What is Fundamental? NOTHING is Fundamental !!!

Frank Dodd (Tony) Smith, Jr. - 2017

Fundamental = Starting Point of a Process Describing Realistic Physics
including Lagrangian and Algebraic Quantum Field Theory (AQFT).
The Starting Point of Our Universe was a Fundamental Spinor Void
Void = NOTHING so NOTHING is Fundamental

This paper explores the Process,
which allows calculation of Standard Model Particle Masses and Force Strengths.

Page 2 is a Graphic Overview.

Pages 3-13 What is Fundamental? NOTHING is Fundamental !!!

Pages 14-110 are my 2018-2019 Calendar with Red Book appendix.

Pages 111-114 are about Leonardo DaVinci’s Salvator Mundi and E8.
What is Fundamental? NOTHING
Frank Dodd (Tony) Smith, Jr. - 2017

Fundamental = Starting Point of a Process Describing Realistic Physics
including Lagrangian and Algebraic Quantum Field Theory (AQFT).
This paper explores the Process through detailed worked examples.
(for further details and calculations see Smith references)
The Starting Point of Our Universe was a Fundamental Spinor Void
Void = NOTHING so NOTHING is Fundamental

Fundamental Spinor Void

based on 0-dim Real Clifford Algebra Cl(Void)
from which emerged by Finkelstein’s process of Iterating Clifford Algebra Formation
Cl(0) = 2^0 = 1-dim
Cl(1) = 2^1 = 2-dim
Cl(2) = 2^2 = 4-dim with 2^1 = 1+1 half-spinor fermions/antifermions

Cl(4) = 2^4 = 16-dim with 2^2 = 2+2 half-spinor fermions/antifermions

Cl(16) = 2^16 = 65,536-dim with 2^8 = 128 + 128 half-spinor fermions/antifermions
128-dim Cl(16) Half-Spinors = 2 copies of Geoffrey Dixon’s 64-dim RxCxHxO
where R = Real, C = Complex, H = Quaternion, O = Octonion Division Algebras
(Dixon, Division Algebras (O, H, C, and R) and Windmill Tilting)
248-dim E8 = 128-dim Cl(16) Half-Spinors + 120-dim Cl(16) BiVectors

By 8-Periodicity of Real Clifford Algebras
Cl(8) x ...( N times tensor product )... x Cl(8) = Cl(8N)
Cl(16) can be factored into the tensor product Cl(8) x Cl(8)
Each of the Cl(8) = 2^8 = 256-dim with 2^4 = 8+8 Cl(8) half-spinor fermions/antifermions

By Triality half-spinors (8 fermions and 8 antifermions) are isomorphic to each other and to 8 vectors

By 8-Periodicity Cl(8) and Cl(16) have basic structure underlying all Real Clifford Algebras.
The Iterated Clifford Algebra Creation Sequence begins with a Compact Quantum Fluctuation in a Parent Universe (Real Form E8(-248)) that Unfolds into an Octonionic Inflation of Our Universe (Real Form E8(8))

(Smith, viXra 1709.0265)

The Creation Sequence can also be seen in terms of Spinor/Clifford Algebra Doubling

\[ \text{Cl}(0,0) \rightarrow \text{Cl}(0,2) \rightarrow \text{Cl}(0,4) \rightarrow \text{Cl}(0,6) \rightarrow \text{Cl}(0,8) \rightarrow \]

that goes to \( \text{Cl}(0,8) \) which has Vector - Half-Spinor Triality

and by 8-Periodicity is the Basic Building Block of Real Clifford Algebras.

The Creation Sequence continues by Tensor Product

\[ \rightarrow \text{Cl}(0,8) \otimes \text{Cl}(0,8) = \text{Cl}(0,16) \rightarrow \text{Cl}(0,16) \otimes \text{Cl}(0,8) = \text{Cl}(0,24) \rightarrow \]

\textbf{Cl}(0,16) contains the Maximal Exceptional E8 Lie Algebra

\textbf{Cl}(0,24) contains the Vector Space of the 24-dim Leech Lattice \( \Lambda_{24} \) that is composed of 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 \( \text{Cl}(0,24) = M(2,\text{Cl}(0,24)) \)

(Porteous, Clifford Algebras and the Classical Groups and Lounesto and Porteous, Lectures on Clifford (Geometric) Algebras and Applications)

\[ \rightarrow M(2,\text{Cl}(0,24)) = \text{Cl}(1,25) \rightarrow \]

Since all the matrix entries are \( \text{Cl}(0,24) = \text{tensor product of 3 copies of Cl}(0,8) \)

8-Periodicity allows formation of the tensor products of copies of \( \text{Cl}(1,25) \)

\[ \rightarrow \text{Completion of Union of All Tensor Products of Cl}(1,25) = \text{hyperfinite AQFT} \]

The hyperfinite AQFT has Real / Octonionic structure inherited from Cl(0,8)

and it also has Quaternionic structure due to

\[ \text{Cl}(1,25) = \text{Cl}(1,9) \otimes \text{Cl}(0,8) \otimes \text{Cl}(0,8) \text{ and } \text{Cl}(1,9) = \text{Cl}(1,5) \otimes \text{Cl}(0,4) = \text{Cl}(2,4) \otimes \text{Cl}(0,4) \]

where

the vector space of \( \text{Cl}(2,4) \) is 6-dim Conformal Spacetime

which contains 4-dim Minkowski Spacetime M4 of Cl(1,3)

and

the vector space of Cl(0,4) corresponds to CP2 = SU(3) / SU(2)xU(1)

so that before breaking Octonionic symmetry non-unitarity of Octonion Quantum Processes allows particle creation during the Inflation Era

(Adler, Quaternionic Quantum Mechanics and Quantum Fields, pages 50-52, 561)

and after breaking non-unitary Octonionic 8-dim Spacetime to unitary Quaternionic Spacetime, thus ending the Inflation Era,

the Spacetime of the hyperfinite AQFT is (4+4)-dim M4 \times CP2 Kaluza-Klein (Real Form E8(-24))
The E8 contained in Cl(0,16) is not a conventional Gauge Group but is a Recipe for a Realistic Physics Lagrangian:

**Fermion Terms:**
E8 / D8 = 128-dim = 8-dim Spacetime Components of 8 Fermion Particles + 8-dim Spacetime Components of 8 Fermion AntiParticles

**Spacetime Base Manifold Terms:**
D8 / D4 x D4 = 64-dim = 8-dim Spacetime Position x 8-dim Spacetime Momentum

**Gauge Boson and Ghost Terms:**
The two 28-dim D4 correspond to the M4 and CP2 of M4 x CP2 Kaluza-Klein

D4_M4 = 16-dim U(2,2) containing SU(2,2) = Spin(2,4) Conformal Gravity and 12 Standard Model Ghosts

D4_CP2 = 8-dim SU(3) Color Force plus 4 Translation Gravity Ghosts and 12 Conformal Gravity Ghosts

Electroweak SU(2) x U(1) come from Little Group of CP2 = SU(3) / SU(2) x U(1) (Batakis, Class. Quantum Grav.3 (1986) L99-L105)

This E8 Structure can be seen in terms of its 240 Root Vectors each of which has a realistic Physics Interpretation:
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,
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 M4 x CP2 Spacetime Base Manifold
32 for M4 position x 8 momentum and 32 for CP2 position x 8 momentum
Higgs and Second and Third Generation Fermions emerge from breaking Octonionic Symmetry of the Inflation Era to Quaternionic Symmetry of Present Era. 
(Mayer, Acta Physica Austriaca, Suppl. XXIII (1981))

