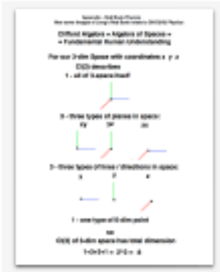
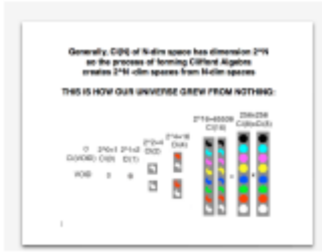
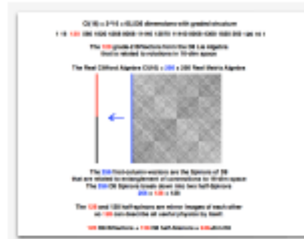
RED BOOK PHYSICS

How Jung's Red Book Archetypes connect with E8 - Cl(16) Physics

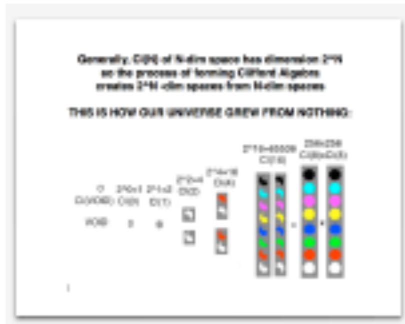
Frank Dodd (Tony) Smith, Jr. - 2018

The first five pages after the cover summarize the rest of this paper.

CLIFFORD ALGEBRAS to E8

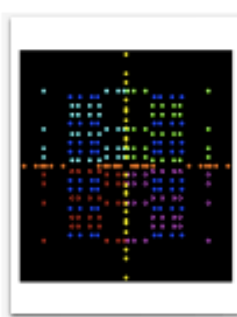
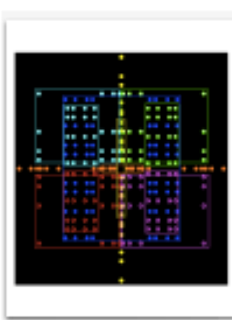
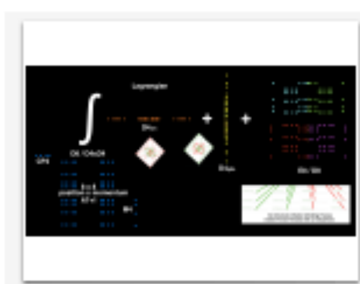

CLIFFORD EVOLUTION of OUR UNIVERSE



CREATION - OCTONIONIC NON-UNITARY INFLATION
28+64+28 = 120 D8 = 4X32 =128 D8 HALF-SPINOR

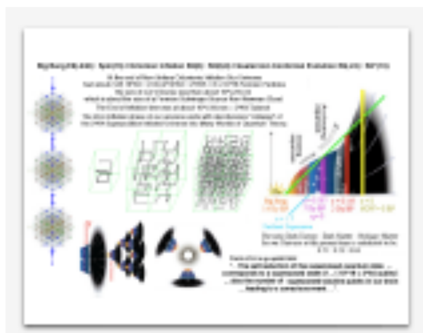



E8 - PARTICLES and FORCES - 8D LAGRANGIAN - TRIALITY

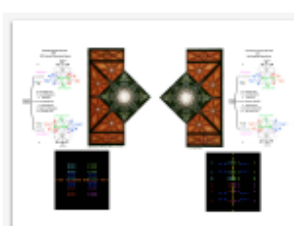





E8 HEISENBERG CREATION-ANNIHILATION - 28+64+(63+1)+64=28

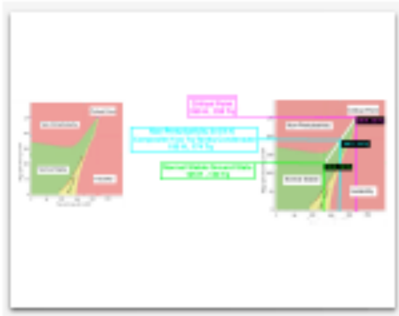
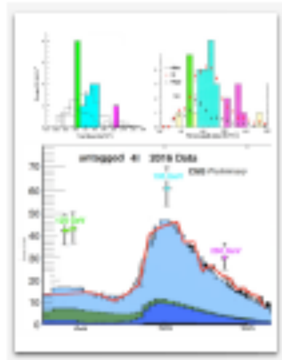
AFTER INFLATION - QUATERNIONIC UNITARY EXPANSION
now - DE : DM : OM = 0.75 : 0.21 : 0.04



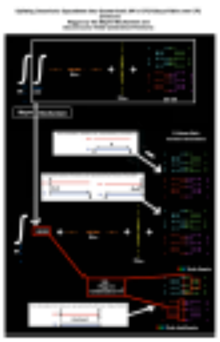
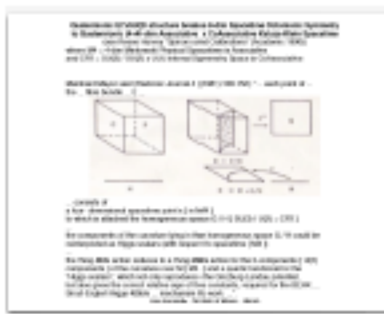
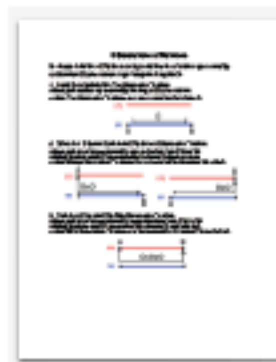
E8 = H4 STANDARD MODEL CP2 + H4 GRAVITY+DARK ENERGY M4
STRINGS = WORLD LINES 26D STRING THEORY - SPIN-2 BOHMIONS
QUANTUM BLOCKCHAINS OF SCHWINGER SOURCES



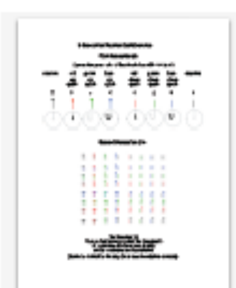
HIGGS = NAMBU-JONA-LASINIO TRUTH QUARK COMPOSITE
FERMILAB TRUTH QUARK MASSES 130 GeV - 174 GeV - 220 GeV
CMS HIGGS MASSES 125 GeV - 195 GeV - 260 GeV

M4xCP2 KALUZA-KLEIN - MAYER HIGGS - 3 FERMION GENERATIONS

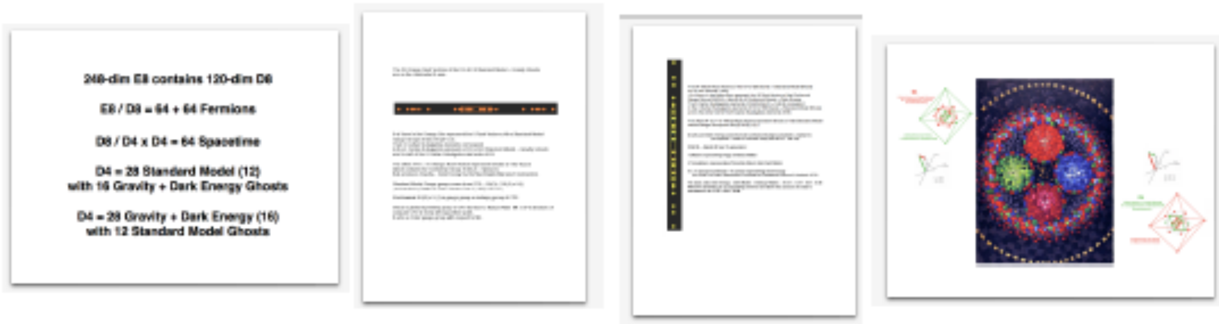




FERMION OCTONIONIC BRAIDS - FERMION MASSES

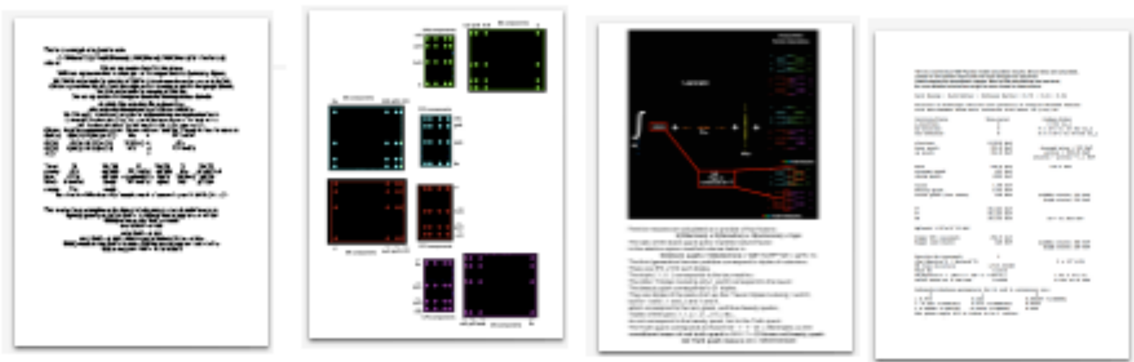




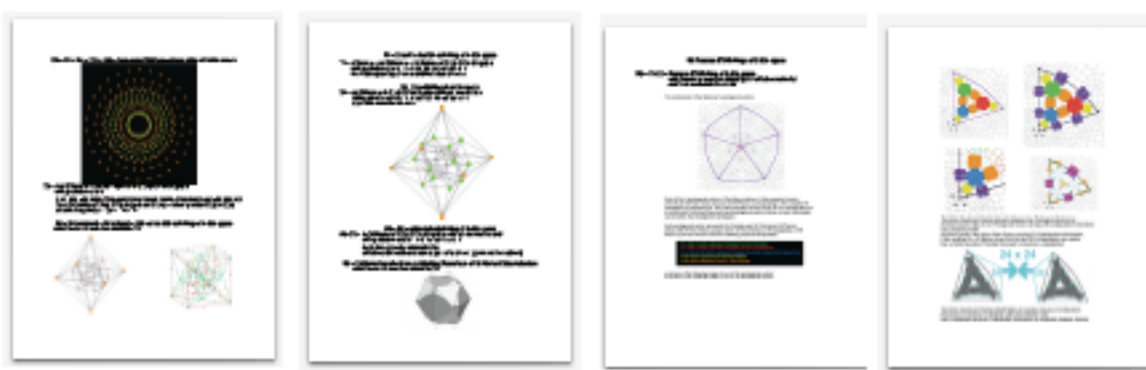
D4 STANDARD MODEL and GRAVITY+DE GHOSTS
D4 GRAVITY+DE and STANDARD MODEL GHOSTS



FORCE STRENGTHS - 4D LAGRANGIAN - CALCULATION RESULTS

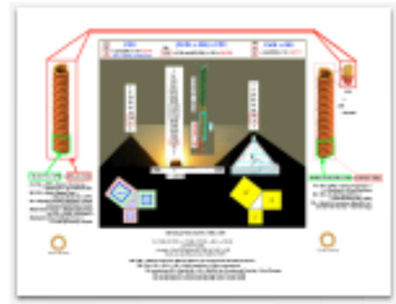


E8 - H4 - F4 - D4 - D3=A3 - H3 - H2=PENROSE STAR

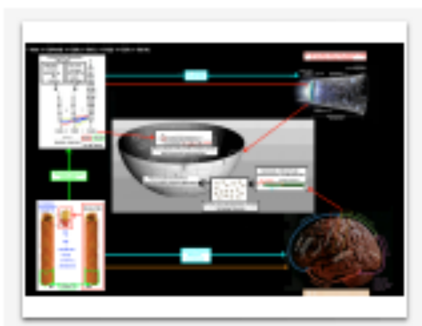
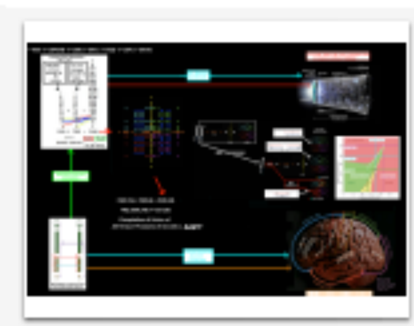


CELLULAR AUTOMATA - CL(8) - CL(16) - MICROTUBULE - PYRAMIDS





SHILOV BOUNDARY HUMAN MIND
COMPLEX DOMAIN UNIVERSAL CONSCIOUSNESS

William KIngdon Clifford (1845 - 1879)
described Geometry in terms of his invention: Real Clifford Algebras,
which he called “**mind-stuff**”, saying:

“... That element of which ... even the simplest feeling is a complex,
I shall call **Mind-stuff**.
A moving molecule of **inorganic matter** does not possess mind or consciousness ; but it **possesses a small piece of mind-stuff**. ...
When molecules are ... combined together ... the elements of mind-stuff which go along with them ... combine ... to form the ... beginnings of Sentience.
When the molecules are so combined as to form the brain and nervous system ... the corresponding elements of mind-stuff are so combined as to form some kind of consciousness ... changes in the complex which take place at the same time get so linked together that the repetition of one implies the repetition of the other.
**When matter takes the complex form of a living human brain,
the corresponding mind-stuff takes the form of a human consciousness** ...”.

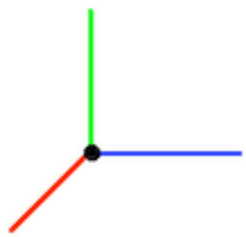
(Wikipedia - (1878, "On the Nature of Things-in-Themselves", Mind, Vol. 3, No. 9, pp. 57–67))

Clifford Algebra = Algebra of Spaces =
= Fundamental Human Understanding

For our 3-dim Space with coordinates x y z

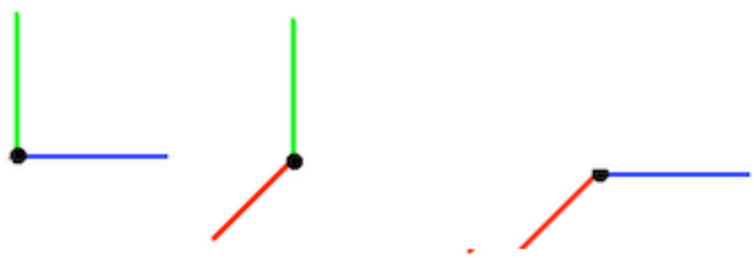
Cl(3) describes

1 - all of 3-space itself



3 - three types of planes in space:

xy yz zx



3 - three types of lines / directions in space:

x y z

1 - one type of 0-dim point

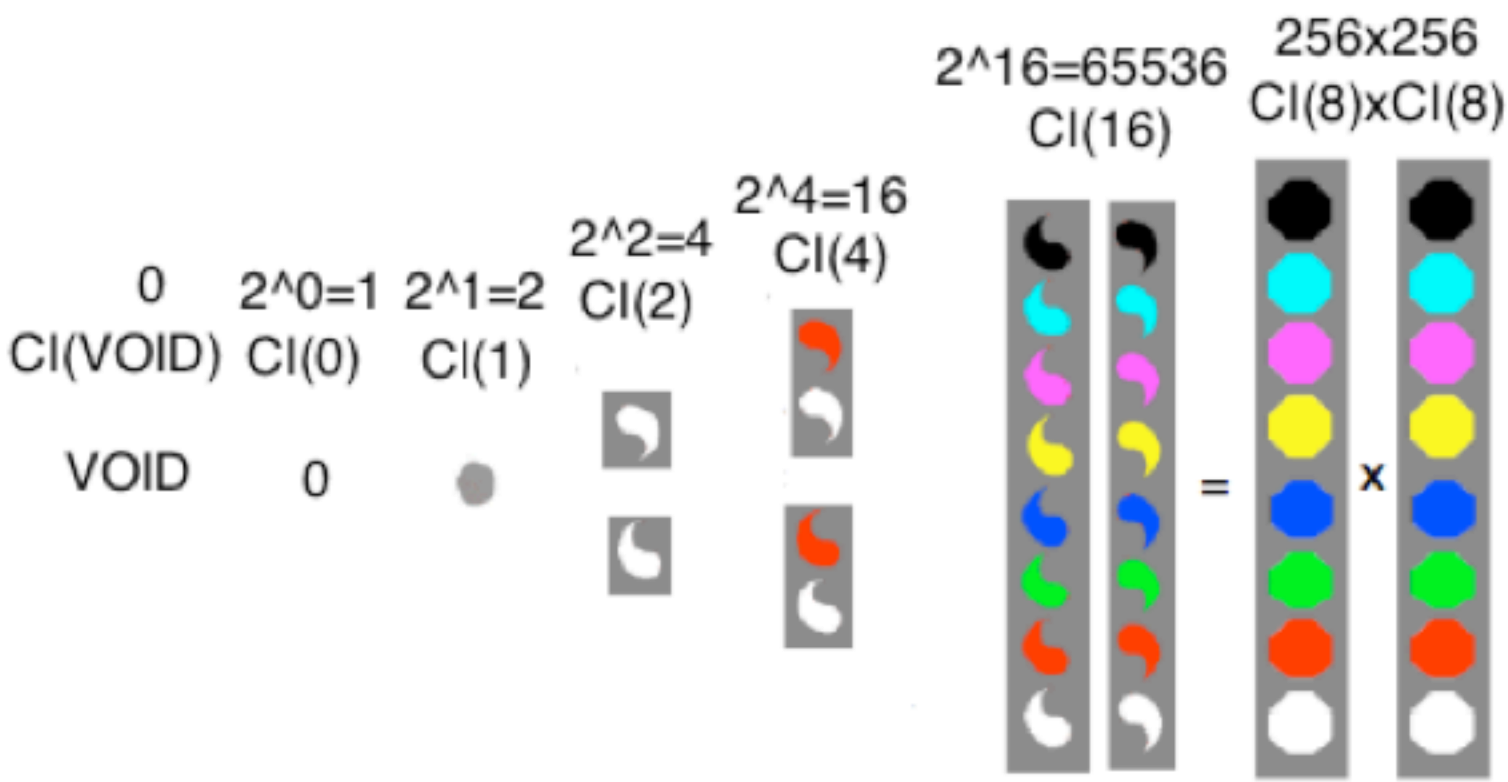
so

Cl(3) of 3-dim space has total dimension

1+3+3+1 = 2^3 = 8

Generally, Cl(N) of N-dim space has dimension 2^N so the process of forming Clifford Algebra creates 2^N -dim spaces from N-dim spaces

THIS IS HOW OUR UNIVERSE GREW FROM NOTHING:

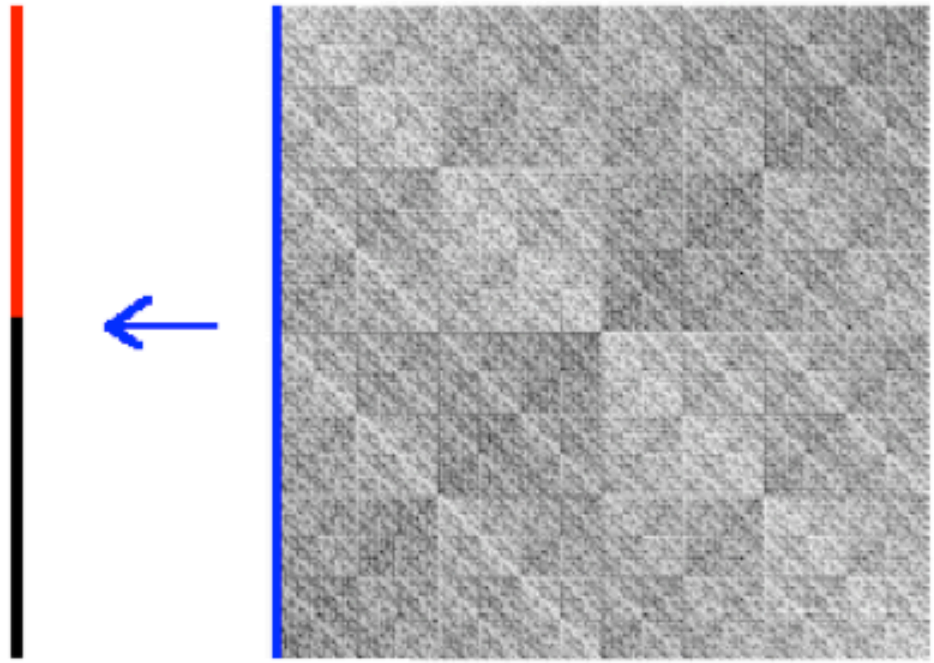


Cl(16) = 2^16 = 65,536 dimensions with graded structure

1 16 120 560 1820 4368 8008 11440 12870 11440 8008 4368 1820 560 120 16 1

The 120 grade-2 BiVectors form the D8 Lie Algebra
that is related to rotations in 16-dim space

The Real Clifford Algebra Cl(16) = 256 x 256 Real Matrix Algebra



The 256 first-column-vectors are the Spinors of D8
that are related to entanglement of connections to 16-dim space
The 256 D8 Spinors break down into two half-Spinors
256 = 128 + 128

The 128 and 128 half-spinors are mirror images of each other
so 128 can describe all useful physics by itself.

