

African IFA to RigVeda-Pachisi to Tarot to Llull to Cartan-Dirac-Riesz-E8Physics

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Abstract

Ancient Africa developed IFA divination with
256 Odu analagous to the Real Clifford Algebra $Cl(8)$
and 16 Orishas analagous to the $8+8$ Spinors of $Cl(8)$
but in Africa IFA was transmitted by oral tradition and not written down.

Humans emerging from Africa via the Arabian Sea settled in nearby India
where ideas of IFA were written in the Sanskrit Rig Veda and encoded in Pachisi.

By about 500 B.C. Pachisi evolved into Tarot.

By about 1300 A.D. Tarot and some ideas of IFA were known in Mallorca
where Ramon Llull used them to develop structures of the $D4$ and $D8$ Lie Algebras
that lived in the IFA Clifford Algebra $Cl(8)$ and its tensor square $Cl(8) \times Cl(8) = Cl(16)$.
Although Llull's work was preserved in writing in Mallorca, his ideas were rejected
by the Intellectual Establishment of Paris and remained dormant for centuries.

Around 1890 Killing and Cartan rediscovered Llull's Lie Algebras.

Only in the 1900s did the work of Cartan
as further developed mathematically by Jovet, Sauter, and Riesz
and as applied by Dirac to physics
show how a $D8$ half-Spinor could be added to $D8$ itself to get $E8$ Physics
and to see how $E8$ Physics lives inside IFA $Cl(8)$.

It has taken until now (the 2000s) for the formal Written Human Culture
to catch up with the informal Oral Ancient African Culture
in understanding a realistic Unified Theory of the Laws of Nature.

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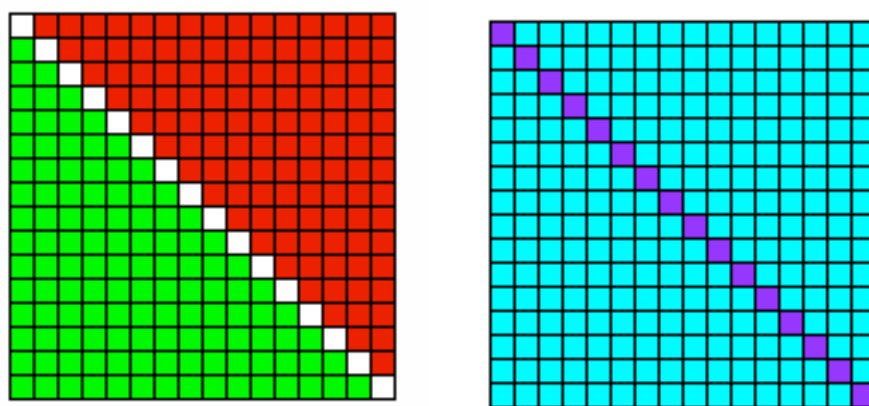
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Introduction

The oldest and most comprehensive Information System of humans on Earth is African IFA Divination based on $16 \times 16 = 256$ elements (tony5m17h.net/VoudouFA.html) It corresponds mathematically to the $Cl(8)$ Real Clifford Algebra with graded structure $256 = 1 + 8 + 28 + 56 + 70 + 56 + 28 + 8 + 1$ and algebraic structure of $M(16, \mathbb{R}) = 16 \times 16$ Matrices of Real Numbers.

Here is how E8 Physics of Gravity and the Standard Model is encoded in IFA:

$$256\text{-dim } 16 \times 16 = \\ = 120\text{-dim Antisymmetric } 16 \times 16 + 136\text{-dim Symmetric } 16 \times 16$$



For Antisymmetric 16×16 each red entry above the diagonal is the negative of the corresponding green entry below the diagonal and the 16 diagonal entries are zero so the number of Antisymmetric entries is 120 corresponding to the D_8 Lie Algebra.

For Symmetric 16×16 each cyan entry above the diagonal is equal to the corresponding cyan entry below the diagonal and the 16 diagonal entries are non-zero so the number of Symmetric entries is $120 + 16 = 136$.

8 of the 136 Symmetric entries of the IFA $Cl(8)$ 16×16 Matrix do not correspond to E8 but

the other $136 - 8 = 128 = 64 + 64$ correspond to 128-dim half-spinor of D_8 .

Since 248-dim $E_8 = 120\text{-dim } D_8 + 128\text{-dim half-spinor of } D_8$
by E_8 / D_8 rank 8 Type EVIII space (OxO)P2 the Octo-Octonionic Projective Plane

256-dim IFA $Cl(8)$ contains $120 + 128 = 248\text{-dim } E_8$

and

encodes the structure of E8 Physics of Gravity and the Standard Model.

Some details of the IFA encoding of E8 Physics is set out Appendix2.

African IFA to RigVeda-Pachisi

From its home in Africa the IFA Information System spread, like humanity itself,



throughout the Earth. Some of its descendant systems, such as

128-element Shinto Divination

64-element I Ching

16-element Ilm Al Raml

are straightforward subsets of 256-element IFA

but

the Rig Veda and its related game Pachisi has a more intricate relationship to IFA.

Within its African home IFA was never written down but was oral tradition

but

when humans left Africa they had less of the direct contact with their Ancestral Home that is useful for preservation of oral tradition.

India was settled from Africa via the Arabian Sea in very early times.

(map adapted from "Past Worlds, The Times Atlas of Archaeology" (Crescent Books 1995))



Indian priests of IFA chose to put the IFA Information System into writing, so they developed Sanskrit from the African Geez language.

In a 16 October 2010 post to his blog at bafsudralam.blogspot.com Clyde Winters said:

"... The Naga were Semitic speaking people from Ethiopia ...

The major gift of the Naga to India was the writing system: Deva-Nagari.

Nagari is the name for the Sanskrit script ... the ancient Ethiopic and Sanskrit writing are one and the same ... the name Nagari for Sanskrit betrays the Ethiopia origin of this form of writing. In Geez, the term nagar means 'speech, to speak'. ...".

Feuerstein, Kak, and Frawley, in their book In Search of the Cradle of Civilization (Quest 1995), say "... The principal and, taken in its totality, the oldest of the four Vedic hymnbodies is the Rig-Veda. ... The Sanskrit word ric, which for euphonic reasons is changed to rig, means literally "praise". ... The Sanskrit word veda means literally "knowledge" or "wisdom". ... **The Rig-Veda is** the oldest book in the Sanskrit language ... More than that, if we are correct, it is **the oldest book in the world ...**".

In "The Indian Games of Pachisi, Chaupar, and Chausar" (Expedition Spring 1964, 32-35) W. Norman Brown said: "... The Rig-Veda ... has references to the use of dice ... cowries, which are used in pachisi, are ... as old in India as the Harappa civilization ... At Mohenjo-daro in the Indus Valley, a portion of a triple-rowed gaming-diagram on brick was recovered, dating perhaps from the last part of the third millennium B.C. ...".

In "Shells as Evidence of the Migrations of Early Culture" (Manchester University Press 1917) J. Wilfrid Jackson said: "... In India the money-cowry seem to have been regarded with special favour for amuletic and currency purposes from very early times ... a cowry game ... is ... related to the Hindu game of Pachisi, also played with cowries. The shells are thrown as dice ... Games like Pachisi, in which cowries are used as dice, are known in the Maldive Islands ... Among the Nagas ... a warrior, having slain an enemy, had the privilege of wearing a kilt decorated with cowry-shells ... A similar custom ... is to be found in East Central Africa, where the Djibba tribe wear ... cowries ...".

Cowries provide evidence not only for an early and strong Africa-India connection, but also for the world-wide reach of trade and ideas in ancient times. For example, Jackson also said: "... The money-cowry ... is, and has been for centuries, a sacred object among the Ojibwa and Menomini Indians of North America, and is employed in initiation ceremonies of the Grand Medicine Society. The use of this particular cowry by these Indians is of peculiar interest; in the first place, owing to it being alien to the American continent, and in the second place, in view of its intimate association with so many remarkable ... beliefs and practices in different parts of the Old World. ...". Since Lake Superior is the primary source on Earth of native copper, the Indians there had world-wide trade in ancient times even preceding the Bronze Age.

**To preserve their heritage of the African IFA Information System,
priests of India not only wrote down the Sanskrit Rig Veda**

(tony5m17h.net/RgVeda.html)

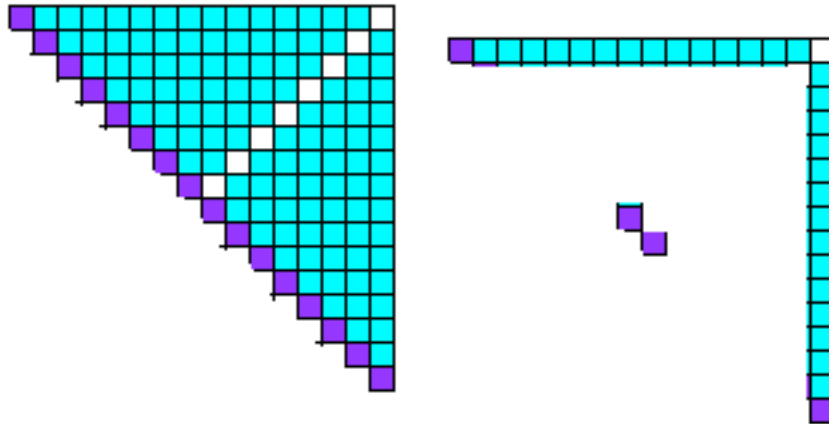
but

**they also developed the game Pachisi
to keep the dynamics of IFA in popular culture.**

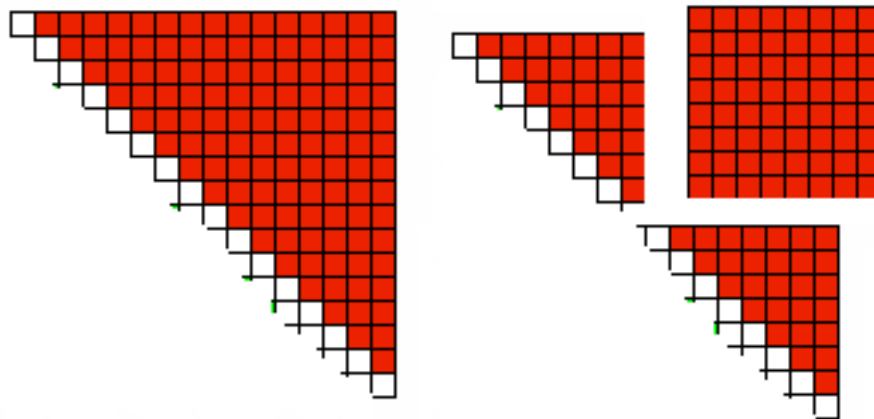
**Here is how the structure of the IFA Information System
has been simplified for transmission to Pachisi:**

First, due to the diagonal-reflection symmetry of Antisymmetric and Symmetric matrices, only the upper triangular parts of the matrices need to be preserved:

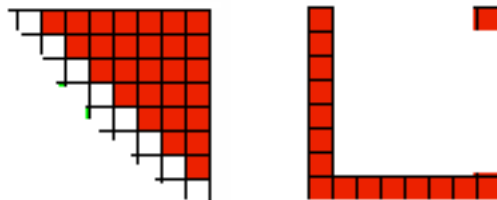
The Symmetric part was simplified by ignoring the part of $Cl(8)$ not in E_8 and then using only 32 entries (from outer shell and diagonal) of those 128 entries



The Antisymmetric part was first cut into 3 sections

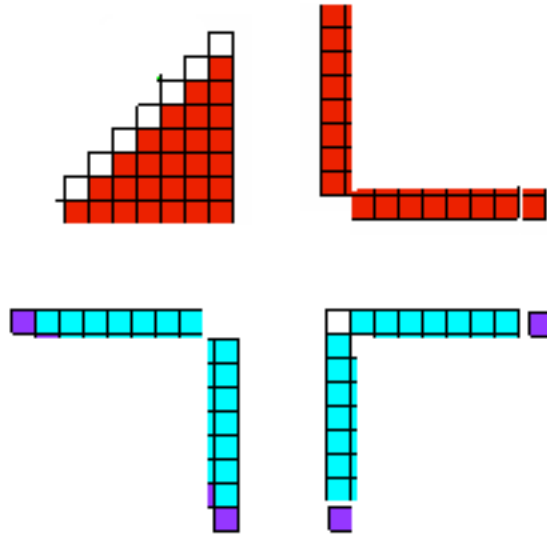


two similar triangular each with 28 entries and one square with 64 entries.
Using only one of the two similar 28-entry triangles plus 16 from the square (outer shell)

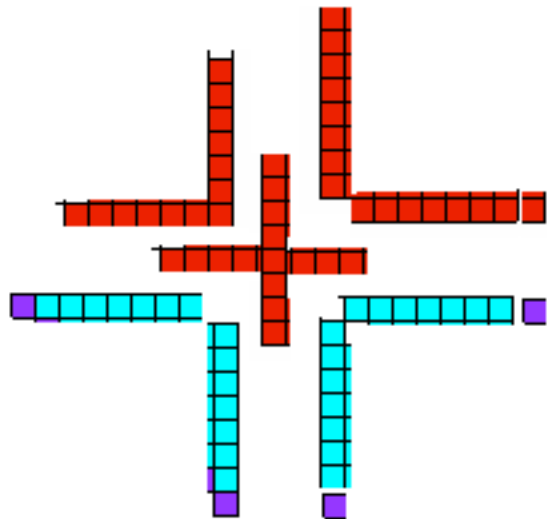


reduced the 120 Antisymmetric entries to $28 + (64-49) = 28+16 = 44$ entries

thus reducing 248-dim E8 to $28 + 16 + 32 = 76$ entries.
 Since most of the IFA E8 structures are outer boundaries of square regions it is natural to construct Pachisi as a boundary-progression board game so the 30-entry Symmetric outer shell is broken into two parts which, when added to the 28-entry and 15-entry Antisymmetric parts, naturally fit together in this configuration