The Higgs is a Condensate of Tquark and Tantiquark resulting in 3 mass states for the Higgs and the Tquark 
(Smith, viXra 1701.0496)

As to the unconventional mass states other than 125 GeV Higgs and 174 GeV Tquark: ATLAS, for the Full 2016 36.1 fb-1 of 2016 data in the Higgs -> ZZ* -> 4l channel, on 5 July 2017 released ATLAS-CONF-2017-058 saying: “... A search for heavy resonances ...[ in the Higgs -> ZZ* -> 4l channel ]... uses proton–proton collision data at a centre-of-mass energy of 13 TeV corresponding to an integrated luminosity of 36.1 fb-1 collected with the ATLAS detector during 2015 and 2016 at the Large Hadron Collider ... excess ...[is]... observed in the data for m4l around 240 ... GeV ... with a local significance of 3.6 sigma ...”. It will be interesting to see whether the 2017 ATLAS data of over 45 fb-1 will confirm or refute the excess at 240 GeV as a Higgs mass state.
Here is a chart showing the 3 Mass States for Higgs and Tquark (viXra 1701.0496):
green dot in the Stable region (green) has 125 GeV Higgs and 130 GeV Tquark
cyan dot on the Non-perturbativity Boundary has 190 GeV Higgs and 174 GeV Tquark
magenta dot at the Critical Point has 250 GeV Higgs and 220 GeV Tquark

CMS, for their Full 35.9 fb-1 of 2016 data in the Higgs -> ZZ* -> 4l channel,
in CMS-PAS-HIG-16-041 has bins of 4 GeV width and shows all 3 Higgs mass states:
low-mass Higgs state (green) with mass 125 GeV
middle-mass Higgs state (cyan) with mass 201 GeV (close to 190 GeV)
high-mass Higgs state (magenta) with mass 261 GeV (close to 240 and 250 GeV)
Semileptonic histograms of CDF and D0 show all 3 Truth Quark Mass States

- **Low-mass Tquark state (green)** with mass 130 GeV
- **Middle-mass Tquark state (cyan)** with mass 174 GeV
- **High-mass Tquark state (magenta)** with mass 220 GeV
The Completion of Union of All Tensor Products of Cl(1,25) = hyperfinite AQFT

(Smith, viXra 1701.0495)

containing the Realistic Physics of the Lagrangian.

It also contains, due to its Cl(1,25) components,
the structure of 26-dim String Theory
in which Strings are seen as Particle World-Lines,
the massless spin 2 state is the carrier of the Bohm Quantum Potential, and
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.

(Green, Schwartz, and Witten, "Superstring Theory" vol. 1)

10-dim String Spacetime is Kaluza-Klein 6-dim Conformal x 4-dim CP2 giving M4 x CP2
8-dim K-K Classical Lagrangian Spacetime as an NJL condensate of Dixon’s
64-dim Particle spinor T = RxCxHxO and the 64-dim AntiParticle spinor Tbar
Each cell of E8 Classical Lagrangian Spacetime corresponds to 65,536-dim Cl(16)
which contains 248-dim E8 = 120-dim D8 bivectors +128-dim D8 half-spinors

Human Brain Microtubules 40 microns long have 65,536 Tubulin Dimers

(image adapted from 12biophys.blogspot.com Lecture 11)

and so can have Bohm Quantum Resonance with Cl(16) Spacetime cells
so that the State of Consciousness of a Human is in exact resonant correspondence with a subset of the cells of E8 Classical Lagrangian Spacetime
Therefore E8 Classical Lagrangian Spacetime NJL Condensate is effectively the Spirit World in which the Human States of Consciousness = Souls exist.

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.

(Schroer, hep-th/9908021)

The Fundamental Fermion Cloud looks like a Kerr-Newman Black Hole.

(Arcos and Pereira, hep-th/0210103)

What is the size of the Fundamental Fermion Kerr-Newman Cloud?
The 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. According to the ATLAS at brauer.maths.qmul.ac.uk/Atlas/v3/spor/M/
the maximal subgroup of the Monster 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 26-dim String Theory Leech Lattice is a superposition of 8 Leech Lattices, 8 x 2^(1+24).Co1 describes the structure of the Cloud. Therefore, the volume of the Cloud should be on the order of 10^27 x Planck scale containing 10^27 particle/antiparticle pairs with size 10^(27/3) x 1.6 x 10^(-33) cm = 10^(27/3) cm.
Fundamental Fermion Clouds are Schwinger Sources.

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

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

Schwinger in 1951 “... 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 ...”.
(Schweber, PNAS 102, 7783-7788)

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)

Wyler 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

“... 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 expirerneter... must detect the particles ...[by]... collision that annihilates the
particle ... the source ... can be ... an abstraction of an annihilation collision, with the
source acting negatively, as a sink ... The basic things are ... the source functions ...
describing the intermediate propagation of the particle ...”
(Schwinger, 1969 - see physics/0610054)

Schwinger Sources can be described by continuous manifold structures
of Bounded Complex Domains and their Shilov Boundaries
and
Wyler’s techniques allow calculation of Particle Masses and Force Strengths
(Smith, viXra 1602.0319)

Results of such calculations are shown in the Technical Endnotes:
**Technical Endnotes:**

**Results of Calculations:**

Quark masses are constituent masses. Most of the calculations are tree-level. Fermions are Schwinger Sources with geometry of Complex Bounded Domains and Kerr-Newman Black Hole structure size about $10^{(-24)}$ cm. Since ratios are calculated, values for one particle mass and one force strength are assumed.

<table>
<thead>
<tr>
<th>Particle/Force</th>
<th>Tree-Level</th>
<th>Higher-Order</th>
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<tbody>
<tr>
<td>e-neutrino</td>
<td>0</td>
<td>0 for nu_1</td>
</tr>
<tr>
<td>mu-neutrino</td>
<td>0</td>
<td>$9 \times 10^{(-3)}$ eV for nu_2</td>
</tr>
<tr>
<td>tau-neutrino</td>
<td>0</td>
<td>$5.4 \times 10^{(-2)}$ eV for nu_3</td>
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<tr>
<td>electron</td>
<td>0.5110 MeV</td>
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<tr>
<td>down quark</td>
<td>312.8 MeV</td>
<td>charged pion = 139 MeV</td>
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<tr>
<td>up quark</td>
<td>312.8 MeV</td>
<td>proton = 938.25 MeV</td>
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<td>muon</td>
<td>104.8 MeV</td>
<td>neutron – proton = 1.1 MeV</td>
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<td>strange quark</td>
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<td>charm quark</td>
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<td>tauon</td>
<td>1.88 GeV</td>
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<tr>
<td>beauty quark</td>
<td>5.63 GeV</td>
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<tr>
<td>truth quark (low state)</td>
<td>130 GeV</td>
<td>(middle state) 174 GeV</td>
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<td>(high state) 218 GeV</td>
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<td>W+</td>
<td>80.326 GeV</td>
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<tr>
<td>W−</td>
<td>80.326 GeV</td>
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<tr>
<td>W0</td>
<td>98.379 GeV</td>
<td>$Z_0 = 91.862$ GeV</td>
</tr>
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</table>