120 D8 BiVectors + 128 D8 half-Spinors = 248-dim E8

248-dim E8 lives in Cl(16)
containing 120-dim D8 biVectors of Cl(16)

E8 / D8 = 64 + 64 Fermions = 128-dim D8 half-Spinors of Cl(16)

D8 / D4 x D4 = 64 Spacetime

D4 = 28 Standard Model (12)
with 16 Gravity + Dark Energy Ghosts

D4 = 28 Gravity + Dark Energy (16)
with 12 Standard Model Ghosts

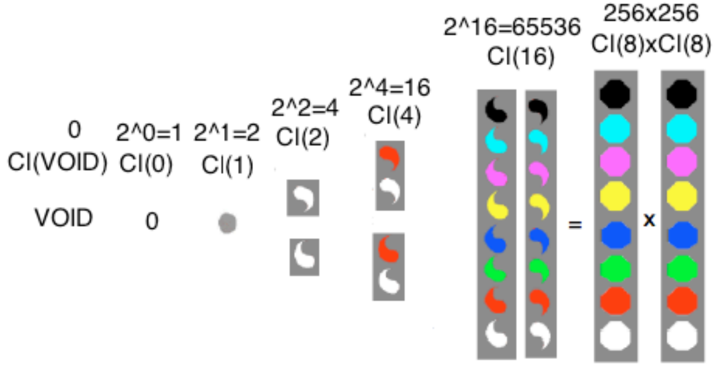
Dimension of Clifford Algebra

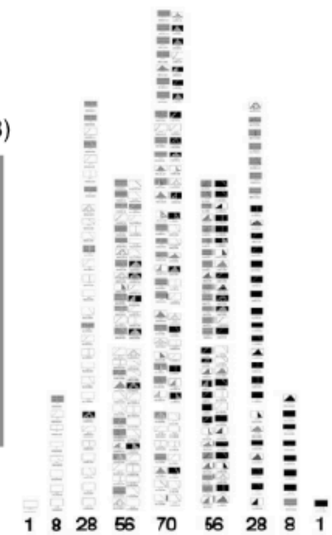
0 2^0=1 2^1=2 2^2=4 2^4=16 2^16=65536 256x256

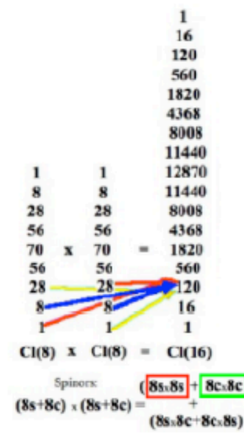
VOID -> Cl(VOID) -> Cl(0,0) -> Cl(0,1)-> Cl(0,2) -> Cl(0,4) -> Cl(0,16) = Cl(0,8)xCl(0,8) --> Cl(0,16)xCl(0,8) = Cl(0,24) -> M(2,Cl(0,24)) = Cl(1,25) ->

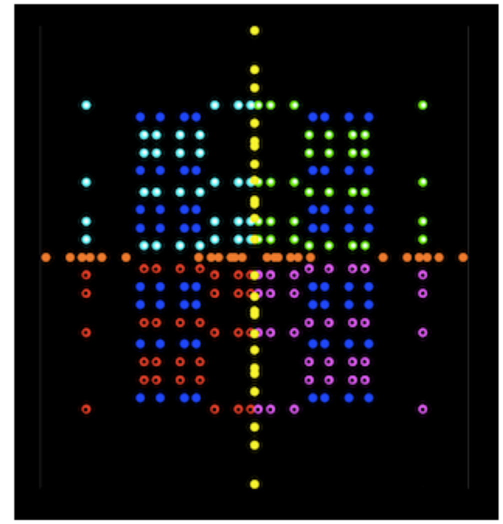
-> Completion of Union of All Tensor Products of Cl(1,25) = hyperfinite AQFT

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)

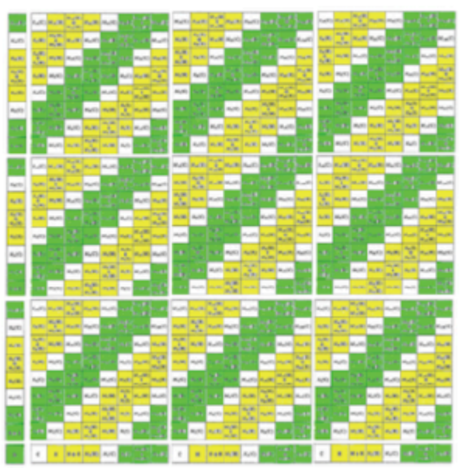








Cl(16) contains 120 + 64 + 64 = 248 = E8
with 112 + 128 = 240 root vectors



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)

240 E8 Root Vectors

112 = 56 + 56 = (24+32) + (24+32)
128 = 1+126+1

D8

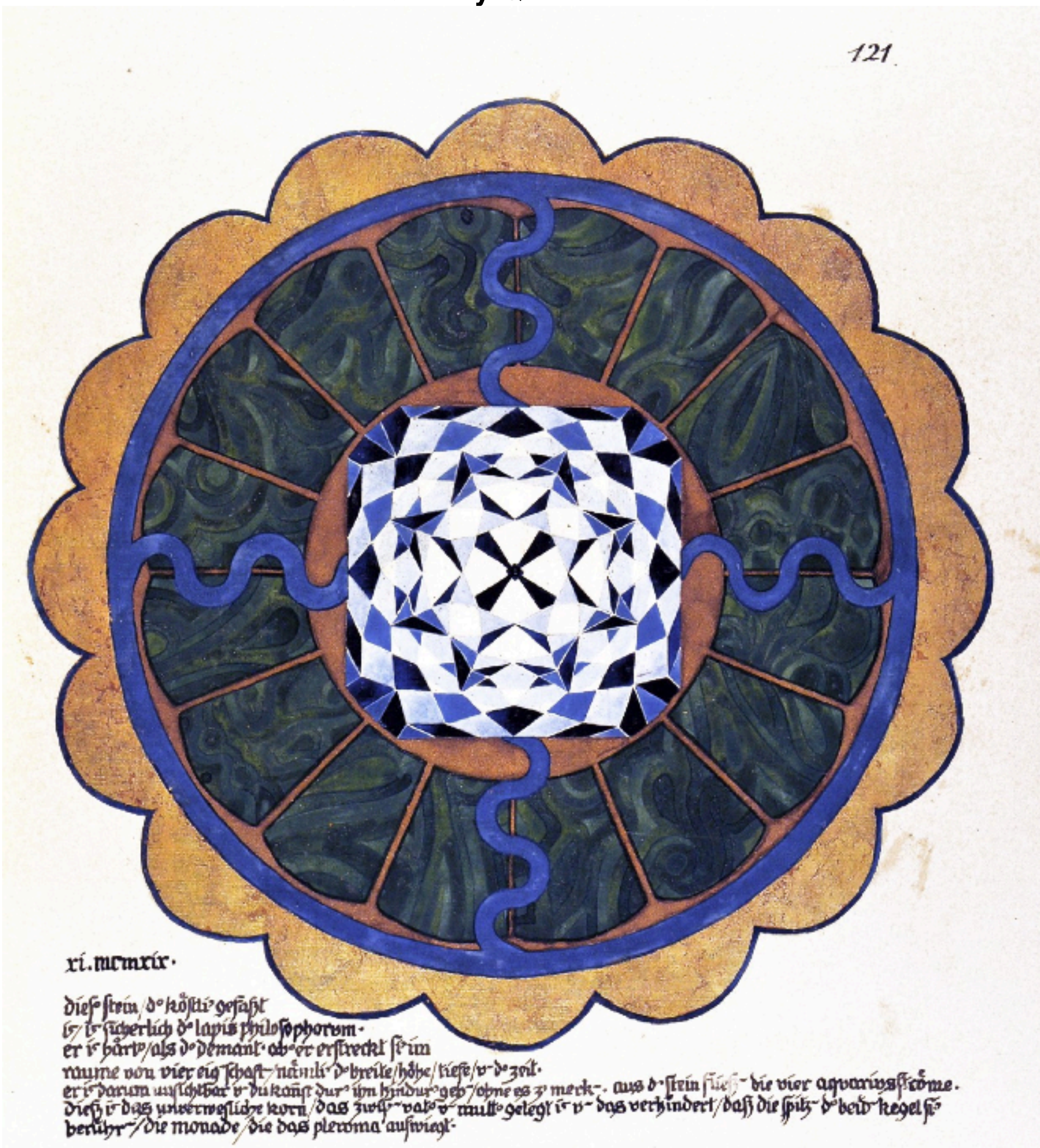
56 + + 56

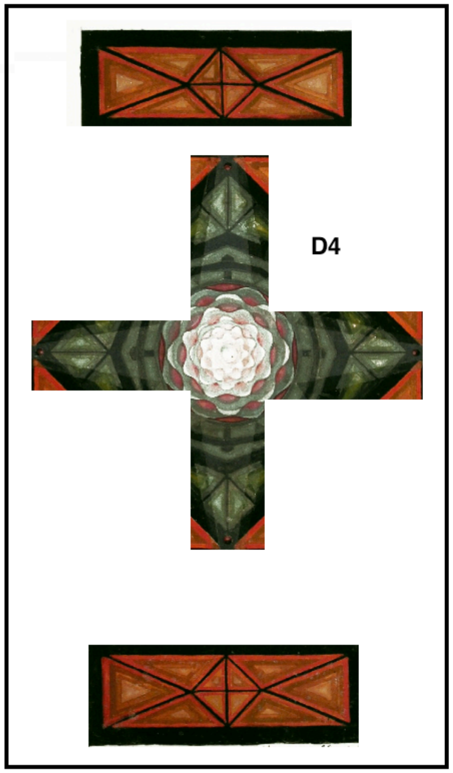
Timelike AntiNeutrino 1 + + 126 E7 + 1 Timelike Neutrino

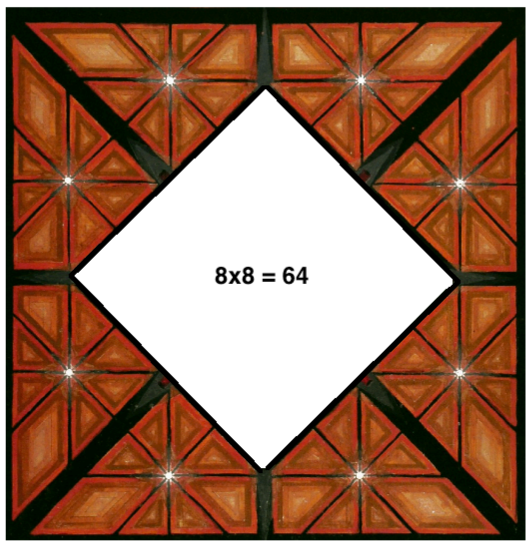
SU(2)

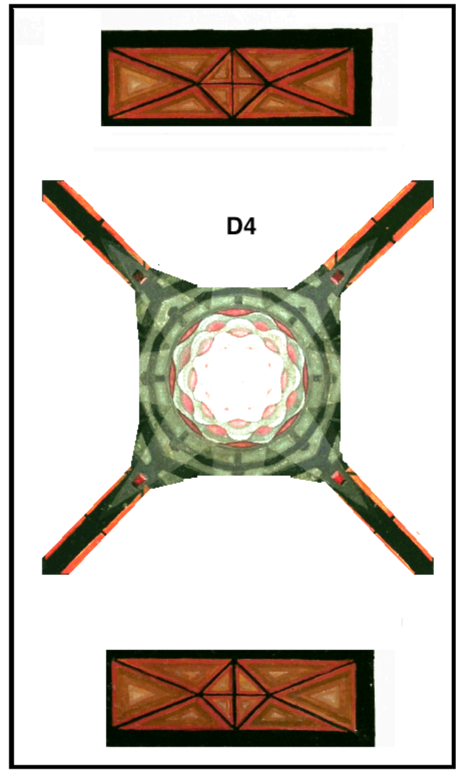
When Our Planck Scale Universe emerged from its Parent Universe by Quantum Fluctuation it was described by SO(16) symmetry of Compact E8(-248). E8 Compact Form E8(-248) with Symmetric Space E8 / Spin(16) represents Our Planck Scale Universe when it emerged from its Parent Universe by Quantum Fluctuation.

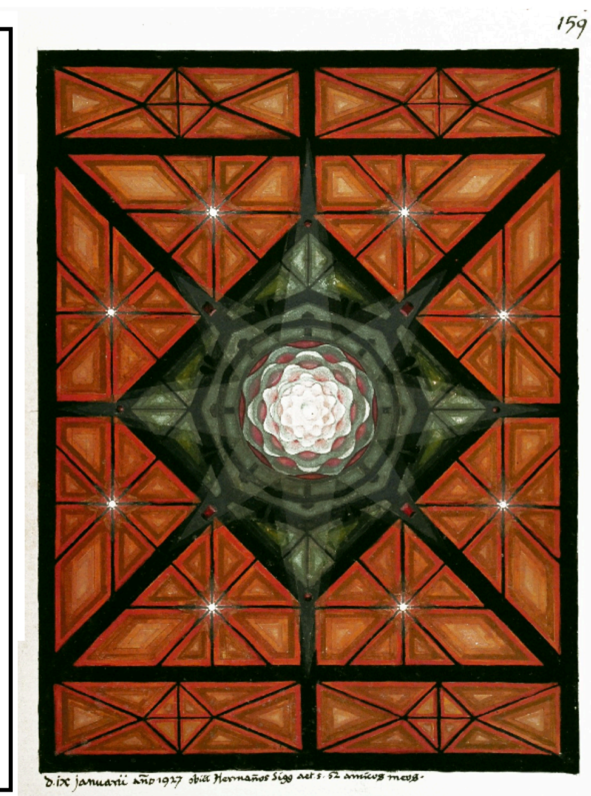
E8 Split Form EVIII E8(8) with Symmetric Space E8 / SO(8,8) represents Our Universe during Octonionic Inflation with Non-Unitary Quantum Processes.




D4


8x8 = 64


D4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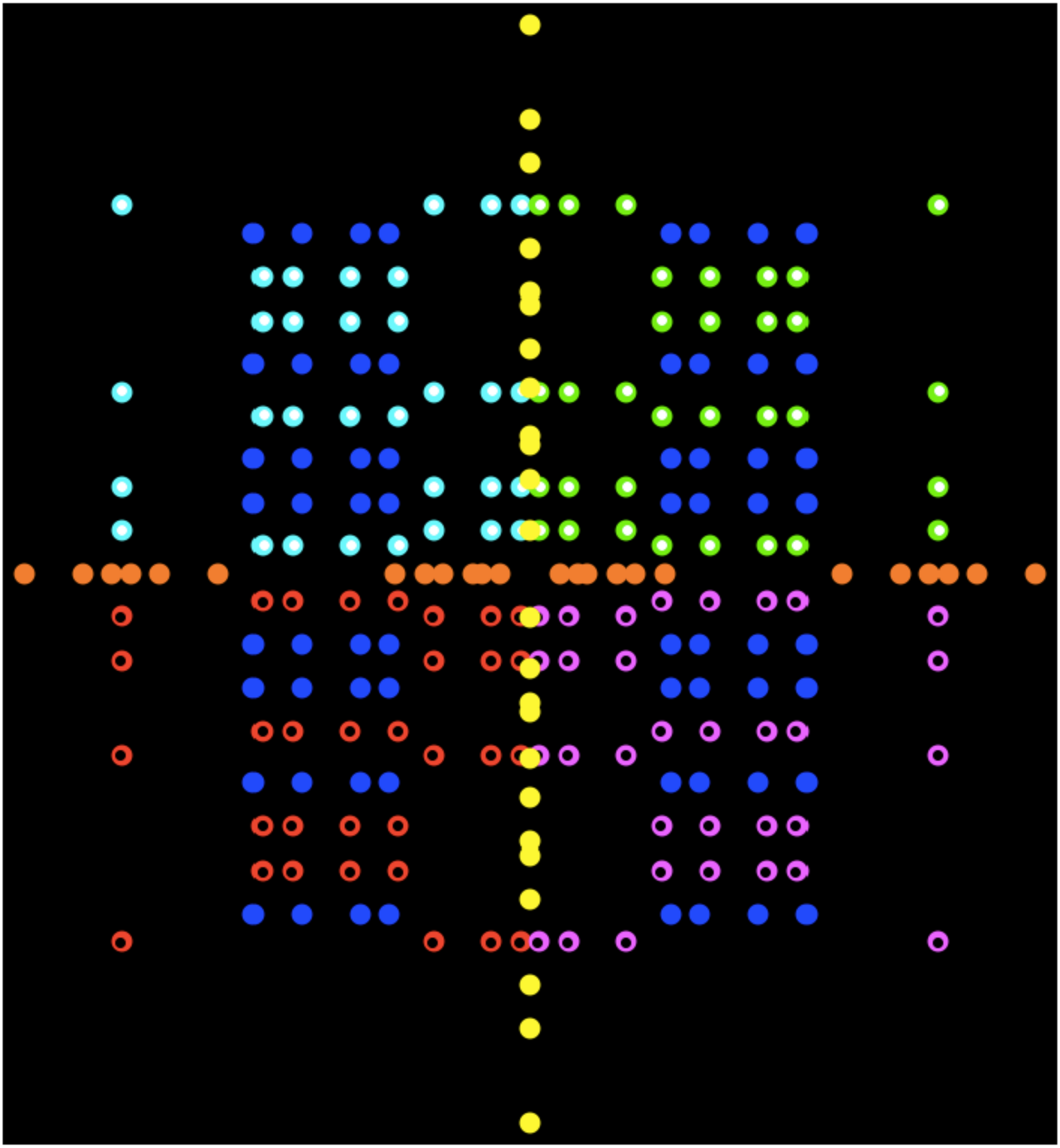
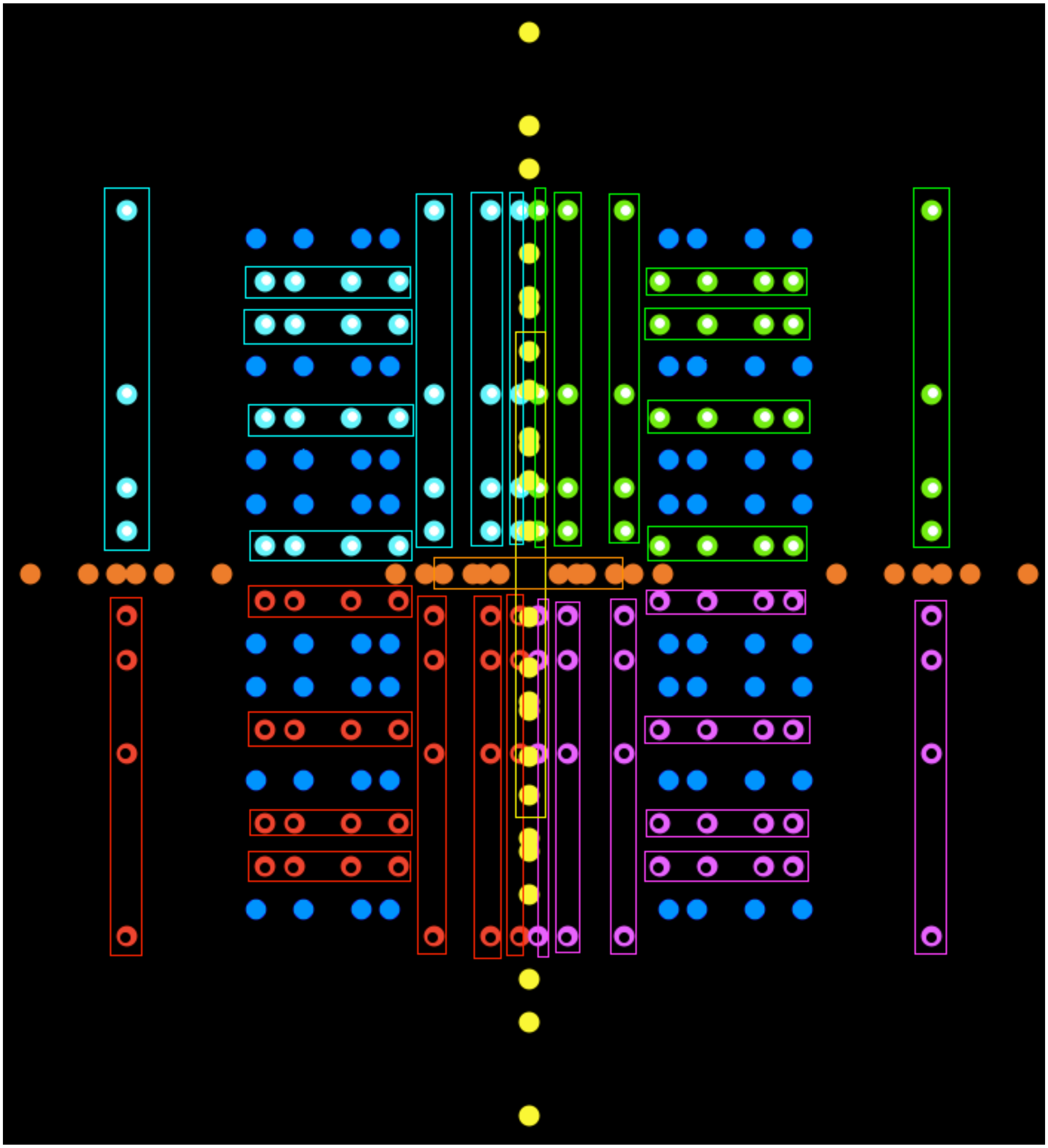
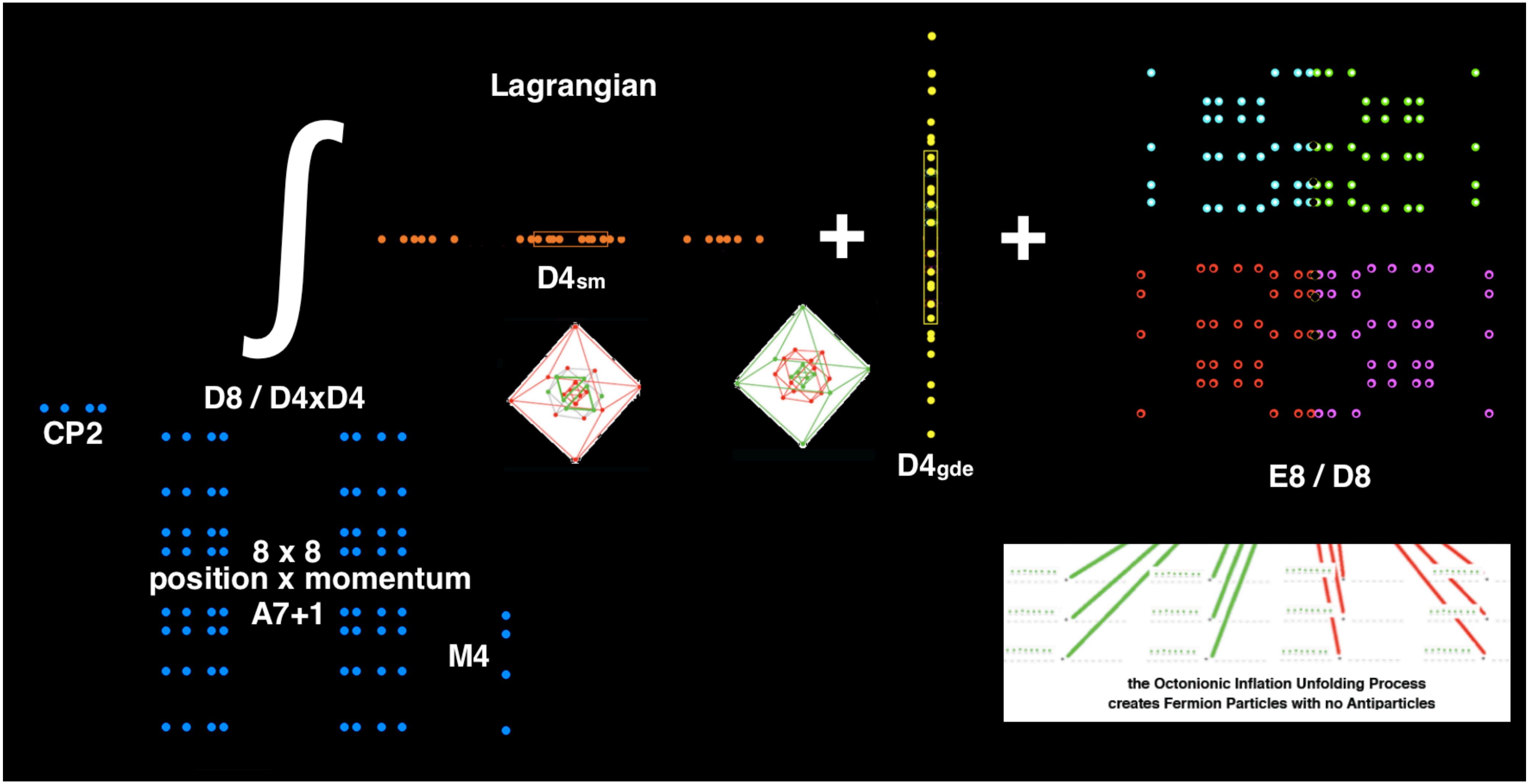
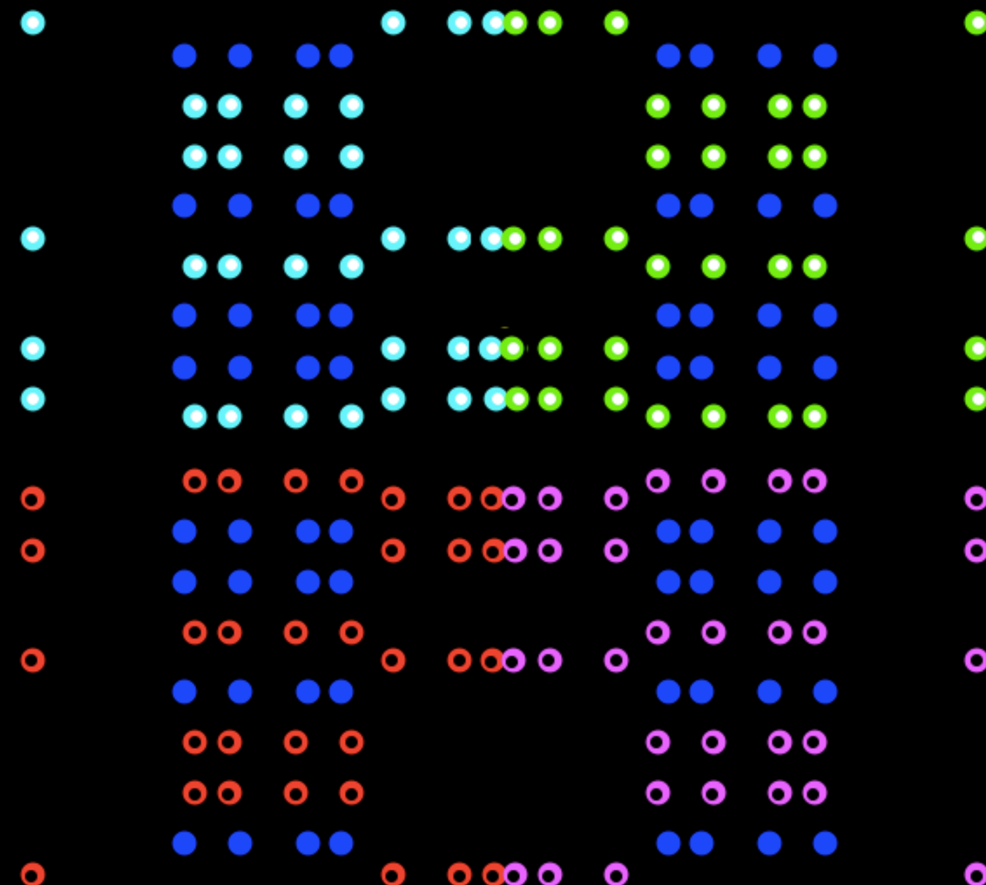
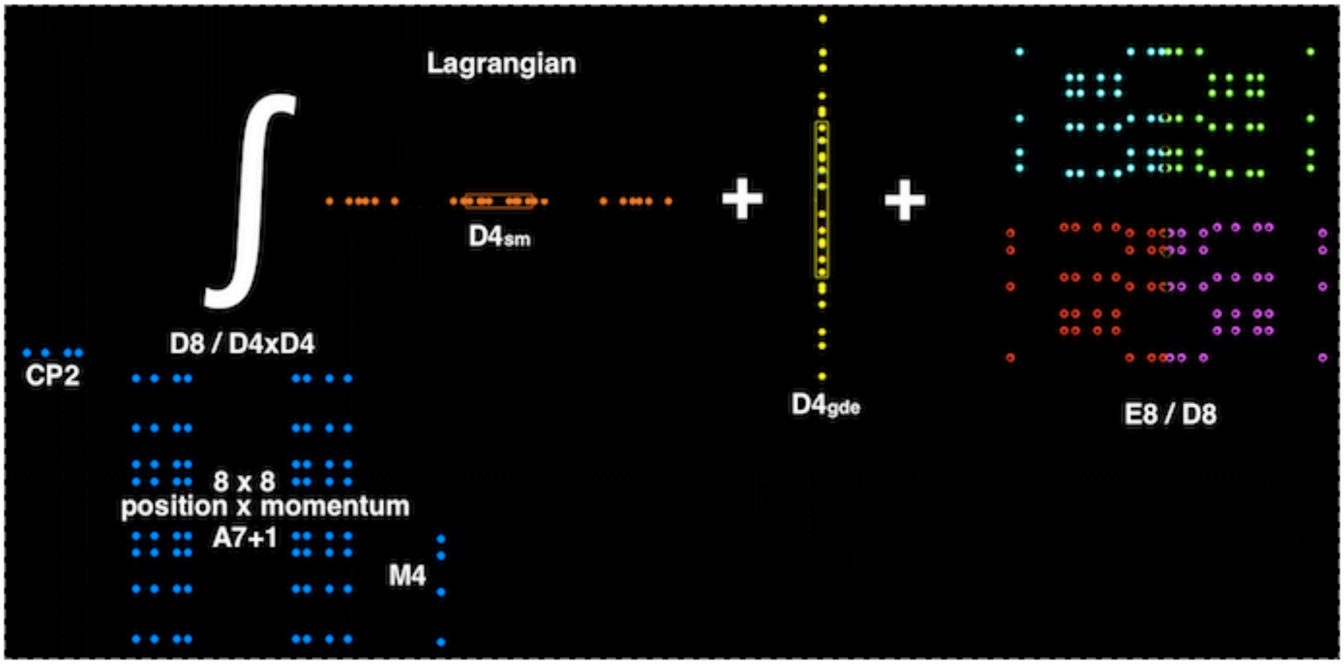