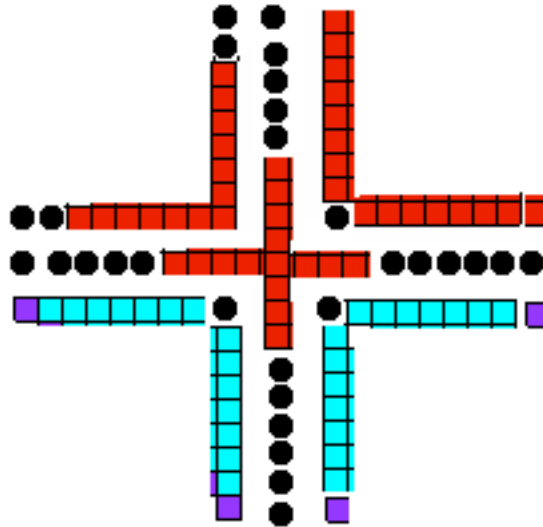


with 3 quadrants that look like a boundary-progression board game but with one triangular quadrant that looks out of place. To make the board look more nearly consistent, move the interior 15 elements of the triangle to the interior of the board to get



with $8+8+8+8+8+8+7+6 = 61$ outer plus 15 inner = 76 entries

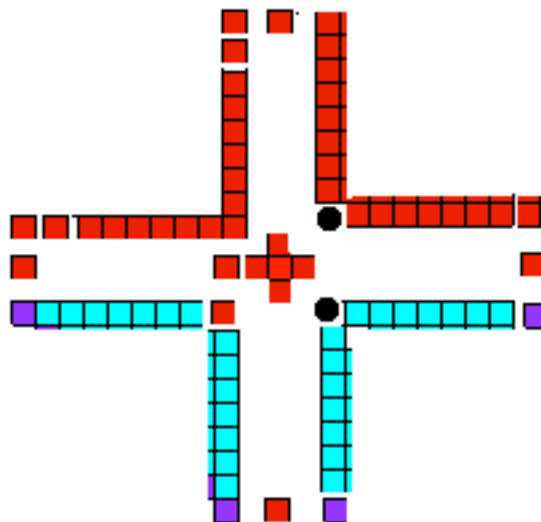
In order to fill out the Pachisi board 29 more entries are needed as filler



to get the total of 105 entries on the full game board for Pachisi.

RigVeda-Pachisi to Tarot

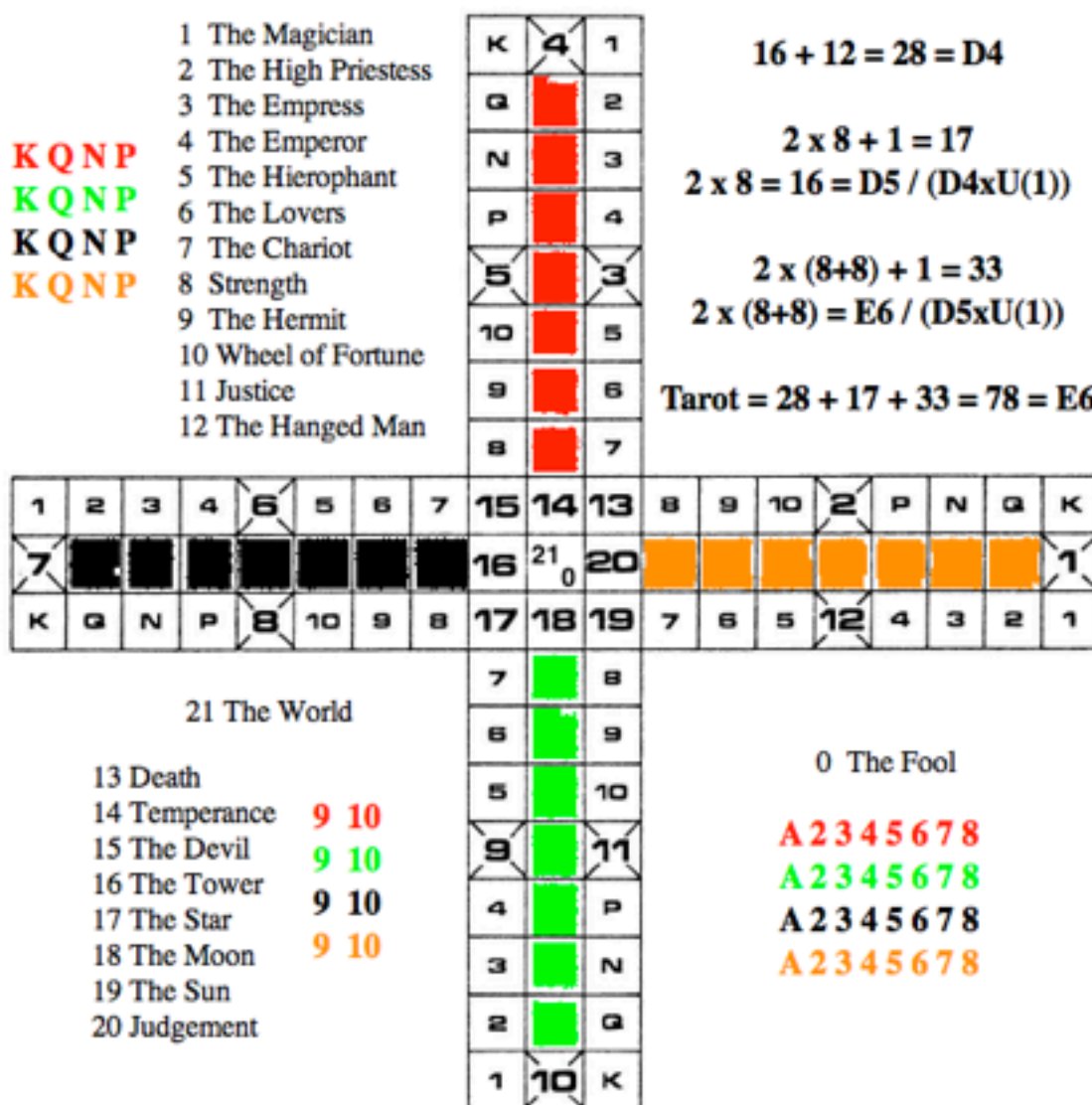
Tarot was developed from Pachisi by getting rid of 26 filler entries and using the 15 inner entries: 4 to complete the exterior arms of D4; 4 to bridge between arms; 1 as an inner corner; and 6 in central configuration, with the remaining 2 filler entries used for the U(1) of D5 / D4xU(1) and E6 / D5xU(1). The red entry at the corner of the left-side blue pair of arms corresponds to the Antisymmetric U(1) in the $U(2,2) = U(1) \times Spin(2,4)$ subalgebra of the D4 which physically represents the propagator phase of Fermions from the Symmetric sector.



Tarot has $105 - 27 = 78$ cards, corresponding to the 78-dim E6 Lie Algebra.

Stephen E. Franklin in "Origins of the Tarot Deck" (www.lordbalto.com) said:
 "... Games are at their most basic level symbol systems not unlike simplified languages ... Pachisi may ... be thought of as inscribed in a 19x19 square ... the outer rim of which has been compressed around the central cross ...
 The Tarot must ... have been created between 654 and 403 B.C. and the probability is high that it first appeared sometime very near the year 540 B.C. ...
 the Tarot was not invented to play card games but survived ... in the same twilight zone ... as Latin, Old Church Slavonic and biblical Hebrew ...
 The similarity of ... Tarot ... court cards to ... four-handed proto-chess ... and the resemblance between the four suits and the four varnas or classes of Hindu society, which appear at least as early as the Rigveda, all point to an Indian origin ... transported to the West ... by the Arabs or the Gypsies ...".

(image modified version of figure from Franklin's article)



Tarot E6 Lie Algebra structure is used in Realistic Physics Model construction.

(tony5m17h.net/stringbraneStdModel.html)

(in this paper I am oversimplifying many things, such as by ignoring signature)

The 16 KQNP correspond to a U(4) Conformal Lie Algebra for Gravity

KQNP
KQNP
KQNP
KQNP

These 12 cards correspond to a symmetric space Spin(8) / U(4) for the Standard Model Gauge Groups

- 1 The Magician
- 2 The High Priestess
- 3 The Empress
- 4 The Emperor
- 5 The Hierophant
- 6 The Lovers
- 7 The Chariot
- 8 Strength
- 9 The Hermit
- 10 Wheel of Fortune
- 11 Justice
- 12 The Hanged Man

which can be thought of as the completion of Spin(8) from a foundation of U(4) so that taken together those 16+12 = 28 cards correspond to the D4 Lie Algebra Spin(8) which

is the grade-2 bivector part of the IFA Cl(8) Clifford Algebra with graded structure

$$256 = (8+8) \times (8+8) = 1 + 8 + 28 + 56 + 70 + 56 + 28 + 8 + 1$$

These 1 + 8 + 8 = 17 cards correspond to two copies of 8-dim spacetime

- 21 The World
- 13 Death
- 14 Temperance **9 10**
- 15 The Devil **9 10**
- 16 The Tower **9 10**
- 17 The Star **9 10**
- 18 The Moon **9 10**
- 19 The Sun
- 20 Judgement

plus

one card for the Complex U(1) needed to glue them together into a Complex spacetime that is 8-Complex-dimensional (16-real-dimensional)

corresponding to a symmetric space Spin(10) / Spin(8) x U(1)

which can be thought of as the completion of Spin(10) from a foundation of Spin(8)

so that

taken together all 28 + 17 = 45 cards correspond to the D5 Lie Algebra Spin(10)

which

appears in the IFA Cl(8) Clifford Algebra with graded structure

$$256 = (8+8) \times (8+8) = 1 + 8 + 28 + 56 + 70 + 56 + 28 + 8 + 1$$

These $1 + (8+8) + (8+8) = 33$ correspond to two copies of $(8+8)$ -dim spinors
 (representing 8 fermion particles + 8 fermion antiparticles)

0 The Fool

A 2345678

A 2345678

A 2345678

A 2345678

plus

one card for the Complex $U(1)$ needed to glue them together into Complex spinors
 corresponding to a symmetric space $E_6 / Spin(10) \times U(1)$
 which can be thought of as the completion of E_6 from a foundation of $Spin(10)$

so that

all $28 + 17 + 33 = 78$ Tarot cards correspond to the E_6 Lie Algebra

which appears in the IFA $Cl(8)$ Clifford Algebra

as spinor structure plus a $U(1)$

$$256 = (8+8) \times (8+8) = 1 + 8 + 28 + 56 + 70 + 56 + 28 + 8 + 1$$

Tarot to Lull

Ramon Lull (1232-1316) of Mallorca lived in a time and place of a unique confluence of Islamic, Christian, and Jewish mystical ideas on a Mediterranean island between Iberia and Africa

so

he was exposed to ideas including

Islamic 16-element Ilm al Raml derived from African 256-element IFA,

Christian-Crusader Troubadour 78-element Tarot,

Jewish Urim v'Thummim system revealed to Moses for decoding the 72 letters

on the 12 stones of the Breastplate of Judgment,

and

he was able to travel easily to Africa, the home of 256-element IFA.

According to Anthony Bonner's book Doctor Illuminatus (Princeton 1993):

"... In the history of Western mysticism,

there is nothing quite like ...[Lull's Quaternary Phase (1274-89)]...

with its curious blend of Troubadour, Franciscan, and Islamic influences,

mixed with Lull's own special outlook based on the Art ...".

"Lull's own special outlook" may have been to see that

72 letters of the Urim v'Thummim Breastplate are contained in the 78-element Tarot

the 78-element Tarot fits inside the 256-element IFA D4 Real Clifford Algebra as

$$1 + 8 + 28 + \dots + 8 + 1$$

fits inside

$$256 = 1 + 8 + 28 + 56 + 70 + 56 + 28 + 8 + 1$$

and as

$$(8+8) + (8+8)$$

fits inside

$$256 = (8+8) \times (8+8)$$

Troubadours propagated songs, poetry, and games such as Tarot.