Mplanck $1.217 \times 10^{19}$ GeV

Higgs VEV (assumed) $252.5$ GeV
Higgs (low state) $126$ GeV (middle state) $182$ GeV (high state) $239$ GeV

Gravity Gg (assumed) $1$

$Gg(M_{proton}^2 / M_{planck}^2) = 5 \times 10^{(-39)}$

EM fine structure $1/137.03608$

Weak Gw $0.2535$

$Gw(M_{proton}^2 / (M_{W^+}^2 + M_{W^-}^2 + M_{Z^0}^2)) = 1.05 \times 10^{(-5)}$

Color Force at $0.245$ GeV $0.6286$ $0.106$ at $91$ GeV

Kobayashi-Maskawa parameters for $W^+$ and $W^−$ processes are:

\[
\begin{array}{ccc}
d & s & b \\
u & 0.975 & 0.222 & 0.00249 -0.00388i \\
c & -0.222 & -0.000161i & 0.974 +0.0000365i & 0.0423 \\
t & 0.00698 & -0.00378i & -0.0418 & -0.00086i & 0.999 \\
\end{array}
\]

The phase angle $d_13$ is taken to be 1 radian.

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

Adler, Quaternionic Quantum Mechanics and Quantum Fields (1995), pages 50-52, 561

Arcos and Pereira, hep-th/0210103

Batakis, Class. Quantum Grav.3 (1986) L99-L105

Dixon, Division Algebras (O, H, C, and R) and Windmill Tilting


Fock, Fundamental of Quantum Mechanics

Green, Schwartz, and Witten, Superstring Theory vol. 1

Hua, Harmonic Analysis of Functions of Several Complex Variables in the Classical Domains

Lounesto and Porteous, Lectures on Clifford (Geometric) Algebras and Applications


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Schwinger, 1969 - see physics/0610054

Smith, viXra 1602.0319

Smith, viXra 1701.0495

Smith, viXra 1701.0496

Smith, viXra 1709.0265


The completion of the union of all tensor products of $\text{Cl}(16) = \text{Cl}(8)\times\text{Cl}(8)$ produces a generalized Hyperfinite III von Neumann factor that gives the $\text{Cl}(16)$-E8 model a natural Algebraic Quantum Field Theory.

The $\text{Cl}(16)$-E8 AQFT inherits structure from the $\text{Cl}(16)$-E8 Local Lagrangian.

The Creation-Annihilation Operator structure of $\text{Cl}(16)$-E8 AQFT is given by the Maximal Contraction of E8 is semidirect product $A_7 \times h_{52}$ where $h_{52} = 92 + 92 = 185$-dim Heisenberg algebra and $A_7 = 63$-dim $\text{SL}(7)$.
<table>
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Lagrangian

D8 / D4xD4 8D SpaceTime

Spin(2,4)
Spin(2,3)

M4 Physical SpaceTime  CP2 Internal Symmetry Space

E8 / D8

the Octonionic Inflation Unfolding Process creates Fermion Particles with no Antiparticles
# February 2018

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

\[ \int \text{Standard Model Gauge Gravity} + \text{Fermion Particle-AntiParticle} \]

8-dim Space Time

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 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, 1E8, 1E8, 1E8, 1E8, 1E8, 1E8, 1E8.

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

Let \( \text{Oct16} = \text{discrete multiplicative group} \{ +/-1, +/-i, +/-j, +/-k, +/-E, +/-I, +/-J, +/-K \} \)

Orbifold by \( \text{Oct16} \) the 8s- to get 8 Fermion Particle Types

Orbifold by \( \text{Oct16} \) 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 1E8, 1E8, and KK8 parts of a D8 give \( SU(3) \) Color Force

Gauge Bosons from 1E8, 1E8, 1E8, and KK8 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 \times Momentum

The automorphism group of a single 26-dim String Theory cell modulo the Leech lattice is the Monster Group of order about \( 8 \times 10^{43} \).

When a fermion particle/antiparticle appears 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 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 \( 2^{4}(1+24) \) times the double cover of Co1, for a total order of about \( 10^{26} \).

(While 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) indistinct 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 \( 10^{27} \times 1 \text{ Planck scale,} \approx 10^{-24} \) cm.
# March 2018

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- Daylight Savings Begins on Sunday, March 11, 2018
- St. Patrick's Day on Monday, March 17, 2018
- Spring Begins on Friday, March 23, 2018
- Palm Sunday on Saturday, March 31, 2018
- Passover on Saturday, March 30, 2018

At the end of Non-Unitary Octonionic Inflation Our Universe had about \((1/2) 16^{64} = (1/2) (2^{64})^64 = 2^{255} = 6 \times 10^{76}\) 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.

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. ..."
## April 2018

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- **April Fool's Day**<br>- **Easter Sunday**<br>- **Earth Day**
Octahedron
1 : \sqrt{3}
1 : 1.7321

Icosahedron
1 : \sqrt{15-6\sqrt{5}}
1 : 1.2584

Dodecahedron

Tetrahedron
1 : 3

SelfDual

Cuboctahedron
1 : 2
(square face inscribed radius)

Cube
1 : \sqrt{3}
1 : 1.7321

Saturn
9.54 AU

Cuboctahedron
D3 Root Vectors
Conformal SU(2,2) = Spin(2,4)

Neptune
30.06 AU

Rhombic Dodecahedron
1 : \sqrt{2}
1 : 1.4142

Uranus
19.19 AU

Pioneer Anomaly
20 AU

Cuboctahedron and Rhombic Dodecahedron are 3-dim central figures of the 4-dim 24-cell
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The Schwinger Sources are finite regions in a Complex Domain spacetime corresponding to Green's functions of particle creation/annihilation.

The force strength of a given force is

\[
\frac{1}{M^{\text{force}^2}} \left( \frac{\text{Vol}(\text{Mforce})}{\text{Vol}(\text{Dforce})} \right)^{\frac{1}{\text{mforce}}} \]

Mforce represents the effective mass;
mforce is 4 for Gravity and Color force, 2 for Weak force, 1 for Electromagnetism

\text{Vol}(\text{Dforce})^{\frac{1}{\text{mforce}}} is 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

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<td>S^4</td>
<td>8\pi^{2/3}</td>
<td>Spin(5) / Spin(7)</td>
<td>IV5</td>
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- Labor Day
- Grandparents Day
- Rosh Hashanah
- Yom Kippur
- Autumn Begins
The first riddle of the first suit has 24 syllables plus 24 gaps. It is followed by 6 lines, each with 6 syllables, or 16 Sanskrit syllables left of the line and 8 Sanskrit syllables right of the line, for 24 Sanskrit syllables per line and 6x24 = 192 syllables for all 6 lines. The grand total is 24+24x192 = 240 = Root Vectors of E8.
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<td>New Year’s Eve</td>
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</table>
Vega = North Star:
11600 BP - Vela X
Manetho Rule of Mortal Humans
37000 BP - Geminga
Wisconsin Glaciation
Manetho Rule of Gods

Sphinx
Regulus
Sinus
Ecliptic
Vega
Vela X
Geminga
Beteigeuse

Third sqrt(2) x 10/9 Pyramid
Second 3-4-5 Pyramid
Great Golden Cl(8) Pyramid
# April 2019 (United States)