Lagrangian
D4sm
+
D4gde
+
E8 / D8
CP2
D8 / D4xD4
8 x 8
position x momentum
A7+1
M4
the Octonionic Inflation Unfolding Process
creates Fermion Particles with no Antiparticles

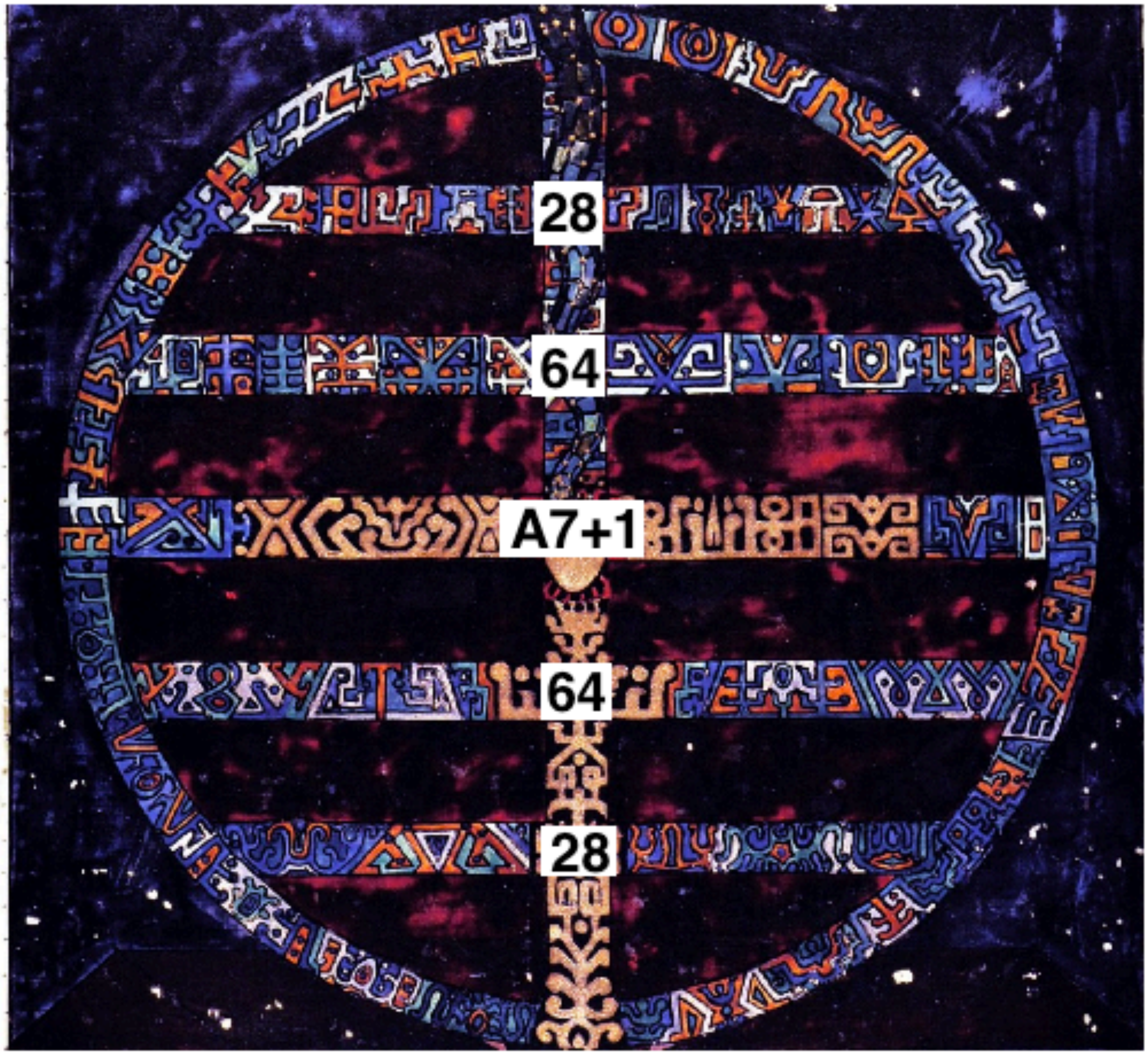




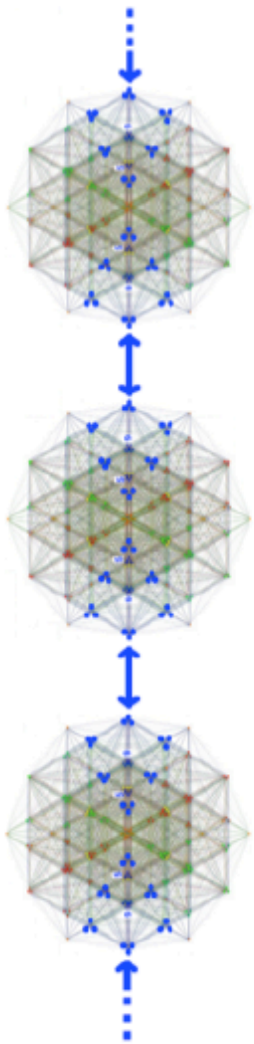
Creation-Annihilation Operators for 8 components of 8+8 Fermions
are
odd-grade-+/-1 part
of
E8 Maximal Contraction generalized Heisenberg Algebra

h92 x A7 = 28 + 64 + ((SL(8,R)+1) + 64 + 28

(see Rutwig Campoamor-Stursberg in Acta Physica Polonica B 41 (2010) 53-77 "Contractions of Exceptional Lie Algebras and SemiDirect Products")


28
64
A7+1
64
28

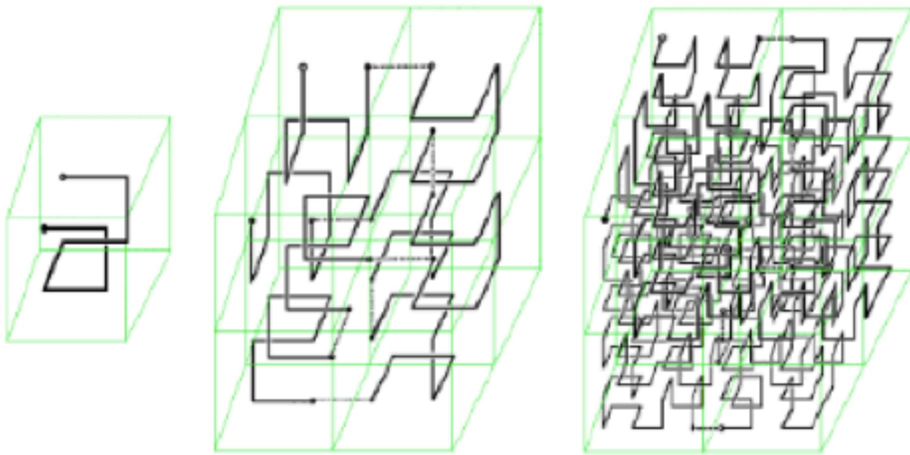
Big Bang E8(-248) : Spin(16) I Octonion Inflation E8(8) : SO(8,8) I Quaternion Conformal Evolution E8(-24) : SO*(16)

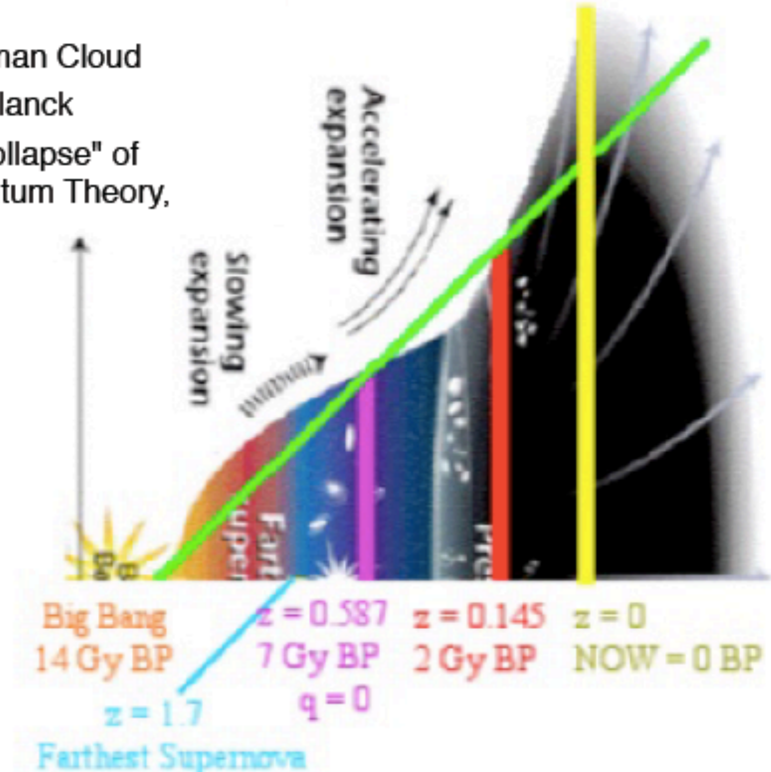


At the end of Non-Unitary Octonionic Inflation Our Universe
had about (1/2) 16^64 = (1/2) (2^4)^64 = 2^255 = 6 x 10^76 Fermion Particles
the size of our Universe was then about 10^(-24) cm
which is about the size of a Fermion Schwinger Source Kerr-Newman Cloud

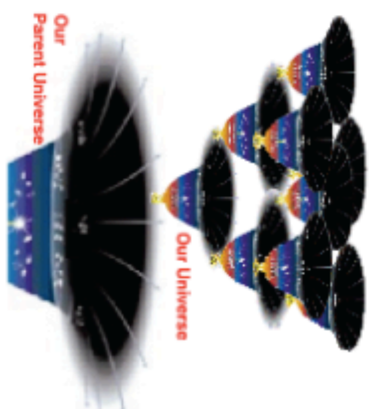
The End of Inflation time was at about 10^(-34) sec = 2^64 Tplanck

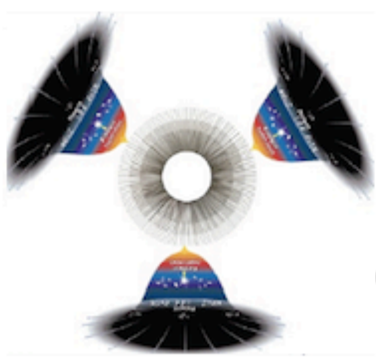
The Zizzi Inflation phase of our universe ends with decoherence "collapse" of
the 2^64 Superposition Inflated Universe into Many Worlds of Quantum Theory,





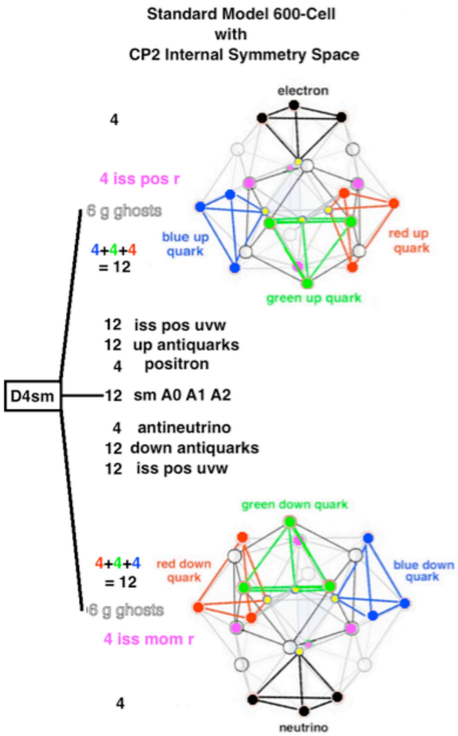
The ratio Dark Energy : Dark Matter : Ordinary Matter
for our Universe at the present time is calculated to be:
0.75 : 0.21 : 0.04

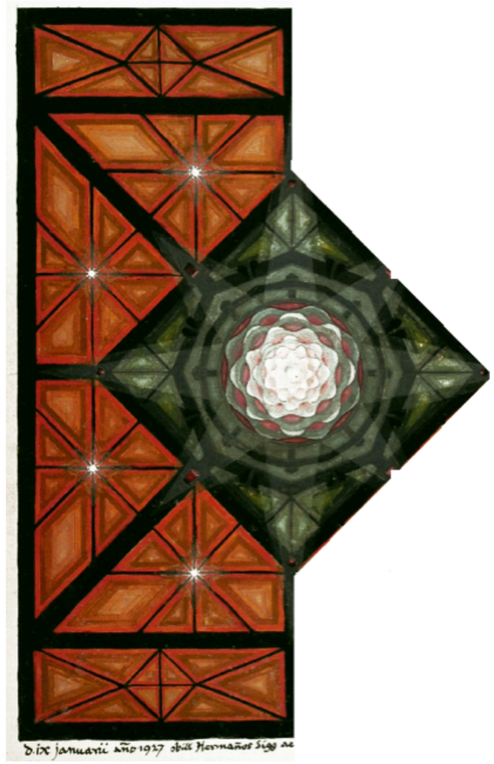


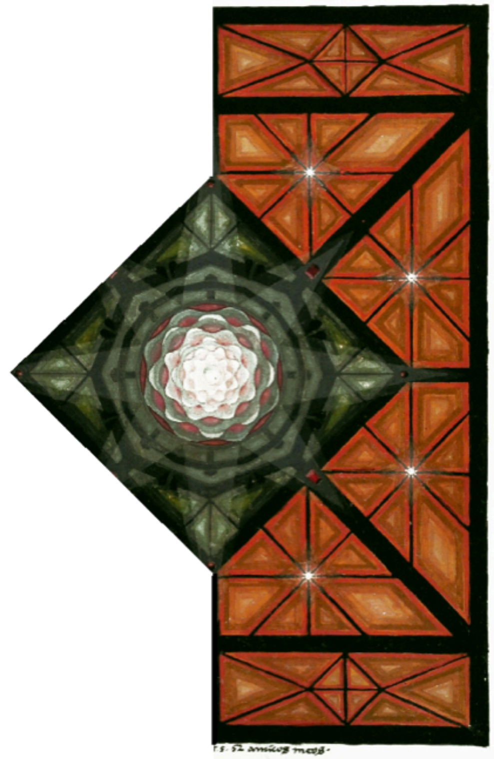


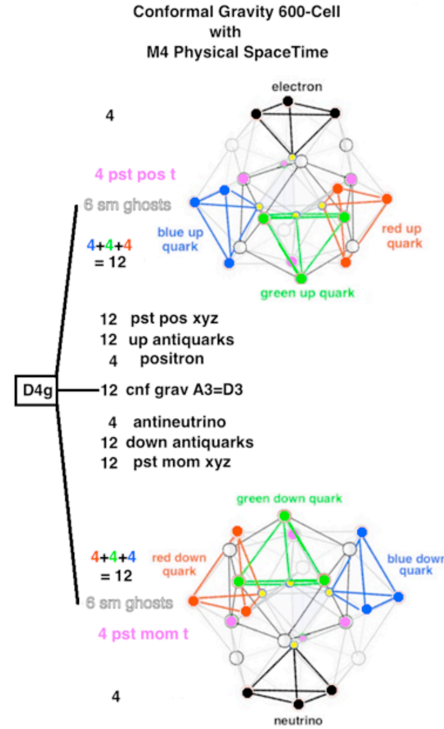
Paola Zizzi in gr-qc/0007006:

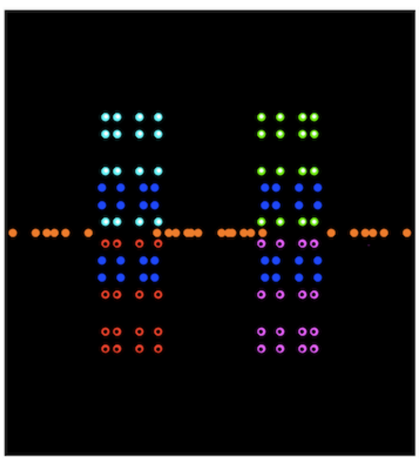
"... The self-reduction of the superposed quantum state ...
corresponds to a superposed state of ... [10^19 = 2^64 qubits]
... also the number of superposed tubulins-qubits in our brain
... leading to a conscious event. ...".

