# E8 Root Vector Geometry - AQFT - 26D String Theory - - Schwinger Sources - Quantum Consciousness

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## Abstract

This paper is intended to be a only rough semi-popular overview of how
the 240 Root Vectors of E8 can be used to construct a useful Lagrangian
and Algebraic Quantum Field Theory (AQFT) in which the Bohm Quantum Potential
emerges from a 26D String Theory with Strings = World-Lines = Path Integral Paths
and the Massless Spin 2 State interpreted as the Bohm Quantum Potential.
For details and references, see viXra/1602.0319.

The 240 Root Vectors of E8 represent the physical forces, particles, and spacetime
that make up the construction of a realistic Lagrangian describing
the Octonionic Inflation Era. The Octonionic Lagrangian can be embedded into
a Cl(1,25) Clifford Algebra which with 8-Periodicity gives an AQFT.
The Massless Spin 2 State of 26D String Theory gives the Bohm Quantum Potential.
The Quantum Code of the AQFT is the Tensor Product Quantum Reed-Muller code.
A Single Cell of the 26D String Theory model has the symmetry of the Monster Group.
Quantum Processes produce Schwinger Sources with size about 10^(-24) cm.
Microtubule Structure related to E8 and Clifford Algebra enable Penrose-Hameroff
Quantum Consciousness. E8 and Cl(8) may have been encoded in the Great Pyramid.
A seperate paper discusses using the Quaternionic M4 x CP2 Kaluza-Klein version
of the Lagrangian to produce the Higgs and 2nd and 3rd Generation Fermions
and a Higgs - Truth Quark System with 3 Mass States for Higgs and Truth Quark.

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The **240 root vectors of E8** are of equal length in 8 dimensions
as they form the 240-vertex Witting-Gossett polytope
so
you can in 8 dimensions visualize how they group together

If you look at the 240 vertices as points on an 8-dim sphere
then
you can pick one point as the North Pole
and
see where the other points fall at their angle of latitude:

**1 is at North Pole**

**56 nearest neighbors of the North Pole**
**are at North Temperate Latitude**

**126 2nd nearest neighbors of the North Pole**
**are at the Equator**

**56 3rd nearest neighbors of the North Pole**
**are at South Temperate Latitude**

**1 4th nearest neighbor of the North Pole**
**is Anitpodal at the South Pole**

Therefore you see that the 240 break down into 1 + 56 + 126 + 56 + 1
but
what you need to see next is which root vector corresponds to which physics thing.

**Geometry of the E8 Lie Group gives you some ideas:**

56 + 56 = 112 Temperate North and South is the D8 = Spin(16) subgroup of E8
and they correspond to Gravity + Dark Energy and the Standard Model gauge groups
and to 8-dimensonal Spacetime position and momentum.

Each 56 breaks down into 24 + 32.

North Temperate 24 = D4 Lie Algebra = Spin(2,6) which contains Conformal Spin(2,4)
which gives Gravity plus Conformal Dark Energy
as well as Ghosts of Standard Model Gauge Bosons

South Temperate 24 = D4 Lie Algebra = Spin(8) which contains SU(4)
which gives SU(3) of the Color Force
which is the Global Group of Kaluza-Klein Internal Symmetry Space CP2
and CP2 = SU(3) / SU(2) x U(1) contains groups of Weak and Electromagnetic Forces
as well as Ghosts of Gravity and Dark Energy

Symmetric space D8 / D4(gravity) x D4(standard model) is 112-28-28 = 64-dim
and it corresponds to 64 = 8-dim position x 8-dim momentum of 8-dim Spacetime
which
8-dim Spacetime reduces to 4+4 dim M4 x CP2 Kaluza-Klein spacetime

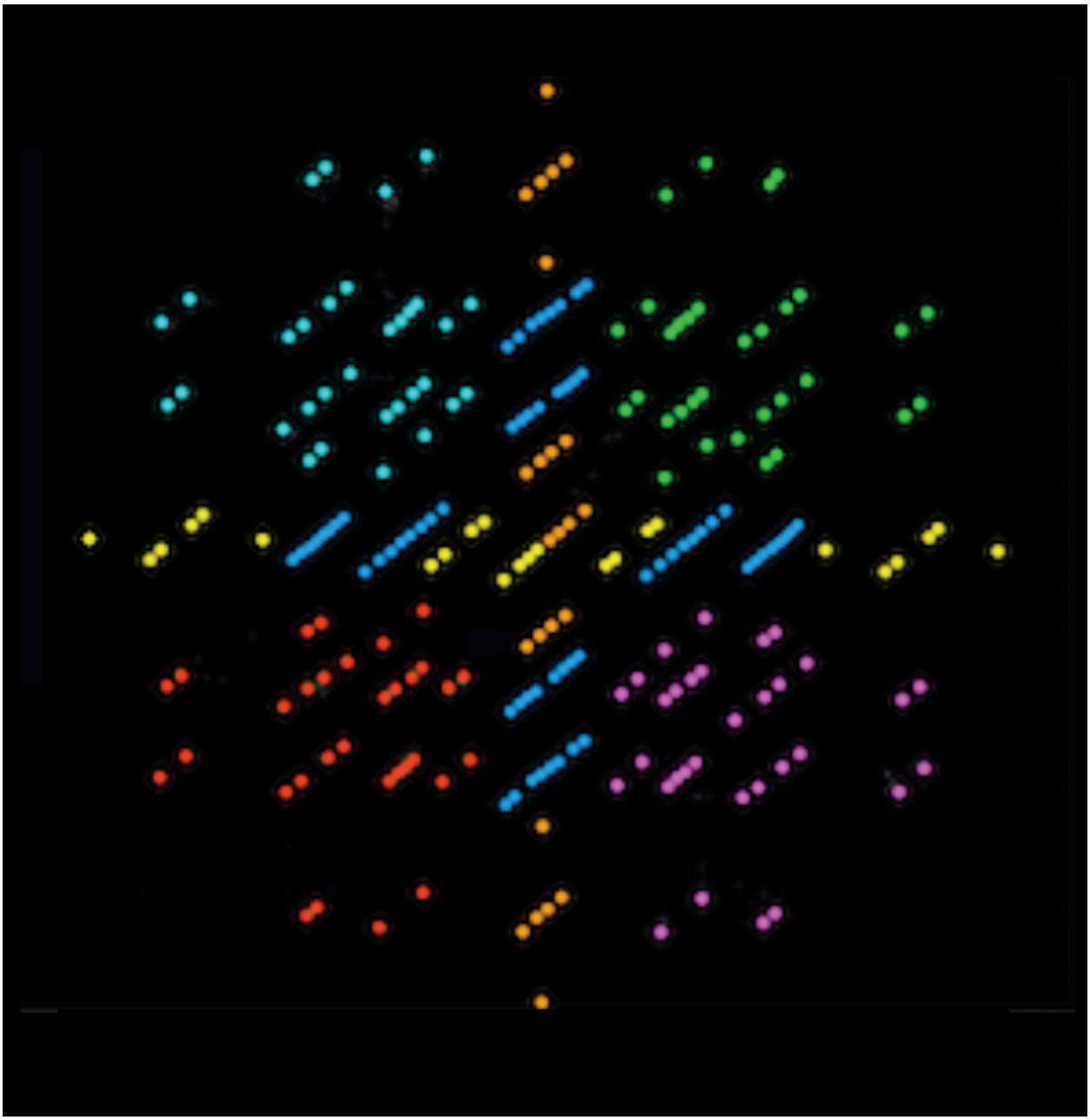
Symmetric space E8 / D8 is 128-dim Rosenfeld OctoOctonionic Projective Plane
which is
1 + 126 + 1 of the North Pole, Equator, and South Pole

The 128 are the 8 Spacetime components of Fermions: 8 Particles and 8 AntiParticles
for 8x8 = 64 Particle components + 8x8 = 64 AntiParticle components.
1 at North Pole = time component of Neutrino
1 at South Pole = time component of AntiNeutrino
126 at Equator = other components of Leptons and Quarks = root vectors of E7

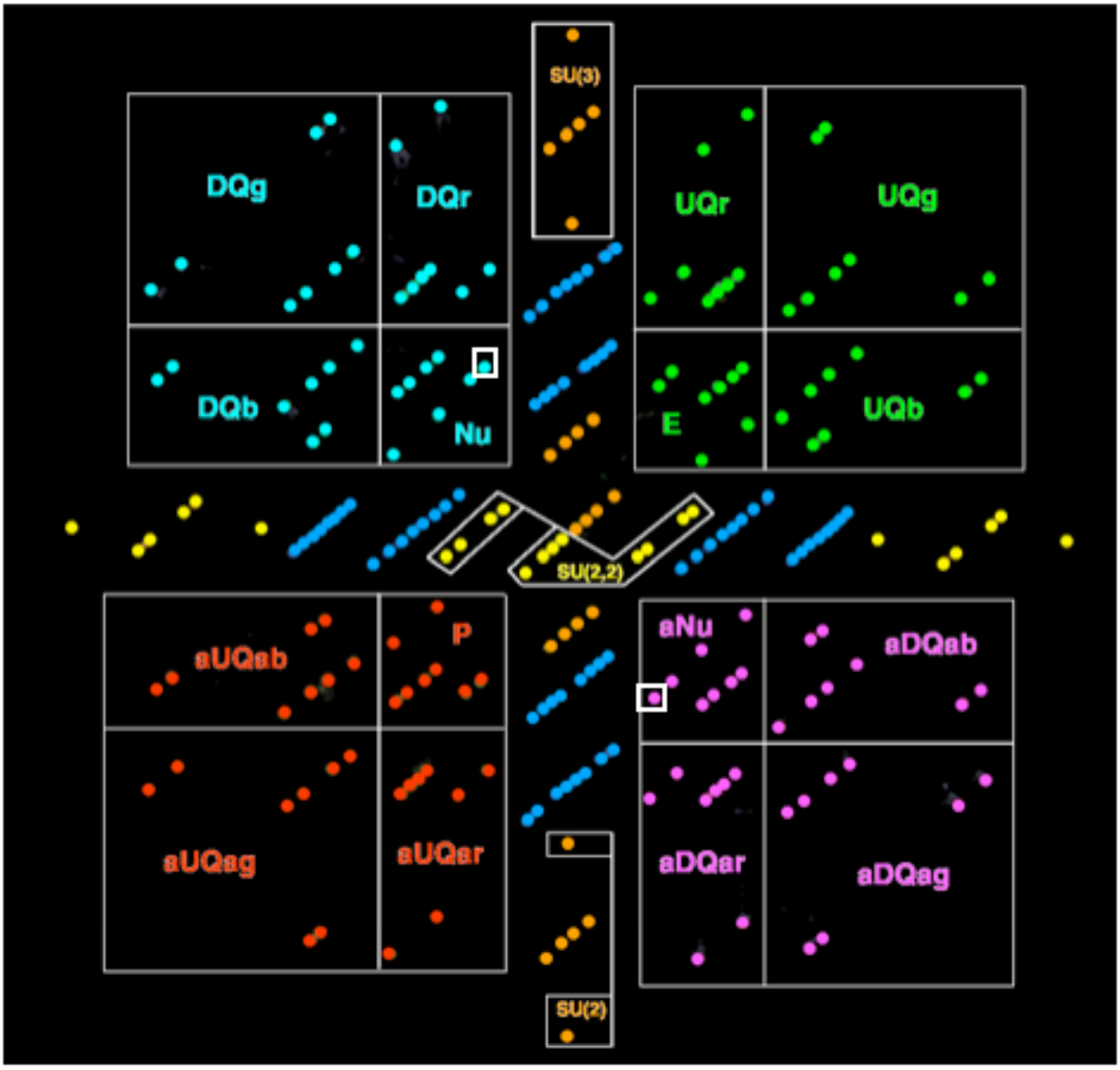
Symmetric space E7 / D6xSU(2) = 64-dim Rosenfeld QuaterOctonionic Projective Plane
corresponds to 8 components of (electron + rgb up quarks) = 8x4 = 32
plus 8 components of (positron + rgb up antiquarks) = 8x4 = 32
D6 x SU(2) has 60+2 = 62 root vectors so if you add 1+1 North and South Poles
you get 64 corresponding to 8 components of (neutrino + rgb down quarks) = 8x4 = 32
plus 8 components of (antineutrino + rgb down antiquarks) = 8x4 = 32