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- **3rd Quarter** on Friday, April 26th
- **Full Moon** on Friday, April 19th
- **1st Quarter** on Sunday, April 14th
- **New Moon** on Monday, April 1st and Friday, April 26th
- **Passover (first day)** on Saturday, April 20th
- **Last Day of Passover** on Thursday, April 25th
- **Easter Sunday** on Sunday, April 21st
- **Yom HaShoah** on Wednesday, April 24th
- **Good Friday (Many regions)** on Friday, April 19th
- **Easter Monday** on Monday, April 22nd

**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) x SU(2)xU(1)**

**SU(2)xU(1) ElectroWeak Force = Local Symmetry of CP2**

---

**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

**E8 / D8 = 128-dim Fermion Spinor Space = 8 components of 8x8 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)**
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- *May 2019 (United States)*
24-Cell D4 to Pyramid F4 to E6 Tarot to 240-Polytope E8 Giza

78-dim E6 = 52-dim F4 + 26-dim J(3,O)o

2 Complex Structure Elements of 78-dim E6 are absorbed into 48+48+48+28 = 144 of 248-dim E8

E6 / (D5xU(1)) = 32-Real-dim Symmetric Space of Type EIII = (C3)xP2
16-Complex-dim NonCompact Dual = Type V Bounded Domain in subspace of J(3,CxO)
Shilov Boundary = Not Tube Type = 8-Complex-dim =
= bundle with fiber S1xS7 and base space S9 with fibration S1 -> S9 -> CP4
each fiber S1xS7 = Shilov Boundary for D5 / (D4xU(1)) = Lie Sphere RP1xS7

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<thead>
<tr>
<th>Force</th>
<th>Hermitian symmetric space</th>
<th>M</th>
<th>Vol(M)</th>
<th>D</th>
<th>Vol(D)</th>
<th>Oforce</th>
<th>Vol(O)</th>
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<tr>
<td>gravity</td>
<td>Spin(5) / Spin(7) / Spin(5)xU(1)</td>
<td>S^4</td>
<td>8pi^4/3</td>
<td>IV5</td>
<td>pl^5/2^4</td>
<td>51</td>
<td>4</td>
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<td>color</td>
<td>SU(3) / SU(4) / SU(3)xU(1)</td>
<td>CP^2</td>
<td>8pi^4/3</td>
<td>B^6(ball)</td>
<td>pl^3/6</td>
<td>4</td>
<td>S^5</td>
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<tr>
<td>Weak</td>
<td>Spin(5) / SU(2)xU(1)</td>
<td>S^2xS^2</td>
<td>2x4pi</td>
<td>IV3</td>
<td>pl^3/24</td>
<td>2</td>
<td>RP^1xS^2</td>
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<tr>
<td>e-mag</td>
<td>U(1)</td>
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<td>T^4</td>
<td>4x2pl</td>
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</table>
Ramon Llull Wheels:

Tensor Product $\mathbb{R} \times \mathbb{C} \times \mathbb{H} \times \mathbb{O} = T = 64$-dim =

$T + T = 128$-dim = $\mathbb{E}/D_8$

120-dim $D_8$ and $\mathbb{E}/D_8 = (O \times O)P_2$

Binary Real Clifford Algebras of tensor product $\mathbb{C}(8) \times \mathbb{C}(8) = \mathbb{C}(16)$

120-dim $D_8$

28-dim $D_4$

64-dim $A_7 + R$

15-dim $\text{Spin}(2,4)$

10-dim $\text{Spin}(2,3)$

15-dim $\text{SU}(4)$

8-dim $\text{SU}(3)$

4-dim $\text{SU}(2) \times \text{U}(1)$

4 x 3 = Cuboctahedron Vertices $D_3 = A_3$

D3 = A3 acts Conformally on M4 of M4 x CP2 Kaluza-Klein

4 + 4 = Cube Vertices = A2 = $\text{SU}(3)$ of CP2 = $\text{SU}(3)/\text{SU}(2) \times \text{U}(1)$

4 = CP2 of M4 x CP2 Kaluza-Klein

4 = SU(2) x U(1) of CP2 = SU(3)/SU(2) x U(1)

42 Assessors = 21-dim Spin(7) + 21-dim Spin(7)

Zero Divisors of Sedenions
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**July 2019 (United States)**

- **2** New Moon
- **4** Independence Day
- **9** 1st Quarter
- **16** Full Moon
- **24** 3rd Quarter
- **31** New Moon
Robert de Marrais said: "256 ions Voudons ... Moreno ... determines that the automorphism group of the 2D'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' 2D's has order 14 x 1 x 6 = 84, based on 7 octahedral lattices ('Box-Kites')."
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- **31st of August**: New Moon
- **5th of August**: New Moon
- **7th of August**: 1st Quarter
- **15th of August**: Full Moon
- **23rd of August**: 3rd Quarter
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 2^8(1+24) times the double cover of Co1, for an order of about 10^+26. Due to superpositions 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 each 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 Sources 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.
# September 2019 (United States)

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As to $\mathbf{T}$, resolve its identity into four orthogonal idempotents

$$\Delta_0 = \frac{1}{4}(1 + i\overline{z})(1 + ie_7) = \left(\frac{1}{2}(1 + i\overline{z})\right)\left(\frac{1}{2}(1 + ie_7)\right)$$

$$\Delta_1 = \frac{1}{4}(1 - i\overline{z})(1 + ie_7) = \left(\frac{1}{2}(1 - i\overline{z})\right)\left(\frac{1}{2}(1 + ie_7)\right)$$

$$\Delta_2 = \frac{1}{4}(1 + i\overline{y})(1 - ie_7) = \left(\frac{1}{2}(1 + i\overline{y})\right)\left(\frac{1}{2}(1 - ie_7)\right)$$

$$\Delta_3 = \frac{1}{4}(1 - i\overline{y})(1 - ie_7) = \left(\frac{1}{2}(1 - i\overline{y})\right)\left(\frac{1}{2}(1 - ie_7)\right)$$

In the Pauli algebra case, we get Dirac spinors by doubling $\mathbf{P}$ to $\mathbf{P}^2$ we double up and use $\mathbf{T}^2$ as our spinor space. Let $\psi$ be a $\mathbf{T}^2$ spinor the following identifications fall out of the mathematics

$$\rho_+\psi : \text{matter}$$

$$\rho_-\psi : \text{antimatter}$$

8 Fermion First-Generation Particles

each with 8 Spacetime Components

$$\rho_+\psi\Delta_0 : \text{matter - neutrino - SU(3) singlet}$$

$$\rho_+\psi\Delta_1 : \text{matter - electron - SU(3) singlet}$$

$$\rho_+\psi\Delta_2 : \text{matter - up quark - SU(3) triplet}$$

$$\rho_+\psi\Delta_3 : \text{matter - down quark - SU(3) triplet}$$

8 Fermion First-Generation AntiParticles

each with 8 Spacetime Components

$$\rho_-\psi\Delta_3 : \text{antimatter - antineutrino - SU(3) antisinglet}$$

$$\rho_-\psi\Delta_2 : \text{antimatter - positron - SU(3) antisinglet}$$

$$\rho_-\psi\Delta_1 : \text{antimatter - anti-up antiquark - SU(3) antitriplet}$$

$$\rho_-\psi\Delta_0 : \text{antimatter - anti-down antiquark - SU(3) antitriplet}$$