Ramon Lull (1232-1316) of Mallorca studied the Islamic 16-element Ilm al Raml,

the Troubadour 78-element Tarot,

and the 256-element IFA

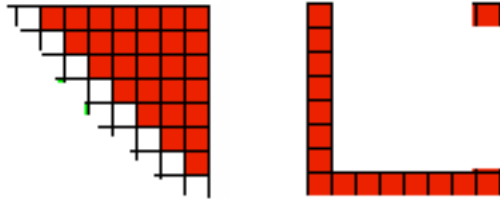
and

found a structure that he summarized in Wheel Diagrams with 16 vertices

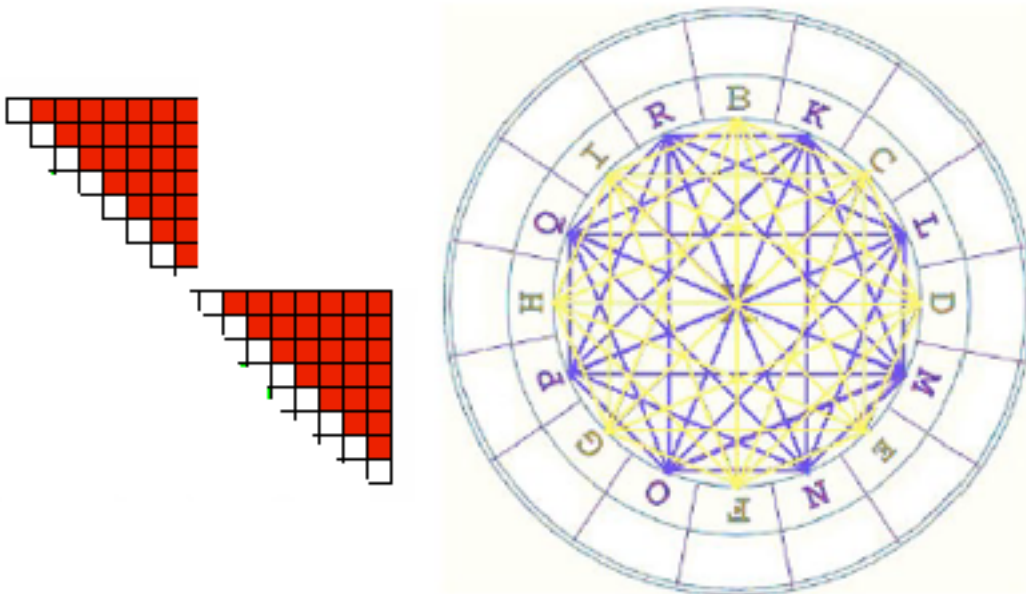
connected to each other by lines such as (some images adapted from lullianarts.net web site)

Of the 120-dim Antisymmetric Part of 16x16 Real matrices

the 78-dim Tarot contains only a 16-dim partial boundary of its 64-dim $U(8)$ square and one 28-dim D_4 triangle plus a single 1-dim $U(1)$ from $D_5 / D_4 \times U(1)$

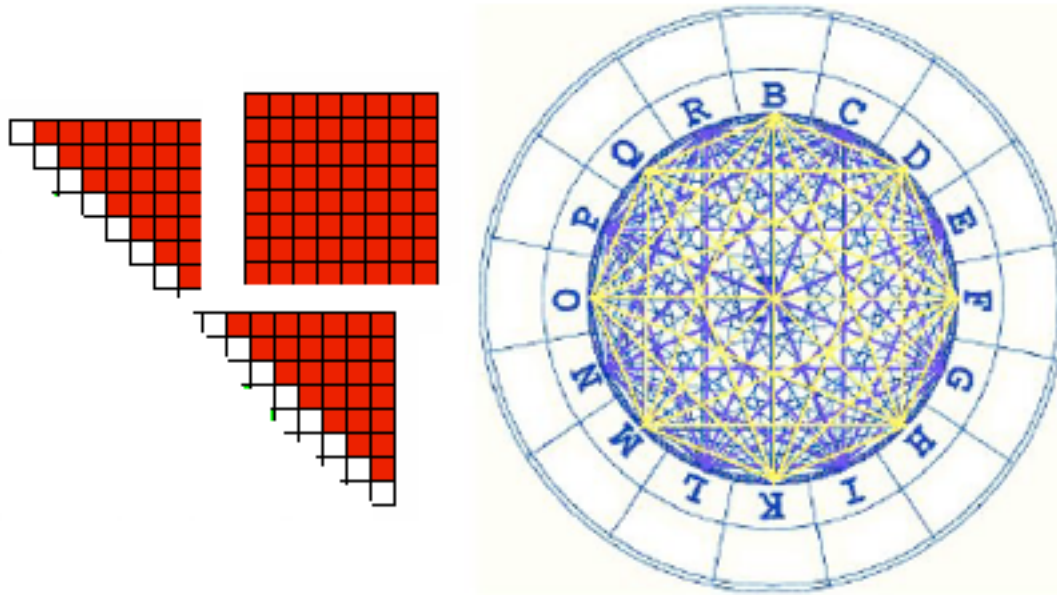


Lull expanded that 45-dim part of the Tarot to include the second D_4 triangle and to represent them in his Wheel Diagram X as two sets of 8 vertices, for a total of 16 vertices, around the X-Wheel within which each set of 8 vertices was connected with the other 7 of that set by 28 lines, each line representing one generator of each of the two copies of 28-dim



The 28 gold lines represent the D_4 containing $U(2,2)$ that gives Conformal Gravity and the 28 purple lines represent second D_4 containing the $SU(3)$ that when combined with Kaluza-Klein Internal Symmetry Space $CP^2 = SU(3) / U(2)$ gives by the Batakis mechanism the Standard Model Gauge Groups $SU(3) \times SU(2) \times U(1)$.

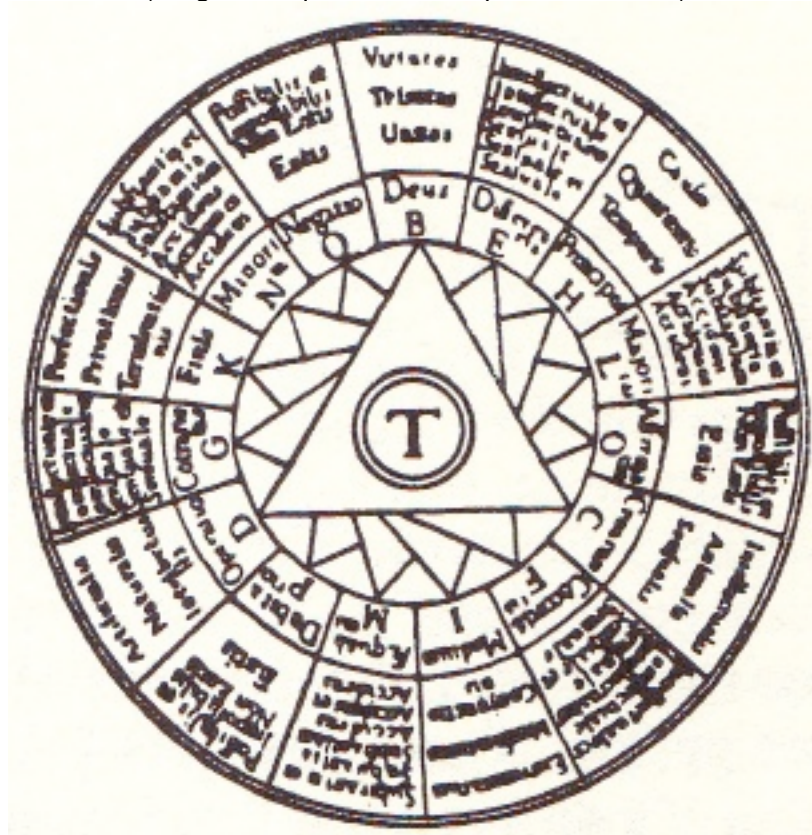
Lull further expanded the 16-dim square-partial-boundary to full square 64-dim size by adding the 64 blue lines that connect a vertex of one D4 with a vertex of the other D4



Adding in 64 blue lines gives $28+28+64 = 120$ lines of the Lullian A-wheel that represents the Spin(16) bivector Lie Algebra D8 of the Clifford Algebra $Cl(16) = Cl(8) \times Cl(8)$

As to the details of the $U(2,2)$ Conformal Gravity of the 28 Gold Lines, Lull constructed a T-Wheel

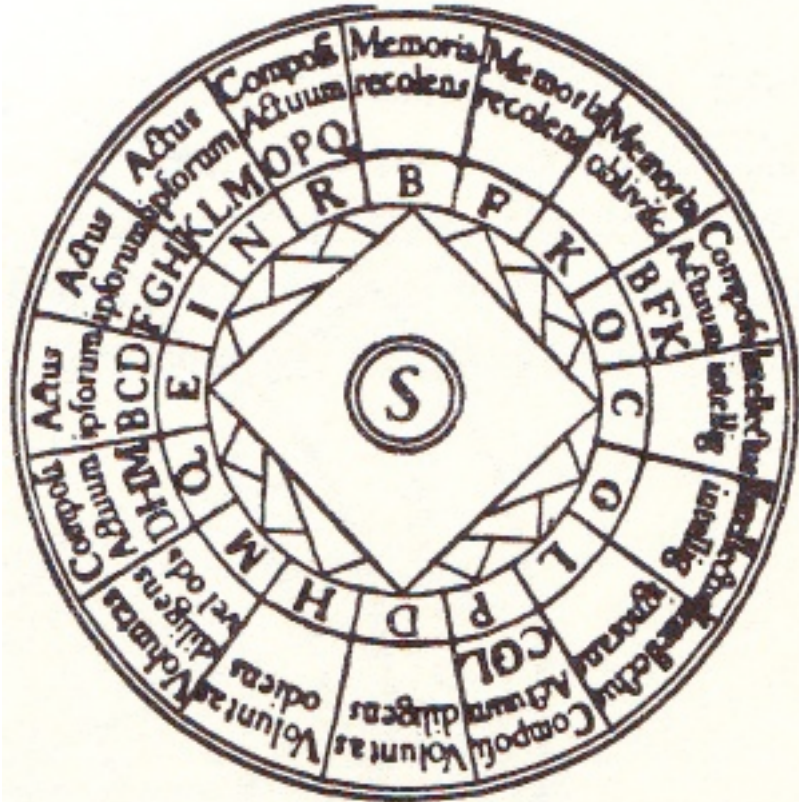
(image from quisestlullus.narpan.net web site)



The 3 vertices of the T-triangle in Lull's T-wheel correspond to a 3-dimensional Cartan subalgebra of the 15-dimensional Conformal Group $SU(2,2) = Spin(2,4)$ that lives in $U(2,2)$ as $U(2,2) = U(1) \times U(2,2)$. The other 4 triangles in Lull's T-wheel correspond to the 12 vertices of the Cuboctahedron Root Vector Polytope of the Conformal Group $SU(2,2) = Spin(2,4)$.

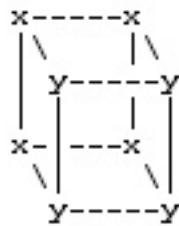
As to the details of the Standard Model of the 28 Purple Lines,
Lull constructed an S-wheel

(image from quiestlullus.narpan.net web site)

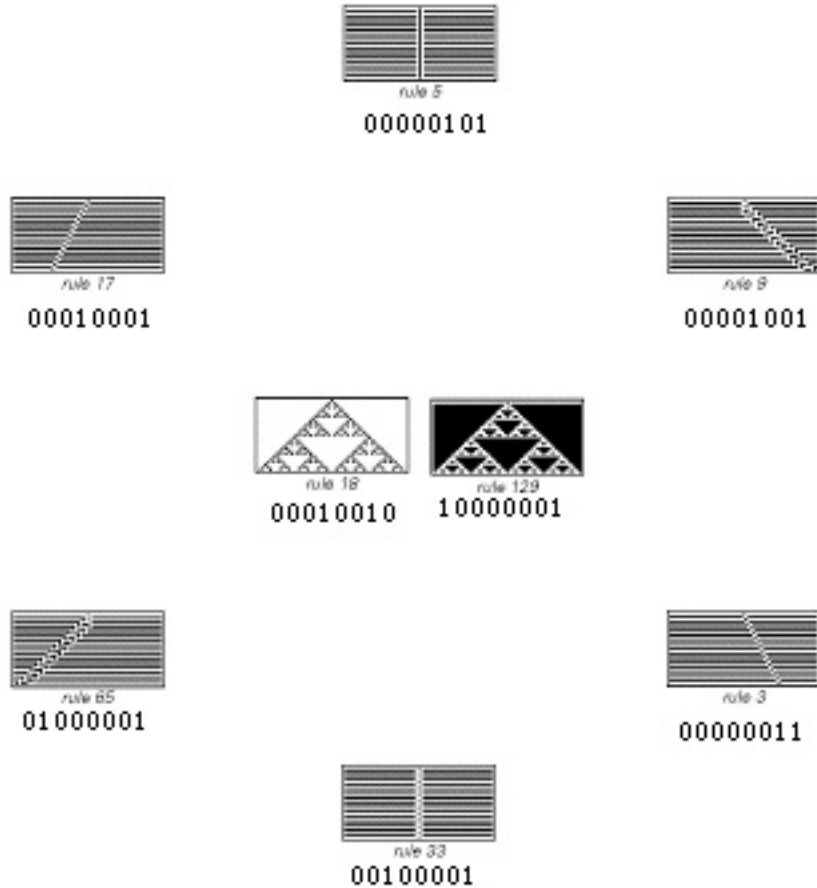


The 4 vertices of the S-square correspond to the 4-dimensional Quaternionic subspaces that emerge below the Planck energy to break Octonionic 8-dim Spacetime into (4+4)-dim Kaluza-Klein spacetime with 4-dim Minkowski Physical Spacetime plus 4-dim Internal Symmetry Space $CP^2 = SU(3) / SU(2) \times U(1)$

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



Looking at the cube along a diagonal axis and projecting all 8 vertices onto a perpendicular plane



you see the Root Vector Diagram of SU(3) and its 8 gluons. (here I have identified the vertices with their corresponding Cellular Automata using a correspondence between the 256 Elementary Cellular Automata and the 256 Odu of IFA - for details see vixra.org/pdf/0907.0040v3.pdf).