**2-dim projection of 240 E8 Root Vectors**
**gives useful visualization of**
**which root vector corresponds to which physics thing**

In 2-dim Projection the Root Vectors no longer have the same distance from origin



but in this particular 2-dim projection the physical interpretations of each Root Vector becomes clear:

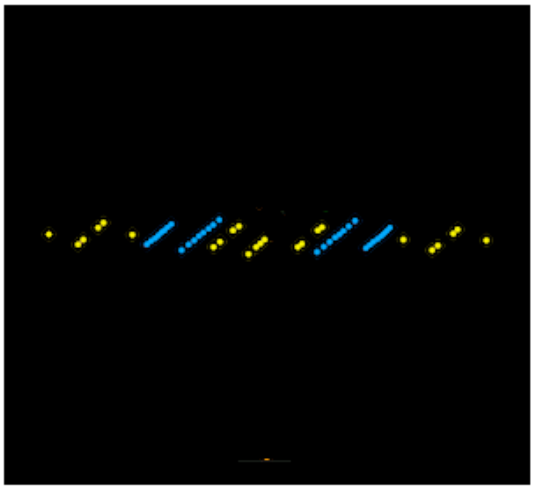



E = electron, UQr = red up quark, UQg = green up quark, UQb = blue up quark
Nu = neutrino, DQr = red down quark, DQg = green down quark, DQb = blue down quark
P = positron, aUQar = anti-red up antiquark,
aUQag = anti-green up antiquark, aUQab = anti-blue up antiquark
aNu = antineutrino, aDQar = anti-red down antiquark
white boxes enclose time components of neutrino and antineutrino
aDQag = anti-green down antiquark, aDQab = anti-blue down antiquark
Each Lepton and Quark has 8 components with respect to 4+4 dim Kaluza-Klein
6 orange SU(3) and 2 orange SU(2) represent Standard Model root vectors
24-6-2 = 16 orange represent U(2,2) Conformal Gravity Ghosts
12 yellow SU(2,2) represent Conformal Gravity SU(2,2) root vectors
24-12 = 12 yellow represent Standard Model Ghosts
32+32 = 64 blue represent 4+4 dim Kaluza-Klein spacetime position and momentum

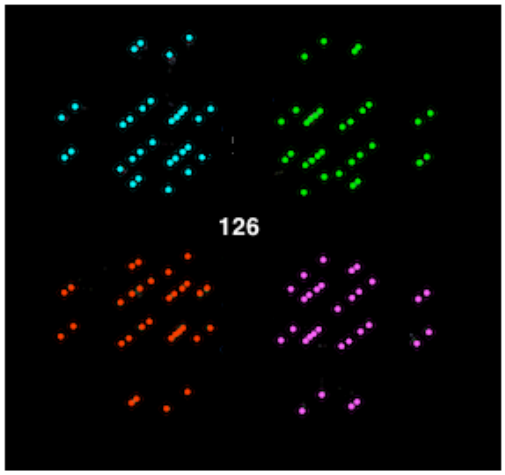
Here is how the 2-dim physical interpretations correspond
to the 8-dim Sphere Latitude decomposition:

1 is at North Pole

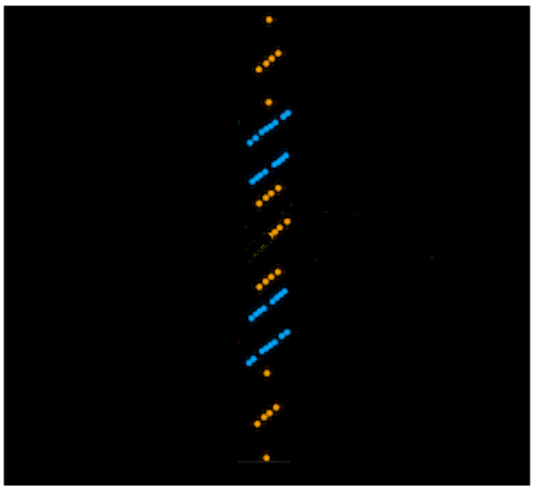

56 nearest neighbors of the North Pole
are at North Temperate Latitude



126 2nd nearest neighbors of the North Pole
are at the Equator




56 3rd nearest neighbors of the North Pole
are at South Temperate Latitude



1 4th nearest neighbor of the North Pole
is Anitpodal at the South Pole

## Recipe for constructing Lagrangian from E8 Root Vectors

My favorite Fundamental Structure of Physics is the Lagrangian.
In his Dirac Lecture, Steven Weinberg says "... Lagrangian density ...
you can think of it as the density of energy.
Energy is the quantity that ... tells us how the system evolves. ...".

The Lagrangian Density contains Boson terms and Fermion terms.
To get the full Lagrangian, you integrate those terms over Spacetime.

The Code or Recipe just says:

put
the Gravity + Dark Energy Gauge Bosons and Standard Model Ghosts
and
the Standard Model Gauge Bosons and Gravity-Dark Energy Ghosts
into the Lagrangian Density Boson terms in accord with the standard way of constructing physics boson terms

and

put
the Fermion Particles and AntiParticles
into the Lagrangian Density Fermion terms in accord with the standard way of constructing physics fermion terms

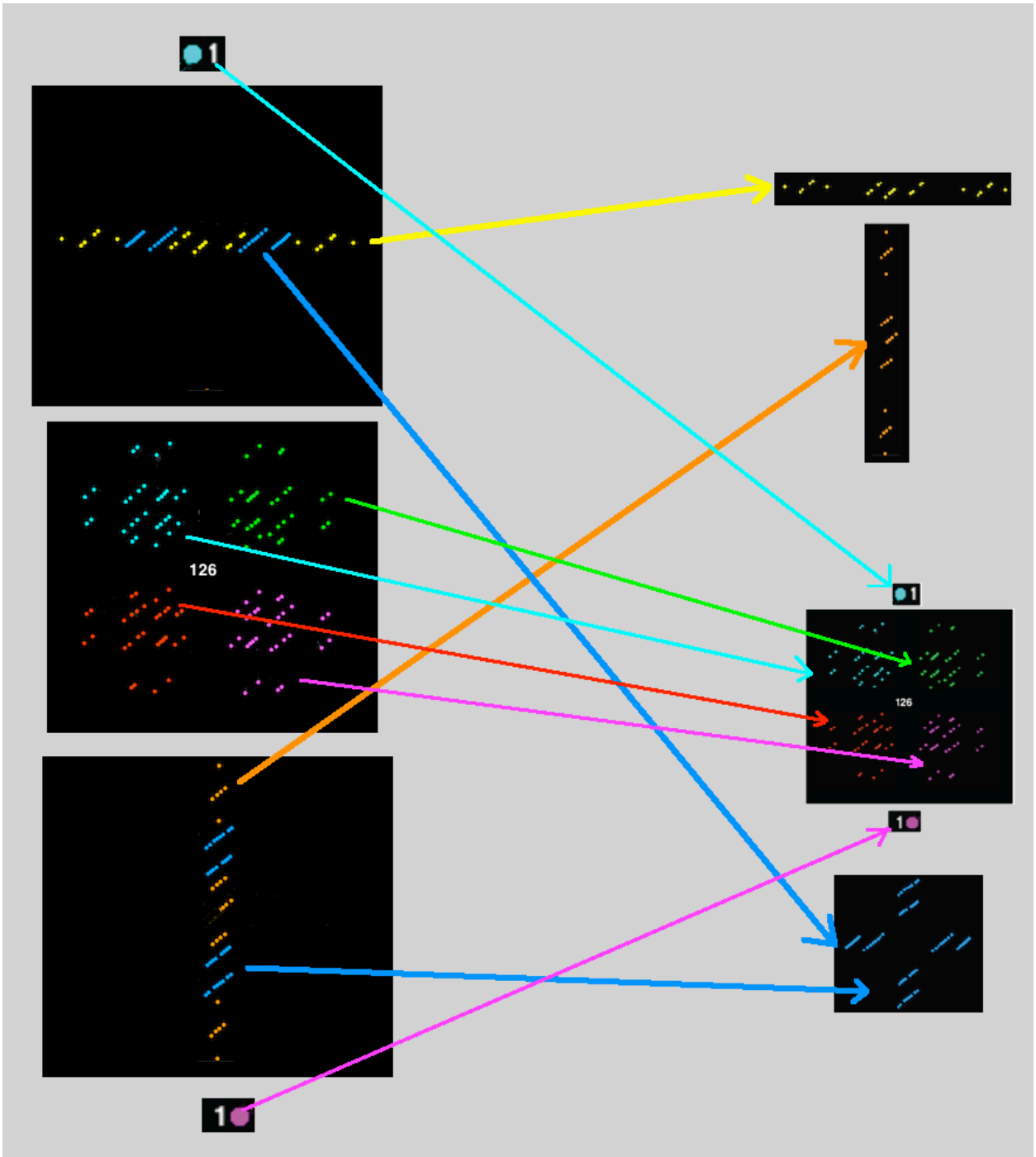
and

put the Spacetime Root Vectors
into the Spacetime Base Manifold over which the Lagrangian Density is integrated.