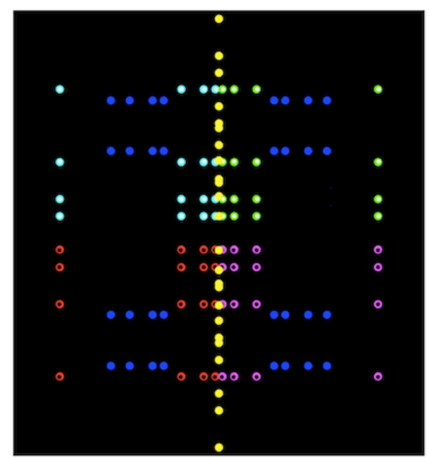

Standard Model 600-Cell
with
CP2 Internal Symmetry Space
electron
4
4 iss pos r
6 g ghosts
blue up quark
red up quark
4+4+4
= 12
green up quark
12 iss pos uvw
12 up antiquarks
4 positron
D4sm
12 sm A0 A1 A2
4 antineutrino
12 down antiquarks
12 iss pos uvw
green down quark
4+4+4
= 12
red down quark
blue down quark
6 g ghosts
4 iss mom r
4
neutrino



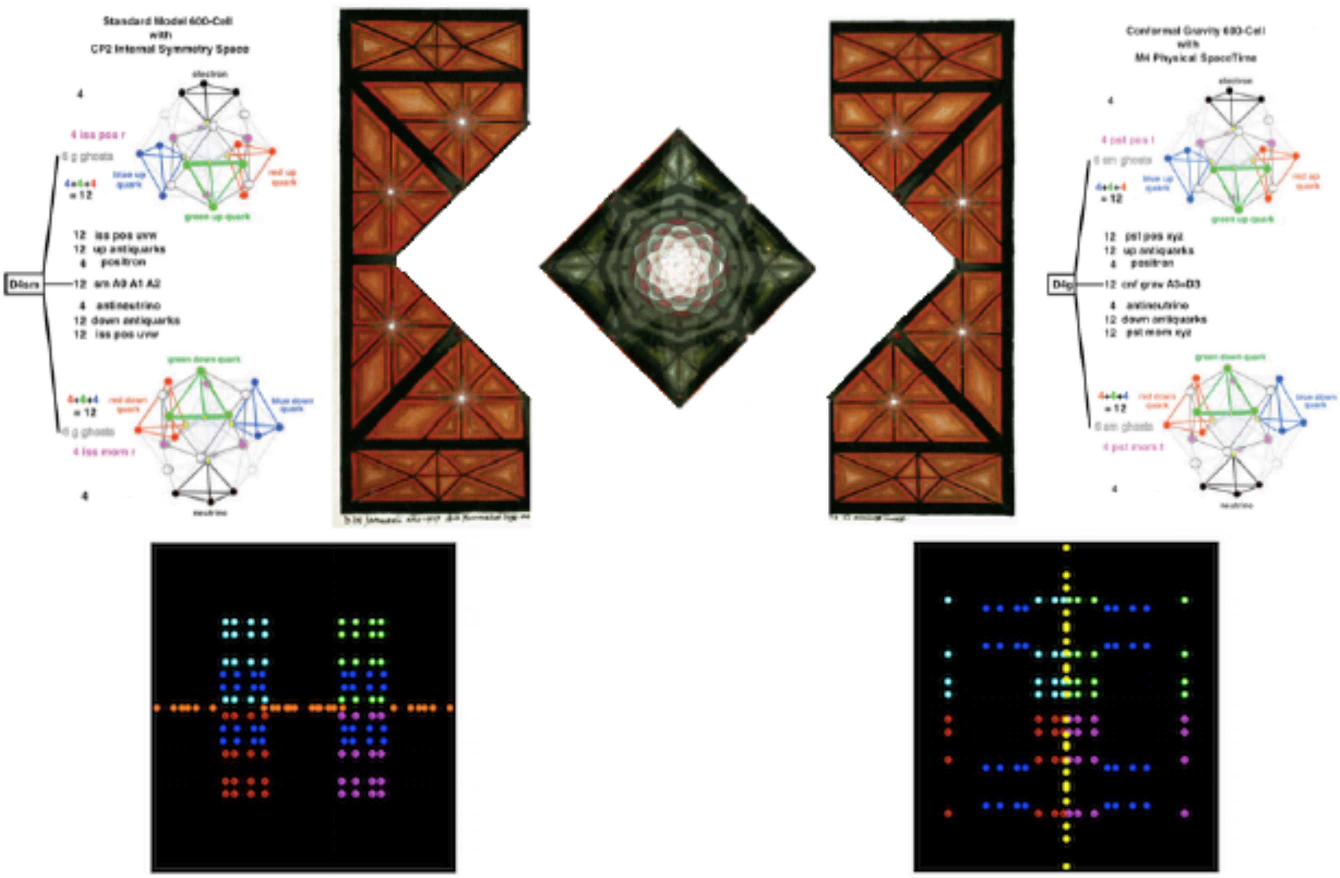



Conformal Gravity 600-Cell
with
M4 Physical SpaceTime
electron
4
4 pst pos t
6 sm ghosts
blue up quark
red up quark
4+4+4
= 12
green up quark
12 pst pos xyz
12 up antiquarks
4 positron
D4g
12 cnf grav A3=D3
4 antineutrino
12 down antiquarks
12 pst mom xyz
green down quark
4+4+4
= 12
red down quark
blue down quark
6 sm ghosts
4 pst mom t
4
neutrino

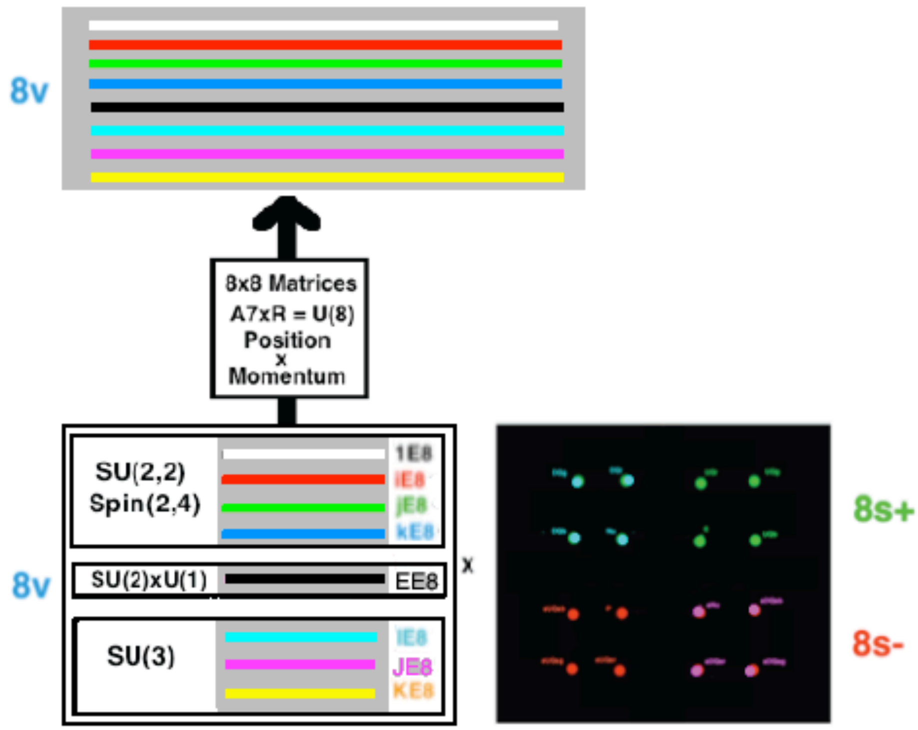




Inflation ends when a preferred Quaternionic Subspacetime freezes out,
converting 8 dim Spacetime into 4+4 dim M4 x CP2 Spacetime where
M4 = Physical Minkowski Spacetime and
CP2 = SU(3) / U(2) Internal Symmetry Space
Octonionic Integral becomes two Quaternionic Integrals



8-dim Octonionic Spacetime was broken into
(4+4)-dim Unitary Quaternionic M4 x CP2 Kaluza-Klein Spacetime
with SO*(16) symmetry of EIX E8(-24).
That transition was
a Weyl Unitary Trick within E8(8) from SO(8,8) to SO*(16)
followed by
a shifting of SO*(16) symmetry from E8(8) to E8(-24)
E8 form EIX E8(-24) with Symmetric Space E8 / SO*(16)
represents Our Universe after End of Inflation



Indra's Net of Schwinger Sources - Bohm Quantum Blockchain

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

$$\int_{8\text{-dim SpaceTime}} \text{Standard Model Gauge Gravity} + \text{Fermion Particle-AntiParticle}$$

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.

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

Stack D8 branes to get SpaceTime with Strings = World-Lines

Let Oct16 = discrete mutiplicative group { +/-1, +/-i, +/-j, +/-k, +/-E, +/-I, +/-J, +/-K}.
Orbifold by Oct16 the 8s+ to get 8 Fermion Particle Types
Orbifold by Oct16 the 8s- to get 8 Fermion AntiParticle Types

Gauge Bosons from 1E8 and EE8 parts of a D8 give U(2) Electroweak Force
Gauge Bosons from IE8, JE8, and KE8 parts of a D8 give SU(3) Color Force
Gauge Bosons from 1E8, iE8, jE8, and kE8 parts of a D8 give U(2,2) Conformal Gravity

The 8x8 matrices for collective coordinates linking one D8 to the next D8 give Position x Momentum

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 appearsTachyons 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 cloud constitutes the Schwinger Source.

The Schwinger Sources are finite regions in a Complex Domain spacetime corresponding to Green's functions of particle creation / annihilation.

Its 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 latice)mdistinct 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, = roughly 10^(-24) cm.

Julian Schwinger describes Elementary Particles  as volumes of space - Sources - whose properties are determined by Green's Functions characteristic of the volumes.

In E8 Physics any Elementary Particle is immediately surrounded by a cloud of virtual particle-antiparticle pairs similar to a Kerr-Newman Black Hole with Symmetric Space - Bounded Complex Domain - Shilov Boundary structure corresponding to its Gauge Group properties.
The Poisson Kernel - Bergman Kernel defines the Green's Function.

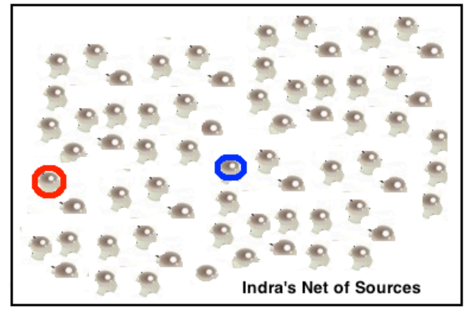
The initial Valence Particle is Planck scale. The number of Virtual Particles is determined by the Planck scale geometry of spacetime. The E8 model at the Planck Scale has spacetime condensing out of Clifford structures forming a Lorentz Leech lattice underlying 26-dim String Theory of World-Lines with 8 + 8 + 8 = 24-dim of fermion particles and antiparticles and of spacetime.
The automorphism group of one 26-dim String Theory cell modulo the Leech lattice is the Monster Group of order about 8 x 10^53.
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 an order of about 10^26. Due to superpostions of algebraically independent E8 Lattices the total number of Virtual particle/ antiparticle pairs is about 10^27 so the volume of the Kerr-Newman Cloud is on the order of 10^27 x Planck scale, and its size should be about 10^(27/3) x 1.6 x 10^(-33) cm = roughly 10^(-24) cm.

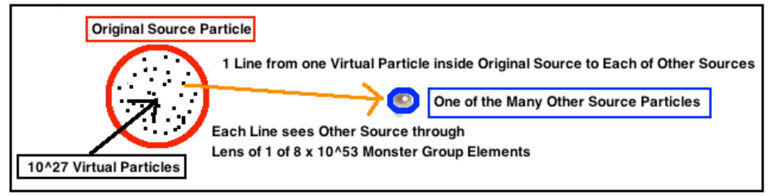
Each Schwinger Source particle-antiparticle pair should see (with Bohm Quantum Potential and Sarfatti Back-Reaction) the rest of our Universe in the perspective of 8 x 10^53 Monster Symmetry so a Schwinger Source acting as a Jewel of Indra's Net of Schwinger Source Bohm Quantum Blockchain Physics can see 10^27 x 8 x 10^53 = 8 x 10^80 Other Sources of an Indra's Net.

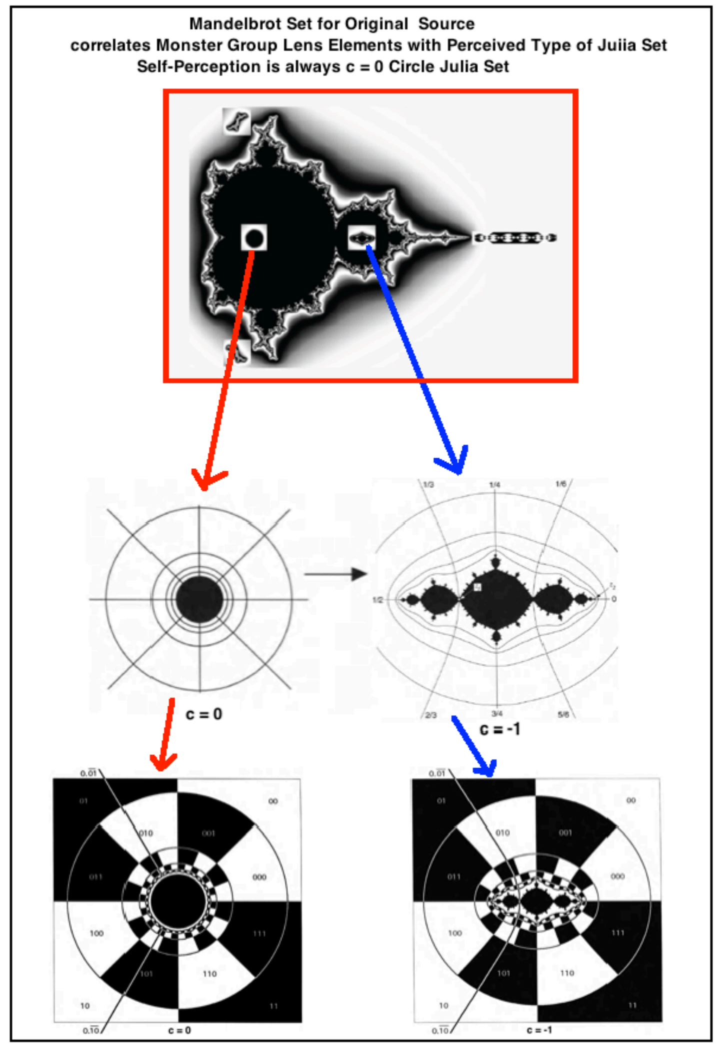
To fit inside the initial Schwinger Source the Information Elements of all the Other Schwinger Sources of Our Universe (10^77 or so) should be distributed as a Fractal Julia Set. There are 2^n stage-n cells in a Binary Decomposition of Julia Sets, so a stage-256 Julia level set based on Binary Decomposition has 2^256 = about 10^77 cells so Full Indra Net information can be seen / reflected by each Schwinger Source Indra Jewel.

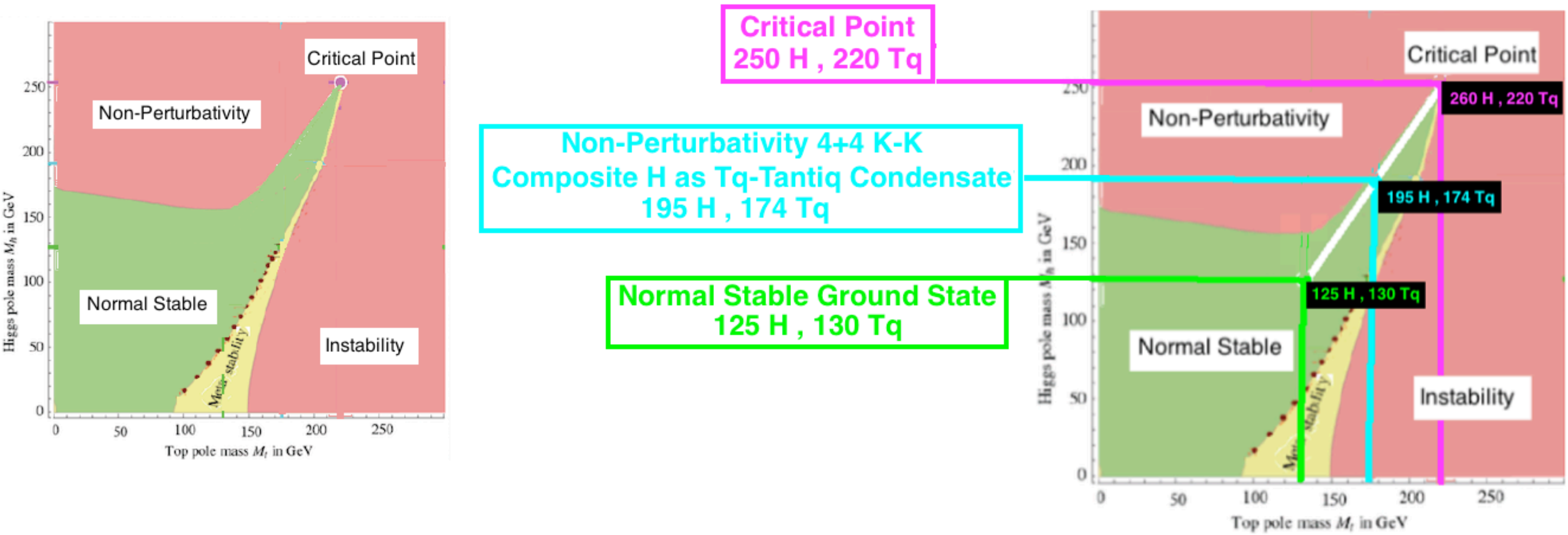
Each Schwinger Source contains 10^27 Virtual pairs of particles each of which can see along a connecting Line an Other Indra's Net Source which Line sees Other Sources through Monster Group Lens elements so that the Other Source appears to the Original Source to be a Julia Set.

Each Schwinger Source has a Mandelbrot Set that tells its Source what each of the many Indra's Net Source Julia set looks like by correlating Monster Group Lens Elements with Types of Julia Set. Self-Perception is always the c = 0 Circle Julia Set.

