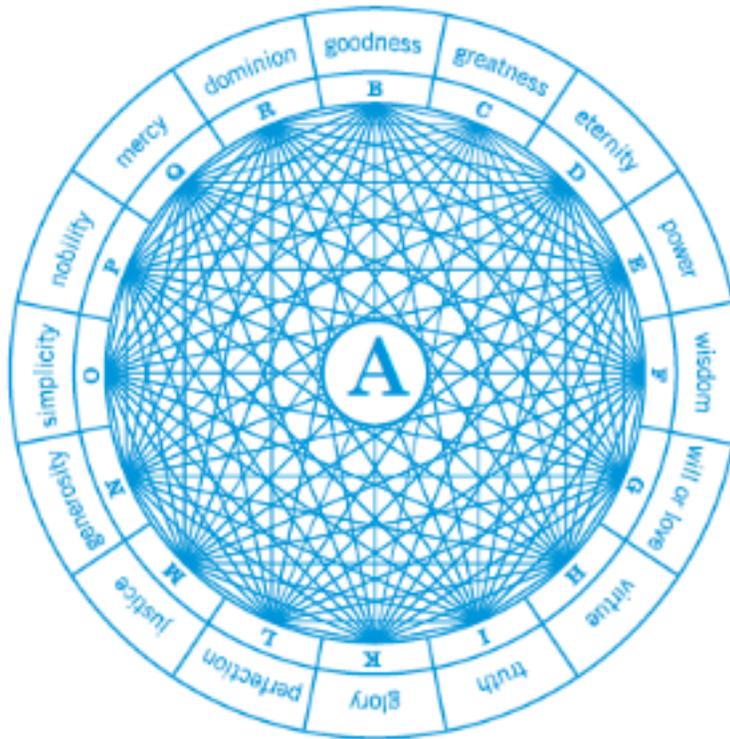
Giordano Bruno wrote five commentaries on Llull, four of them on the Art - more attention than he gave to any other thinker

...

**Giordano Bruno ... saw .... Llull's ... Art ... as a way  
to explore the connections among his infinity of worlds**

...

about 1274 ... began ... the quaternary phase ... **Figure A** ... a circle around which are



... sixteen virtues .... out of which are formed a hundred and twenty compartments ...

the change from the quaternary to the ternary phase ... begins ... in 1290 ...

**Figure ... A** ...



contains nine principles ... Figure A has none of the crisscrossed lines of the quaternary version ... as often represented in ... another fashion ... that began with Lavinheta's Explanatio of 1523 ...". The Figure A with 9 vertices and 36 crisscrossed lines that was commonly shown in Ternary Art works beginning in 1523 is



**Quaternary Phase Figure A has 16 vertices and 120 lines corresponding to the Real Clifford Algebra  $Cl(16)$  with 120 bivectors.**

**$Cl(16)$  contains the E8 of E8 Physics as the 120 bivectors plus 128 half-spinors**

**so**

**if Giordano Bruno had been aware of the Quaternary Phase he might have anticipated more aspects of E8 Physics.**

**Ternary Phase Figure A has only 9 vertices.** Although the corresponding 36 lines were omitted from Figure A by Lull, they had been by the time of Bruno been put into Ternary Figure A by Lavinheta et al. Lull's inclusion of the 36 in his Ternay Phase as the Third Figure of the Ternary Art

*The Third Figure*

BC	CD	DE	EF	FG	GH	HI	IK
BD	CE	DF	EG	FH	GI	HK	
BE	CF	DG	EH	FI	GK		
BF	CG	DH	EI	FK			
BG	CH	DI	EK				
BH	CI	DK					
BI	CK						
BK							

(image from Bonner book)

may have represented the 36-dimensional Spin(9) Lie Algebra whose relation to E8 Physics is indirect at best:

If you add the 16-dimensional spinors of Spin(9) to 36-dimensional Spin(9) itself you get 52-dimensional F4.

F4 is embedded in the Real Clifford Algebra  $Cl(8)$  as

$$52\text{-dim F4} = 8\text{-dim Vectors} + 28\text{-dim BiVectors} + 16\text{-dim Spinors}$$

By 8-Periodicity of Real Clifford Algebras the tensor product  $Cl(8) \times Cl(8) = Cl(16)$  and 248-dim E8 = 120-dim Bivectors of  $Cl(16)$  + 128-dim Half-Spinors of  $Cl(16)$

( see viXra 1208.0145 for more about F4 and E8 )

**The F4 /  $Cl(8)$  Physics of Lull's Ternary Art is only a Pale Shadow of the E8 /  $Cl(16)$  Physics of Lull's Quaternary Art but was sufficient for Giordano Bruno to propose that Lullian Art could give a realistic description of the Physics of the MultiVerse.**

**Giordano Bruno (1548-1600) not only influenced Cosmos 2014  
but also  
influenced  
Giambattista Vico (1668-1744)**

Samuel Beckett in "Dante - Bruno - Vico - Joyce" said:

"... **Giordano Bruno's** treatment of identified contraries ...