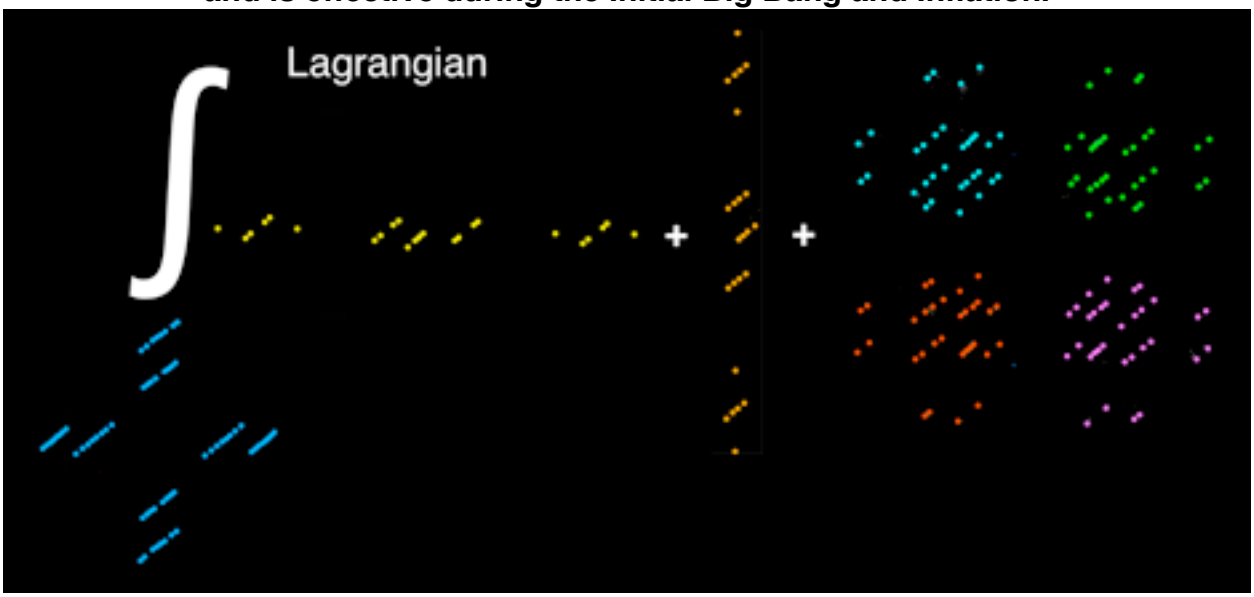
In terms of the preceding pictures of physics of E8 Root Vectors
the Code or Recipe gives a Lagrangian that is a realistic physics model.

Of course, to completely carry out the Code or Recipe you need to write out
the Lagrangian terms in the math language of conventional physics
and that is described in some of the long papers I have written
(see my web site and my viXra papers).

Here I am just trying to show the basic underlying structure of E8 Geometry
so I am not writing down the extensive details in this paper.


1
126
1
126
1
1

**The fundamental Lagrangian formed by this structure**
**is an Octonionic structure over 8-dim Spacetime**
**and is effective during the Initial Big Bang and Inflation.**




Inflation Ends when a preferred Quaternionic Subspacetime freezes out, converting 8 dim Spacetime into 4+4 dim M4 x CP2 Spacetime where
M4 = Physical Minkowski Spacetime and CP2 = SU(3) / U(2) Internal Symmetry Space
and the Octonionic Integral becomes two Quaternionic Integrals
but
the Octonionic Lagrangian can be used as a basis for constructing an AQFT
(Algebraic Quantum Field Theory)
by embedding each local E8 local classical Lagrangian into a copy of Cl(0,16)
The E8 Physics Creation Sequence begins with Spinor/Clifford Algebra Doubling

**Cl(0,0) -> Cl(0,2) -> Cl(0,4) -> Cl(0,6) -> Cl(0,8) ->**

that goes to Cl(0,8) which has Vector - Half-Spinor Triality
and is the Basic Building Block of 8-Periodicity of Real Clifford Algebras
whereby the Creation Sequence continues by Tensor Product

**-> Cl(0,8)xCl(0,8) = Cl(0,16) -> Cl(0,16)xCl(0,8) = Cl(0,24) ->**

Cl(0,16) contains the Maximal Exceptional E8 Lie Algebra
Cl(0,24) contains the Vector Space of the 24-dim Leech Lattice Λ24 that is 3 copies of E8 Lattices ( 2 being Integral Domains and 1 not Algebraically closed )

The Creation Sequence continues by constructing the Conformal Structure
of 2x2 matrices with entries in Cl(0,24) = M(2,Cl(0,24))

**-> M(2,Cl(0,24)) = Cl(1,25) ->**

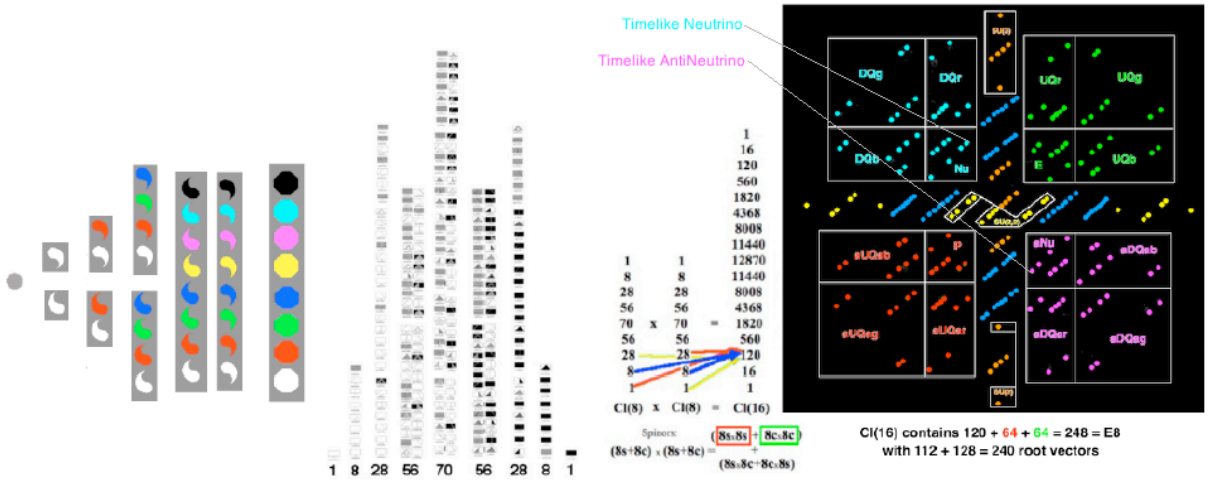
Since all the matrix entries are Cl(0,24) = tensor product of 3 copies of Cl(0,8)
8-Periodicity allows formation of the tensor products of copies of Cl(1,25)

**-> Completion of Union of All Tensor Products of Cl(1,25) = hyperfinite AQFT**

( This hyperfinite algebra structure corresponds to the Universal Action Reservoir
of Garrett Lisi in arXiv physics/0605068 )

Cl(0,0) -> Cl(0,2) -> Cl(0,4) -> Cl(0,6) -> Cl(0,8) -> Cl(0,8)xCl(0,8) = Cl(0,16) --> Cl(0,16)xCl(0,8) = Cl(0,24) -> M(2,Cl(0,24)) = Cl(1,25) ->
-> Completion of Union of All Tensor Products of Cl(1,25) = hyperfinite AQFT

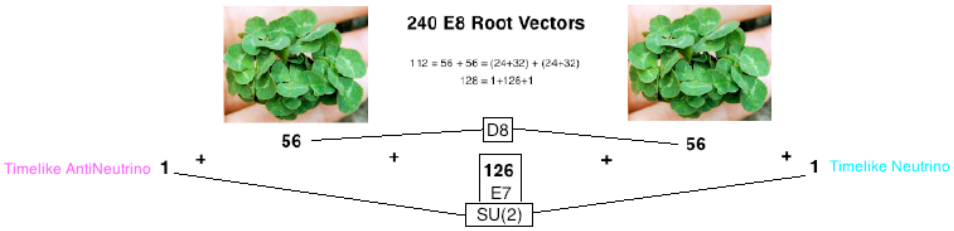
Cl(1,25) = Cl(1,9)xCl(0,8)xCl(0,8) and Cl(1,9) = Cl(1,5) x Cl(0,4) = Cl(2,4) x Cl(0,4)



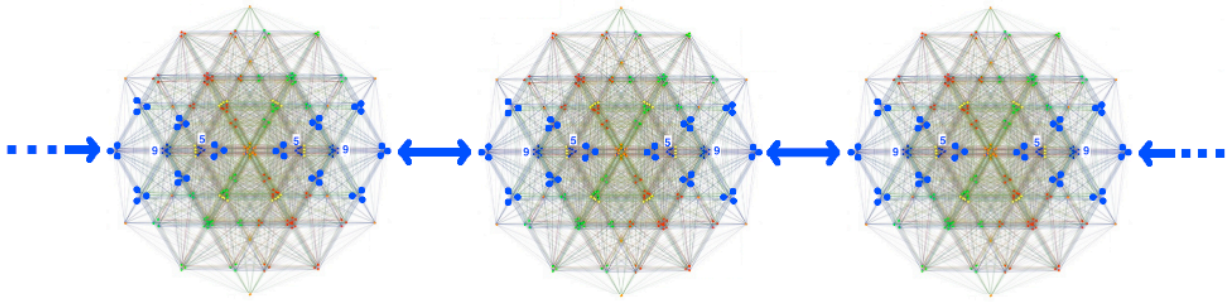

The completion of the union of all tensor products of Cl(16) = Cl(8)xCl(8) produces a generalized Hyperfinite II1 von Neumann factor that gives the Cl(16)-E8 model a natural Algebraic Quantum Field Theory

The Cl(16)-E8 AQFT inherits structure from the Cl(16)-E8 Local Lagrangian

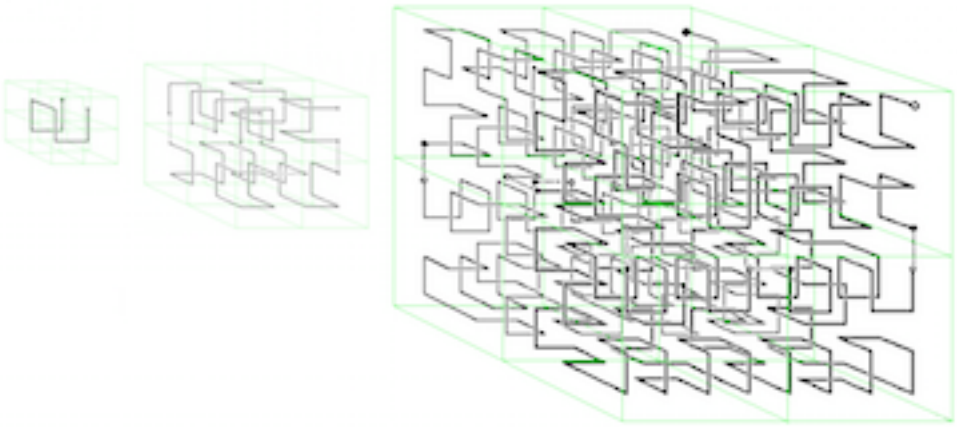
The Creation-Annihilation Operator structure of Cl(16)-E8 AQFT is given by the Maximal Contraction of E8 = semidirect product A7 x h92 where h92 = 92+1+92 = 185-dim Heisenberg algebra and A7 = 63-dim SL(8)




One Cl(1,25) containing one Cl(0,16) containing one E8 gives a Lagrangian description of one local spacetime neighborhood. To get a realistic global spacetime structure, take the tensor product Cl(1,25) x ... x Cl(1,25) with all E8 local 8-dim Octonionic spacetimes consistently aligned as described by 64-dim D8 / D4xD4 (blue dots) (this visualization uses a hexagonal type of projection of the 240 E8 root vectors to 2-dim)



which then fill up spacetime according to Gray Code Hilbert's curves:



The Union of all Cl(1,25) tensor products is
the Union of all subdivided 8-HyperCubes
and
their Completion is a huge superposition of 8-HyperCube Continuous Volumes
which Completion belongs to the Third Grothendieck Universe.