$$\rho_+\psi\Delta_0 : \text{matter - neutrino - SU(3) singlet}$$

$$\rho_+\psi\Delta_1 : \text{matter - electron - SU(3) singlet}$$

$$\rho_+\psi\Delta_2 : \text{matter - up quark - SU(3) triplet}$$

$$\rho_+\psi\Delta_3 : \text{matter - down quark - SU(3) triplet}$$

$$\rho_-\psi\Delta_3 : \text{antimatter - antineutrino - SU(3) antisinglet}$$

$$\rho_-\psi\Delta_2 : \text{antimatter - positron - SU(3) antisinglet}$$

$$\rho_-\psi\Delta_1 : \text{antimatter - anti-up antiquark - SU(3) antitriplet}$$

$$\rho_-\psi\Delta_0 : \text{antimatter - anti-down antiquark - SU(3) antitriplet}$$

$$= 8x8 + 8x8 = 64 + 64 = T + T = 128 = T_2 =$$

$$= E_8 / D_8 = (OxO)P_2 = \text{Halfspinors of C(16)}$$

Geoffrey Dixon wrote a 1995 paper in which he represented the Leech lattice over $O^3$.

the final result breaks up the inner shell of $\Lambda_24$, which is of order $K_{24} = 196560$.

into three subsets with orders $3 \times 240 = 720$,

$3 \times 240 \times 16 = 11520$, and $3 \times 240 \times 16 \times 16 = 184320$,

the sum of all three orders being 196560.

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.

<table>
<thead>
<tr>
<th>Particle/Force</th>
<th>Tree-Level</th>
<th>Higher-Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-neutrino</td>
<td>0</td>
<td>0 for nu_1 9 x 10^{-3} eV for nu_2</td>
</tr>
<tr>
<td>mu-neutrino</td>
<td>0</td>
<td>0 for nu_3 5.4 x 10^{-2} eV for nu_3</td>
</tr>
<tr>
<td>tau-neutrino</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>electron</td>
<td>0.5110 MeV</td>
<td></td>
</tr>
<tr>
<td>down quark</td>
<td>312.8 MeV</td>
<td>proton = 938.25 MeV</td>
</tr>
<tr>
<td>up quark</td>
<td>312.8 MeV</td>
<td>neutron - proton = 1.1 MeV</td>
</tr>
<tr>
<td>muon</td>
<td>104.8 MeV</td>
<td>106.2 MeV</td>
</tr>
<tr>
<td>strange quark</td>
<td>625 MeV</td>
<td></td>
</tr>
<tr>
<td>charm quark</td>
<td>2090 MeV</td>
<td></td>
</tr>
<tr>
<td>tauon</td>
<td>1.88 GeV</td>
<td></td>
</tr>
<tr>
<td>beauty quark</td>
<td>5.63 GeV</td>
<td></td>
</tr>
<tr>
<td>truth quark (low state)</td>
<td>130 GeV</td>
<td>(middle state) 174 GeV</td>
</tr>
<tr>
<td>truth quark (high state)</td>
<td>218 GeV</td>
<td></td>
</tr>
<tr>
<td>W+</td>
<td>80.326 GeV</td>
<td></td>
</tr>
<tr>
<td>W-</td>
<td>80.326 GeV</td>
<td></td>
</tr>
<tr>
<td>W0</td>
<td>98.379 GeV</td>
<td>20 = 91.862 GeV</td>
</tr>
<tr>
<td>Mplanck 1.217x10^19 GeV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higgs VEV (assumed)</td>
<td>252.5 GeV</td>
<td></td>
</tr>
<tr>
<td>Higgs (low state)</td>
<td>126 GeV</td>
<td>(middle state) 182 GeV</td>
</tr>
<tr>
<td>Gravity Gg (assumed)</td>
<td>1</td>
<td>(high state) 239 GeV</td>
</tr>
<tr>
<td>Gw(Mproton^2 / Mplanck^2)</td>
<td>1/137.03608</td>
<td>5 x 10^{-39}</td>
</tr>
<tr>
<td>EM fine structure</td>
<td>1.05 x 10^{-5}</td>
<td></td>
</tr>
<tr>
<td>Weak Gw</td>
<td>0.2535</td>
<td></td>
</tr>
<tr>
<td>Gw(Mproton^2 / (Mw+^2 + Mw-^2 + Mw^0)^2)</td>
<td>0.6286</td>
<td>0.106 at 91 GeV</td>
</tr>
</tbody>
</table>

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

$$d \quad s \quad b$$

$$u \quad 0.975 \quad 0.222 \quad 0.00249 \quad -0.00388i$$

$$c \quad -0.222 \quad -0.00161i \quad 0.974 \quad -0.000365i \quad 0.0423$$

$$t \quad 0.00698 \quad -0.00378i \quad -0.0418 \quad -0.000861 \quad 0.999$$

The phase angle d13 is taken to be 1 radian.
<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>29</td>
<td>30</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>6</td>
<td></td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>13</td>
<td>◆ Full Moon</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>20</td>
<td>Last Day of Sukkot</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>27</td>
<td>◆ New Moon</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
<td>1</td>
</tr>
</tbody>
</table>

**October 2019 (United States)**

- **30** Rosh Hashana
- **7**
- **14** Columbus Day (Most regions)
  - First Day of Sukkot
- **20** Last Day of Sukkot
- **27** ◆ New Moon
- **5** 1st Quarter
- **13** ◆
- **19** 3rd Quarter
<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
</tr>
</thead>
<tbody>
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<tr>
<td>3</td>
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<tr>
<td></td>
<td>4</td>
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<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>The Prophet's Birthday</td>
<td></td>
<td></td>
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<tr>
<td>11</td>
<td>Veteran's Day</td>
<td>12</td>
<td>Full Moon</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>17</td>
<td></td>
<td>18</td>
<td></td>
<td>19</td>
<td>3rd Quarter</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td>25</td>
<td></td>
<td>26</td>
<td>New Moon</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>27</td>
<td></td>
<td>28</td>
<td>Thanksgiving Day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>29</td>
<td></td>
<td>30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
December 2019 (United States)
Tensor Product $\text{Cl}(0,8) \times \text{Cl}(p,q) = M(R,16) \times \text{Cl}(p,q) = \text{Cl}(p,q+8)$

Real Clifford Algebras $\text{Cl}(p,q)$

<table>
<thead>
<tr>
<th>$p$</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q$</td>
<td>0</td>
<td>C</td>
<td>H</td>
<td>H $\oplus$ H</td>
<td>$M_2(R)$</td>
<td>$M_4(C)$</td>
<td>$M_4(H)$</td>
<td>$M_4(H)$ $\oplus$ $M_4(H)$</td>
<td>$M_8(C)$</td>
<td>$M_8(H)$ $\oplus$ $M_8(H)$</td>
<td>$M_16(C)$</td>
<td>$M_16(H)$ $\oplus$ $M_16(H)$</td>
<td>$M_32(C)$</td>
<td>$M_32(H)$ $\oplus$ $M_32(H)$</td>
<td>$M_64(C)$</td>
<td>$M_64(H)$ $\oplus$ $M_64(H)$</td>
<td>$M_128(C)$</td>
</tr>
</tbody>
</table>

$H = \text{Quaternion}$

$C = \text{Complex}$

$R = \text{Real}$
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, $\text{Cl}(N)$ 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:**

\[
\begin{array}{cccc}
0 & 2^0=1 & 2^1=2 & 2^2=4 \\
\text{Cl(VOID)} & \text{Cl(0)} & \text{Cl(1)} & \text{Cl(2)} \\
\text{VOID} & 0 & \text{Cl(2)} & 2^4=16 \\
2^8=65536 & \text{Cl(8)} & 256x256 \\
\end{array}
\]
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
The completion of the union of all tensor products of $\text{Cl}(16) = \text{Cl}(8) \times \text{Cl}(8)$ produces a generalized Hyperfinite III von Neumann factor that gives the $\text{Cl}(16)$-E8 model a natural Algebraic Quantum Field Theory.