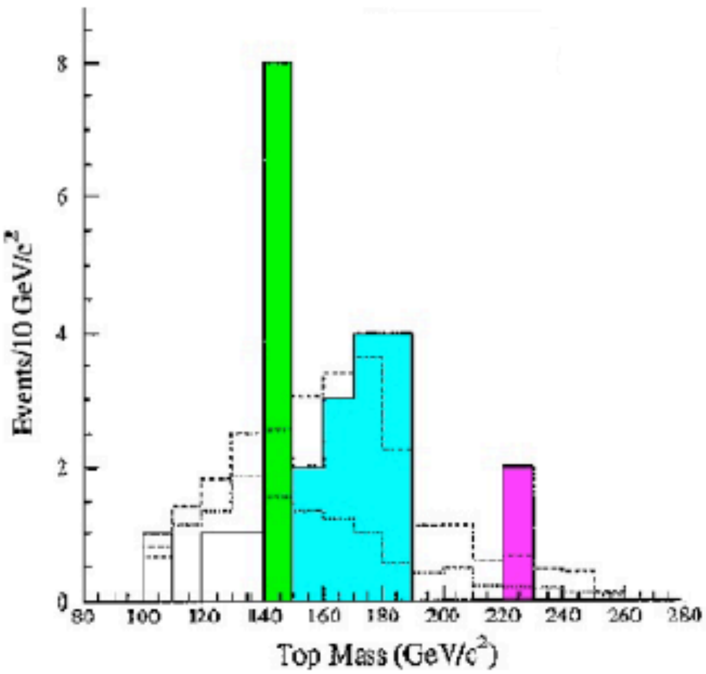


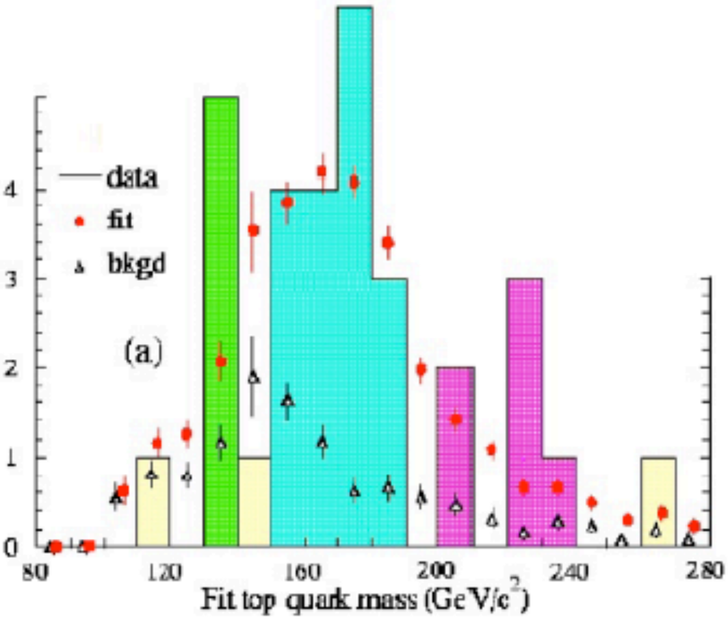


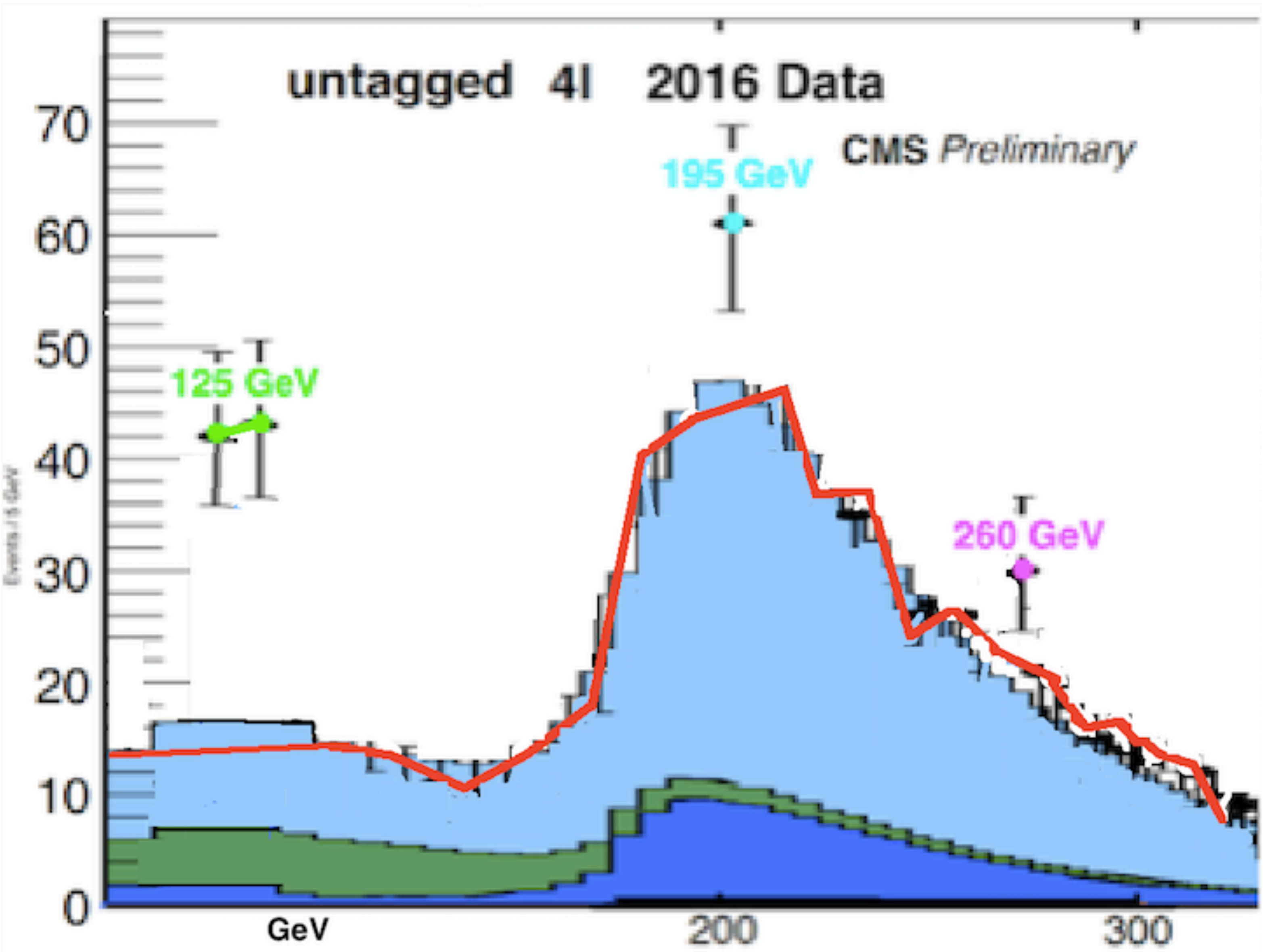




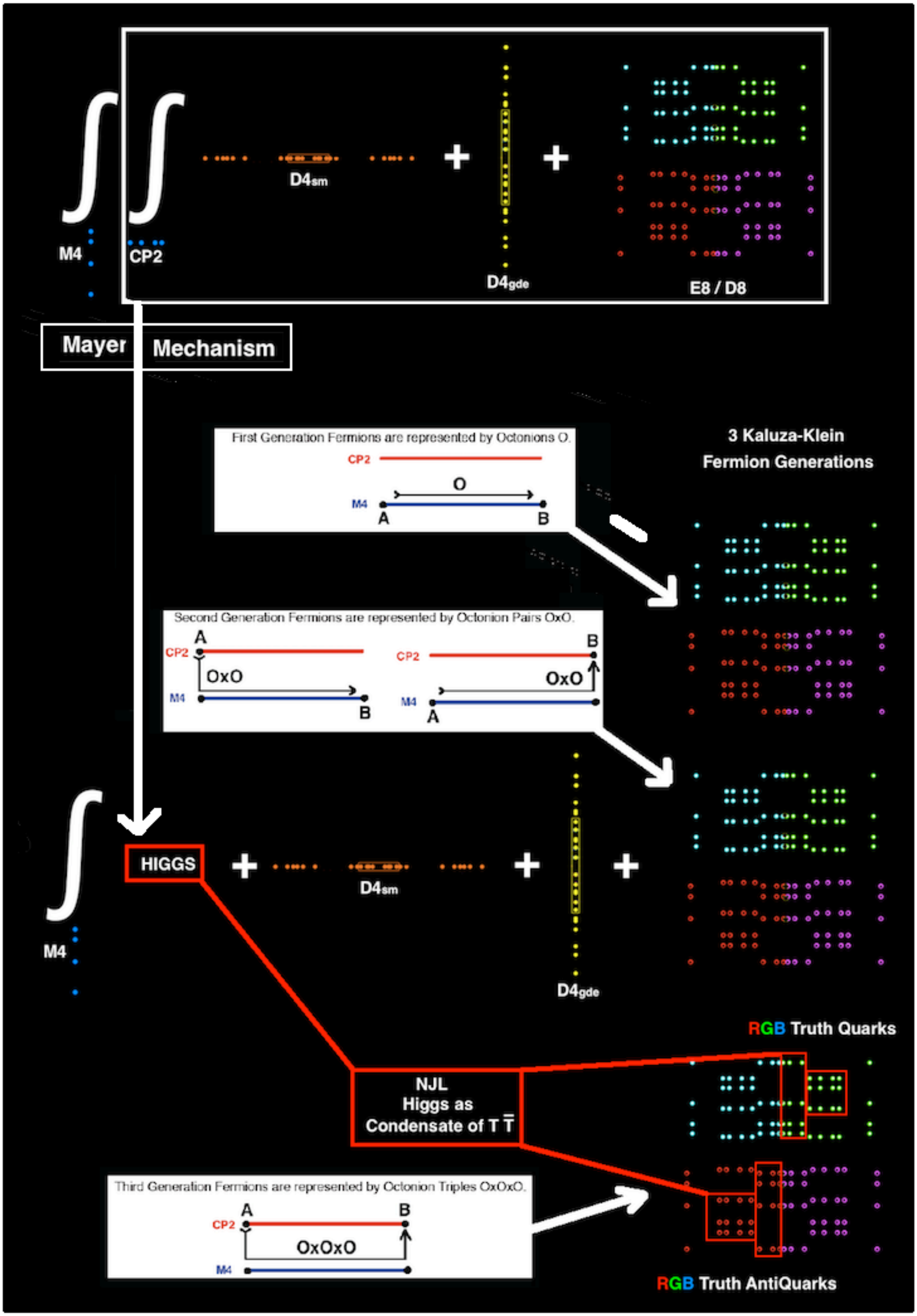
Critical Point
Non-Perturbativity
Normal Stable
Instability
Meta-stability
Higgs pole mass M_h in GeV
Top pole mass M_t in GeV
Critical Point
250 H , 220 Tq
Non-Perturbativity 4+4 K-K
Composite H as Tq-Tantiq Condensate
195 H , 174 Tq
Normal Stable Ground State
125 H , 130 Tq
Critical Point
260 H , 220 Tq
Non-Perturbativity
195 H , 174 Tq
125 H , 130 Tq
Normal Stable
Instability
Higgs pole mass M_h in GeV
Top pole mass M_t in GeV


Events/10 GeV/c²
Top Mass (GeV/c²)


data
fit
bkgd
(a)
Fit top quark mass (GeV/c²)


untagged 4l 2016 Data
CMS Preliminary
195 GeV
125 GeV
260 GeV
GeV

Splitting Octonionic Spacetime into Quaternionic M4 x CP2 Kaluza-Klein over CP2 produces
Higgs by the Mayer Mechanism and
Second and Third Generation Fermions

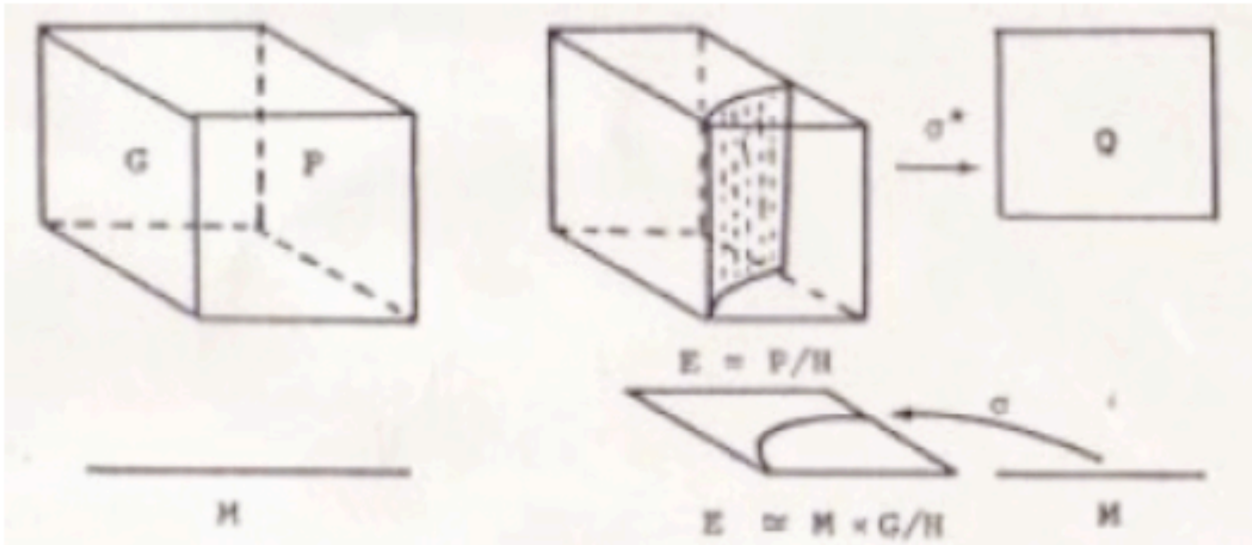


Quaternionic E7xSU(2) structure breaks 8-dim Spacetime Octonionic Symmetry to Quaternionic (4+4)-dim Associative x CoAssociative Kaluza-Klein Spacetime

(see Reese Harvey "Spinors and Calibrations" (Academic 1990))

where M4 = 4-dim Minkowski Physical Spacetime is Associative
and CP2 = SU(3) / SU(2) x U(1) Internal Symmetry Space is CoAssociative

Meinhard Mayer said (Hadronic Journal 4 (1981) 108-152): "... each point of ... the ... fibre bundle ... E ...



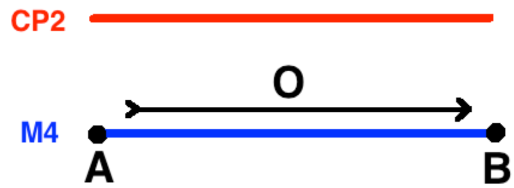
... consists of
a four- dimensional spacetime point x [in M4]
to which is attached the homogeneous space G / H [SU(3) / U(2) = CP2]
...
the components of the curvature lying in the homogeneous space G / H could be reinterpreted as Higgs scalars (with respect to spacetime [M4])
...
the Yang-Mills action reduces to a Yang-Mills action for the h-components [U(2) components] of the curvature over M [M4] and a quartic functional for the "Higgs scalars", which not only reproduces the Ginzburg-Landau potential, but also gives the correct relative sign of the constants, required for the BEHK ... Brout-Englert-Higgs-Kibble ... mechanism to work. ...".

(see Appendix - Details of Mayer - Higgs)

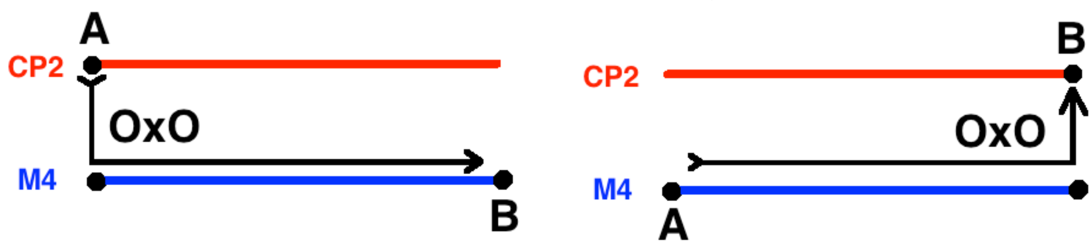
3 Generations of Fermions

In Kaluza-Klein M4 x CP2 there are 3 possibilities for a fermion represented by an Octonion O basis element to go from point A to point B:

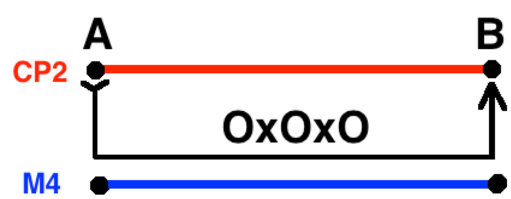
1 - A and B are both in M4: First Generation Fermion
whose path can be represented by the single O basis element
so that First Generation Fermions are represented by Octonions O.



2 - Either A or B, but not both, is in CP2: Second Generation Fermion
whose path must be augmented by one projection from CP2 to M4,
which projection can be represented by a second O basis element
so that Second Generation Fermions are represented by Octonion Pairs OxO.



3 - Both A and B are in CP2: Third Generation Fermion
whose path must be augmented by two projections from CP2 to M4,
which projections can be represented by a second O and a third O,
so that Third Generation Fermions are represented by Octonion Triples OxOxO.

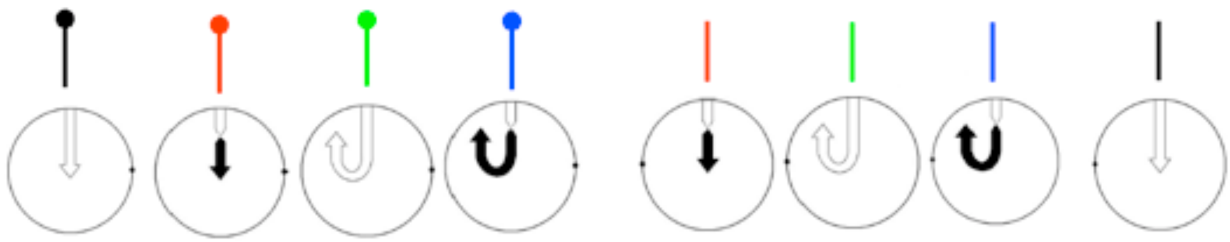


3 Generation Fermion Combinatorics

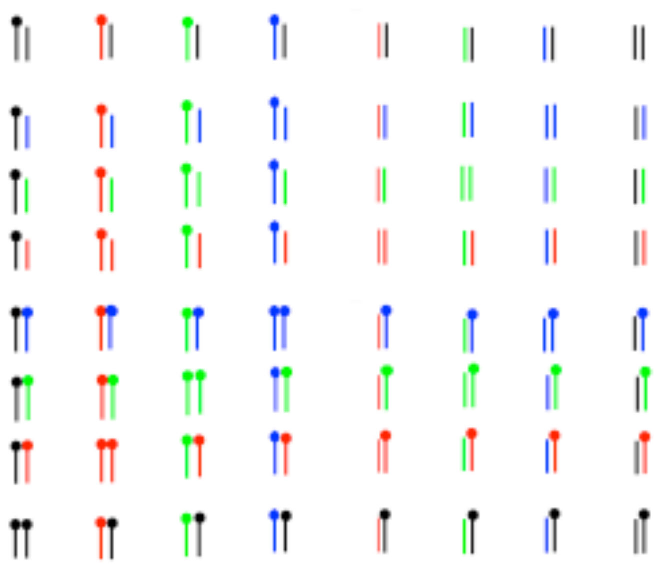
First Generation (8)

(geometric representation of Octonions is from arXiv 1010.2979)

electron	red up quark	green up quark	blue up quark	red down quark	green down quark	blue down quark	neutrino
E	I	J	K	i	j	k	1



Second Generation (64)

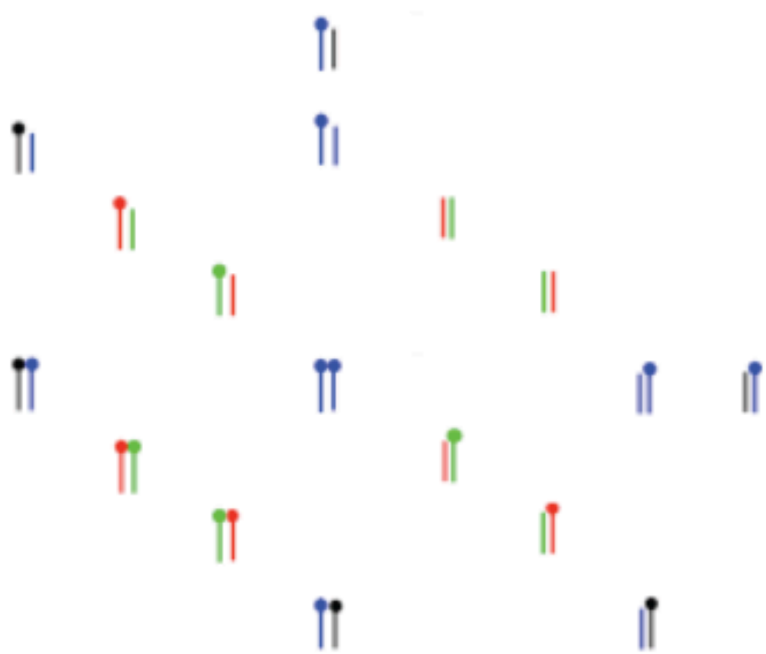


Mu Neutrino (1)
Rule: a Pair belongs to the Mu Neutrino if:
All elements are Colorless (black)
and all elements are Associative
(that is, is 1 which is the only Colorless Associative element) .

Muon (3)
Rule: a Pair belongs to the Muon if:
All elements are Colorless (black)
and at least one element is NonAssociative
(that is, is E which is the only Colorless NonAssociative element).