The Cl(1,25) E8 AQFT inherits structure from the Cl(1,25) E8 Local Lagrangian

$$\int$$ Gauge Gravity + Standard Model + Fermion Particle-AntiParticle

8-dim SpaceTime .
whereby World-Lines of Particles are represented by Strings moving in a space
whose dimensionality includes 8v = 8-dim SpaceTime Dimensions +
+ 8s+ = 8 Fermion Particle Types + 8s- = 8 Fermion AntiParticle Types
combined in the traceless part J(3,O)o of the 3x3 Octonion Hermitian Jordan Algebra

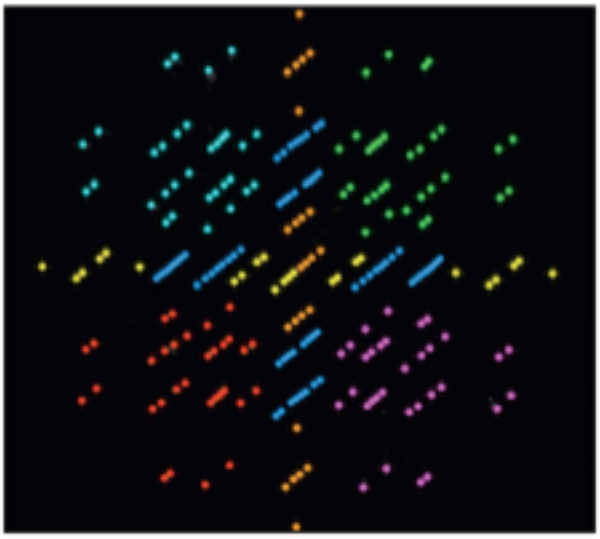
a 8s+ 8v

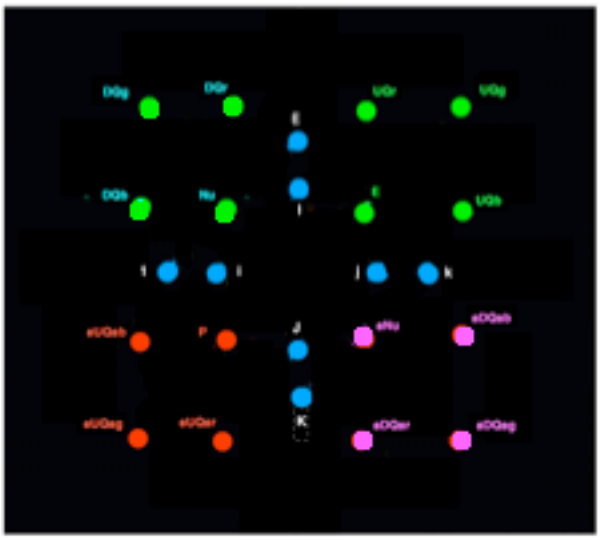
8s+* b 8s-

8v* 8s-* -a-b

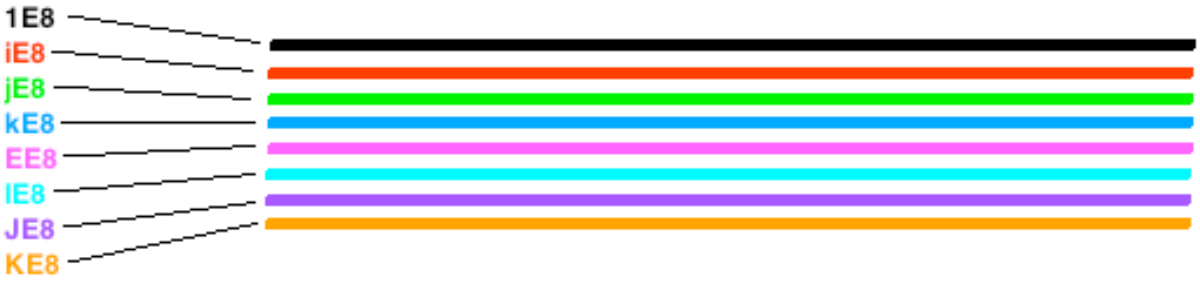
which has total dimension 8v + 8s+ + 8s- + 2 = 26 and is the space of a
26D String Theory with Strings seen as World-Lines.

24 = 8v + 8s+ + 8s- of the 26 dimensions of 26D String Theory correspond to 24x8 = 192 of the 240 E8 Root Vectors by representing the 8v + 8s+ + 8s- as superpositions of their respective 8 components

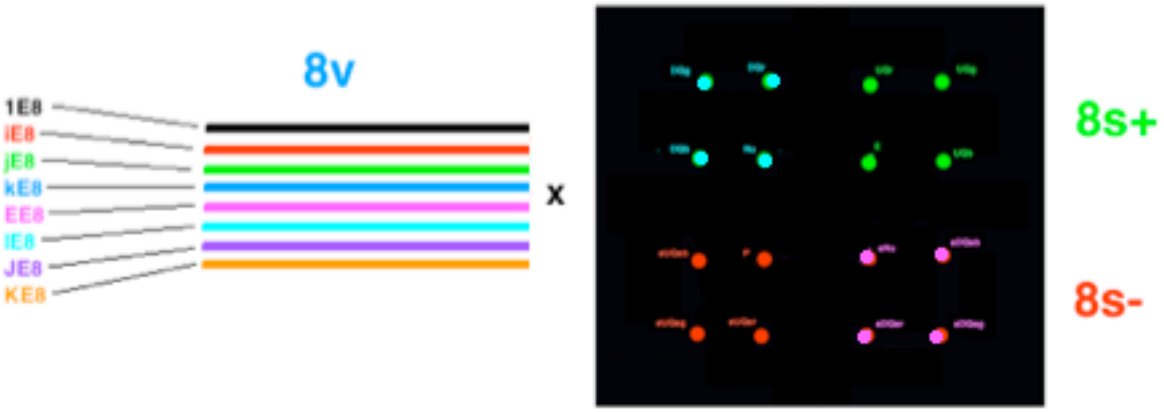




8v SpaceTime is represented by D8 branes. A D8 brane has Planck-Scale Lattice Structure superpositions of 8 types of E8 Lattice denoted by 1E8, iE8, jE8, kE8, EE8, IE8, JE8, KE8



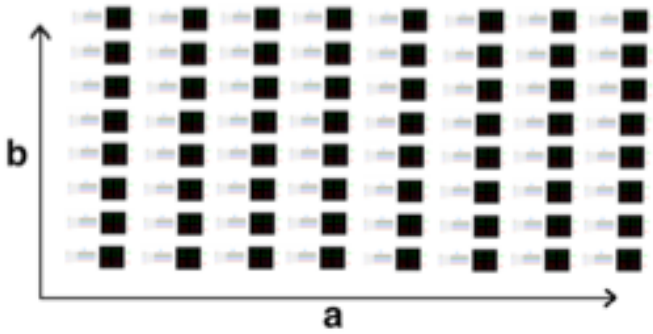
A single Snapshot of SpaceTime is represented by a D8 brane at each point of which is placed Fermion Particles or AntiParticles represented by 8+8 = 16 orbifolded dimensions of the 26 dimensions of 26D String Theory.



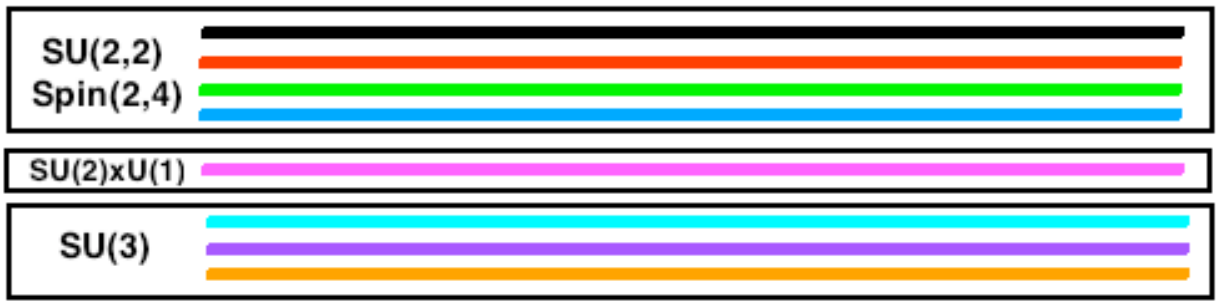

It is necessary to patch together SpaceTime Snapshots to form a Global Structure describing a Many-Worlds Global Algebraic Quantum Field Theory (AQFT)
whose structure is described by Deutsch
in "The Fabric of Reality" (Penguin 1997 pp. 276-283):

"… 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 some regions of the multiverse, and in some places in space,
the snapshots of some physical objects do fall, for a period, into chains,
each of whose members determines all the others to a good approximation …".

The Many-Worlds Snapshots are structured as a 26-dim Lorentz Leech Lattice of 26D String Theory parameterized by the a and b of J(3,O)o
as indicated in this 64-element subset of Snapshots



The 240 - 192 = 48 = 24+24 Root Vector Vertices of E8 that do not represent
the 8-dim D8 brane or the 8+8 = 16 dim of Orbifolds for Fermions
do represent the Gauge Bosons (and their Ghosts) of E8 Physics:
Gauge Bosons from 1E8, iE8, jE8, and kE8 parts of a D8 give U(2,2) Conformal Gravity
Gauge Bosons from EE8 part of a D8 give U(2) Electroweak Force
Gauge Bosons from IE8, JE8, and KE8 parts of a D8 give SU(3) Color Force




Each Deutsch chain of determination represents a World-Line of Particles / AntiParticles
corresponding to a String of 26D String Theory
such as the red line in this 64-element subset of Snapshots

**26D String Theory is the Theory of Interactions of Strings = World-Lines = Paths**
( World-Lines = Path Integral Paths of Garrett Lisi in arXiv physics/0605068 )

Interactions of World-Lines can describe Quantum Theory
according to Andrew Gray ( arXiv quant-ph/9712037 ):
"... probabilites are ... assigned to entire fine-grained histories ...
base[d] ... on the Feynman path integral formulation ...
The formulation is fully relativistic and applicable to multi-particle systems.
It ... makes the same experimental predictions as quantum field theory …".