The $\text{Cl}(16)$-E8 AQFT inherits structure from the $\text{Cl}(16)$-E8 Local Lagrangian

The Creation-Annihilation Operator structure of $\text{Cl}(16)$-E8 AQFT is given by the Maximal Contraction of E8 = semidirect product $A7 \times h52$ where $h92 = 92 \times 1 + 92 = 185$-dim Heisenberg algebra and $A7 = 63$-dim $\text{SL}(7)$

240 E8 Root Vectors

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240 E8 Root Vectors
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.
Lagrangian

D8 / D4xD4  
8D SpaceTime

Spin(2,4)  
Spin(2,3)

D4  

M4 Physical SpaceTime  
CP2 Internal Symmetry Space

E8 / D8

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

\[ h^{92} \times A_{7} = 28 + 64 + ((SL(8,R)+1) + 64 + 28 \]

At the end of Non-Unitary Octonionic Inflation Our Universe had about \((1/2)\), \(16^64 = (1/2) \cdot (2^4)^{64} = 2^{255} = 6 \times 10^{76}\) 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,
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.
The Cl(16)-E8 AQFT inherits structure from the C(16)-E8 Local Lagrangian

\[ \int \text{Standard Model Gauge Gravity + Fermion Particle-AntiParticle} \]

8-dim SpaceTime

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 TE8, IE8, JE8, KE8, EE8, IE8, JE8, KE8

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

Let Oct16 = discrete multiplicative group \{+/-1, +/-i, +/-j, +/-k, +/-E, +/-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 IE8 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 IE8, 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 \(8 \times 10^{53}\).

When a fermion particle/antiparticle appears 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 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 \(2^{4(1+24)}\) times the double cover of Co1, for a total order of about \(10^{28}\).

(Once 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-integer domain E8 lattice) indistinct 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 \(10^{27} \times \text{Planck scale}, \approx 10^{-24}\) 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 $8 \times 10^{53}$. The Cloud structure comes from the 24-dim Leech lattice part of the Monster Group which is $2^{4}(1+24)$ times the double cover of Co1, for an order of about $10^{26}$. Due to superpositions 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 $10^{27} \times$ Planck scale, and its size should be about $10^{(27/3)} \times 1.6 \times 10^{(-33)} \text{ cm} = \text{ roughly } 10^{(4/24)} \text{ cm}.$

Each Schwinger Source particle-antiparticle pair should see (with Bohm Quantum Potential and Saffati Back-Reaction) the rest of our Universe in the perspective of $8 \times 10^{53}$ Monster Symmetry so a Schwinger Source acting as a Jewel of Indra's Net of Schwinger Source Bohm Quantum Blockchain Physics can see $10^{27} \times 8 \times 10^{53} = 8 \times 10^{80}$ 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 $2^{256} = \text{ about } 10^{77}$ 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.
Splitting Octonionic Spacetime into Quaternionic $\text{M}_4 \times \text{CP}_2$ Kaluza-Klein over $\text{CP}_2$
produces
Higgs by the Mayer Mechanism and
Second and Third Generation Fermions
Quaternionic $E_7 \times SU(2)$ structure breaks 8-dim Spacetime Octonionic Symmetry
to Quaternionic (4+4)-dim Associative $\times$ CoAssociative Kaluza-Klein Spacetime
(see Reese Harvey “Spinors and Calibrations” (Academic 1990))
where $M_4 = 4$-dim Minkowski Physical Spacetime is Associative
and $CP^2 = SU(3) / SU(2) \times U(1)$ 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 $M_4$ ]
to which is attached the homogeneous space $G/H$ [ $SU(3)/U(2) = CP^2$ ]

... the components of the curvature lying in the homogeneous space $G/H$ could be
reinterpreted as Higgs scalars (with respect to spacetime [ $M_4$ ])

... the Yang-Mills action reduces to a Yang-Mills action for the h-components [ $U(2)$
components ] of the curvature over $M$ [ $M_4$ ] 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 $M_4 \times \mathbb{CP}^2$ 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 $M_4$: 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 $\mathbb{CP}^2$: Second Generation Fermion
whose path must be augmented by one projection from $\mathbb{CP}^2$ to $M_4$,
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 $\mathbb{CP}^2$: Third Generation Fermion
whose path must be augmented by two projections from $\mathbb{CP}^2$ to $M_4$,
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 )

<table>
<thead>
<tr>
<th>electron</th>
<th>red up</th>
<th>green up</th>
<th>blue up</th>
<th>red down</th>
<th>green down</th>
<th>blue down</th>
<th>neutrino</th>
</tr>
</thead>
<tbody>
<tr>
<td>quark</td>
<td></td>
<td>quark</td>
<td></td>
<td>quark</td>
<td>quark</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ E \rightarrow I \rightarrow J \rightarrow K \rightarrow i \rightarrow j \rightarrow k \rightarrow 1 \]

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:

\[ V(Q_{\text{fermion}}) \times N(\text{Graviton}) \times N(\text{octonion}) \times \text{Sym} \]

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

\[ \frac{V(Q_{\text{down quark}})}{V(Q_{\text{electron}})} = \frac{V(S^7 \times R P^1)}{1} = \frac{\pi^5}{3}. \]

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:
\[ \{E, E, E\} \quad \{E, E, 1\} \quad \{E, 1, E\} \quad \{1, E, E\} \quad \{1, 1, E\} \quad \{1, E, 1\} \quad \{E, 1, 1\} \]
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 GeV**.

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 \( \frac{6}{2} = 3 \), so the **red beauty quark mass is \( m_B = 5.63111 \text{ GeV} \)**.

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 \( \frac{161}{7} = 23 \) times the red beauty quark mass, and the **red T-quark mass is \( m_T = 129.5155 \text{ GeV} \)**.
248-dim E8 contains 120-dim D8

\[ \frac{E8}{D8} = 64 + 64 \text{ Fermions} \]

\[ \frac{D8}{D4 \times D4} = 64 \text{ Spacetime} \]

\[ D4 = 28 \text{ Standard Model (12)} \]
\[ \text{with 16 Gravity + Dark Energy Ghosts} \]

\[ D4 = 28 \text{ Gravity + Dark Energy (16)} \]
\[ \text{with 12 Standard Model Ghosts} \]
The 24 orange are Root Vectors of the CP2-related D4 local isotropy group in the symmetric space D8 / D4 x D4 that acts on the CP2 Internal Symmetry Space of Kaluza-Klein M4 x CP2.

8 orange are Root Vectors for Standard Model SU(3) x SU(2) x U(1) which have 2+1+1 = 4 Cartan SubAlgebra dimensions.