Since each gluon links 4-dim Physical Spacetime to color Internal Symmetry Space, the gauge group SU(3) acts globally on CP2 Internal Symmetry Space, as can be seen by the fibration $CP^2 = SU(3) / U(2)$

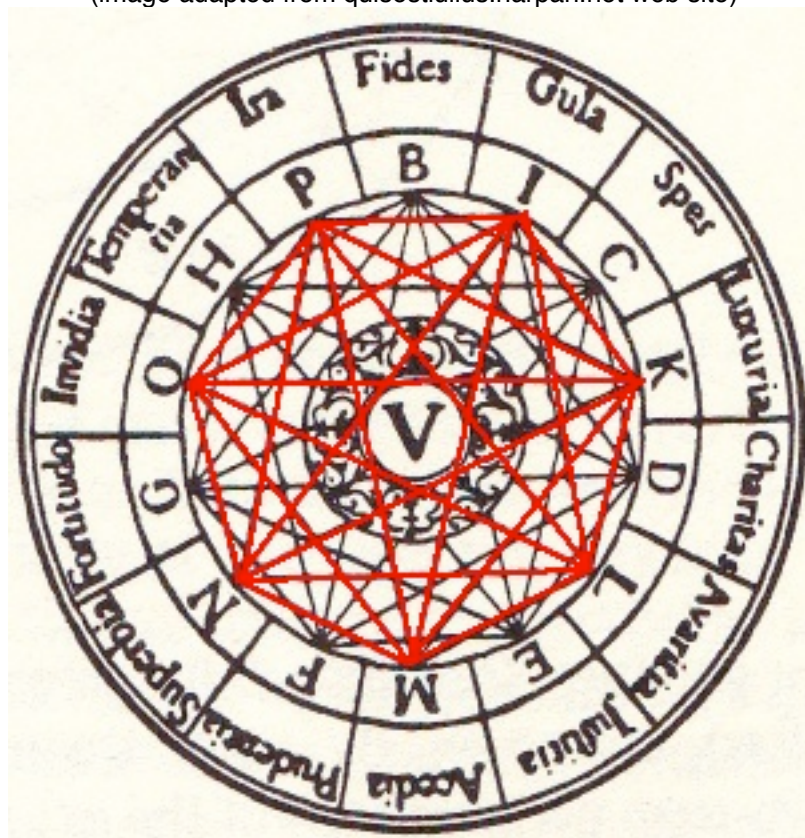
The third of the remaining squares, that is the final square, corresponds to the 3 SU(2) weak bosons and the U(1) electromagnetic photon. Since $SU(2) \times U(1) = U(2)$, and since $CP^2 = SU(3) / U(2)$, they act locally on CP2 Internal Symmetry Space.

Each D4 Lie Algebra generates the 28 rotations of the 7-sphere S7 that lives in 8-dim Euclidean space.
 Although the 1-sphere S1 is the Lie Group U(1) based on Complex Numbers and
 the 3-sphere S3 is the Lie Group Sp(1) = SU(2) = Spin(3) based on Quaternions,
 the Non-Associativity of Octonions prevents the 7-sphere S7 from forming a Lie Group.

If you try to make a Lie Algebra out of the 7 generators of S7
 you find that the products do NOT form a closed 7-dim Lie Algebra
 but
 that you generate two more things:
 a 14-dim G2 Lie Algebra that generates the Automorphisms of the Octonions and
 a second 7-sphere S7.
 If you put all those things together the S7 combines with the new 21-dim G2 x S7
 to form the 28-dim D4 Lie Algebra.

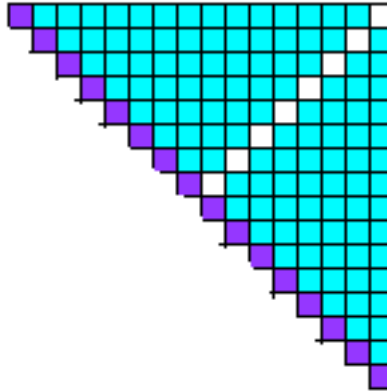
Ramon Llull describe that Octonion structure for the full two copies of D4 in Cl(8)
 in terms of his V-wheel with 7+7 = 14 vertices

(image adapted from quise8tullus.narpan.net web site)



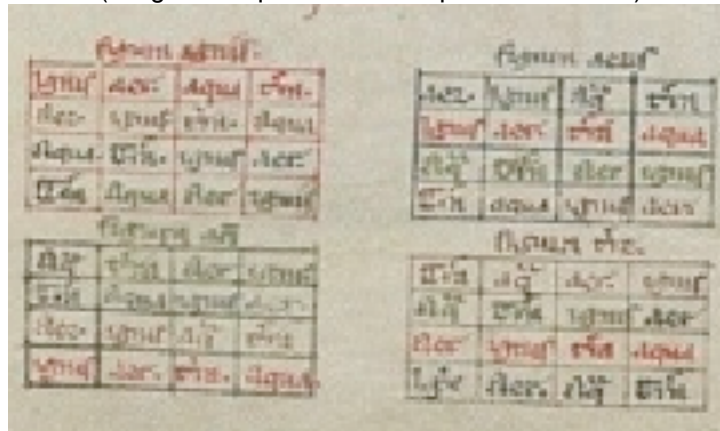
where 21 red lines connect the vertices of one set of 7 vertices of one D4
 and 21 black lines connect the vertices of the other 7 vertices of the other D4.
 Each heptagon can be used to describe the 480 different Octonion Products.

As to **the 136-dim Symmetric part of 16x16 Real matrices**
 the 78-dim Tarot does not contain any of the 8 antidiagonal elements
 but contains a single 1-dim U(1) from E6 / D5xU(1)
 plus 16 of 64 entries in each of two 64-element triangular blocks



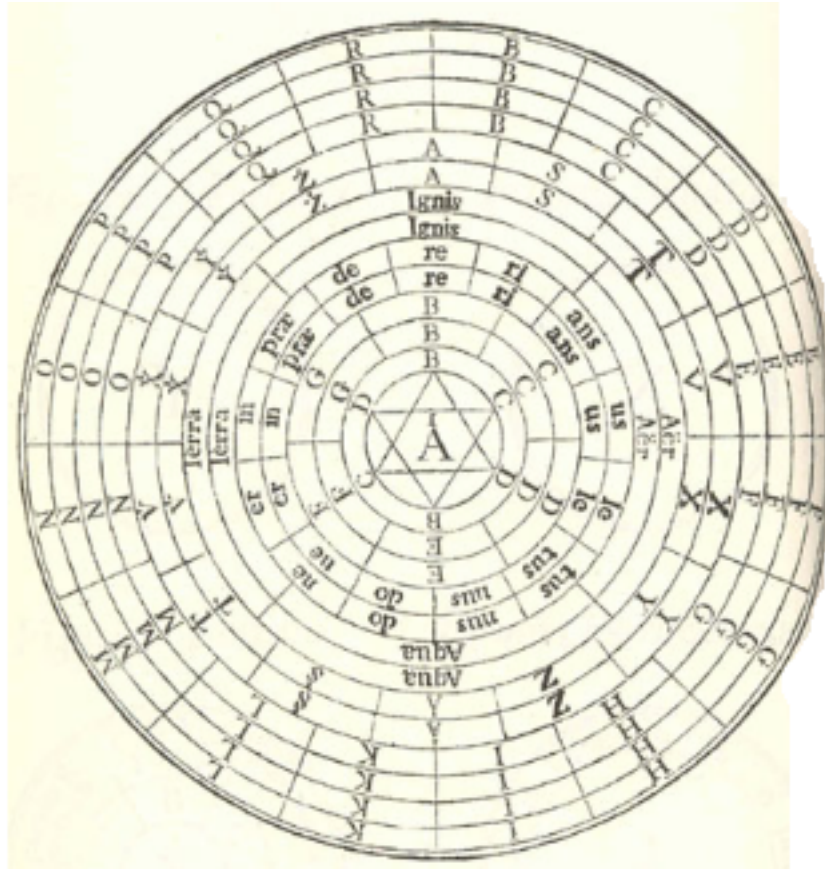
Physically one of the 64-element blocks of the Symmetric Part of Tarot corresponds to the 8 components (with respect to 8-dim Kaluza-Klein spacetime) of the 8 First-Generation Fundamental Fermion Particles and the other 64-element block corresponds to the components of the Fermion Antiparticles.

Ramon Llull's 64-element Elemental Figure is effectively an 8x8 matrix corresponding to
 (image from quisestlullus.narpan.net web site)



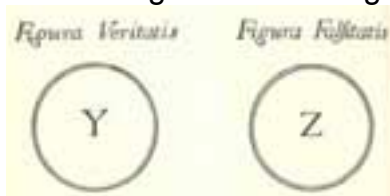
the Fermion Particle and Fermion Antiparticle 64-element Symmetric Tarot blocks
 thus
 constructing a $64+64 = 128$ -dimensional D8 half-Spinor space
 that when combined with the 120-dimensional D8 of the Lullian A-Wheel produces
 $120\text{-dim D8} + 128\text{-dim D8 half-Spinor} = 248\text{-dim E8 Lie Algebra}$

As to how all the parts of Lull's model fit together, Lull used a system of revolving concentric circles - his Universal Figure (image from quiseatlullus.narpan.net web site)



The outer 4 rings of 16 elements each represent the Elemental Figure Fermion Particles
 The next (going in toward the center) 2 rings of 14 elements each represent the D4 and its Lie subalgebras producing the Gauge Groups of Gravity and the Standard Model.
 The next 2 rings of 4 elements each represent the 4+4 = 8 dimensions of Spacetime.
 The next 2 rings of 13 elements each represent the 26-dimensional String Theory with Strings seen as World-Lines of Fermions, producing a Bohm-type Quantum Theory.
 At the center are 3 rings of 6 elements each surrounding a 6-vertex Star of David whose $3 \times 6 + 6 = 24$ elements correspond to the vertices of the 24-cell that is the basic element of the Integral Domain Lattice of Integral Quaternions that describe each of the 4-dimensional parts of (4+4)-dimensional Kaluza-Klein Spacetime.

The binary overall structure of Clifford Algebras including $Cl(8)$ is described by Lull



in terms of his True-False Y-wheel and Z-wheel.

In his time around 1300 A.D. Ramon Llull could not use the language of 2000 A.D. math and physics to explain his Tarot-type model to the world. As Anthony Bonner' said in his book Doctor Illuminatus (Princeton 1993):

"... Even ...[Llull's]... disciple, le Myesier, complained ... about "the confusion caused by the meanings of the alphabet of the Ars demonstrativa and its sixteen figures, which confound the mind." ...

Llull ... tr[ie]d to persuade the Parisian schoolmen ...[by]... us[ing] the bizarre vocabulary more sparingly, and modify[ing] the Art itself so that it would not look so alarming. ... Towards the beginning of 1290 in Montpellier, therefore, Llull set about ... beginning a new phase of the Art ...

As a result of the "weakness of human intellect", the number of figures [wa]s reduced and the algebraic notation vanishe[d] ...

Llull's last works were written in December 1315 in Tunis, at which point he disappears from history. ... he must have died sometime between then and March 1316

...

the Dominican inquisitor general of Aragon, Nicholas Eymerich (1320-99), began a campaign against the doctrines of Ramon Llull ...[that]... culminated ... in two events: The first was the publication in January ... 13676 ... of the Directorium inquisitorum, his notorious manual on inquisitorial methods ... it contained a list of a hundred errors of Ramon Llull ... on February 6, a papal bull was promulgated censuring Llull and condemning twenty of his books ... Llull's followers ... won in 1416 ... the promulgation by the Papal Court ... invalidating the bull of forty years earlier. ... Veneration of Llull was ... permitted withn the Franciscan Order and locally in Majorca ... his feast day was set on 3 July ...

The second condemnation of Llullist doctrines came from ... the Faculty of Theology of the University of Paris. In 1390 ... the Faculty of Theology publish[ed] an edict prohibiting the teaching of Llullist doctrines. ...[It]... cut off ... considerable interest in Llull in Paris ...".

In short:

Ramon Llull expanded the 78-dim Tarot outline structure to the old full 256-dim IFA including the E8 Lie Algebra and the realistic structure of E8 Physics
but
he was 600 years ahead of rediscovery of his mathematics
and
700 years ahead of the time of detailed experimental confirmation
with the result that
the Paris-based Establishment of his time ignored and attacked his work
even when he tried to dumb it down to their level.

Llull to Cartan-Dirac-Riesz-E8Physics

Llull's description of the D8 Lie Algebra of dimension $120 = 8(16-1)$ remained undeveloped and unappreciated for 600 years until Killing and Cartan classified Lie Groups.

Roger Penrose in his book "The Road to Reality" (Knopf 2004) said:

"... classification ...[of]... Lie groups ... started with Wilhelm Killing ... whose basic papers appeared in 1888-1890, and was essentially completed in 1894 ... by ... Elie Cartan ... It turns out that there are four families, known as A_m , B_m , C_m , D_m ... of respective dimension $m(m+2)$, $m(2m+1)$, $m(2m+1)$, $m(2m-1)$, called the classical groups ... and five exceptional groups known as E_6 , E_7 , E_8 , F_4 , G_2 , of respective dimension 78, 133, 248, 52, 14. ...".