Green, Schwartz, and Witten say in their book "Superstring Theory"
vol. 1 (Cambridge 1986)
"... For the ... closed ... bosonic string [ 26D String Theory ] .... The first excited level ...
consists of ... the ground state ... tachyon ... and ... a scalar ... 'dilaton' ... and ...
SO(24) ... little group of a ...[26-dim]... massless particle ... and ...
a ... massless ... spin two state ...".

Closed string tachyons localized at orbifolds of fermions produce virtual clouds of particles / antiparticles that dress fermions.

Dilatons are Goldstone bosons of spontaneously broken scale invariance that (analagous to Higgs) go from mediating a long-range scalar gravity-type force to the nonlocality of the Bohm-Sarfatti Quantum Potential.

The SO(24) little group is related to the Monster automorphism group that is the symmetry of each cell of Planck-scale local lattice structure.

**The massless spin 2 state = Bohmion = Carrier of the Bohm Force of the Bohm Quantum Potential.**

**The Creation-Annihilation Operator structure of the Bohm Quantum Potential of 26D String Theory and AQFT Quantum Code Information System**

is given by the
Maximal Contraction of E8 = semidirect product A7 x h92
where h92 = 92+1+92 = 185-dim Heisenberg algebra and A7 = 63-dim SL(8)

The Maximal E8 Contraction A7 x h92 can be written as a 5-Graded Lie Algebra
28 + 64 + (SL(8,R) + 1) + 64 + 28

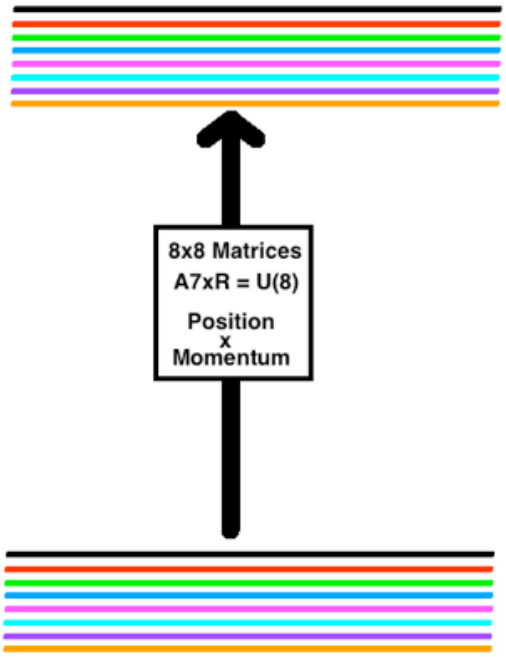
Central Even Grade 0 = SL(8,R) + 1

The 1 is a scalar and SL(8,R) = Spin(8) + Traceless Symmetric 8x8 Matrices,
so SL(8,R) represents a local 8-dim SpaceTime in Polar Coordinates.

Odd Grades -1 and +1 = 64 + 64
Each = 64 = 8x8 = Creation/Annihilation Operators
for 8 components of 8 Fundamental Fermions.

Even Grades -2 and +2 = 28 + 28
Each = Creation/Annihilation Operators
for 28 Gauge Bosons of Gravity + Standard Model.

The 8x8 matrices linking one D8 to the next D8 of a World-Line String
give A7xR = U(8) representing Position x Momentum




Cerf and Adami in quantum-ph/9512022 describe virtual qubit-anti-qubit pairs
(they call them ebit-anti-ebitpairs) that are related to negative conditional entropies for
quantum entangled systems and are similar to fermion particle-antiparticle pairs.
Therefore quantum information processes can be described by
particle-antiparticle diagrams much like particle physics diagrams and
the **Algebraic Quantum Field Theory of the Cl(1,25) E8 Physics Model**
**should have a Quantum Code Information System**
that is based on structure of a unit cell in 26D String Theory
represented by Real Clifford Algebra Cl(0,8) x Cl(0,8) x Cl(0,8) = Cl(0,24)

Since Quantum Reed-Muller code [[ 256 , 0 , 24 ]]
corresponds to
Real Clifford Algebra Cl(0,8)

**Tensor Product Quantum Reed-Muller code**
**[[ 256 , 0 , 24 ]] x [[ 256 , 0 , 24 ]] x [[ 256 , 0 , 24 ]]**
**corresponds to**
**AQFT (Algebraic Quantum Field Theory) hyperfinite von Neumann factor algebra**
**that is Completion of the Union of All Tensor Products of Cl(1,25)**

**A Single Cell of E8 26-dimensional Bosonic String Theory,**
**in which Strings are physically interpreted as World-Lines,**
**can be described by taking the quotient of its 24-dimensional O+, O-, Ov subspace modulo the 24-dimensional Leech lattice.**
**Its automorphism group is the largest finite sporadic group, the Monster Group, whose order is**
**8080, 17424, 79451, 28758, 86459, 90496, 17107, 57005, 75436, 80000, 00000**
**=**
**2^46 .3^20 .5^9 .7^6 .11^2 .13^3 .17.19.23.29.31.41.47.59.71**
**or about 8 x 10^53.**

**What happens to a Fundamental Fermion Particle whose World-Line string intersects a Single Cell ?**

The Fundamental Fermion Particle does not remain a single Planck-scale entity. Tachyons create clouds of particles/antiparticles as described by Bert Schroer in hep-th/9908021: "... any compactly localized operator applied to the vacuum generates clouds of pairs of particle/antiparticles ... More specifically it leads to the impossibility of having a local generation of pure one-particle vectors unless the system is interaction-free ...".

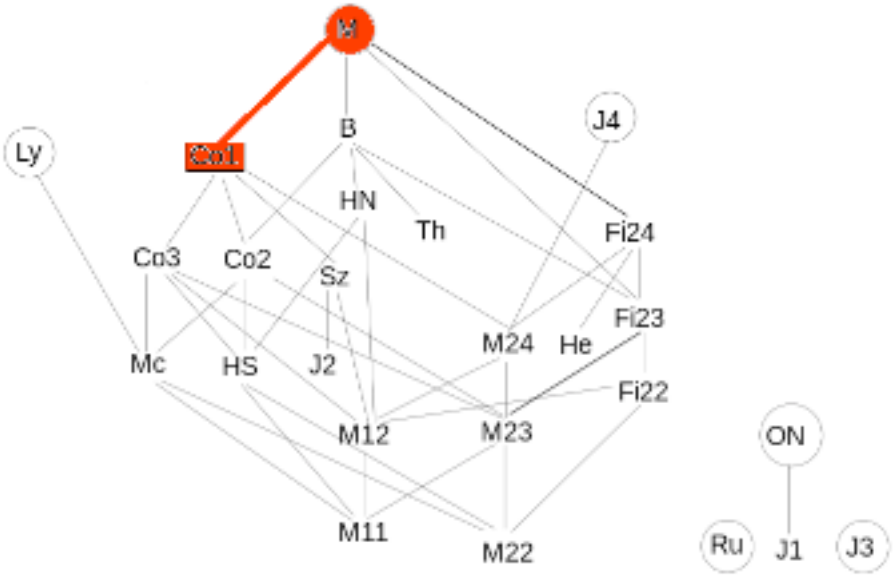
**What is the structural form of the Fundamental Fermion Cloud ?**

In "Kerr-Newman [Black Hole] solution as a Dirac particle", hep-th/0210103, H. I. Arcos and J. G. Pereira say: "... For m^2 < a^2 + q^2 , with m, a, and q respectively the source mass, angular momentum per unit mass, and electric charge, the Kerr-Newman (KN) solution of Einstein's equation reduces to a naked singularity of circular shape, enclosing a disk across which the metric components fail to be smooth ... due to its topological structure, the extended KN spacetime does admit states with half-integral angular momentum. ... The state vector ... evolution is ... governed by the Dirac equation. ... for symmetry reasons, the electric dipole moment of the KN solution vanishes identically, a result that is within the limits of experimental data ... a and m are thought of as parameters of the KN solution, which only asymptotically correspond respectively to angular momentum per unit mass and mass. Near the singularity, a represents the radius of the singular ring ... With ... renormalization ... for the usual scattering energies, the resulting radius is below the experimental limit for the extendedness of the electron ...".

**What is the size of the Fundamental Fermion Kerr-Newman Cloud ?**

The FFKN Cloud is one Planck-scale Fundamental Fermion Valence Particle plus an effectively neutral cloud of particle/antiparticle pairs. The symmetry of the cloud is governed by the 24-dimensional Leech lattice by which the Single Cell was formed.

Here (adapted from Wikipedia ) is a chart of the Monster M and its relation to other Sporadic Finite Groups and some basic facts and commentary:




The largest such subgroups of M are B, Fi24, and Co1.

B, the Baby Monster, is sort of like a downsized version of M,
as B contains Co2 and Fi23 while M contains Co1 and Fi24.

Fi24 (more conventionally denoted Fi24') is of order 1255205709190661721292800 = 1.2 x 10^24 It is the centralizer of an element of order 3 in the monster group M and is a triple cover of a 3-transposition group. It may be that Fi24' symmetry has its origin in the Triality of E8 26-dim String Theory.

The order of Co1 is 2^21.3^9.5^4.7^2.11.13.23 or about 4 x 10^18.
Aut(Leech Lattice) = double cover of Co1.
The order of the double cover 2.Co1 is 2^22.3^9.5^4.7^2.11.13.23 or about 0.8 x 10^19.
Taking into account the non-sporadic part of the Leech Lattice symmetry
according to the ATLAS at brauer.maths.qmul.ac.uk/Atlas/v3/spor/M/
the maximal subgroup of M involving Co1 is 2^(1+24).Co1 of order
139511839126336328171520000 = 1.4 x 10^26
**As 2.Co1 is the Automorphism group of the Leech Lattice modulo to which the Single Cell was formed, and as**
**the E8 26-dim String Theory Leech Lattice is a superposition of 8 Leech Lattices, 8 x 2^(1+24).Co1 describes the structure of the FFKN Cloud. Therefore,**
**the volume of the FFKN Cloud should be on the order of 10^27 x Planck scale,**
**and**
**the FFKN Cloud should contain on the order of 10^27 particle/antiparticle pairs and its size should be somewhat larger than, but roughly similar to,**
**10^(27/3) x 1.6 x 10^(-33) cm = roughly 10^(-24) cm.**

**FFKN Clouds are Schwinger Sources.**

**Schwinger Sources, Hua Geometry, and Wyler Calculations**

Fock “Fundamental of Quantum Mechanics” (1931) showed that sources require Linear Operators “... represented by a definite integral [of a]... kernel ... function ...”.