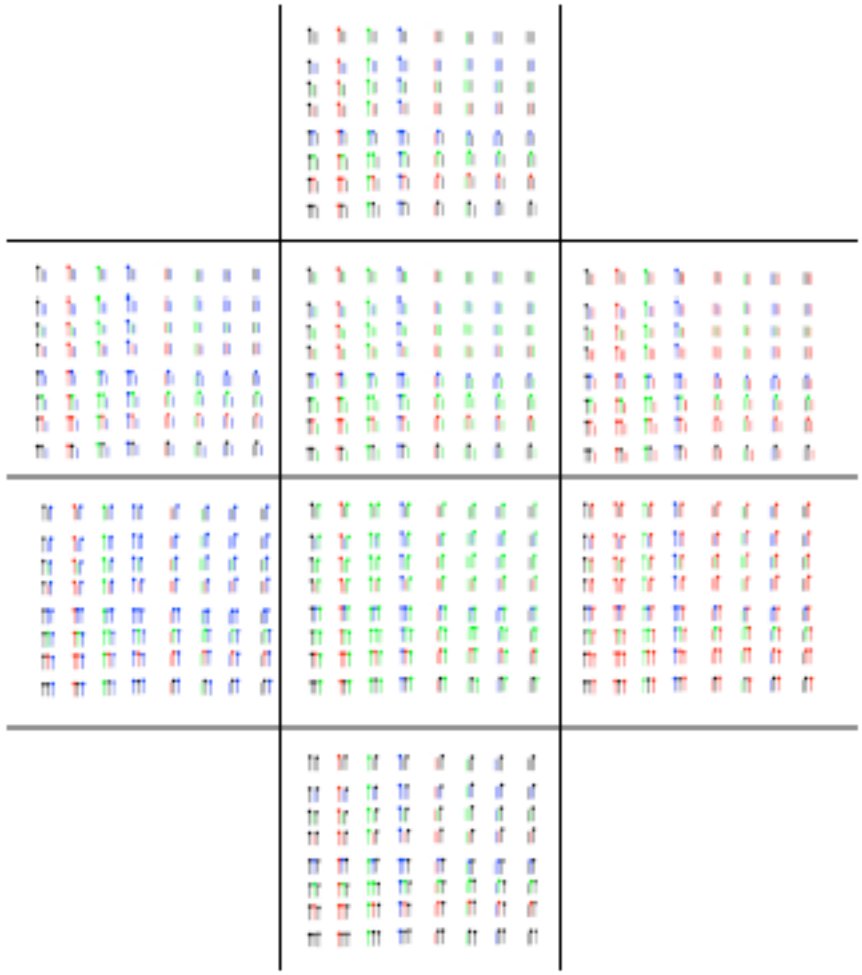
Blue Strange Quark **(3)**
Rule: a Pair belongs to the Blue Strange Quark if:
There is at least one Blue element and the other element is Blue or Colorless (black)
and all elements are Associative (that is, is either 1 or i or **j** or k).

Blue Charm Quark **(17)**
Rules: a Pair belongs to the Blue Charm Quark if:
1 - There is at least one Blue element and the other element is Blue or Colorless (black)
and at least one element is NonAssociative (that is, is either E or **I** or J or K)
2 - There is one Red element and one Green element (Red **x** Green = Blue).



(Red and Green Strange and Charm Quarks follow similar rules)

Third Generation (512)



Tau Neutrino (1)
Rule: a Triple belongs to the Tau Neutrino if:
All elements are Colorless (black)
and all elements are Associative
(that is, is 1 which is the only Colorless Associative element)

Tauon (7)
Rule: a Triple belongs to the Tauon if:
All elements are Colorless (black)
and at least one element is NonAssociative (that is, is E which is the only Colorless NonAssociative element)

Blue Beauty Quark (7)

Rule: a Triple belongs to the Blue Beauty Quark if:

There is at least one Blue element and all other elements are Blue or Colorless (black) and all elements are Associative (that is, is either 1 or i or j or k).

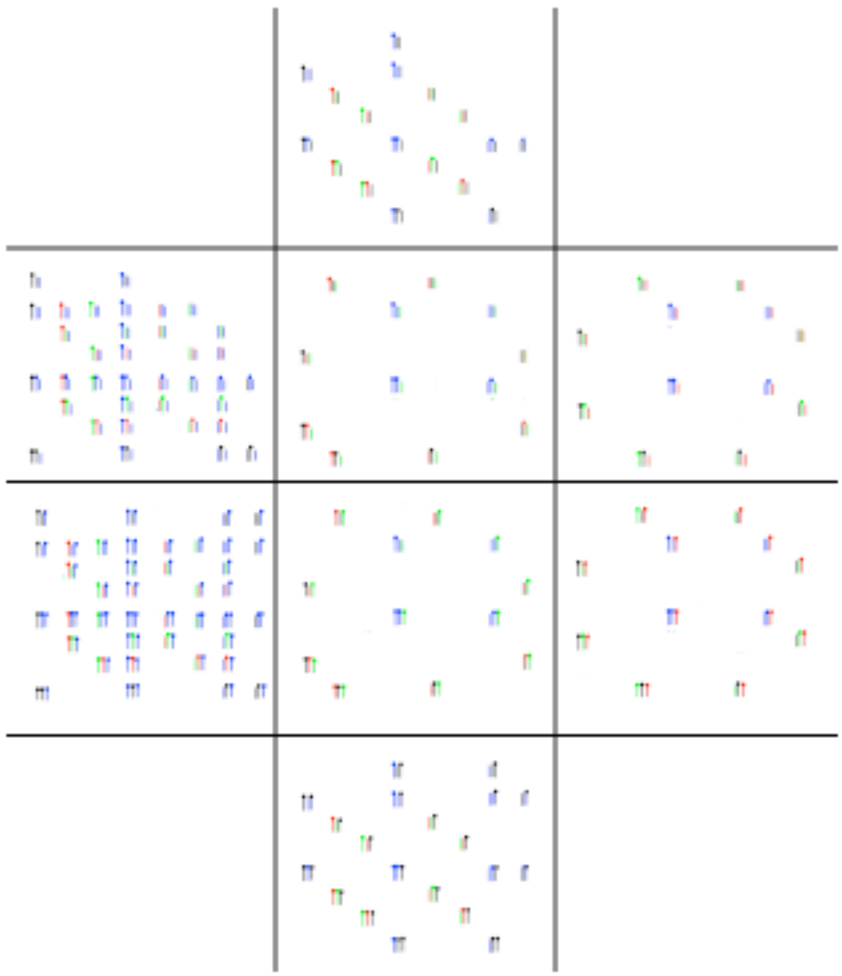
Blue Truth Quark (161)

Rules: a Triple belongs to the Blue Truth Quark if:

1 - There is at least one Blue element and all other elements are Blue or Colorless (black)
and at least one element is NonAssociative (that is, is either E or I or J or K)

2 - There is one Red element and one Green element and the other element is Colorless (Red x Green = Blue)

3 - The Triple has one element each that is Red, Green, or Blue,
in which case the color of the Third element (for Third Generation) is determinative and must be Blue.



(Red and Green Beauty and Truth Quarks follow similar rules)

Fermion masses are calculated as a product of four factors:

V(Qfermion) x N(Graviton) x N(octonion) x Sym

The ratio of the down quark spinor manifold volume factor
to the electron spinor manifold volume factor is

V(Qdown quark) / V(Qelectron) = V(S^7x RP^1)/1 = pi^5 / 3.

The third generation fermion particles correspond to triples of octonions.
There are 8^3 = 512 such triples.
The triple { 1,1,1 } corresponds to the tau-neutrino.
The other 7 triples involving only 1 and E correspond to the tauon:
{ E, E, E } { E, E, 1 } { E, 1, E } { 1, E, E } { 1, 1, E } { 1, E, 1 } { E, 1, 1 }
The symmetry of the 7 tauon triples is the same
as the symmetry of the first generation tree-level-massive fermions,
3 down, quarks, the 3 up quarks, and the electron,
so by the Sym factor the tauon mass should be the same as
the sum of the masses of the first generation massive fermion particles.
Therefore the **tauon mass is calculated at tree level as 1.877 Ge**V.

The beauty quark corresponds to 21 triples.
They are triples of the same form as the 7 tauon triples involving 1 and E,
but for 1 and I, 1 and J, and 1 and K = red, green, and blue beauty quarks.
The seven red beauty quark triples correspond to the seven tauon triples,
except that the beauty quark interacts with 6 Spin(0,5) gravitons
while the tauon interacts with only two.
The red beauty quark constituent mass should be the tauon mass times
the third generation graviton factor 6/2 = 3,
so the **red beauty quark mass is mb = 5.63111 GeV**.

Triples of the type { 1, I, J } , { I, J, K }, etc.,
do not correspond to the beauty quark, but to the truth quark.
The truth quark corresponds to those 512 - 1 - 7 - 21 = 483 triples,
so the constituent mass of the red truth quark
is 161 / 7 = 23 times the red beauty quark mass,
and the **red T-quark mass is mt = 129.5155 GeV**

248-dim E8 contains 120-dim D8

E8 / D8 = 64 + 64 Fermions

D8 / D4 x D4 = 64 Spacetime

D4 = 28 Standard Model (12)
with 16 Gravity + Dark Energy Ghosts

D4 = 28 Gravity + Dark Energy (16)
with 12 Standard Model Ghosts

The 24 Orange Root Vectors of the D4 of E8 Standard Model + Gravity Ghosts
are on the Horizontal X-axis.

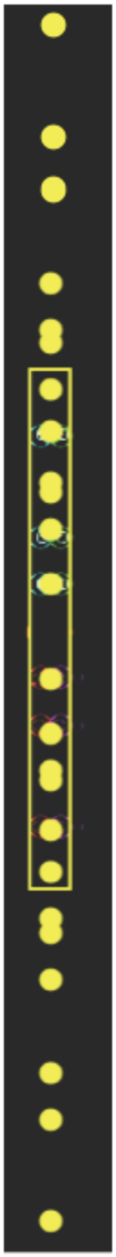
8 of them in the Orange Box represent the 8 Root Vectors of the Standard Model
Gauge Groups SU(3) SU(2) U(1).
Their 4 Cartan Subalgebra elements correspond
to the 4 Cartan Subalgebra elements of D4 of E8 Standard Model + Gravity Ghosts
and to half of the 8 Cartan Subalgebra elements of E8.

The other 24-8 = 16 Orange Root Vectors represent Ghosts of 16D U(2,2)
which contains the Conformal Group SU(2,2) = Spin(2,4)
that produces Gravity + Dark Energy by the MacDowell-Mansouri mechanism.

Standard Model Gauge groups come from CP2 = SU(3) / SU(2) x U(1)
(as described by Batakis in Class. Quantum Grav. 3 (1986) L99-L105)

Electroweak SU(2) x U(1) is gauge group as isotropy group of CP2.

SU(3) is global symmetry group of CP2 but due to Kaluza-Klein M4 x CP2 structure of
compact CP2 at every M4 spacetime point,
it acts as Color gauge group with respect to M4.



The 24 Yellow Root Vectors of the D4 of E8 Gravity + Standard Model Ghosts are on the Vertical Y-axis.
12 of them in theYellow Box represent the 12 Root Vectors of the Conformal Gauge Group SU(2,2) = Spin(2,4) of Conformal Gravity + Dark Energy.
The 4 Cartan Subalgebra elements of SU(2,2)xU(1) = U(2,2) correspond to the 4 Cartan Subalgebra elements of D4 of E8 Gravity + Standard Model Ghosts and to the other half of the 8 Cartan Subalgebra elements of E8.

The other 24-12 = 12 Yellow Root Vectors represent Ghosts of 12D Standard Model whose Gauge Groups are SU(3) SU(2) U(1).

Gravity and Dark Energy come from its Conformal Subgroup SU(2,2) = Spin(2,4)
(see Appendix - Details of Conformal Gravity and ratio DE : DM :OM)

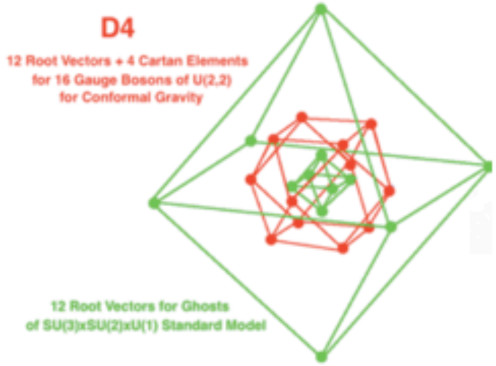
SU(2,2) = Spin(2,4) has 15 generators:

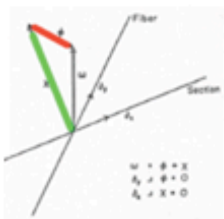
1 Dilation representing Higgs Ordinary Matter

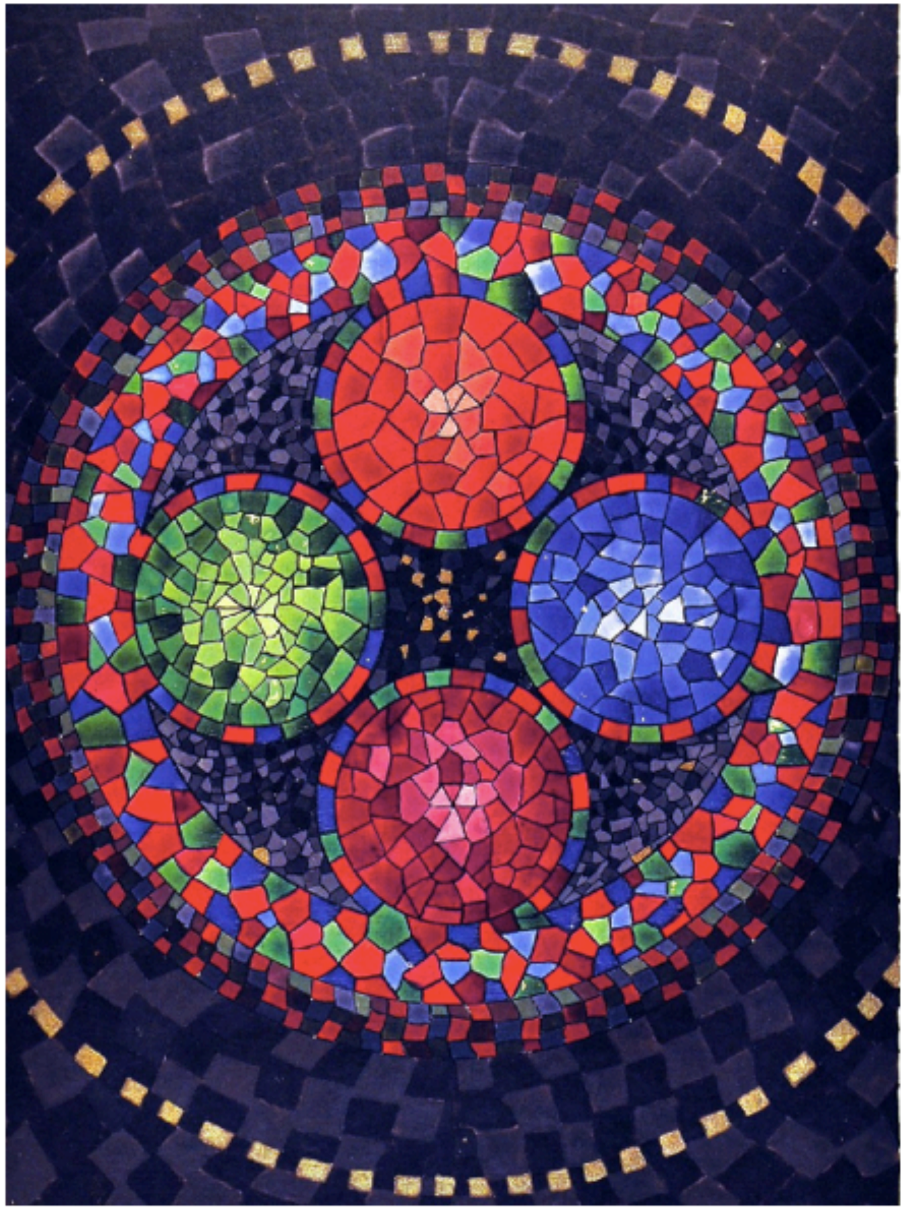
4 Translations representing Primordial Black Hole Dark Matter

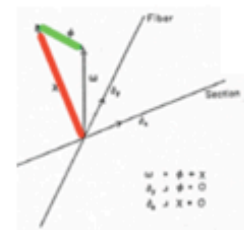
10 = 4 Special Conformal + 6 Lorentz representing Dark Energy
(see Irving Ezra Segal, "Mathematical Cosmology and Extragalactic Astronomy" (Academic 1976))

The basic ratio Dark Energy : Dark Matter : Ordinary Matter = 10:4:1 = 0.67 : 0.27 : 0.06
When the dynamics of our expanding universe are taken into account, the ratio is calculated to be **0.75 : 0.21 : 0.04**


D4
12 Root Vectors + 4 Cartan Elements
for 16 Gauge Bosons of U(2,2)
for Conformal Gravity
12 Root Vectors for Ghosts
of SU(3)xSU(2)xU(1) Standard Model


Fiber
Section




Fiber
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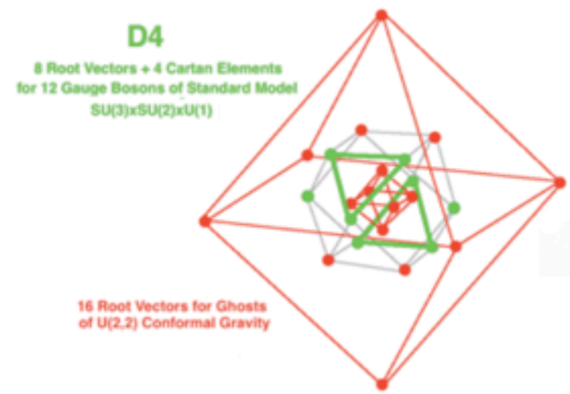

D4
8 Root Vectors + 4 Cartan Elements
for 12 Gauge Bosons of Standard Model
SU(3)xSU(2)xU(1)
16 Root Vectors for Ghosts
of U(2,2) Conformal Gravity

The force strength of a given force is

(1 / Mforce^2) (Vol(MISforce)) (Vol(Qforce) / Vol(Dforce)^(1 / mforce))

where:

Mforce represents the effective mass;
MISforce represents the relevant part of the target Internal Symmetry Space;
Vol(MISforce) stands for volume of MISforce and is sometimes also denoted by Vol(M);
Qforce represents the link from the origin to the relevant target for the gauge boson;
Vol(Qforce) stands for volume of Qforce;
Dforce represents the complex bounded homogeneous domain
of which Qforce is the Shilov boundary;
mforce is the dimensionality of Qforce, which is
Vol(Dforce)^(1 / mforce) stands for a dimensional normalization factor
(to reconcile the dimensionality of the Internal Symmetry Space of the target vertex
with the dimensionality of the link from the origin to the target vertex).