There is no difference, says Bruno

between the smallest possible chord and the smallest possible arc,

no difference between the infinite circle and the straight line.

The maxima and minima of particular contraries are one and indifferent.

Minimal heat equals minimal cold.

Consequently transmutations are circular. Therefore ...

the minima ... coincide ... with the maxima in the succession of transmutations.

... And all things are ultimately identified with God, the universal monad ...

From these considerations ... **Giambattista Vico** ...

evolved a Science and Philosophy of History ...

the passage from Scipio to Caesar is as inevitable

as the passage from Caesar to Tiberius,

since the flowers of corruption in Scipio and Caesar

are the seeds of vitality in Caesar and Tiberius.

Thus ... human progression ... depends for its movement on individuals,

and ... at the same time is independent of individuals

in virtue of what appears to be a preordained cyclicism. ...

It follows that History ... is not the result of Fate or Chance ...

but the result of a ... force he called Divine Providence ...

His division of the development of human society into three ages:

Theocratic,

Heroic,

Human (civilized)

with a corresponding classification of language:

Hieroglyphic (sacred)

Metaphorical (poetic),

Philosophical (capable of abstraction and generalisation),

was by no means new, although it must have appeared so to his contemporaries.

He derived this convenient classification from the Egyptians, via Herodotus. ...".

( see viXra 1404.0057 )

Donald Phillip Verene in "Knowledge of Things Human and Divine: **Vico's New Science** ..." said:

"... **Fas [ compare IFA ] is divine law**, as opposed to ius or human law ...

natural law ...[was]... communicated by God to Adam and by Adam to Noah.

Noah ... passed these down to his descendants ...

from their common creator the nations are the same in their form of origin ...

law is present in language from the beginning ...  
 all nations originally think in terms of poetic characters ...  
 from this type of unreflective thought, governed by fantasia,  
 there develops reflective thought and the human society that is based on it ...  
 there was a time when  
 life was a mute yet communal affair of feelings, sensings, and expressions.  
 This mute language is ... the ... basis of all human community and communication ...  
 Vico speaks of an “eternal point of the perfect state of the nations”.  
 This state of perfection would come about when all the sciences, disciplines, and arts  
 have been fully directed toward the perfection of man’s nature  
 and have reached ... acme ...  
 when all the sciences, disciplines, and arts have grasped their own natures  
 as developed from the religions and laws of humanity  
 and have ... come to serve them ...  
**The state of perfection of the nations** is not the heroic age  
 but the recapturing of a  
 heroic moment of the **integration of human and divine things in the third age**  
 ...  
**James Joyce** ... made ... **Vico** ... the central figure of ... **Finnegans Wake** ...”.

Bill Cole Cliett in his 2011 book “Riverrun to Livvy” said:

**“... the last piece of the Wake’s puzzle will fall into place  
 on the same day  
 physicists find the formula that unifies all the forces of nature ...”.**

Since the  
**CI(16) - E8 Lagrangian - AQFT model “unifies all the forces of nature”**  
 ( see viXra 1405.0030 )

**here is a pattern of pieces of the Wake’s puzzle:**

“Finnegans Wake” contains ( **my comments in red** ):

Book I of 8 Episodes  
**8 of E8**

Books II and III of 4 + 4 Episodes  
**8 + 4 + 4 = 16 of CI(16)**

Book IV of a Final Episode 0

0 =  = **Ouroboros Recursive Periodicity AQFT**

# Finnegans Wake

Finnegan = Fin + Again = End + ReWaken

I = 8

I.1

“... riverrun, past Eve and Adam’s, from swerve of shore to bend of bay,  
brings us by a commodius vicus of recirculation ...  
nor had topsawyer’s rocks by the stream Oconee exaggerated themselfe  
to Laurens County’s gorgios while they went doublin their number all the time ...”