The connection of the 248-dim Lie Algebra E_8 with the Clifford Algebra $Cl(16)$ and its 120-dim bivector algebra D_8 and 128-dim half-spinor space only became clear in the 1900s based on the work of Cartan as further developed by Jovet, Sauter, and Riesz mathematically and applied by Dirac to physics.

Perti Lounesto in his article on "History of Clifford Algebras"

in the book "Clifford Numbers and Spinors" by Marcel Riesz (Kluwer 1993) said:

"... E. Cartan 1908 ... identified the Clifford algebras $Cl(p,q)$ as matrix algebras with entries in R [Real Numbers], C [Complex Numbers], H [Quaternions], $R+R$, $H+H$ and found a periodicity of 8 ...

Cartan also observed spinor modules of orthogonal Lie algebras in 1913 ...

Jovet 1930 and Sauter 1930 replaced column spinors by square matrices in which only the first column was non-zero -

thus spinor spaces became minimal left ideals in a matrix algebra.

Riesz 1947 used primitive idempotents of Clifford algebras to construct spinor spaces as minimal left ideals in Clifford algebras ...".

Roger Penrose in his book "The Road to Reality" (Knopf 2004) said:

"... One reason that Clifford Algebras are important is for their role in defining spinors. In physics, spinors made their appearance in Dirac's equation for the electron (Dirac 1928), the electron's state being a spinor quantity ...".

In the 1900s, Irving Ezra Segal showed the connection between the Conformal Group and the Dark Energy of Gravity; MacDowell and Mansouri showed how gauging the Conformal Group produces Gravity; and the Dirac Equation was generalized to the Standard Model. During the 2000s Dark Energy was observed by WMAP and Planck and the LHC discovered a Higgs state, confirming the basic Standard Model structure so

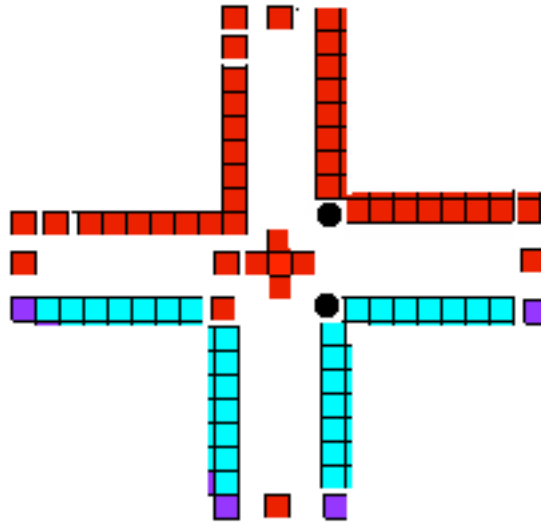
**it is only now (the 2000s) that the formal Written Human Culture
has caught up with the informal Oral Ancient African Culture
and the 700-year old model of Ramon Llull
in understanding a realistic Unified Theory of the Laws of Nature.**

Appendix1: E6 to D4

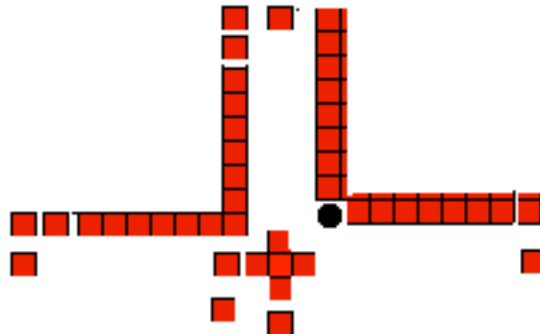
There are two chains from E6 to D4:

The chain E6 to D5 to D4

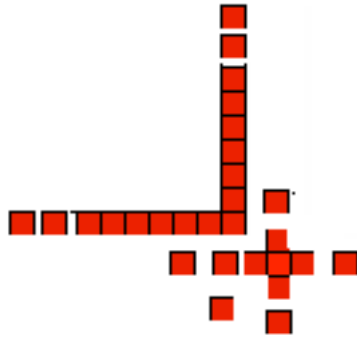
78-dim E6



contains 45-dim D5 by E6 / D5xU(1) rank 2 Type EIII space (CxO)P2 whose related Type V Exceptional Complex Domain is not of Tube Type. In E8 Physics its Shilov Boundary is seen as a bundle with fibre S1xS7 and base space whose own fibration is S1 -> S9 -> CP4. It is used in E8 Physics as a representation space for first-generation Fermion Particles and AntiParticles.

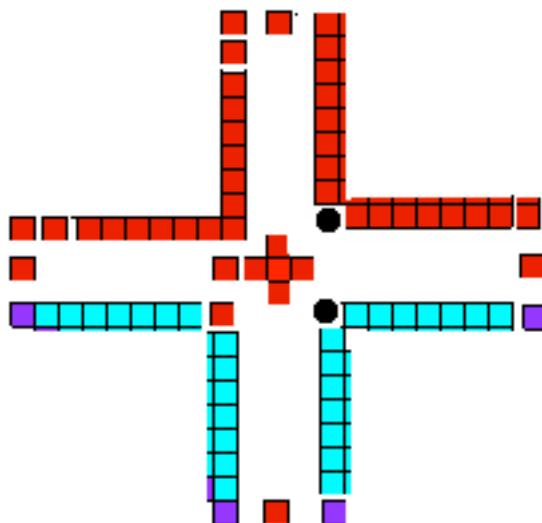


which contains 28-dim D_4 by $D_5 / D_4 \times U(1)$ Lie sphere rank 2 Type BDI space whose related Type IV(8) Complex Domain is Tube Type with Shilov Boundary $RP^1 \times S^7$. It is used in E8 Physics as a representation for 8-dimensional Spacetime.

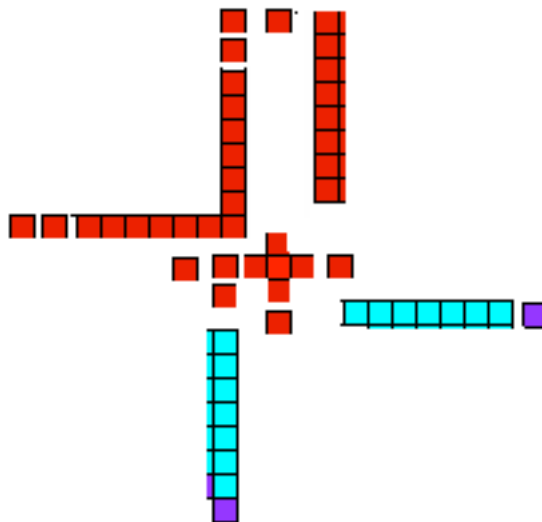


The chain E6 to F4 to B4 to D4

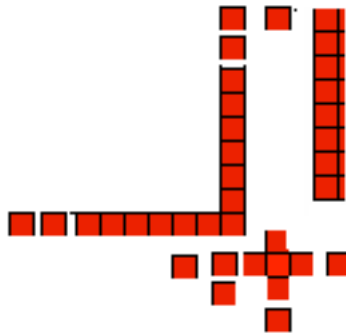
78-dim E6



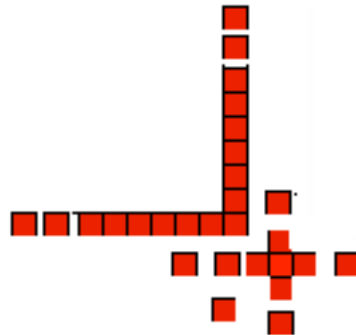
contains 52-dim F4 by E6 / F4 Type EIV rank 2 space that is the set of OP2 in $(C \times O)^2$ and is related to the 26-dim traceless part $J(3, O)_o$ of the 27-dim Jordan Algebra $J(3, O)$



which contains 36-dim B_4 by $F_4 / B_4 = OP_2 =$ Octonionic Projective Plane

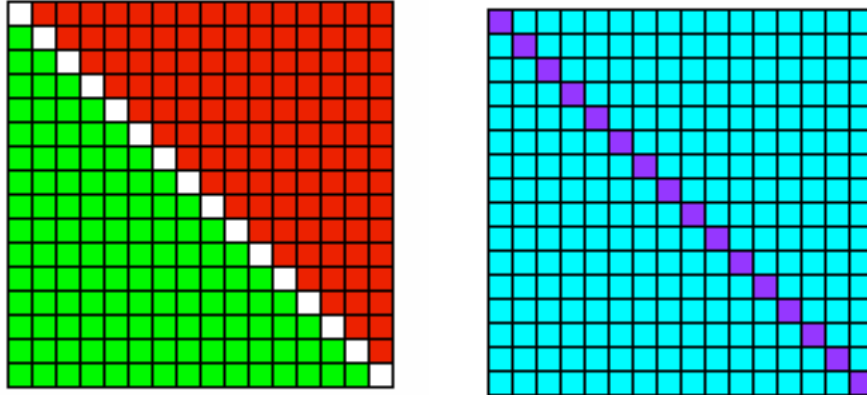


which contains $16+12 = 28$ -dim D_4 by $B_4 / D_4 = OP_1 =$ the 8-sphere S^8



Appendix2: Some Details of E8 encoding in IFA

$$\begin{aligned} \text{IFA Cl}(8) &= 256\text{-dim } 16 \times 16 \text{ Real Matrices } M(16, \mathbb{R}) = \\ &= 120\text{-dim Antisymmetric } 16 \times 16 + 136\text{-dim Symmetric } 16 \times 16 \end{aligned}$$



For Antisymmetric 16×16 each red entry above the diagonal is the negative of the corresponding green entry below the diagonal and the 16 diagonal entries are zero so the number of Antisymmetric entries is 120 corresponding to the D_8 Lie Algebra.

For Symmetric 16×16 each cyan entry above the diagonal is equal to the corresponding cyan entry below the diagonal and the 16 diagonal entries are non-zero so the number of Symmetric entries is $120 + 16 = 136$.

8 of the 136 Symmetric entries of the IFA $Cl(8)$ 16×16 Matrix do not correspond to E_8 but

the other $136 - 8 = 128 = 64 + 64$ correspond to 128-dim half-spinor of D_8 .

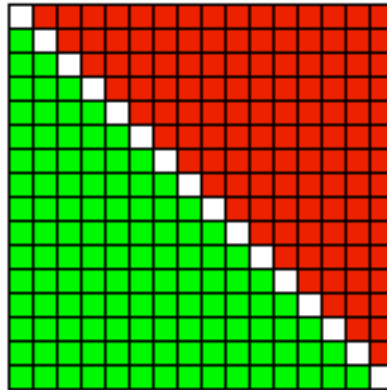
$$\begin{aligned} \text{Since } 248\text{-dim } E_8 &= 120\text{-dim } D_8 + 128\text{-dim half-spinor of } D_8 = \\ &= 120\text{-dim Antisymmetric part} + 128 \text{ of } 136\text{-dim Symmetric part of } M(16, \mathbb{R}) \end{aligned}$$

$$256\text{-dim IFA Cl}(8) \text{ contains } 120 + 128 = 248\text{-dim } E_8$$

and so

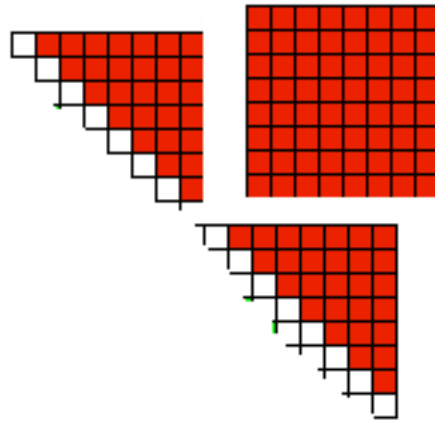
encodes the structure of E_8 Physics of Gravity and the Standard Model.

Antisymmetric Part:



Due to the diagonal-reflection symmetry of Antisymmetric and Symmetric matrices, only the upper triangular parts of the matrices need to be used in visualization.

The 120-dim Antisymmetric part corresponds to the 120-dim D8 Lie Algebra. It has 3 components: a 64-dim Square plus two 28-dim Triangles.



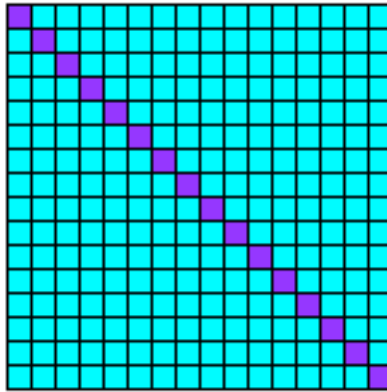
Each 28-dim Triangle corresponds to a 28-dim D4 Lie Algebra so that the 64-dim Square corresponds to the Coset Space $D8 / D4 \times D4$

The 64-dim Square also corresponds to a $U(8)$ subalgebra of D8 representing relationships between 8-dim Position and 8-dim Momentum of 8-dim Spacetime that obtains a (4+4)-dim Kaluza-Klein structure.

One of the 28-dim D4 contains a 15-dim $A3 = D3$ Lie Algebra of the Conformal Group that produces Gravity by a generalized MacDowell-Mansouri mechanism.

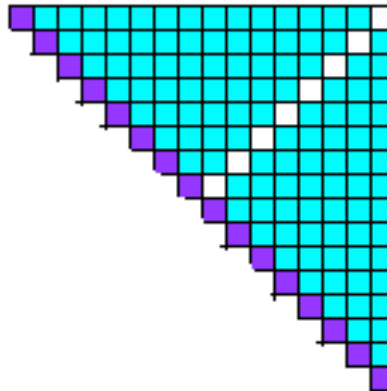
The other 28-dim D4 contains a 15-dim $A3 = D3$ Lie Algebra with an $A3 = SU(3)$ subalgebra that in conjunction with 8-dim Kaluza-Klein spacetime containing 4-dim Internal Symmetry Space part $CP2 = SU(3) / SU(2) \times U(1)$ produces the Standard Model gauge groups by the Batakis mechanism.