Hua “Harmonic Analysis of Functions of Several Complex Variables in the Classical Domains” (1958) showed Kernel Functions for Complex Classical Domains.

Schwinger (1951 - see Schweber, PNAS 102, 7783-7788) “... introduced a description in terms of Green’s functions, what Feynman had called propagators ... The Green’s functions are vacuum expectation values of time-ordered Heisenberg operators, and the field theory can be defined non-perturbatively in terms of these functions ...[which]... gave deep structural insights into QFTs; in particular ... the structure of the Green's functions when their variables are analytically continued to complex values ...”.

Wolf (J. Math. Mech 14 (1965) 1033-1047) showed that the Classical Domains (complete simply connected Riemannian symmetric spaces) representing 4-dim Spacetime with Quaternionic Structure are:

S1 x S1 x S1 x S1 = 4 copies of U(1)
S2 x S2 = 2 copies of SU(2)
CP2 = SU(3) / SU(2)xU(1)
S4 = Spin(5) / Spin(4) = Euclidean version of Spin(2,3) / Spin(1,3)

Armand Wyler (1971 - C. R. Acad. Sc. Paris, t. 271, 186-188) showed how to use Green’s Functions = Kernel Functions of Classical Domain structures characterizing Sources = Leptons, Quarks, and Gauge Bosons,
to calculate Particle Masses and Force Strengths

Schwinger (1969 - see physics/0610054) said: “... operator field theory ... replace[s] the particle with ... properties ... distributed througout ... small volumes of three-dimensional space ... particles ... must be created ... even though we vary a number of experimental parameters ... The properties of the particle ... remain the same ... We introduce a quantitative description of the particle source in terms of a source function ...
we do not have to claim that we can make the source arbitrarily small ...
the experimeter... must detect the particles ...[by]... collision that annihilates the particle ... the source ... can be ... an abstraction of an annilhilation collision, with the source acting negatively, as a sink ... The basic things are ... the source functions ... describing the intermediate propagation of the particle ...”.

Schwinger Sources can be described by continuous manifold structures
of Bounded Complex Domains and their Shilov Boundaries
but
the Cl(16)-E8 model at the Planck Scale has spacetime condensing out of Clifford structures forming a Leech lattice underlying 26-dim String Theory of World-Lines with 8 + 8 + 8 = 24-dim of fermion particles and antiparticles and of spacetime.

The automorphism group of a single 26-dim String Theory cell modulo the Leech lattice is the Monster Group of order about 8 x 10^53.

When a fermion particle/antiparticle appears in E8 spacetime it does not remain a single Planck-scale entity because Tachyons create a cloud of particles/antiparticles.
The cloud is one Planck-scale Fundamental Fermion Valence Particle plus an effectively neutral cloud of particle/antiparticle pairs forming a Kerr-Newman black hole.
That Kerr-Newman cloud constitutes the E8 Physics model Schwinger Source.

The cloud structure comes from the 24-dim Leech lattice part of the Monster Group which is 2^(1+24) times the double cover of Co1, for a total order of about 10^26.

Since a Leech lattice is based on copies of an E8 lattice
and since there are 7 distinct E8 integral domain lattices
there are 7 (or 8 if you include a non-integral domain E8 lattice) distinct Leech lattices.
The physical Leech lattice is a superposition of them,
effectively adding a factor of 8 to the order,
so the volume of the Kerr-Newman Cloud is on the order of 10^27 x Planck scale
and the Kerr-Newman Cloud should contain about 10^27 particle/antiparticle pairs
and its size should be about 10^(27/3) x 1.6 x 10^(-33) cm = roughly 10^(-24) cm.

The Cl(1,25) E8 model Lagrangian over 4-dim Minkowski SpaceTime M4 is

$$\int_{\text{4-dim M4}} \text{GG} + \text{SM} + \text{Fermion Particle-AntiParticle} + \text{Higgs}$$

Consider the Fermion Term.
In the conventional picture, the spinor fermion term is of the form m S S* where m is the fermion mass and S and S* represent the given fermion.
The Higgs coupling constants are, in the conventional picture, ad hoc parameters, so that effectively the mass term is, in the conventional picture, an ad hoc inclusion.

The Cl(1,25) E8 model constructs the Lagrangian integral such that the mass m emerges as the integral over the Schwinger Source spacetime region of its Kerr-Newman cloud of virtual particle/antiparticle pairs plus the valence fermion so that the volume of the Schwinger Source fermion defines its mass, which, being dressed with the particle/antiparticle pair cloud, gives quark mass as constituent mass.

Fermion Schwinger Sources correspond to the Lie Sphere Symmetric space

$$\text{Spin}(10) / \text{Spin}(8)\text{xU}(1)$$

which has
local symmetry of the Spin(8) gauge group from which the first generation spinor fermions are formed as +half-spinor and -half-spinor spaces
and Bounded Complex Domain D8 of type IV8 and Shilov Boundary Q8 = RP1 x S7

Consider the GG + SM term from Gauge Gravity and Standard Model Gauge Bosons.
The process of breaking Octonionic 8-dim SpaceTime down to Quaternionic (4+4)-dim M4 x CP2 Kaluza-Klein creates differences in the way gauge bosons "see" 4-dim Physical SpaceTime. There 4 equivalence classes of 4-dimensional Riemannian Symmetric Spaces with Quaternionic structure consistent with 4-dim Physical SpaceTime:

S4 = 4-sphere = Spin(5) / Spin(4) where Spin(5) = Schwinger-Euclidean version of the Anti-DeSitter subgroup of the Conformal Group that gives MacDowell-Mansouiri Gravity

CP2 = complex projective 2-space = SU(3) / U(2) with the SU(3) of the Color Force

S2 x S2 = SU(2)/U(1) x SU(2)/U(1) with two copies of the SU(2) of the Weak Force

S1 x S1 x S1 x S1 = U(1) x U(1) x U(1) x U(1) = 4 copies of the U(1) of the EM Photon
( 1 copy for each of the 4 covariant components of the Photon )

The Gravity Gauge Bosons (Schwinger-Euclidean versions) live in
a Spin(5) subalgebra of the Spin(6) Conformal subalgebra of D4 = Spin(8).
They "see" M4 Physical spacetime as the 4-sphere S4
so that their part of the Physical Lagrangian is

$$\int_{S4} \text{Gravity Gauge Boson Term}$$

an integral over SpaceTime S4.
The Schwinger Sources for GRb bosons are the Complex Bounded Domains and Shilov Boundaries for Spin(5) MacDowell-Mansouri Gravity bosons.
However, due to Stabilization of Condensate SpaceTime
by virtual Planck Mass Gravitational Black Holes,
for Gravity, the effective force strength that we see in our experiments
is not just composed of the S4 volume and the Spin(5) Schwinger Source volume,
but is suppressed by the square of the Planck Mass.
The unsuppressed Gravity force strength is the Geometric Part of the force strength.

The Standard Model SU(3) Color Force bosons live in
a SU(3) subalgebra of the SU(4) subalgebra of D4 = Spin(8).
They "see" M4 Physical spacetime as the complex projective plane CP2
so that their part of the Physical Lagrangian is

$$\int_{CP2} \text{SU(3) Color Force Gauge Boson Term}$$

an integral over SpaceTime CP2.
The Schwinger Sources for SU(3) bosons are the Complex Bounded Domains and
Shilov Boundaries for SU(3) Color Force bosons.
The Color Force Strength is given by
the SpaceTime CP2 volume and the SU(3) Schwinger Source volume.
Note that since the Schwinger Source volume is dressed with the particle/antiparticle
pair cloud, the calculated force strength is
for the characteristic energy level of the Color Force (about 245 MeV).

The Standard Model SU(2) Weak Force bosons live in
a SU(2) subalgebra of the U(2) local group of CP2 = SU(3) / U(2)
They "see" M4 Physical spacetime as two 2-spheres S2 x S2
so that their part of the Physical Lagrangian is

$$\int_{S2xS2} \text{SU(2) Weak Force Gauge Boson Term}$$

an integral over SpaceTime S2xS2.
The Schwinger Sources for SU(2) bosons are the Complex Bounded Domains and
Shilov Boundaries for SU(2) Weak Force bosons.
However, due to the action of the Higgs mechanism,
for the Weak Force, the effective force strength that we see in our experiments
is not just composed of the S2xS2 volume and the SU(2) Schwinger Source volume,
but is suppressed by the square of the Weak Boson masses.
The unsuppressed Weak Force strength is the Geometric Part of the force strength.

The Standard Model U(1) Electromagnetic Force bosons (photons) live in
a U(1) subalgebra of the U(2) local group of CP2 = SU(3) / U(2)
They "see" M4 Physical spacetime as four 1-sphere circles S1xS1xS1xS1 = T4
(T4 = 4-torus) so that their part of the Physical Lagrangian is

$\int$ (U(1) Electromagnetism Gauge Boson Term

T4 .
an integral over SpaceTime T4.
The Schwinger Sources for U(1) photons
are the Complex Bounded Domains and Shilov Boundaries for U(1) photons.
The Electromagnetic Force Strength is given by
the SpaceTime T4 volume and the U(1) Schwinger Source volume.

Schwinger Sources as described above are continuous manifold structures
of Bounded Complex Domains and their Shilov Boundaries
but
the E8 model at the Planck Scale has spacetime condensing out of Clifford
structures forming a Leech lattice underlying 26-dim String Theory of World-Lines
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That cloud constitutes the Schwinger Source.