Genesis River Oconee = Ocho = 8 = Octonions of E8  
doublin = Powers of 2 = Clifford Algebra Cl(8) =  $2^8$  and Cl(16) = Cl(8)xCl(8)

I.6

“... the choicest and the cheapest from Atlanta to Oconee ...  
what would that fargazer seem to seemself to seem seeming of, dimm it all?  
Answer: A collideorscape! ...”

collideorscape = Fermilab + LHC = Truth Quark + Higgs

I.8

“... El Negro ... La Plate ... neuphraties ... Neva ... Mersey ...Waal ... chattahoochee ...  
wabbash ...jordan ... niester ... Saint Lawrence ... Laagen ... Niger ... O’Delawarr ...  
Susquehanna ... hudson ... marne ... chinook’s ... Floss ... Alt-muehler ... Hoangho ...  
Shannons ... Orbe ... Oronoko ... limpopo ... Scamander ... Seints ... Kishtna ... Indes ...”

Many Rivers represent Many Possible Quantum Worlds

... Hadn’t he seven dams to wive him?  
And every dam had her seven crutches.  
And every crutch its seven hues. ...”

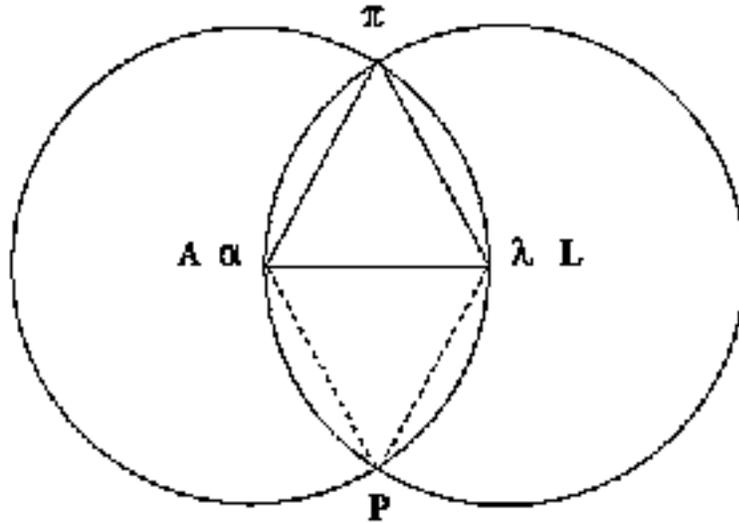
7 dams = 7-Sphere of Vector of Cl(8) = SpaceTime  
7 crutches = 7-Spheres of +half-spinor of Cl(8) = Fermion Particles  
7 hues = 7-Sphere of -half-spinor of Cl(8) = Fermion AntiParticles  
7 = 7 = 7 Related by Triality

$$\mathbb{I} = 4$$

II.2

“... Sunday King. His sevenscoloured's soot ( Ocho! Ochon! ) ... Heptagrammaton ...  
 Ocho = 8 Octonions    Hepta = 7 Imaginary Octonions = 7-Sphere

... construct an aquilittoral dryankle ... Concoct an equo-angular trillitter ...



Two Circles =  $M_4 \times CP^2$  of  $4 + 4$   
 Two Triangles  $ALP + \alpha \lambda \pi =$   
 = 3 Imaginary Quaternions of  $M_4 + 3$  Imaginary Quaternions of  $CP^2$

II.4

“... - Three quarks for Muster Mark! ...

Quarks =  $CP^2$  of  $M_4 \times CP^2 = 4 + 4$

# III = 4

## III.1

“... mailman ...

Messages communicate across SpaceTime = M4 of M4 x CP2 = 4 + 4

Letter, carried ... hundredlettered name ... last word of perfect lan-guage

Language = Quantum Information = Clifford Algebra

=

... seven senses ... threestar monothong ...”

7 = Imaginary Octonions      3star + 1 mono = M4 Space + Time

## III.4

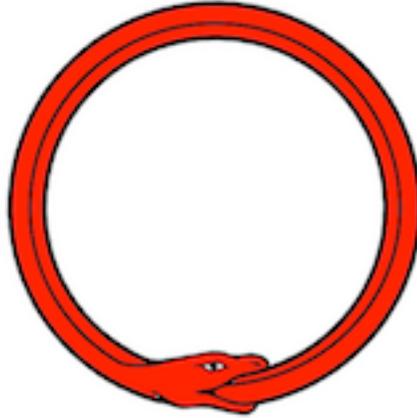
“... Tiers, tiers and tiers. Rounds.”

Tiers of E8 Lattices      Rounds = Quantum Superpositions

$$IV = \bigcirc$$

IV.0

“.. A way a lone a last a loved a long the”



( image from Wikipedia )

I.1

“... riverrun, past Eve and Adam’s, from swerve of shore to bend of bay,  
brings us by a commodius vicus of recirculation ...”