Symmetric Part:

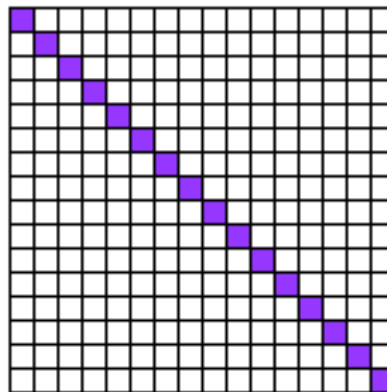


Due to the diagonal-reflection symmetry of Antisymmetric and Symmetric matrices, only the upper triangular parts of the matrices need to be used in visualization.

The $120 + 16 = 136$ -dim Symmetric part of the $Cl(8)$ matrix algebra $M(16, R)$



contains 8 anti-diagonal elements that are not contained in the E_8 Lie Algebra, but both $Cl(8)$ and E_8 contain the 16-element Diagonal whose elements



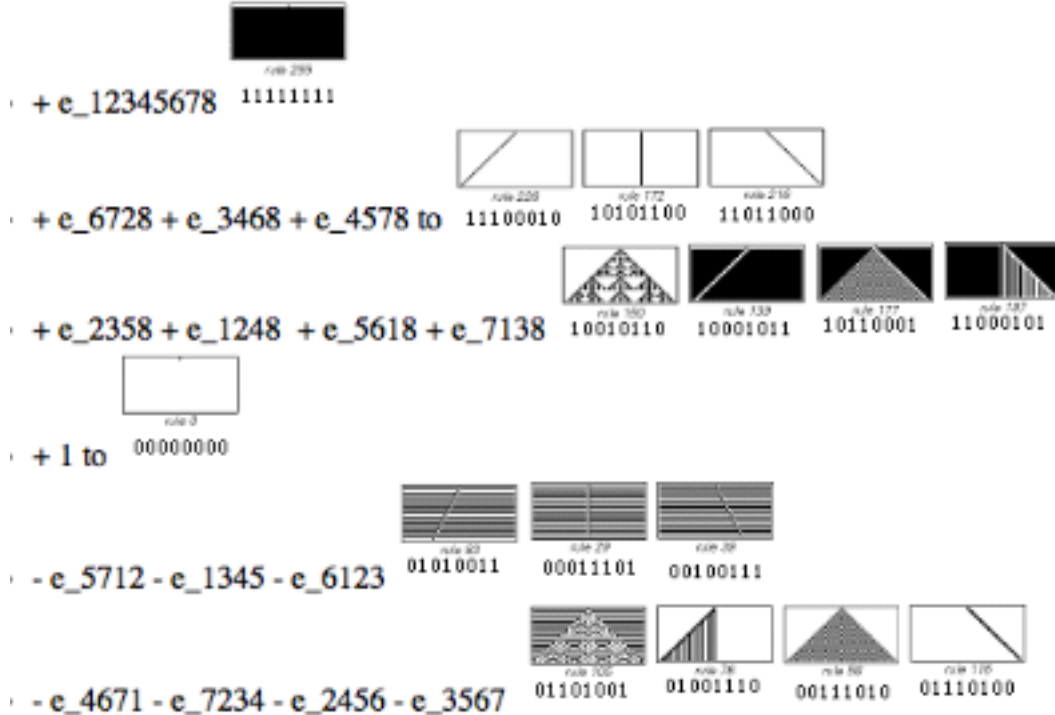
give 16 terms $Cl(8) = 16 \times 16$ Real Matrix Algebra Primitive Idempotent

$$f = (1/2)(1 + e_{1248})(1/2)(1 + e_{2358})(1/2)(1 + e_{3468})(1/2)(1 + e_{4578}) =$$

$$= (1/16)(1 + e_{1248} + e_{2358} + e_{3468} + e_{4578} + e_{5618} + e_{6728} + e_{7138}$$

$$- e_{3567} - e_{4671} - e_{5712} - e_{6123} - e_{7234} - e_{1345} - e_{2456} + e_J)$$

which in terms of the 256 Elementary Cellular Automata are



which are related to the two 8-dim $Cl(8)$ half-spinors

the 8 **+** half-spinors

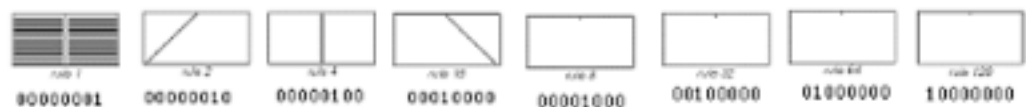


the 8 **-** half-spinors



which in turn are related by Triality to the 8-dim $Cl(8)$ vectors

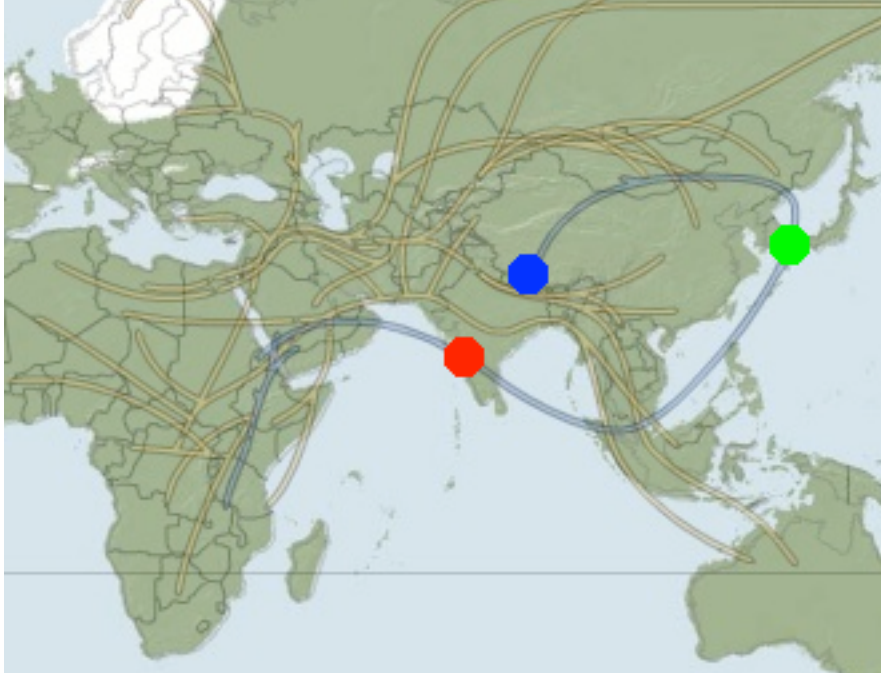
the 8 **vectors**



When the 56 + 56 off-diagonal elements are added to the 8 + 8 $Cl(8)$ half-spinors you get the 64 + 64 = 128 elements of a half-spinor space of $Cl(16) = Cl(8) \times Cl(8)$.

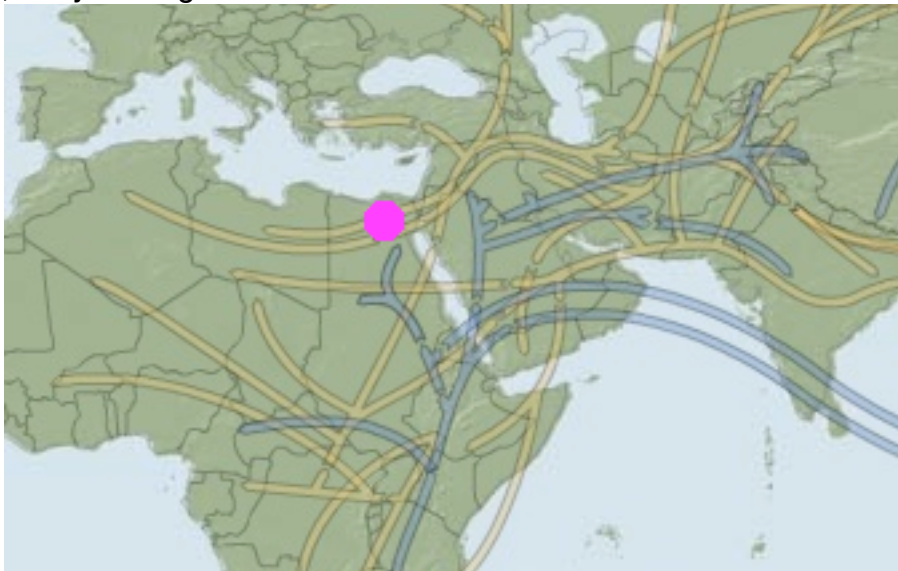
Appendix3 - Comparison of Arabian Sea Africa-India connection with Nile River Africa-Egypt connection

About 50,000 years ago, according to the National Geographic Genographic project,



Y-chromosome DNA indicated that basic human physiology had emerged from Africa to **India** then to **Japan** and on to **Tibet**

By about 40,000 years ago



Y-chromosome DNA population M96 had branched into the **Nile River Valley**

Around 50,000 years ago

Japanese were separated from their African Homeland by the East Pacific Ocean, the Sunda Shelf, the Indian Ocean, and the Arabian Sea which was so great a distance that contact with Africa was so tenuous that they only retained about 1/2 of their IFA Cultural Heritage as evidenced by the fact that Shinto Futomani Divination uses 128 elements, 1/2 of the 256 of IFA
Tibetan were separated from their African Homeland by Mountains and Land of China, the East Pacific Ocean, the Sunda Shelf, the Indian Ocean, and the Arabian Sea which was so great a distance that contact with Africa was so much more tenuous that they only retained about 1/4 of their IFA Cultural Heritage as evidenced by the fact that the I Ching uses 64 elements, 1/4 of the 256 of IFA
Indians were separated from their African Homeland by the Arabian Sea which was close enough to Africa to maintain regular contact but far enough that they felt isolated from the very close contact needed to maintain the details of the oral traditions of IFA, so the Indian priests of IFA chose to put the IFA Information System into writing and to do so developed Sanskrit and wrote the Rig Veda.

About 10,000 years later (around 40,000 years ago)

the Builders of the Great Pyramid had migrated throughout the length of the Nile, along which substantially contiguous settlements enabled them to maintain enough contact to maintain the details of the oral traditions of IFA so that when they built the earliest of the pyramids, the Great Pyramid, they did not deface it with any writing.

However,

the Great Pyramid was a huge engineering project requiring coordinated work

(image from Wikipedia)



by large numbers of people, so an engineering language developed among the builders, first based upon hand signals (see Stan Tenen's www.meru.org) and then translated into a written alphabetical language, Hebrew.

After the Great Pyramid complex had been completed, the Tower of Babel breakdown occurred, the cooperative community fragmented, skills became diluted so that later pyramids were not up to Great Pyramid standards, and a less-sophisticated heiroglyphic writing evolved and was used on later structures.

Appendix4 - Poster

The poster on the following page was produced for the NSBP/NSHP 2010
Joint Annual Conference of the
National Society of Black Physicists
and the
National Society of Hispanic Physicists
to be held 10-14 February 2010.

The conference was cancelled
so
the poster is put here so that it might be seen by anyone interested.