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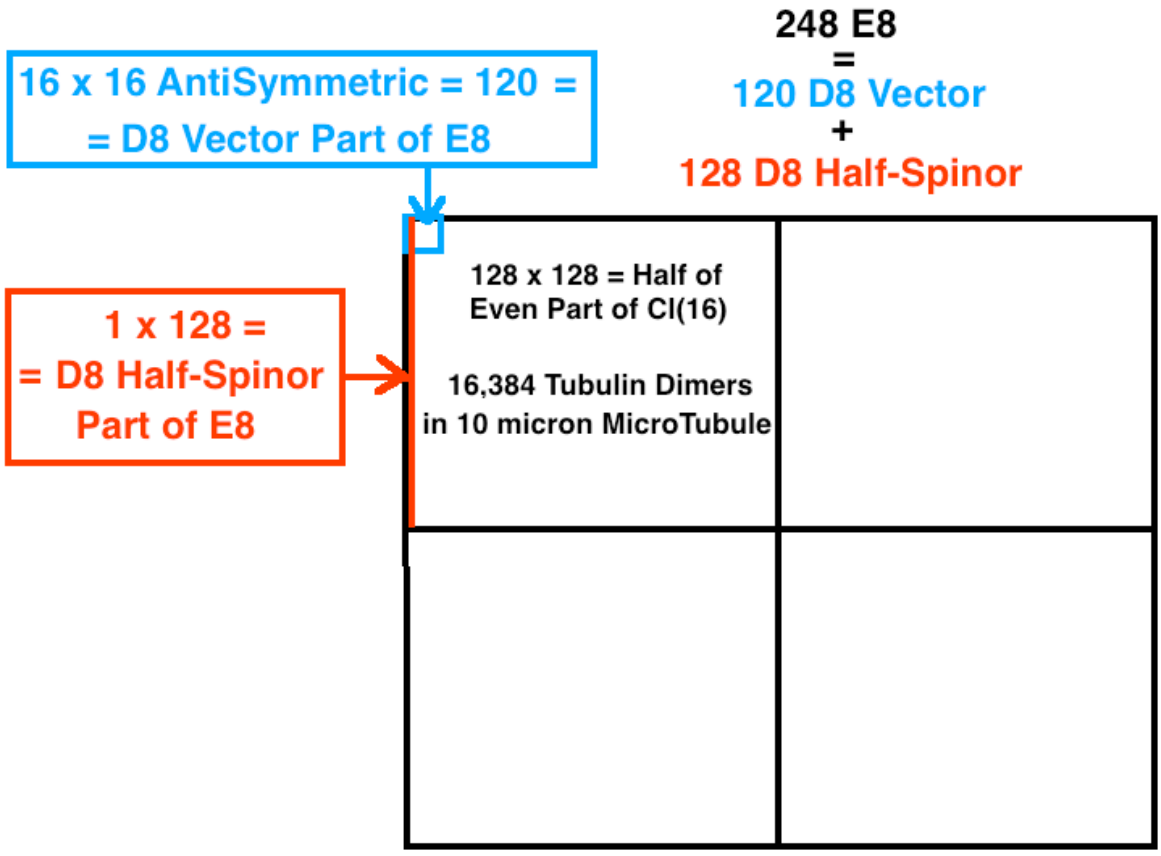
and since there are 7 distinct E8 integral domain lattices
there are 7 (or 8 if you include a non-integral domain E8 lattice) distinct Leech lattices.
The physical Leech lattice is a superposition of them,
effectively adding a factor of 8 to the order.)

The volume of the Kerr-Newman Cloud is on the order of 10^27 x Planck scale,
so the Kerr-Newman Cloud should contain about 10^27 particle/antiparticle pairs
and its size should be about 10^(27/3) x 1.6 x 10^(-33) cm = roughly 10^(-24) cm.

“... Bohm’s Quantum Potential can be viewed as an internal energy of a quantum system ...” according to Dennis, de Gosson, and Hiley ( arXiv 1412.5133 ) and
Peter R. Holland says in "The Quantum Theory of Motion" (Cambridge 1993):
"... the total force ... from the quantum potential ... does not ... fall off with distance ... because ... the quantum potential ... depends on the form of ...[the quantum state]... rather than ... its ... magnitude ...".

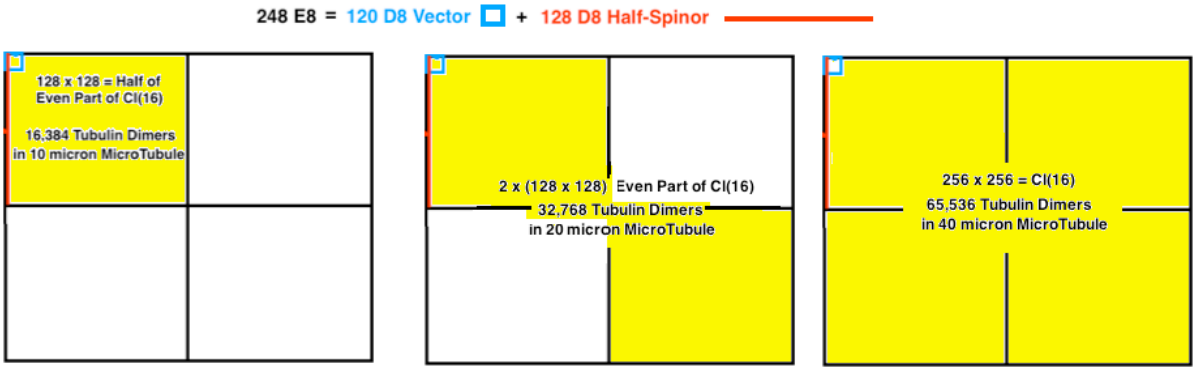
**Penrose-Hameroff-type Quantum Consciousness is due to Resonant Quantum Potential Connections among Quantum State Forms. The Quantum State Form of a Conscious Brain is determined by the configuration of a subset of its 10^18 to 10^19 Tubulin Dimers with math description in terms of a large Real Clifford Algebra.**

Microtubule binary math / code system corresponds
to Clifford Algebras Cl(8) and Cl(8)xCl(8) = Cl(16) containing E8
A 40 micron Microtubule contains Dimers representing the 65,536 elements of Cl(16)
which contains the 248 elements of Lie Algebra E8 that defines E8 Physics Lagrangian.




E8 lives in only half of the block diagonal Even Part half of Cl(16) so that
E8 of E8 Physics can be represented by the 16,384 Dimers of a 10 micron Microtubule.

Microtubules spend most of their lives between 10 microns and 40 microns,
sizes that can represent E8 as half of the Even Part (half) of Cl(16) ( 10 microns )




or as the Even Part (half) of Cl(16) ( 20 microns ) or as full Cl(16) ( 40 microns ).

In a given Microtubule
the 128 D8 Half-Spinor part is represented by a line of 128 Dimers in its stable GTP region
and

the 120 D8 Vector part by a 12 x 10 block of Dimers in its stable GTP region
( image adapted from 12biophys.blogspot.com Lecture 11 )

**How do the Microtubules communicate with each other ?**

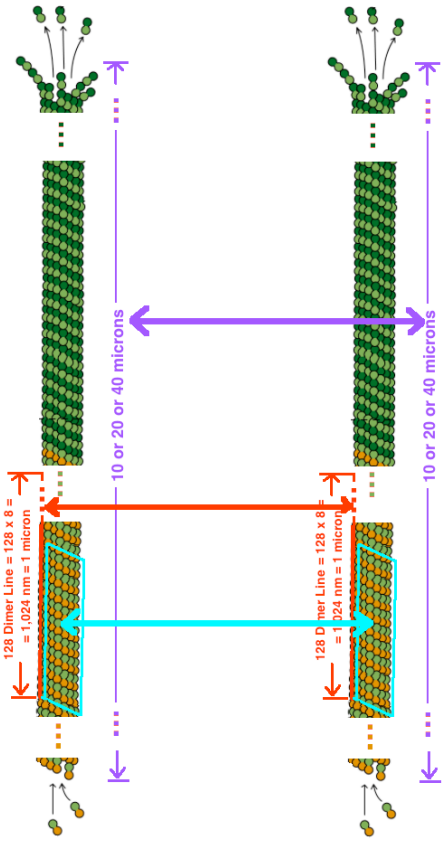
Consider the Superposition of States State 0 and State 1 involving one Tubulin Dimer with Conformation Electron mass m and State1 / State 0 position separation a .

**The Superposition Separation Energy Difference is the internal energy**

$$E\_ssediff = G\ m^2 / a$$

that can be seen as either the **energy of 26D String Theory spin two gravitons or the Bohm Quantum Potential internal energy**, equivalently.

Communication between two Microtubules is by the Bohm Quantum Potential
between their respective corresponding Dimers ( purple arrow )
with the correspondence being based on connection between respective E8 subsets,
the 128 D8 Half-Spinors ( red arrow ) and the 120 D8 BiVectors ( cyan arrow )




**How is information encoded in the Microtubules ?**

Each Microtubule contains E8, allowing Microtubules to be corrrelated with each other.
The parts of the Microtubule beyond E8 are in Cl(16) for 40 micron Microtubules,
or the Even Subalgebra of Cl(16) for 20 micron Microtubules,
or half of the Even Subalgebra of Cl(16) for 10 micron Microtubules
so since by 8-Periodicity of Real Clifford Algebras Cl(16) = Cl(8) x Cl(8) and
since Cl(8) information is described by the Quantum Reed-Muller code [[ 256 , 0 , 24 ]]
the information content of Cl(16) and its Subalgebras is described by the
Tensor Product Quantum Reed-Muller code [[ 256 , 0 , 24 ]] x [[ 256 , 0 , 24 ]]

For a 40-micron Microtubule there are, outside the 248-E8 part, about 65,000 TD Qubits
available to describe one Quantum Thought State among about 2^65,000 possibilities.

65,536-dimensional Cl(16) not only contains the E8 of E8 Physics
and the information content of Microtubules
but also contains the information content of DNA chromosome condensation
and the information content of mRNA triple - amino acid transformations.

In “Living Matter: Algebra of Molecules” (CRC Press 2016) Valery V. Stcherbic and Leonid P. Buchatsky say: “... DNA structure contains four nucleotides:
adenine A, guanine G, cytosine C and thymine T. ...

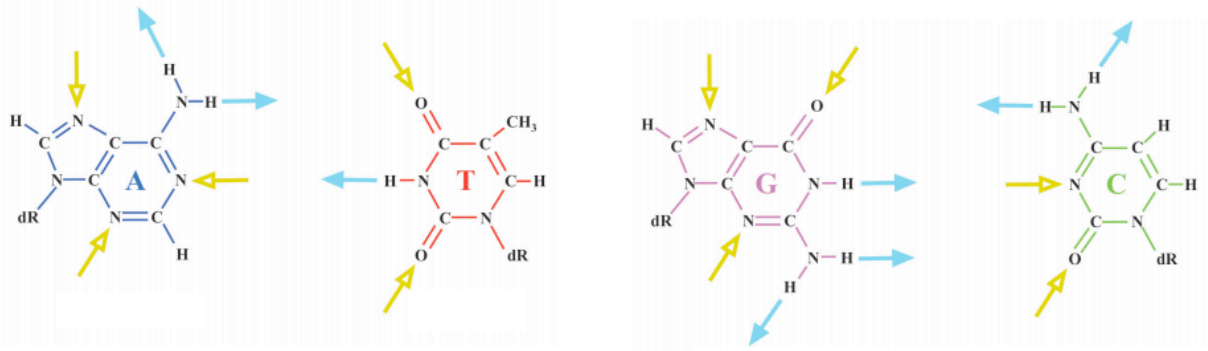



**Figure 1.4** Potential vectors of hydrogen bond of DNA nucleotides.
Yellow arrows—acceptors, blue arrows—donors of hydrogen.

The space of DNA nucleotide states contains T2^3 ⊗ C2^4 ⊗ A2^5 ⊗ G2^6 = 2^18 elements of Clifford algebras. This space reduction to four nucleotides means compression of DNA information by a factor of 2^18 / 4 = 65536.
Reduction of the nucleotide state space leads
to DNA compactization and chromosome condensation. ...”.