Qforce, Hermitian symmetric space, Dforce, mforce, and Vol(Dforce) for four forces are:

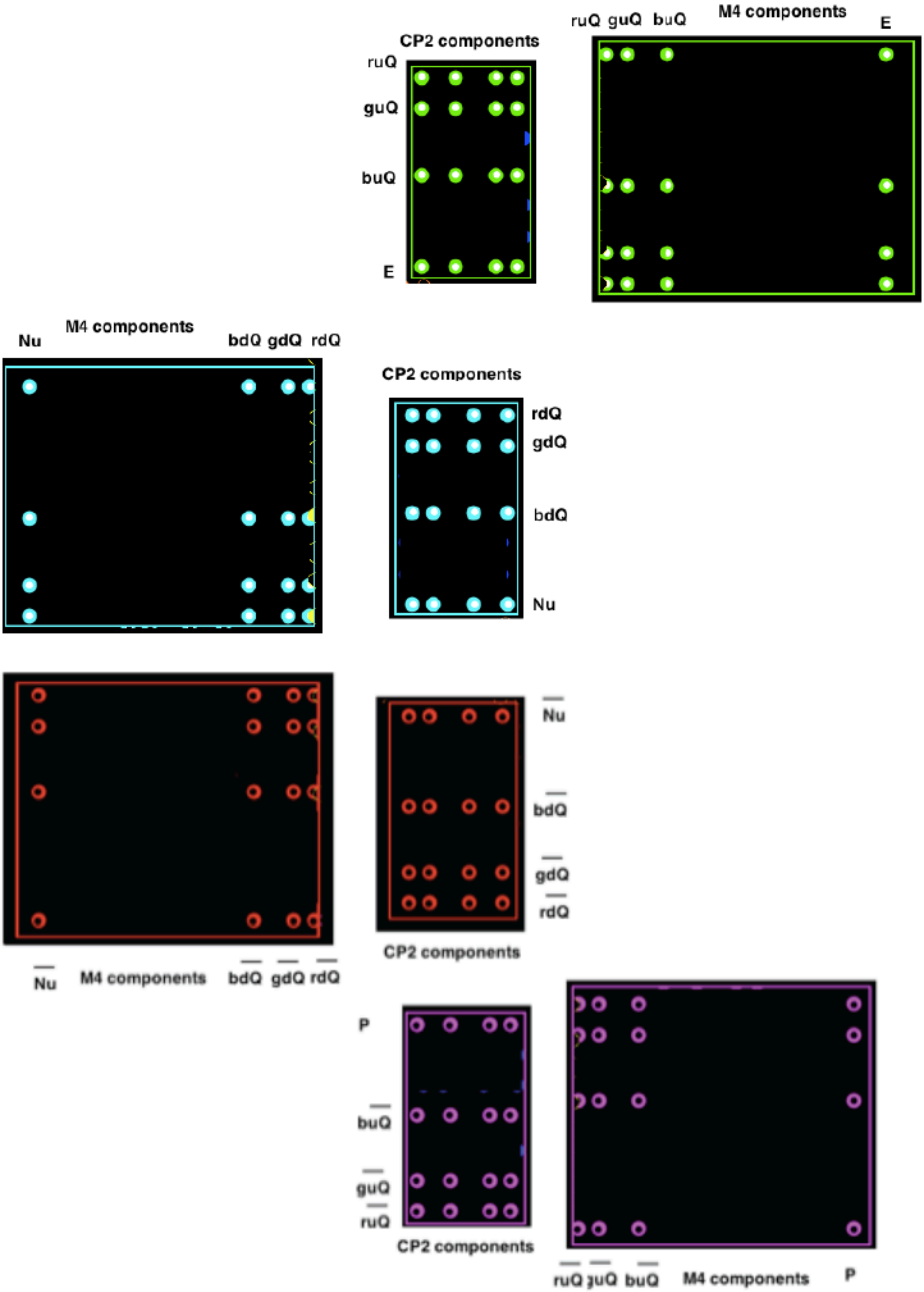
Spin(5)	Spin(7) / Spin(5)xU(1)	IV5	4	RP^1xS^4
SU(3)	SU(4) / SU(3)xU(1)	B^6(ball)	4	S^5
SU(2)	Spin(5) / SU(2)xU(1)	IV3	2	RP^1xS^2
U(1)	-	-	1	-

Force	M	Vol(M)	Q	Vol(Q)	D	Vol(D)
gravity	S^4	8pi^2/3	RP^1xS^4	8pi^3/3	IV5	pi^5/2^4 5!
color	CP^2	8pi^2/3	squashed S^5	4pi^3	B^6(ball)	pi^3/6
Weak	S^2xS^2	2x4pi	RP^1xS^2	4pi^2	IV3	pi^3/24
e-mag	T^4	4x2pi	-	-	-	-

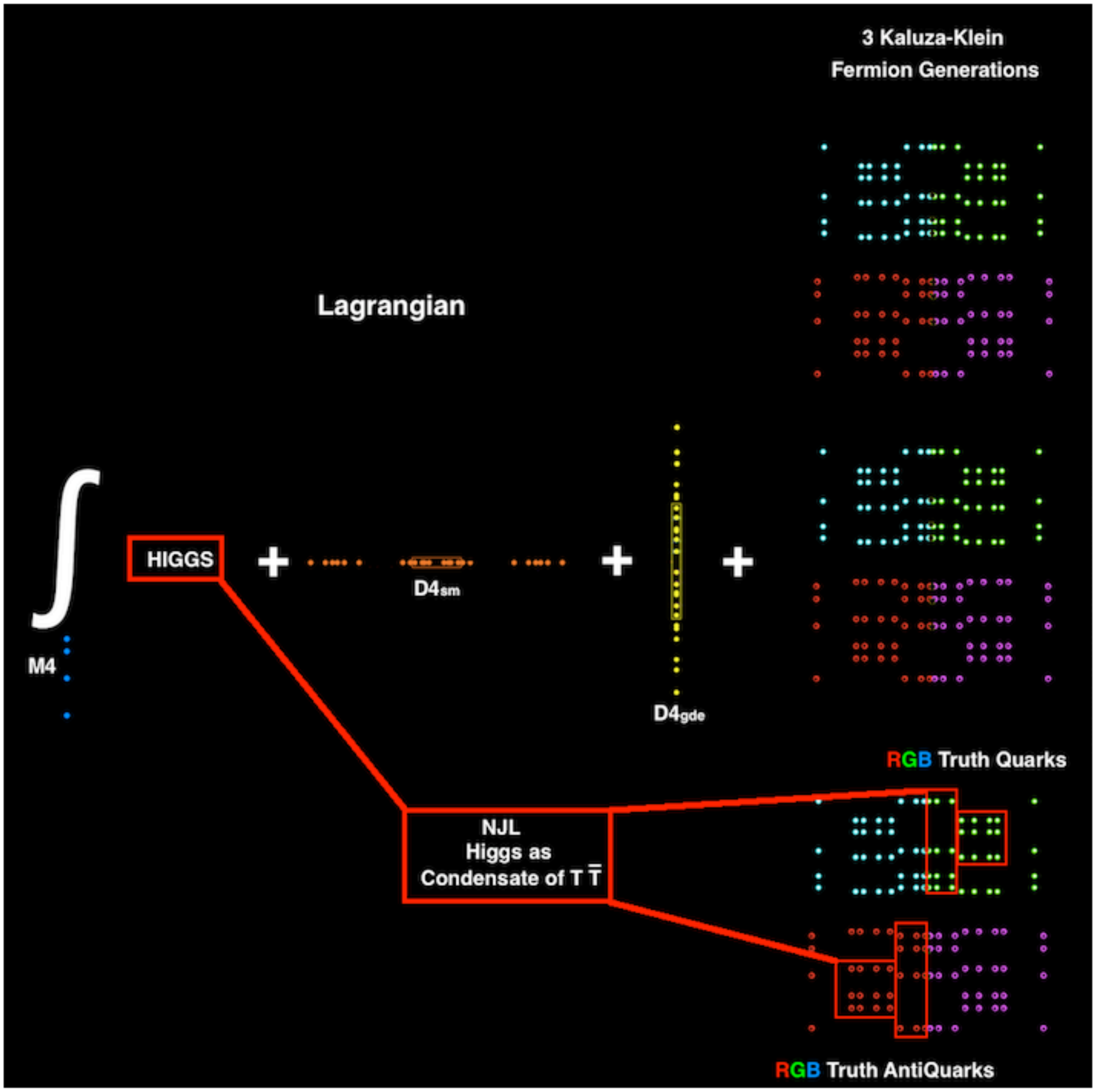
squashed S5 = Shilov boundary of complex domain of symmetric space SU(4) / SU(3) x U(1)

The relative force strengths at the characteristic energy level of each force are:

Spin(5) gravity at 10^19 GeV = 1 ; GGmproton^2 approx 5 x 10^-39
SU(3) color at 245 MeV = 0.6286
at 5.3 GeV = 0.166
at 34 GeV = 0.121
at 91 GeV = 0.106 ; with nonperturbative effects = 0.125
SU(2) weak at 100 GeV = 0.2535 ; GWmproton^2 approx 1.05 x 10^-5
U(1) e-mag at 4 KeV = 1/137.03608



CP2 components
ruQ
guQ
buQ
E
ruQ guQ buQ
M4 components
E
Nu
M4 components
bdQ gdQ rdQ
CP2 components
rdQ
gdQ
bdQ
Nu
$\overline{\text{Nu}}$
$\overline{\text{bdQ}}$
$\overline{\text{gdQ}}$
$\overline{\text{rdQ}}$
CP2 components
$\overline{\text{Nu}}$
M4 components
$\overline{\text{bdQ}}$ $\overline{\text{gdQ}}$ $\overline{\text{rdQ}}$
P
$\overline{\text{buQ}}$
$\overline{\text{guQ}}$
$\overline{\text{ruQ}}$
CP2 components
$\overline{\text{ruQ}}$ $\overline{\text{guQ}}$ $\overline{\text{buQ}}$
M4 components
P



Fermion masses are calculated as a product of four factors:

V(Qfermion) x N(Graviton) x N(octonion) x Sym

The ratio of the down quark spinor manifold volume factor
to the electron spinor manifold volume factor is

V(Qdown quark) / V(Qelectron) = V(S^7x RP^1)/1 = pi^5 / 3.

The third generation fermion particles correspond to triples of octonions.
There are 8^3 = 512 such triples.
The triple { 1,1,1 } corresponds to the tau-neutrino.
The other 7 triples involving only 1 and E correspond to the tauon:
The beauty quark corresponds to 21 triples.
They are triples of the same form as the 7 tauon triples involving 1 and E,
but for 1 and I, 1 and J, and 1 and K,
which correspond to the red, green, and blue beauty quarks,
Triples of the type { 1, I, J } , { I, J, K }, etc.,
do not correspond to the beauty quark, but to the Truth quark.
The Truth quark corresponds to those 512 - 1 - 7 - 21 = 483 triples, so the
constituent mass of red truth quark is 161 / 7 = 23 times red beauty quark

red Truth quark mass is mt = 129.5155 GeV

Here is a summary of E8 Physics model calculation results. Since ratios are calculated, values for one particle mass and one force strength are assumed.
Quark masses are constituent masses. Most of the calculations are tree-level, so more detailed calculations might be even closer to observations.

Dark Energy : Dark Matter : Ordinary Matter = 0.75 : 0.21 : 0.04

Fermions as Schwinger Sources have geometry of Complex Bounded Domains with Kerr-Newman Black Hole structure size about 10^(-24) cm.

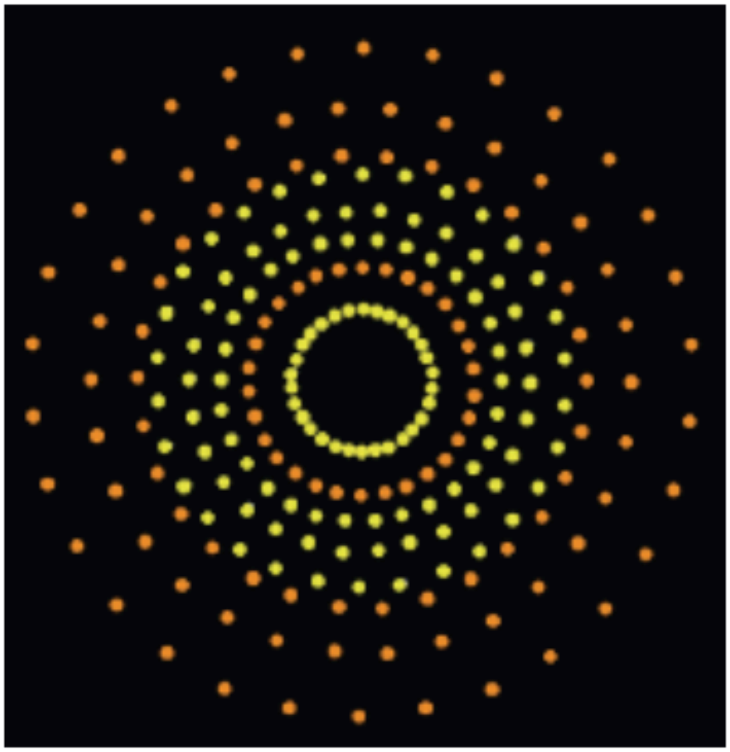
Particle/Force	Tree-Level	Higher-Order
e-neutrino	0	0 for nu_1
mu-neutrino	0	9 x 10^(-3) eV for nu_2
tau-neutrino	0	5.4 x 10^(-2) eV for nu_3
electron	0.5110 MeV	
down quark	312.8 MeV	charged pion = 139 MeV
up quark	312.8 MeV	proton = 938.25 MeV
		neutron - proton = 1.1 MeV
muon	104.8 MeV	106.2 MeV
strange quark	625 MeV	
charm quark	2090 MeV	
tauon	1.88 GeV	
beauty quark	5.63 GeV	
truth quark (low state)	130 GeV	(middle state) 174 GeV
		(high state) 218 GeV
W+	80.326 GeV	
W-	80.326 GeV	
W0	98.379 GeV	Z0 = 91.862 GeV
Mplanck 1.217x10^19 GeV		
Higgs VEV (assumed)	252.5 GeV	
Higgs (low state)	126 GeV	(middle state) 182 GeV
		(high state) 239 GeV
Gravity Gg (assumed)	1	
(Gg)(Mproton^2 / Mplanck^2)		5 x 10^(-39)
EM fine structure	1/137.03608	
Weak Gw	0.2535	
Gw(Mproton^2 / (Mw+^2 + Mw-^2 + Mz0^2))		1.05 x 10^(-5)
Color Force at 0.245 GeV	0.6286	0.106 at 91 GeV

Kobayashi-Maskawa parameters for W+ and W- processes are:

	d	s	b
u	0.975	0.222	0.00249 -0.00388i
c	-0.222 -0.000161i	0.974 -0.0000365i	0.0423
t	0.00698 -0.00378i	-0.0418 -0.00086i	0.999

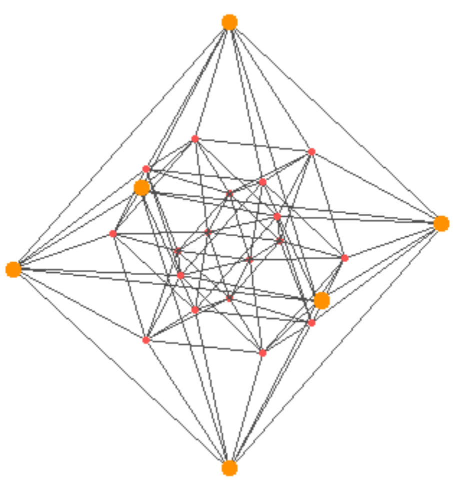
The phase angle d13 is taken to be 1 radian.

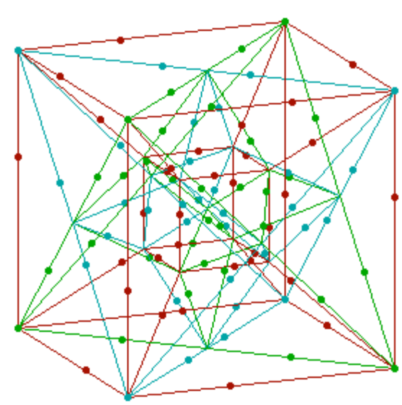
E8 = H4 + H4 = 120 + 120 = 240-vertex Witting polytope tiling of 8-dim space



E8 = 120 BiVectors + 128 half-Spinors of Cl(16) Clifford Algebra
with graded structure
1 16 120 560 1820 4368 8008 11440 12870 11440 8008 4368 1820 560 120 16 1
By 8-Periodicity of Real Clifford Algebras: Cl(16) = tensor product Cl(8) x Cl(8)
so with that product E8 = F4 x F4

H4 = 24 (vertices) + 96 (edges) = 120-vertex 600-cell tiling of 4-dim space
with Coxeter Group determined by E8



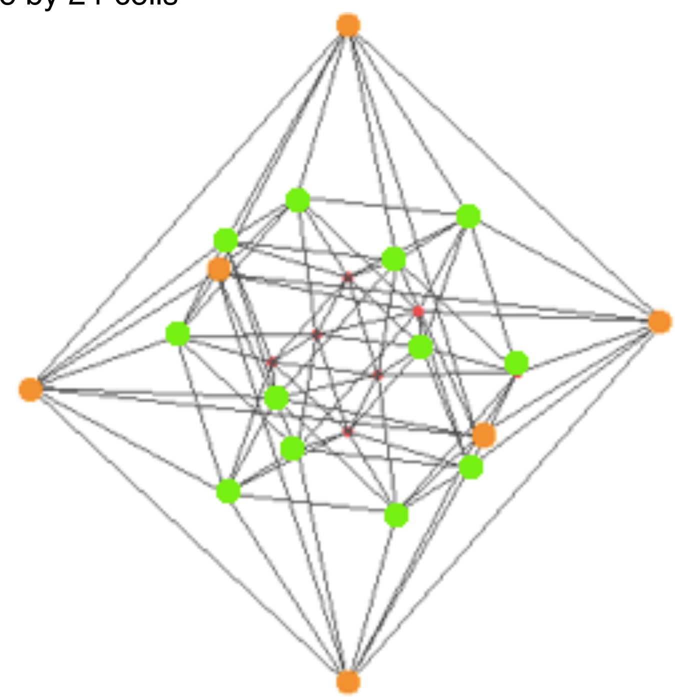


F4 = 24 cell + dual 24-cell tiling of 4-dim space

F4 = 8 Vectors + 28 BiVectors + 16 Spinors of Cl(8) Clifford Algebra
with graded structure 1 8 28 56 70 56 28 8 1
tile 4-dim space by 24-cells and their dual 24-cells

D4 24-cell tiling of 4-dim space

D4 = 28 BiVectors of Cl(8) Clifford Algebra with 24 root vectors
with graded structure 1 8 28 56 70 56 28 8 1
tile 4-dim space by 24-cells



A3 = D3 = cuboctahedral tiling of 3-dim space

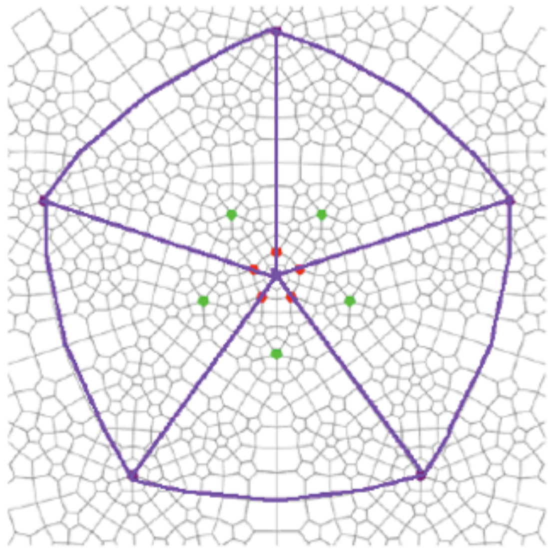
A3=D3 = 15 BiVectors of Cl(6) Clifford Algebra with 12 root vectors and
with graded structure 1 6 15 20 15 6 1
tile 3-dim space by cuboctahedra
which can be seen as a central part of a 24-cell (green vertices above)

H3 = 12-Vertex Icosahedron as Jitterbug Transform of 12-Vertex Cuboctahedron
with Coxeter Group determined by D6

H2 Penrose STAR tilings of 2-dim space

H2 = I^5_2 = Penrose STAR tiling of 2-dim space
with Coxeter group determined by A4 which contains A2
and field extension Q(sqrt(5))

The central part of the tiling has 5 pentagonal sectors

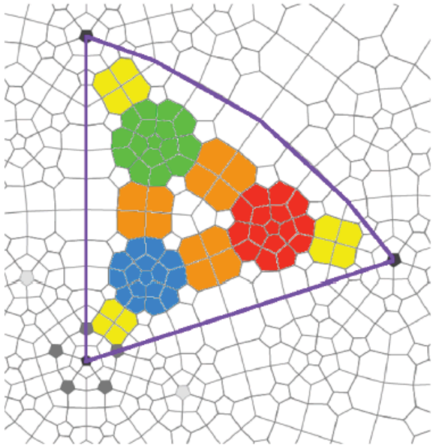


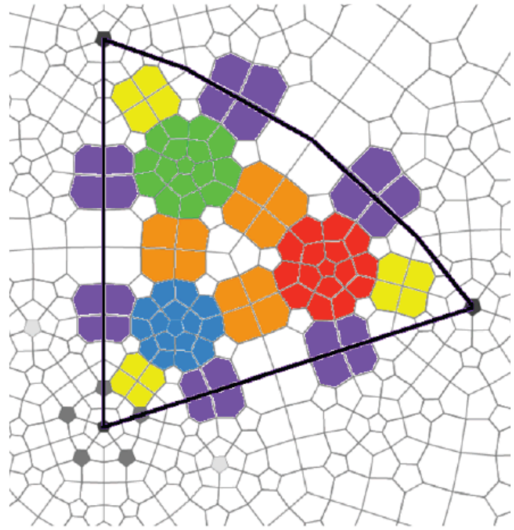
Each of the 5 pentagonal sectors of the tiling contains a 2-dim projected version of the 8-dim E8 Root Vector structure of E8 Physics corresponding to the Complex E6 subalgebra of Octonionic E8. The outer boundary of each sector is not a straight line but is curved with Conformal Symmetry and pentagonal sectors further out are conformally curved rather than straight-line pentagons.