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 structure of compact CP2 at every M4 spacetime point, it acts as Color gauge group with respect to M4.
D4 of Conformal Gravity and Standard Model Ghosts

The 24 yellow are Root Vectors of the M4-related D4 local isotropy group in the symmetric space D8 / D4 x D4 that acts on the M4 Internal Symmetry Space of Kaluza-Klein M4 x CP2

12 yellow are Root Vectors for Conformal Gravity U(2,2) which has 4 Cartan SubAlgebra dimensions.

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

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

\[(1 / \text{Mforce}^2) \cdot (\text{Vol(MISforce)}) \cdot (\text{Vol(Qforce)} / \text{Vol(Dforce)})^{(1 / \text{mforce})}\]

where:
- \(\text{Mforce}\) represents the effective mass;
- \(\text{MISforce}\) represents the relevant part of the target Internal Symmetry Space;
- \(\text{Vol(MISforce)}\) stands for volume of \(\text{MISforce}\) and is sometimes also denoted by \(\text{Vol(M)}\);
- \(\text{Qforce}\) represents the link from the origin to the relevant target for the gauge boson;
- \(\text{Vol(Qforce)}\) stands for volume of \(\text{Qforce}\);
- \(\text{Dforce}\) represents the complex bounded homogeneous domain of which \(\text{Qforce}\) is the Shilov boundary;
- \(\text{mforce}\) is the dimensionality of \(\text{Qforce}\), which is
- \(\text{Vol(Dforce)}^{(1 / \text{mforce})}\) 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).

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

<table>
<thead>
<tr>
<th>Force</th>
<th>M</th>
<th>Vol(M)</th>
<th>Q</th>
<th>Vol(Q)</th>
<th>D</th>
<th>Vol(D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spin(5)</td>
<td>Spin(7) / Spin(5)xU(1)</td>
<td>IV5</td>
<td>4</td>
<td>RP^1xS^4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SU(3)</td>
<td>SU(4) / SU(3)xU(1)</td>
<td>B^6(ball)</td>
<td>4</td>
<td>S^5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SU(2)</td>
<td>Spin(5) / SU(2)xU(1)</td>
<td>IV3</td>
<td>2</td>
<td>RP^1xS^2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U(1)</td>
<td></td>
<td></td>
<td>-</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Force</th>
<th>M</th>
<th>Vol(M)</th>
<th>Q</th>
<th>Vol(Q)</th>
<th>D</th>
<th>Vol(D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravity</td>
<td>S^4</td>
<td>8pi^2/3</td>
<td>RP^1xS^4</td>
<td>8pi^3/3</td>
<td>IV5</td>
<td>pi^5/2^4 5!</td>
</tr>
<tr>
<td>Color</td>
<td>CP^2</td>
<td>8pi^2/3</td>
<td>squashed S^5</td>
<td>4pi^3</td>
<td>B^6(ball)</td>
<td>pi^3/6</td>
</tr>
<tr>
<td>Weak</td>
<td>S^2xS^2</td>
<td>2x4pi</td>
<td>RP^1xS^2</td>
<td>4pi^2</td>
<td>IV3</td>
<td>pi^3/24</td>
</tr>
<tr>
<td>Electromag</td>
<td>T^4</td>
<td>4x2pi</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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
Fermion masses are calculated as a product of four factors:

\[ V(Q_{\text{fermion}}) \times N(\text{Graviton}) \times N(\text{octonion}) \times \text{Sym} \]

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

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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 \( \{1, I, J\}, \{I, J, K\}, \text{etc.} \),

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 mass,

**red Truth quark mass is** \( m_t = 129.5155 \text{ GeV} \)
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-Neuamn Black Hole structure size about $10^{-24}$ cm.

<table>
<thead>
<tr>
<th>Particle/Force</th>
<th>Tree-Level</th>
<th>Higher-Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-neutrino</td>
<td>0</td>
<td>0 for nu_1</td>
</tr>
<tr>
<td>mu-neutrino</td>
<td>0</td>
<td>$9 \times 10^{-3}$ eV for nu_2</td>
</tr>
<tr>
<td>tau-neutrino</td>
<td>0</td>
<td>$5.4 \times 10^{-2}$ eV for nu_3</td>
</tr>
<tr>
<td>electron</td>
<td>0.5110 MeV</td>
<td></td>
</tr>
<tr>
<td>down quark</td>
<td>312.8 MeV</td>
<td>charged pion = 139 MeV</td>
</tr>
<tr>
<td>up quark</td>
<td>312.8 MeV</td>
<td>proton = 938.25 MeV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>neutron - proton = 1.1 MeV</td>
</tr>
<tr>
<td>muon</td>
<td>104.8 MeV</td>
<td>106.2 MeV</td>
</tr>
<tr>
<td>strange quark</td>
<td>625 MeV</td>
<td>(middle state) 174 GeV</td>
</tr>
<tr>
<td>charm quark</td>
<td>2090 MeV</td>
<td>(high state) 218 GeV</td>
</tr>
<tr>
<td>tauon</td>
<td>1.88 GeV</td>
<td></td>
</tr>
<tr>
<td>beauty quark</td>
<td>5.63 GeV</td>
<td></td>
</tr>
<tr>
<td>truth quark (low state)</td>
<td>130 GeV</td>
<td>(middle state) 174 GeV</td>
</tr>
<tr>
<td>W+</td>
<td>80.326 GeV</td>
<td>(high state) 218 GeV</td>
</tr>
<tr>
<td>W-</td>
<td>80.326 GeV</td>
<td></td>
</tr>
<tr>
<td>W0</td>
<td>98.379 GeV</td>
<td>20 = 91.862 GeV</td>
</tr>
</tbody>
</table>

$M_{\text{Planck}} = 1.217 \times 10^{19}$ GeV

Higgs $W$EV (assumed) | 252.5 GeV
Higgs (low state)     | 126 GeV

$G_{\text{Gg}}$ (assumed) | 1
$(G_{\text{Gg}})^{1/2} = (M_{\text{Proton}}^2 / M_{\text{Planck}}^2)$ | $5 \times 10^{-39}$
EM fine structure | $1/137.03608$
Weak Gw | 0.2535
$G_{\text{W}} = (M_{\text{Proton}}^2 / (M_{\text{W}+}^2 + M_{\text{W}-}^2 + M_{\text{Z}0}^2))$ | $1.05 \times 10^{-5}$
Color Force at 0.245 GeV | 0.6286

Color Force at 0.106 at 91 GeV

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

\[
\begin{pmatrix}
0.975 & -0.00388 i \\
-0.222 & 0.00249 & -0.000161 i \\
0.974 & -0.0000365 i & 0.0423 \\
0.00698 & -0.00378 i & -0.0418 & -0.000861 i \\
\end{pmatrix}
\]

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

\[ H2 = I^{5\_2} = \text{Penrose STAR tiling of 2-dim space} \]

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 = 2\times8 \text{ of which represent Complex Fermion Particles}
- 16 = 2\times8 \text{ of which represent Complex Fermion AntiParticles}
- 16 = 2(6+4) \text{ of which represent Complex (4+4)-dim Kaluza-Klein SpaceTime}
- 12 \text{ of which represent the Standard Model}
- 12 \text{ 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 has shown that V7(2) = Spin(7) / Spin(3) can be identified with the Zero Divisors of Sedenions which have 7^28 = 128 Associative Triples and for which Zero Divisors are given by the function \( V7(2) = G2 \rightarrow S3 \) (3-spheres) and which have 4-2 = 24 2D Irreducible Components and 15-4 = 11 Die Sphère Spin7(1) / Spin(3)u(1). whose 10D correspond to Cl(8) 4 4 D Conformal over Cl(4,7) that V19,8 = Spin(10) / Spin(3)u(1) is related to, but not identified with, the Zero Divisors of 32-ons which have 35 = 120 = 155 Associative Triples and which have 8 8 4 2D Irreducible Components and 25-4 = 21 Die Sphère Spin7(1) / Spin(3)u(1) whose 10D correspond to M0 String Theory and to 26-dim traceless J(3,0) then V19,8 = Spin(10) / Spin(3)u(1) is related to, but not identified with, the Zero Divisors of M10 25-ons corresponding to Cl(8) which have 1+1=2 = 2x4 = 8x4 = 32x4 = 128x4 = 1024 Associative Triples and which have 56 56 32 2D Irreducible Components and 25-4 = 21 Die Sphère Spin7(1) / Spin(3)u(1).