Information lost by condensing DNA is stored in Microtubules through
Anaphase after which it has been restored to the new Duplicated DNA

**The DNA information condensation factor of 65,536 is the dimension of Cl(16)
which is
the Real Clifford Algebra containing 248-dim E8 of E8 Physics
as 120-dim bivector D8 plus 128-dim D8 half-spinor
and is also
the Clifford Algebra of Microtubule information in Quantum Consciousness.**

**What about information in the Many Microtubules of Human Consciousness ?**

The information in one Microtubule is based on Cl(16)
which is contained in the Cl(1,25) of 26D String Theory E8 Physics

**How does this give rise to Penrose-Hameroff Quantum Consciousness ?**

Consider the Superposition of States State 0 and State 1 involving one Tubulin Dimer with Conformation Electron mass m and State1 / State 0 position separation a .
The Superposition Separation Energy Difference is the internal energy

$$E\_ssediff = G\ m^2 / a$$

that can be seen as the energy of 26D String Theory spin two gravitons
which physically represent the Bohm Quantum Potential internal energy.

For a given Tubulin Dimer a = 1 nanometer = 10^(-7) cm so that
T = h / E_electron = ( Compton / Schwarzschild ) ( a / c ) = 10^26 sec = 10^19 years

Now consider the case of N Tubulin Dimers in Coherent Superposition
connected by the Bohm Quantum Potential Force that does not fall off with distance.

Jack Sarfatti defines coherence length L by L^3 = N a^3 so that
the Superposition Energy E_N of N superposed Conformation Electrons is

$$E\_N = G\ M^2 / L = N^{(5/3)}\ E\_ssediff$$

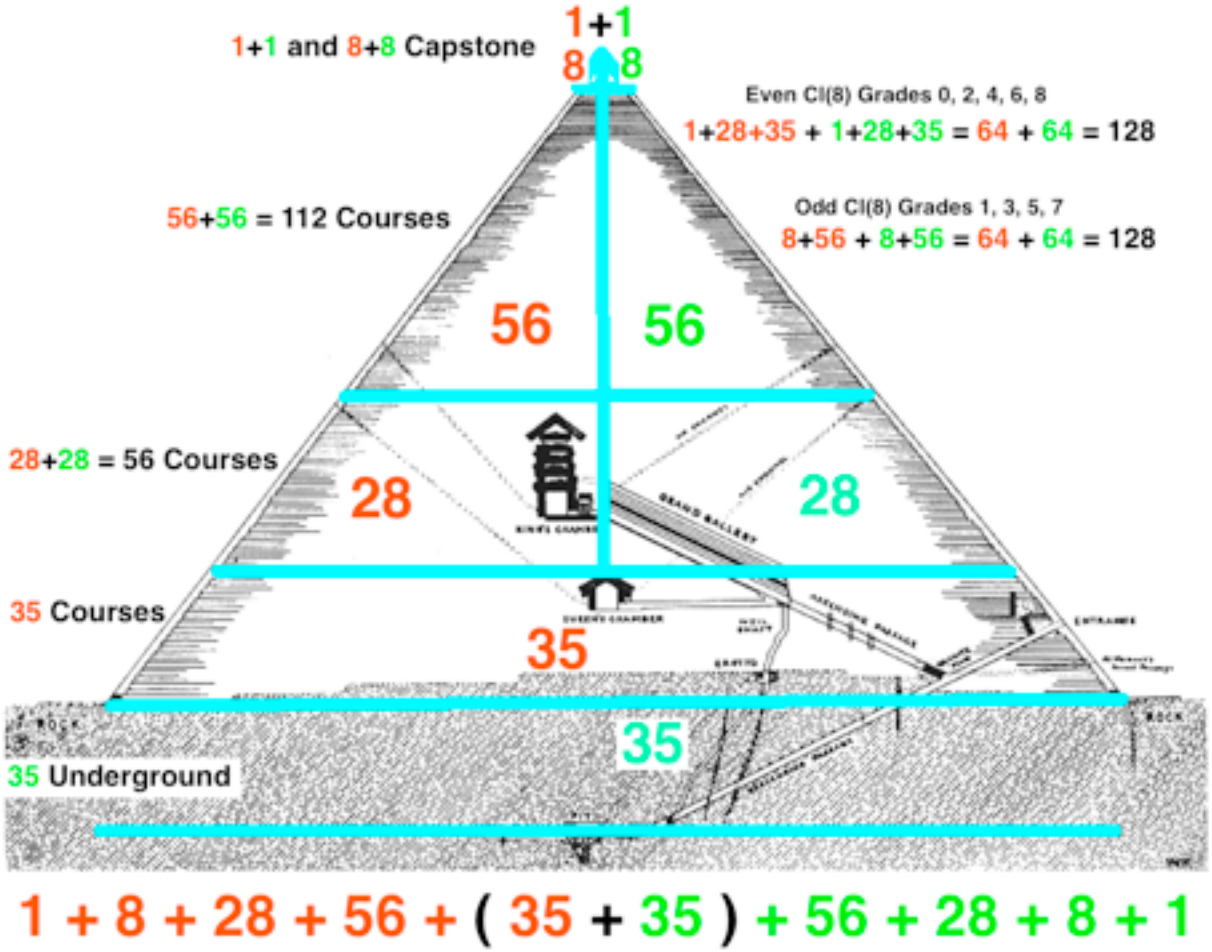
The decoherence time for the system of N Tubulin Electrons is

$$T\_N = h / E\_N = h / N^{(5/3)}\ E\_ssediff = N^{(-5/3)}\ 10^{26}\ sec$$

so we have the following rough approximate Decoherence Times T_N

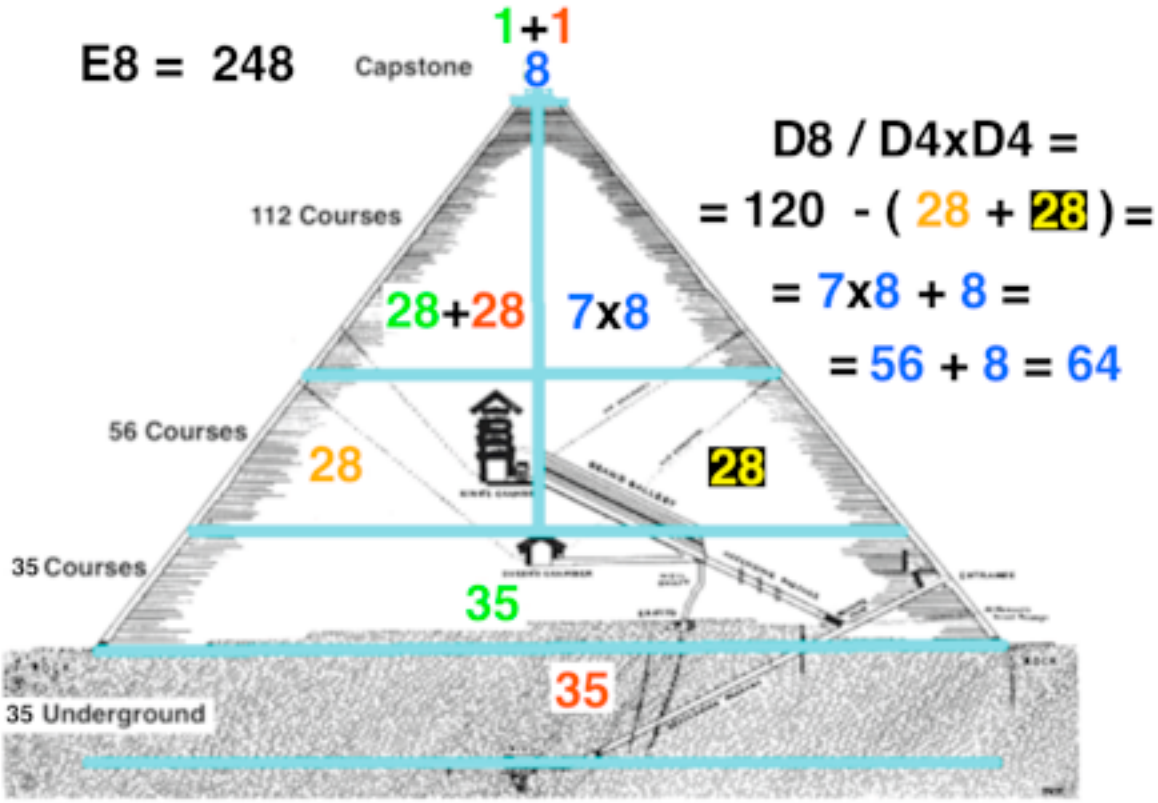
```
Number of Involved                Time
  Tubulin Dimers                  T_N
10^(11+9) = 10^20     10^(-33 + 26) = 10^(-7) sec     10^11 neurons
                                                          x
                                                      10^9 TD / neuron
                                                          =
                                                      10^20 Tubuin Dimers
                                                        in Human Brain
10^16              10^(-27 + 26) = 10^(-1) sec - 10 Hz
                         Human Alpha EEG is 8 to 13 Hz
                   Fundamental Schumann Resonance is 7.8 Hz
     Time of Traverse by a String World-Line Quantum Bohmion of a Quantum
     Consciousness Hamiltonian Circuit of 10^16 TD separated from nearest
     neighbors by 10 nm is 10^16 x 10 nm / c = (10^16 x 10^(-6)) cm / c =
                           = 10^10 cm / c = 0.3 sec
```

Clifford Algebras were not known to European mathematicians until Clifford in the 19th century and not known to European physicists until Dirac in the 20th century but it seems to me that their structure was known to Africans in ancient times. For example, the courses of the Great Pyramid of Giza correspond to the graded structure of Cl(8):

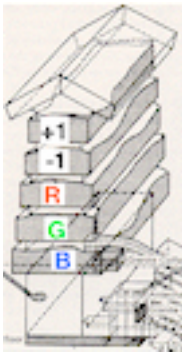



( image adapted from David Davidson image - for larger size see tony5m17h.net/GreatPyrCl8.png )

248-dim E8 (like 256-dim Cl(8)) can also be seen in terms of the Great Pyramid
(the 8-dim difference is related to the Cl(8) Primitive Idempotent and the Higgs).




E8 / D8 = 248 - 120 = 128 = 64 + 64

The 28 is in the area of the Upper Chamber 

which has 5 slabs
that represent the 5 charges ( +1,-1 electric and R,G,B color ) of the Standard Model.

The 28 is in the area of the Grand Gallery 
which rises at a
slope of about 26 degrees, or about half of the Golden Ratio slope of the Great Pyramid
which is arccosine( 1 / ((1 + sqrt(5))/2) ) = 51.8 degrees.
The Grand Gallery could represent a segment of a space-time path ( World-Line )
in the context of Conformal Gravity