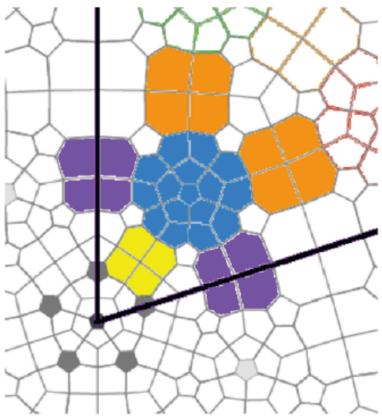
Each pentagonal sector represents the Complex part of Octonionic E8 Physics whose 240 E8 Root Vectors project to the 72 Root Vectors of E6 subalgebra of E8 which 72 E6 Root Vectors have the following physical interpretation

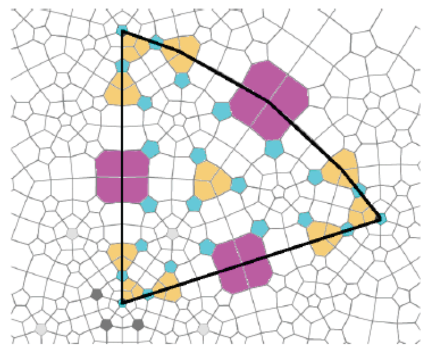
16 = 2x8 of which represent Complex Fermion Particles
16 = 2x8 of which represent Complex Fermion AntiParticles
16 = 2x(4+4) of which represent Complex (4+4)-dim Kaluza-Klein SpaceTime
12 of which represent the Standard Model
12 of which represent Gravity + Dark Energy

as shown in the following image of one of the pentagonal sectors:

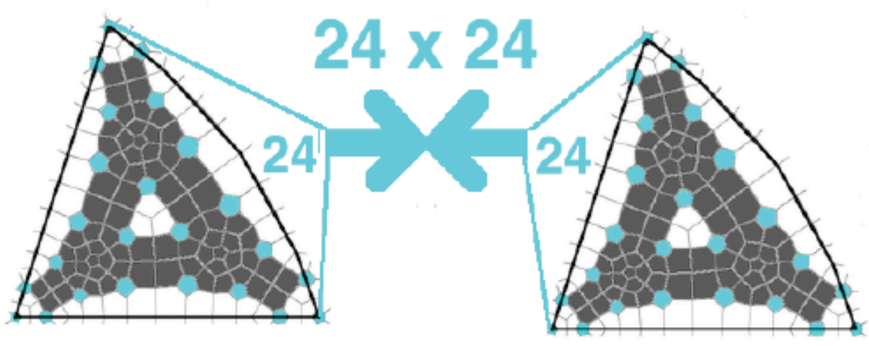




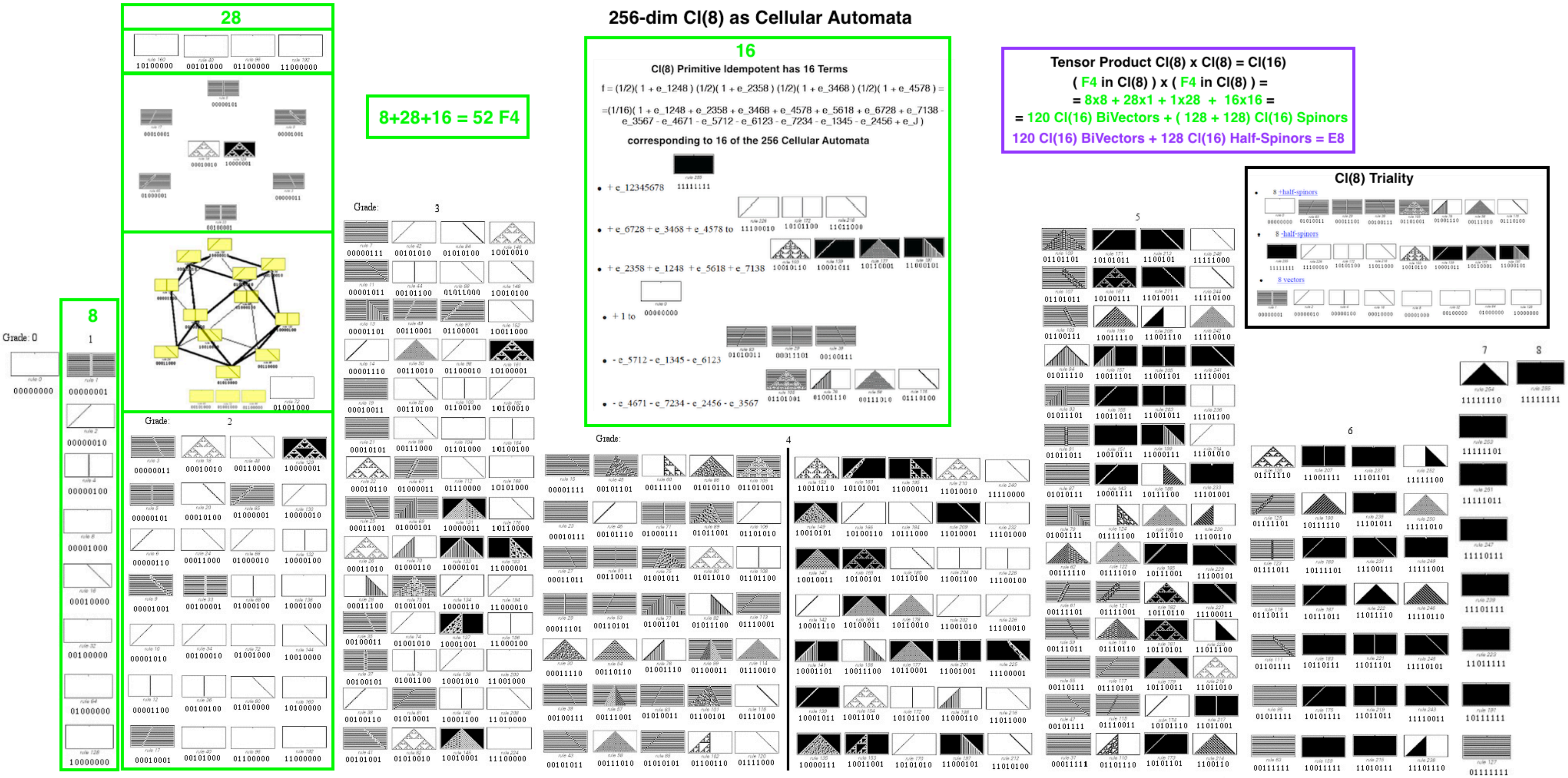




The Bohm Quantum Potential interacts between two Pentagonal Sectors by
24 Bohm Carrier Tiles of one Pentagonal Sector carrying E8 Configuration Information
and comparing it with
24 Bohm Carrier Tiles of the Other Sector carrying E8 Configuration Information.
If the resulting 24 x 24 Matrix shows that the two E8 Configurations are similar,
then a Bohm Quantum Potential Resonant Connection is established.

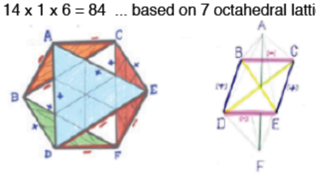


The Bohm Quantum Potential 24x24 Matrix is traceless because Configuration
Resonance is sensitive to similarity rather than dilation scale
and is symmetric because Configuration Resonance is symmetric between Sectors.

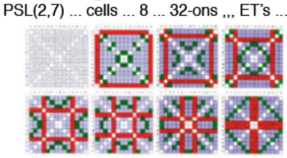


Guillermo Moreno (arXiv math/0512517) has shown that **V(7,2) = Spin(7) / Spin(5)** can be identified with the **Zero Divisors of Sedenions** which have 7+28 = 35 Associative Triples and for which Zero Divisors are given by the fibration V(7,2) -> G2 -> S3 [3-sphere] and which have 4-2=2 ZD Irreducible Components and 10-dim Lie Sphere Spin(7) / Spin(5)xU(1) whose 10D correspond to **Cl(1,9) = Cl(2,8) Conformal over Cl(1,7)**
that **V(15,2) = Spin(15) / Spin(13)** is related to, but not identified with, the **Zero Divisors of 32-ons** which have 35 + 120 = 155 Associative Triples and which have 8-2=6 ZD Irreducible Components and 26-dim Lie Sphere Spin(15) / Spin(13)xU(1) whose 26D correspond to **26D String Theory and to 26-dim traceless J(3,O)o**
that **V(127,2) = Spin(127) / Spin(125)** is related to, but not identified with, the **Zero Divisors of Voudon 256-ons** corresponding to Cl(8) which have 1+6+28+120+496+2016+8128=10795 Associative Triples and which have 64-2=62 ZD Irreducible Components and 250-dim Lie Sphere Spin(127) / Spin(125)xU(1)

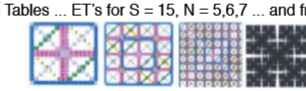
Robert de Marrais said "... 256 ... 2^8 ions Voudons ... Moreno ... determines that the automorphism group of the ZD's of all 2^n-ions ... obey a simple pattern: for n ≥ 4 this group has the form G2 x (n-3) x S3 (... order-6 permutation group on 3 elements) ... This says the automorphism group of the Sedenions' ZD's has order 14 x 1 x 6 = 84 ... based on 7 octahedral lattices ("Box-Kites") ...

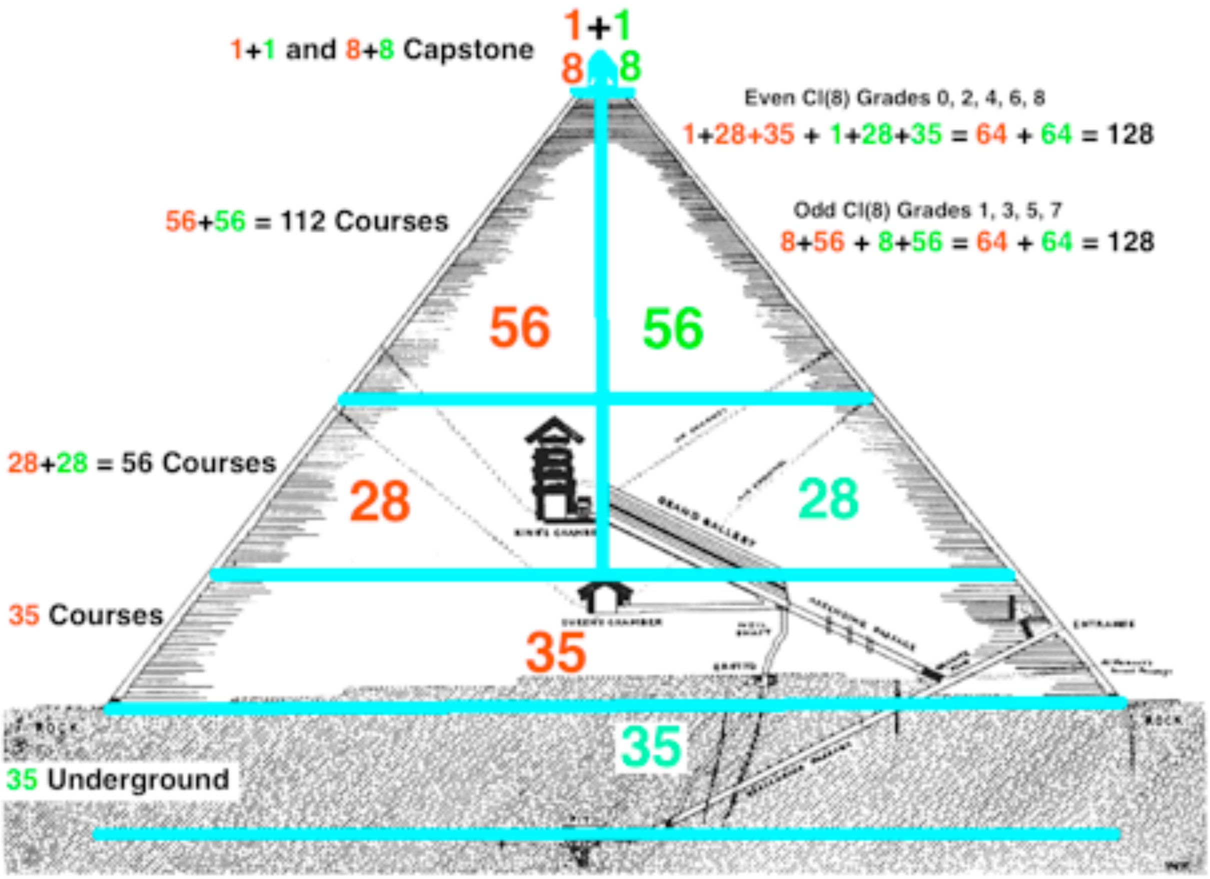


... Harmonics of Box-Kites, called here "Kite-Chain Middens," ... extend indefinitely into higher forms of 2^n -ions. All non-Midden-collected ZD diagonals in the ... 32-ons ... belong... to a set of 15 "emanation tables," ... they house 168 ... PSL(2,7) ... cells ... 8 ... 32-ons ,,, ET's ... from S = 8 to 15 ...

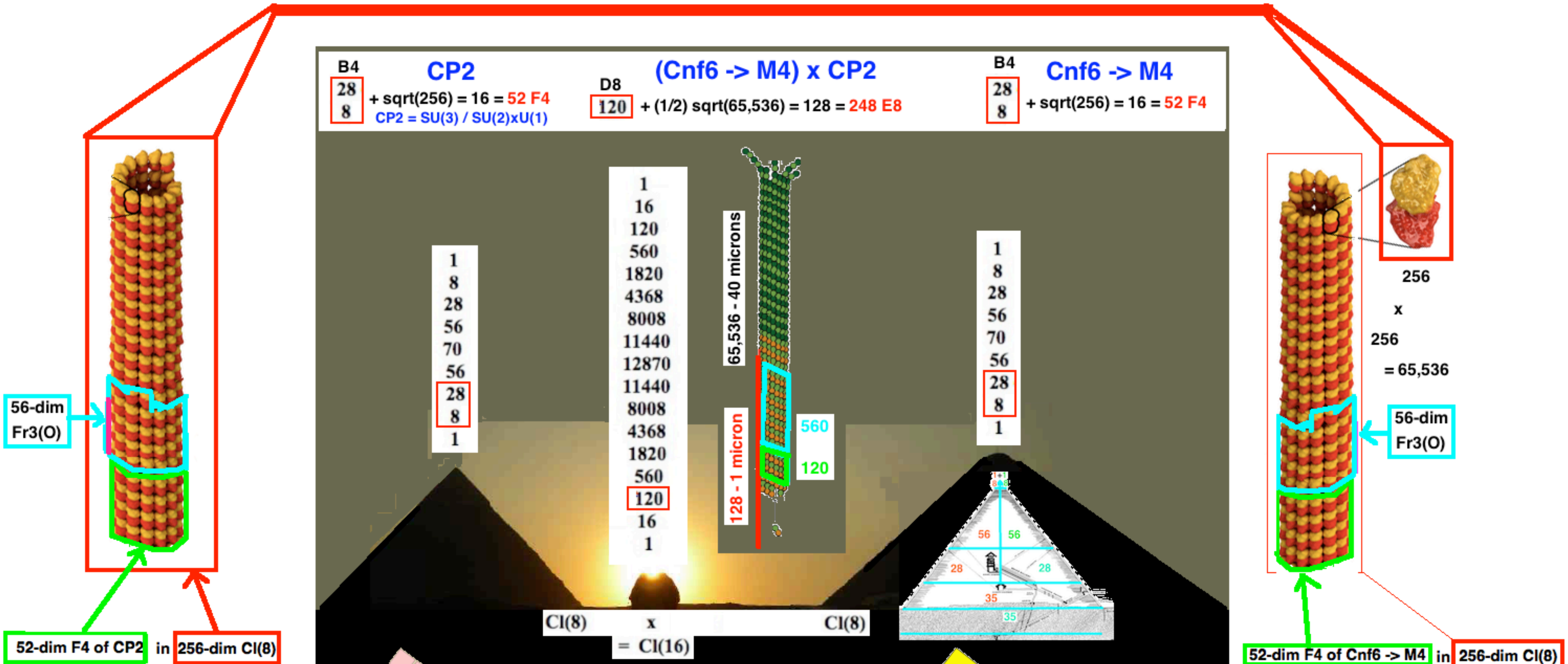


[here are] ... Emanation Tables ... ET's for S = 15, N = 5,6,7 ... and fractal limit ...





1 + 8 + 28 + 56 + (35 + 35) + 56 + 28 + 8 + 1



F4 / B4 = OP2 = Spinor Fermions =
= 8 Particles + 8 AntiParticles
B4 / D4 = 8-dim SpaceTime =
= Kaluza-Klein M4 x CP2
D4 = Spin(8) contains Spin(6) = SU(4)
contains SU(3) Color Force
SU(3) Color Force = Global Symmetry
of CP2 = SU(3) / SU(2)xU(1)
SU(2)xU(1) ElectroWeak Force =
= Local Symmetry of CP2

F4 / B4 = OP2 = Spinor Fermions =
= 8 Particles + 8 AntiParticles
B4 / D4 = 8-dim SpaceTime =
= Kaluza-Klein M4 x CP2
D4 = Spin(4,4) contains Spin(2,4) of
Conformal Gravity + Dark Energy

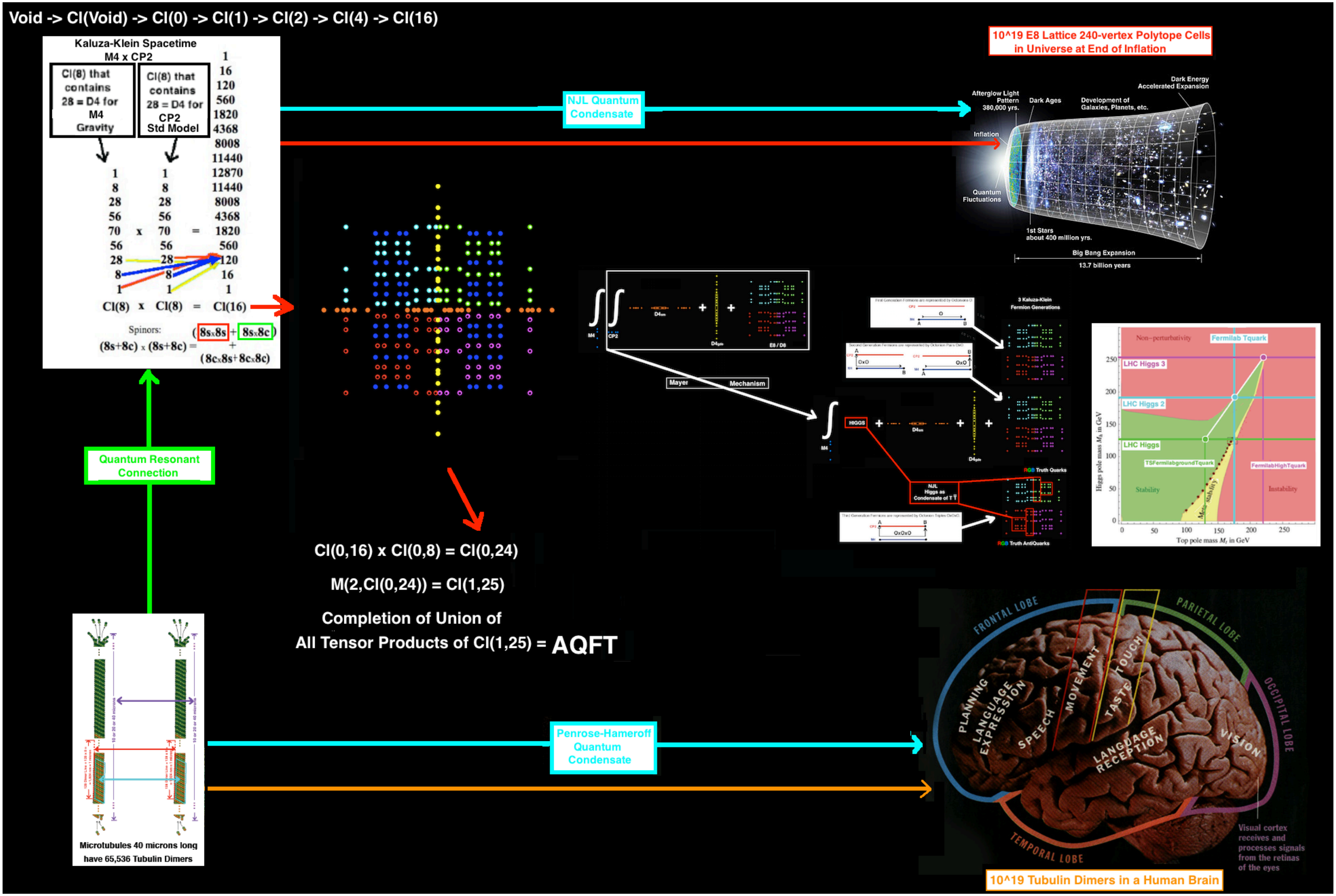
Cross section

E8 Kaluza-Klein (Cnf6 -> M4) x CP2

In (Cl(8) of CP2) x (Cl(8) of Cnf6 -> M4) = Cl(16) containing E8
at each of the 256 points of Cl(8) of Cnf6 -> M4 there are all 256 points of Cl(8) of CP2
D8 = Cl(16) BiVectors = 120
E8 / D8 = 128-dim Fermion Spinor Space = 8 components of 8+8 Fermions
D8 / D4 x D4 = A7+1 = 64 = 8-dim position x 8-dim momentum
D4 containing D3 = Spin(2,4) = A3 = SU(2,2) for Conformal Gravity + Dark Energy
D4 containing D3 = SU(4) containing Color Force SU(3)
10xFr3(O) = Cl(16) TriVectors = 560

Cross section

Void -> Cl(Void) -> Cl(0) -> Cl(1) -> Cl(2) -> Cl(4) -> Cl(16)


Void -> Cl(Void) -> Cl(0) -> Cl(1) -> Cl(2) -> Cl(4) -> Cl(16)
Kaluza-Klein Spacetime
M4 x CP2
Cl(8) that contains 28 = D4 for M4 Gravity
Cl(8) that contains 28 = D4 for CP2 Std Model
1 16 120 560 1820 4368 8008 11440 12870 11440 8008 4368 1820 560 120 16 1
1 8 28 56 70 56 28 8 1 x 1 8 28 56 70 56 28 8 1 =
Cl(8) x Cl(8) = Cl(16)
Spinors:
(8s+8c) x (8s+8c) = (8sx8s + 8sx8c) + (8cx8s + 8cx8c)
NJL Quantum Condensate
10^19 E8 Lattice 240-vertex Polytope Cells in Universe at End of Inflation
Dark Energy Accelerated Expansion
Afterglow Light Pattern 380,000 yrs.
Dark Ages
Development of Galaxies, Planets, etc.
Inflation
Quantum Fluctuations
1st Stars about 400 million yrs.
Big Bang Expansion
13.7 billion years
Quantum Resonant Connection
Mayer Mechanism
3 Kaluza-Klein Fermion Generations
HIGGS
NJL Higgs as Condensate of T T̄
RGB Truth Quarks
RGB Truth AntiQuarks
Non-perturbativity
Fermilab Tquark
LHC Higgs 3
LHC Higgs 2
LHC Higgs
TSFermilabgroundTquark
FermilabHighTquark
Stability
Meta-stability
Instability
Higgs pole mass M_h in GeV
Top pole mass M_t in GeV
Cl(0,16) x Cl(0,8) = Cl(0,24)
M(2,Cl(0,24)) = Cl(1,25)
Completion of Union of
All Tensor Products of Cl(1,25) = AQFT
Microtubules 40 microns long have 65,536 Tubulin Dimers
Penrose-Hameroff Quantum Condensate
FRONTAL LOBE
PARIETAL LOBE
OCCIPITAL LOBE
TEMPORAL LOBE
PLANNING
LANGUAGE EXPRESSION
SPEECH
MOVEMENT
TOUCH
TASTE
LANGUAGE RECEPTION
VISION
Visual cortex receives and processes signals from the retinas of the eyes
10^19 Tubulin Dimers in a Human Brain