Robert de Marrais said, "... 256 ... 2n8 ions Voudons ... Moreno ... determines that the automorphism group of the Z0d's of all 2n8-ons ... obey a simple pattern: for n \geq 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' Z0d 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 2n8-ons. All non-Midden-collected 2D diagonals in the ... 32-ons ... belong ... to a set of 15 "emanation tables." ... they house 108 ... PSL(2,7) ... cells ... 8 ... 3D-ons ... ET's ... from 0 = 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
52-dim F4 of CP2 in 256-dim Cl(8)

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

E8 Kaluza-Klein (Cn6 -> M4) x CP2

In (Cl(8) of CP2) x (Cl(8) of Cn6 -> M4) = Cl(16) containing E8

at each of the 256 points of Cl(8) of Cn6 -> M4 there are all 256 points of Cl(8) of CP2

E8 / D8 = 128-dim Fermion Spinor Space = 8 components of 8x8 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)
Void → Cl(Void) → Cl(0) → Cl(1) → Cl(2) → Cl(4) → Cl(16)

Kaluza-Klein Spacetime
M₄ x CP₂

Cl(8) that contains
2B = D₄ for M₄ Gravity

<table>
<thead>
<tr>
<th>M₄ x CP₂ Std Model</th>
<th>1</th>
<th>16</th>
<th>120</th>
<th>560</th>
<th>1820</th>
<th>4368</th>
<th>8008</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16</td>
<td>120</td>
<td>560</td>
<td>1820</td>
<td>4368</td>
<td>8008</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>11440</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>28</td>
<td>56</td>
<td>56</td>
<td>56</td>
<td>56</td>
<td>56</td>
<td>56</td>
</tr>
<tr>
<td>70 x 70 = 120</td>
<td>8008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 x 28 = 120</td>
<td>8008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 x 28 x 28 x 28</td>
<td>8008</td>
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Cl(8) x Cl(8) = Cl(16)

Spins:
(8s + 8c) x (8s + 8c)

10¹⁹ E₈ Lattice 240-vertex Polytape Cells in Universe at End of Inflation

HNL Quantum Condensate

Lagrangian

3d Kaluza-Klein Parthen Generations

M(2, Cl(0,24)) = Cl(1,25)

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

Quantum Resonant Connection

Microtubules 40 microns long have 52,528 Tubulin Dimers

10¹⁹ Tubulin Dimers in a Human Brain
Wikipedia: "... Christ as Salvator Mundi (Saviour of The World) ... is a painting ... from c. 1500 ... by Leonardo da Vinci ... The painting shows Christ, in Renaissance dress, giving a benediction with his raised right hand and crossed fingers while holding a crystal sphere in his left hand ...

... It was ... possibly painted for Louis XII of France and his consort, Anne of Brittany ... shortly after the conquests of Milan and Genoa around 1500 [and] subsequently owned by Charles I of England and recorded in his art collection in 1649 ... Leonardo painted the orb as if it were a hollow glass bubble that does not refract or distort the light passing through it ...[instead of]... paint[ing] the distortion that would occur when looking through a solid clear orb ...

Since Leonardo’s orb is a hollow sphere instead of a solid ball Leonardo’s markings are all on the surface of the 2-dim sphere boundary of the ball in 3-dim space.

E8-Cl(16) Physics (viXra 1602.0319) is based on the 240 Root Vectors of E8 which are points on the 7-dim sphere boundary of the ball in 8-dim space.

\[
248\text{-dim } E_8 = 120\text{-dim } D_8 + 128\text{-dim } D_8 + \text{half-spinor} = \\
= D_4 \times D_4 + 8 \times 8 + 128\text{-dim } D_8 + \text{half-spinor } D_8 + s
\]

The structure of E8 was depicted by Flammarion (wood engraving on page 163 of his 1888 book "L'Atmosphere Meteorologie Populaire") on a Celestial Sphere beyond our Earthly Plane and its Star-Sun-Moon-Planets Sphere (viXra 1304.0071):
Flammarion’s 1888 engraving was much later than Leonardo’s 1500 painting so it did not directly influence Leonardo, but its basic components were well known from at least the time of Ramon Llull (1232-1315)

who, according to R. Pring-Mill, Studies on Ramon Lull , Barcelona, PAM-Curial, 1991, p. 62, produced a “Scheme of the simplified aristotelian cosmos” as a circle centered by 4 layers Earth, Water, Air, and Fire and then by 7 layers Moon, Mercury, Venus, Sun, Mars, Jupiter, and Saturn and an 8th layer for the fixed Stars described by the Zodiac
and the 13th layer of Angels, Saints, and the Heavenly Empire of Jesus and G-d which I interpret as E8 Physics by which G-d governs Our Universe.

that is beyond the outer 4+7+1 = 12 layers of Earth, Sun, Moon, Planets, Stars:

The Flammarion Celestial Sphere representation of E8 corresponds to Leonardo’s Sphere with markings also representing E8.

Flammarion’s Celestial Sphere has two copies of D4 each with 24 Root Vectors and 128 Root Vectors from +half-spinors D8+s of D8 and

8 levels of 8 Spacetime dimensions for position x momentum = 8x8 = 64 Root Vectors thus giving 24 + 24 + 128 + 64 = 240 Root Vectors of E8.


is not shown explicitly by Leonardo, but is represented by Leonardo as


Leonardo’s Celestial Sphere represents E8 in this way:
Two markings correspond to $64+64 = 128$-dim $E_8/D_8$
(8x8 Fermion and 8x8 AntiFermion components)
The third marking corresponds to 64-dim $D_8/D_4 \times D_4$
(8-dim Spacetime 8x8 Position x Momentum)
One of the $D_4$ groups of markings corresponds to
the Standard Model and Gravity-Dark Energy Ghosts.
The other $D_4$ group of markings corresponds to
24 of each $D_4$ group of markings are $D_4$ Root Vectors,
the others are composite structures such as
Gauge-Boson-bound (mesons, baryons, atoms) and Gravity-bound (black holes, planets, stars, galaxies).

E8-CI(16) Physics Calculations of Particle Masses and Force Strengths
from Green’s Functions = Kernel Functions of Schwinger Sources
make use of Shilov Boundaries of Complex Domains whose structure
is inherited from the geometry of $E_8$. 