African Origins

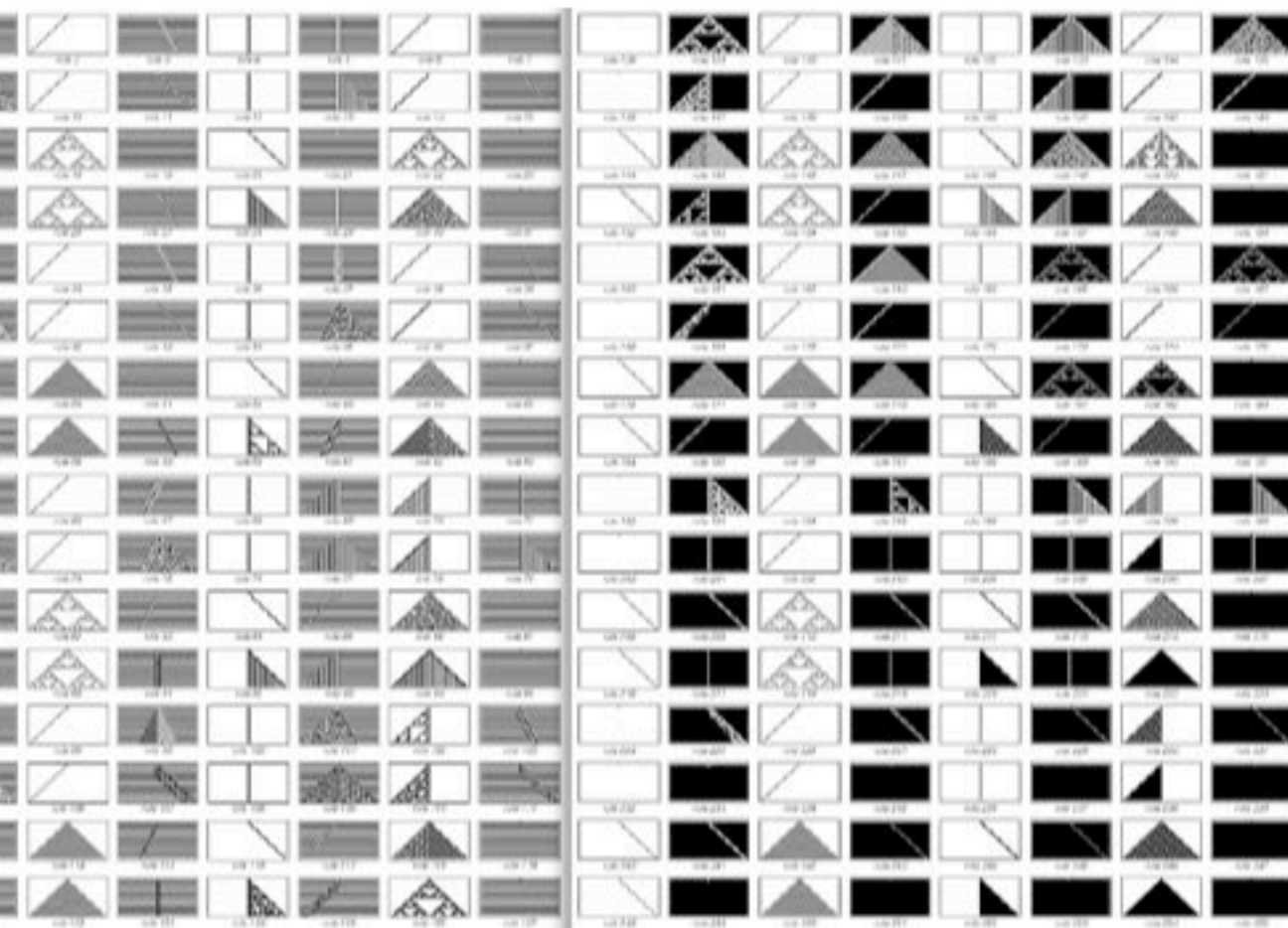


Africans developed IFA Oracle divination based on the square of 16 = 16x16 = 256 = 2⁸ corresponding to the vertices of an 8-dimensional hypercube and to the binary 2-choice Clifford algebra Cl(8) and so to related ones such as Cl(8)xCl(8) = Cl(16).

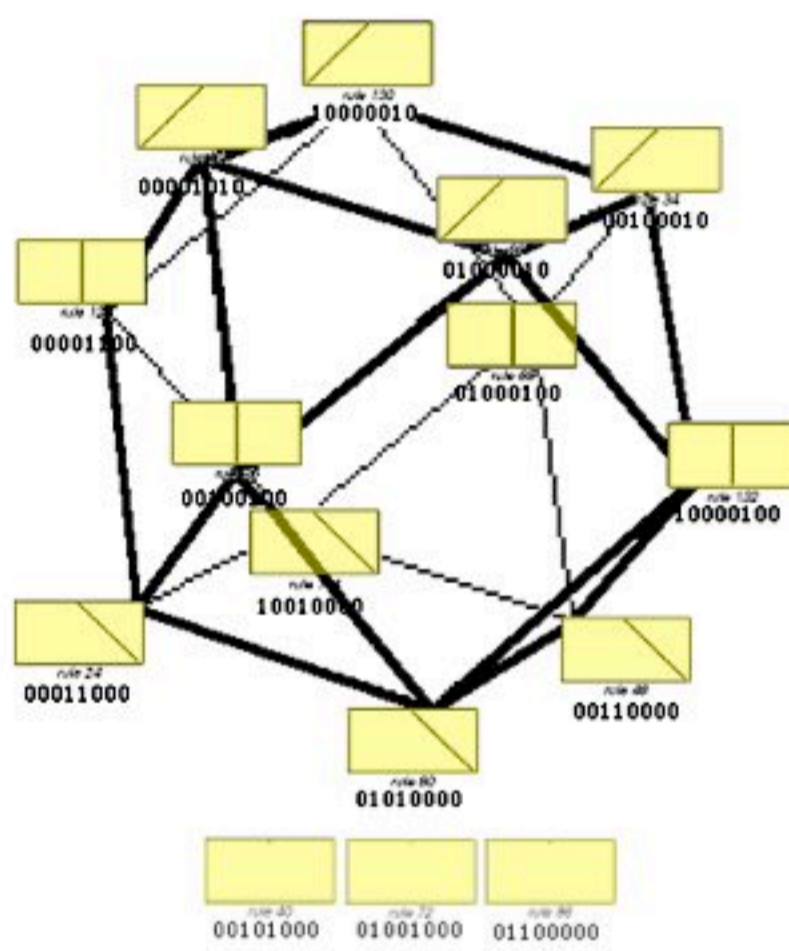
Since the number of sub-hypercubes in an 8-dimensional hypercube is 6,561 = 81x81 = 3⁸, the IFA Oracle has N=8 ternary 3-structure as well as binary 2-structure:

| N | 2 ^N | 3 ^N |
|---|----------------|----------------|
| 0 | 1 | 1 |
| 1 | 2 | 3 |
| 2 | 4 = 2x2 | 9 = 3x3 |
| 3 | 8 | 27 |
| 4 | 16 = 4x4 | 81 = 9x9 |
| 5 | 32 | 243 |
| 6 | 64 = 8x8 | 729 = 27x27 |
| 7 | 128 | 2187 |
| 8 | 256 = 16x16 | 6561 = 81x81 |

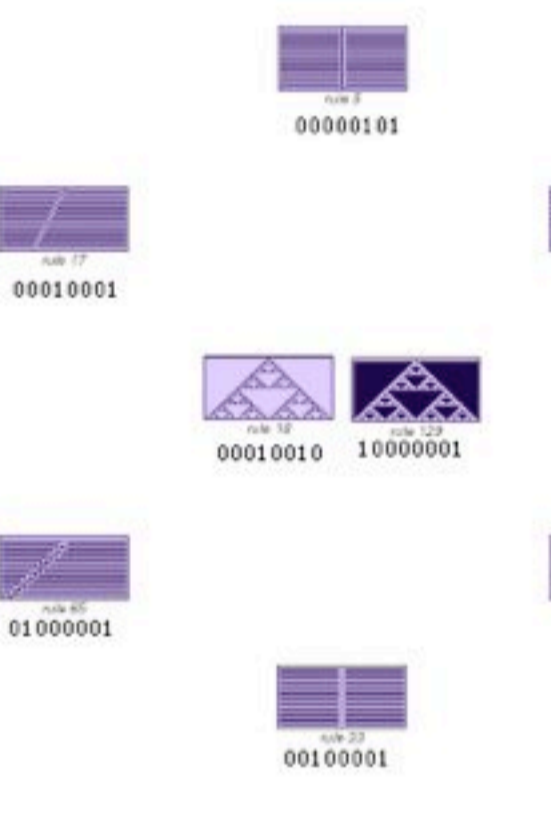
As ancient African games such as Oware show, binary 2-structure corresponds to static states and ternary 3-structure corresponds to dynamic states. Mathematically, using binary 2-choice static states to define dynamics on 3 ternary neighbor states produces the 256 Elementary Cellular Automata:



15 of the elements represent Conformal Spin(2,4) of Gravity:

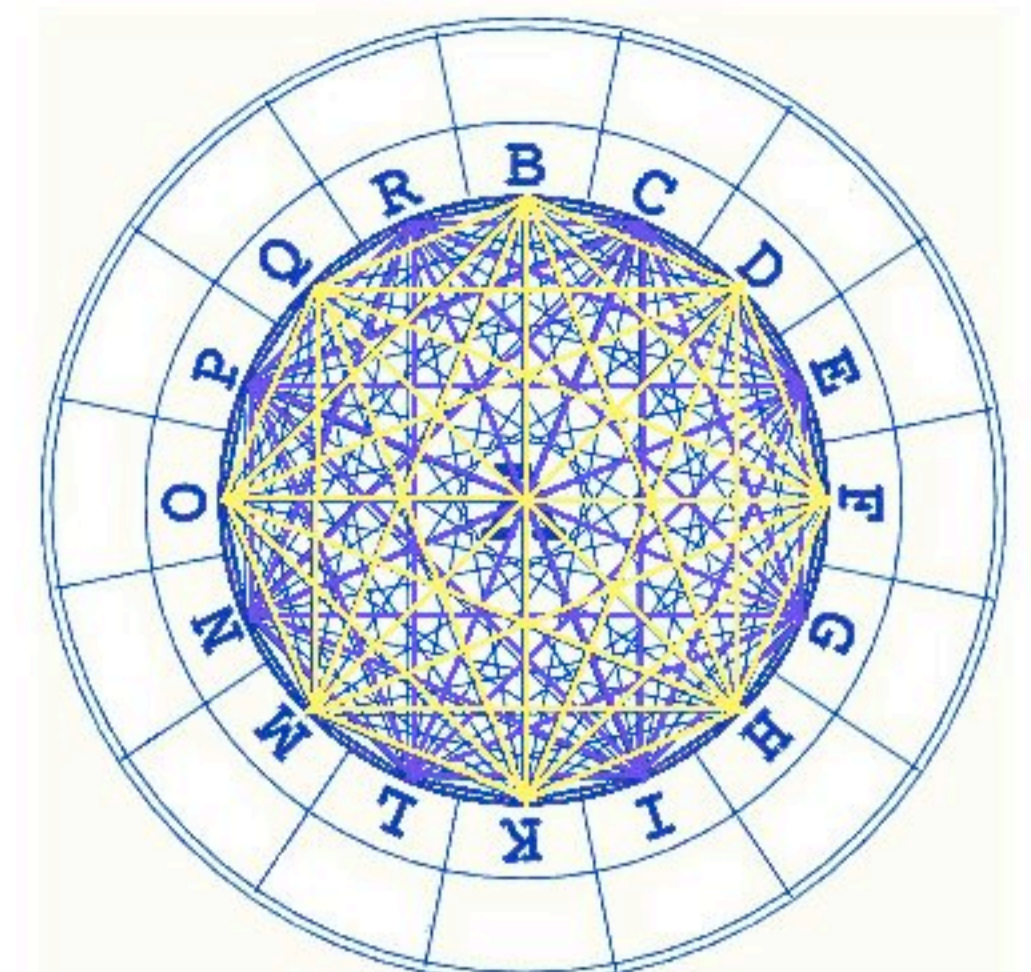
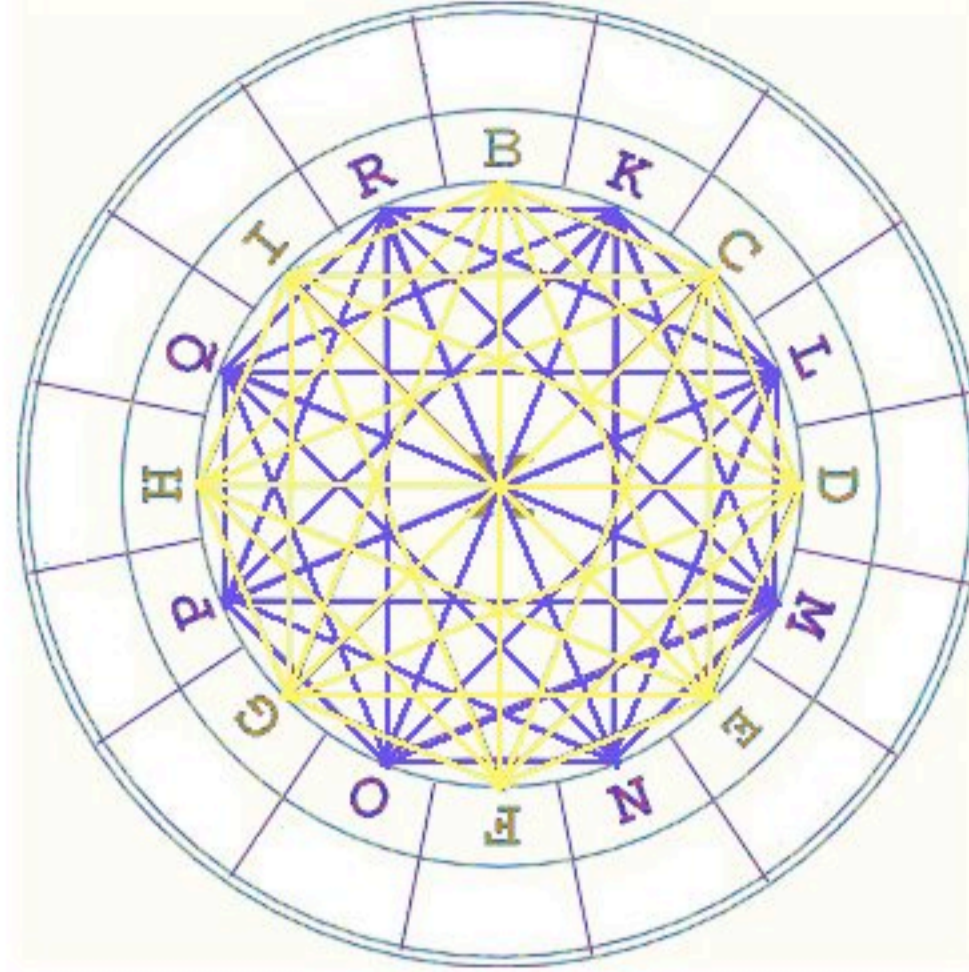


8 of the elements represent the SU(3) Color Force:



Hispanic Development

Ramon Llull (1232-1316) of Mallorca studied the 16 possibilities of the Ilm al Raml, which are derived from 16 of the 16x16 = 256-element African IFA divination system, and found a structure that he summarized in Wheel Diagrams with 16 vertices connected to each other by lines and in Cubic 4x4x4 = square 8x8 = 64-element Elemental Figures (Images adapted from lullianarts.net web site):



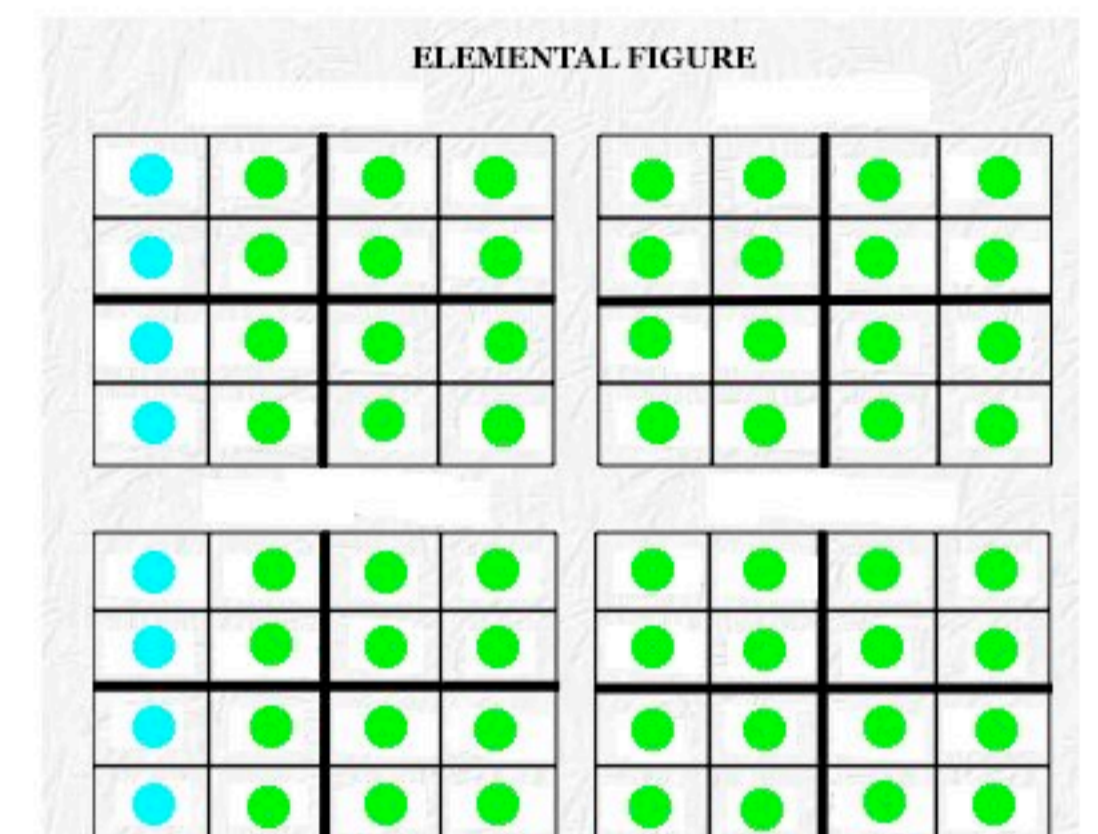
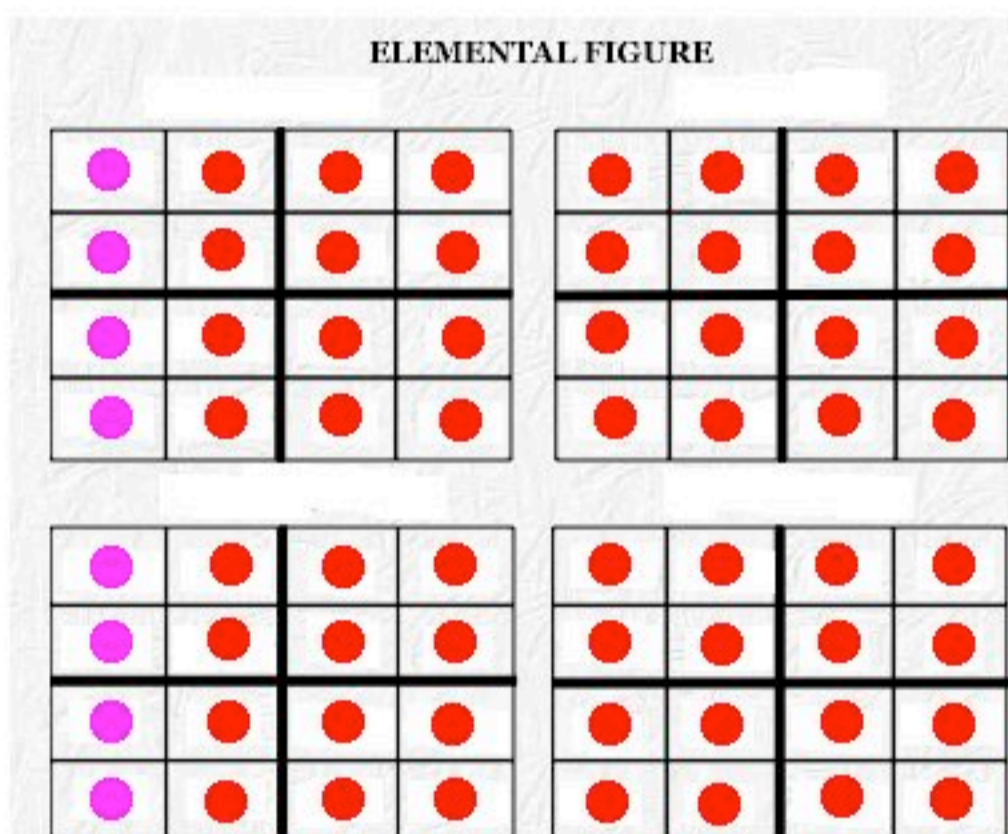
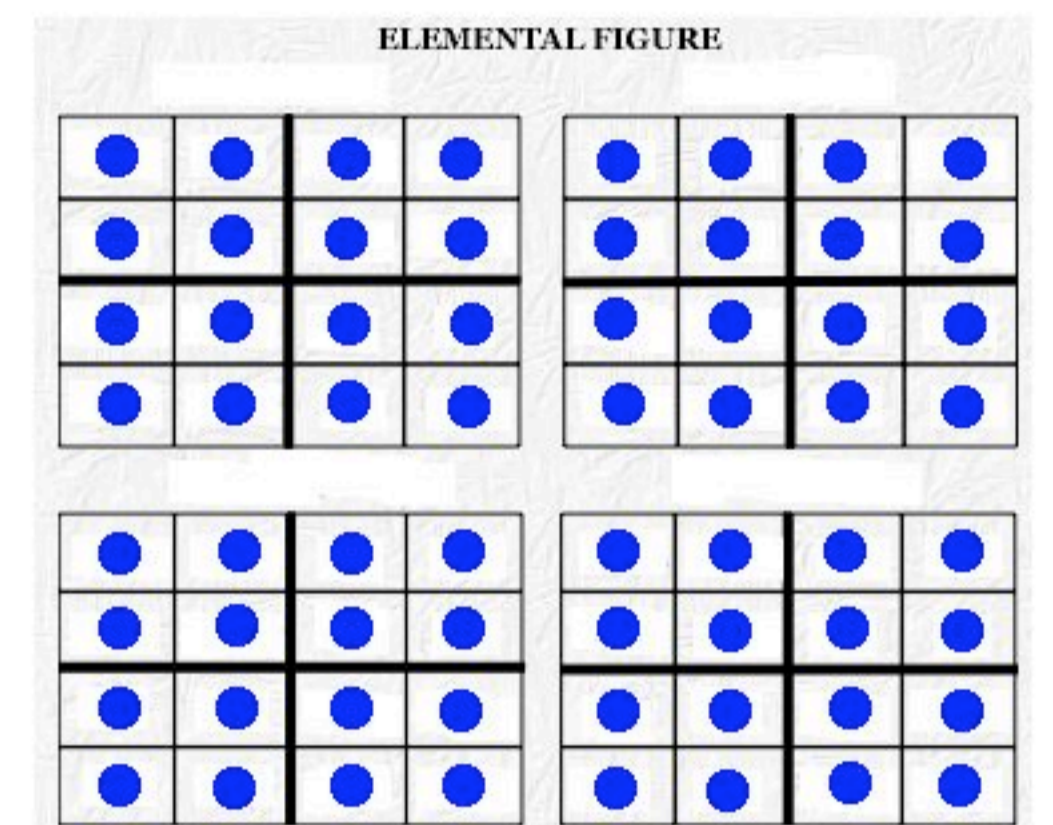
The 28 gold lines (gold 8-HyperCube points) represent Gravity and the 28 purple lines (purple 8-HyperCube points) represent the Standard Model.

Adding in 64 blue lines (blue 8-HyperCube points without white dots) gives 120 lines that represent the Spin(16) BIVector Lie Algebra of the Clifford Algebra Cl(16) = Cl(8) x Cl(8):

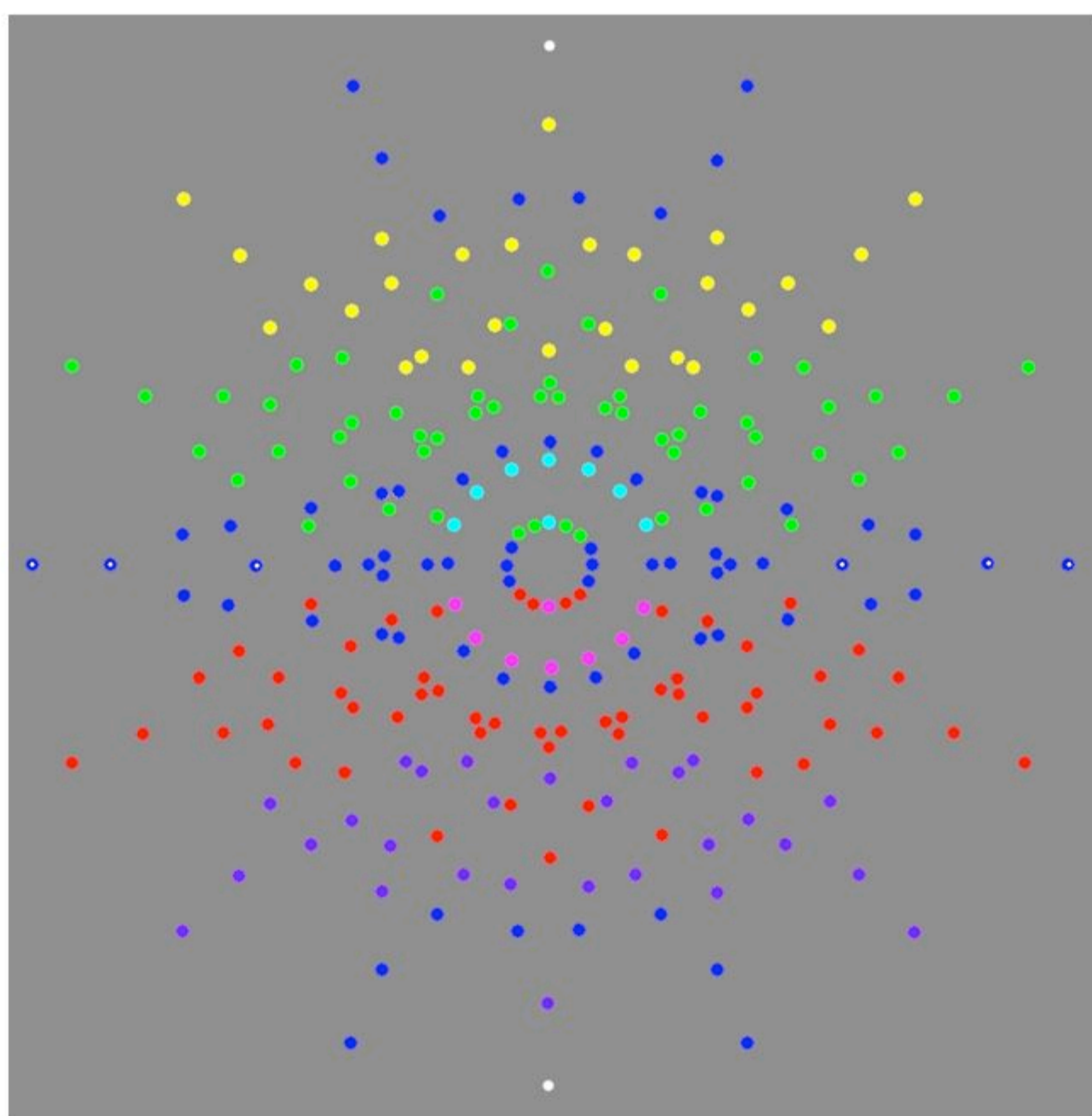
The 64 blue lines, and the 64 pure blue 8-HyperCube points, represent 8-dimensional Kaluza-Klein Vector SpaceTime and can be shown as a 64-element Elemental Figure.

By Triality Automorphisms, the 8+56 = 64-element magenta and red 8-HyperCube points that represent 8 Fermion Particles can also be shown as a 64-element Elemental Figure and the 8+56 = 64-element cyan and green 8-HyperCube points that represent 8 Fermion Antiparticles can also be shown as a 64-element Elemental Figure.

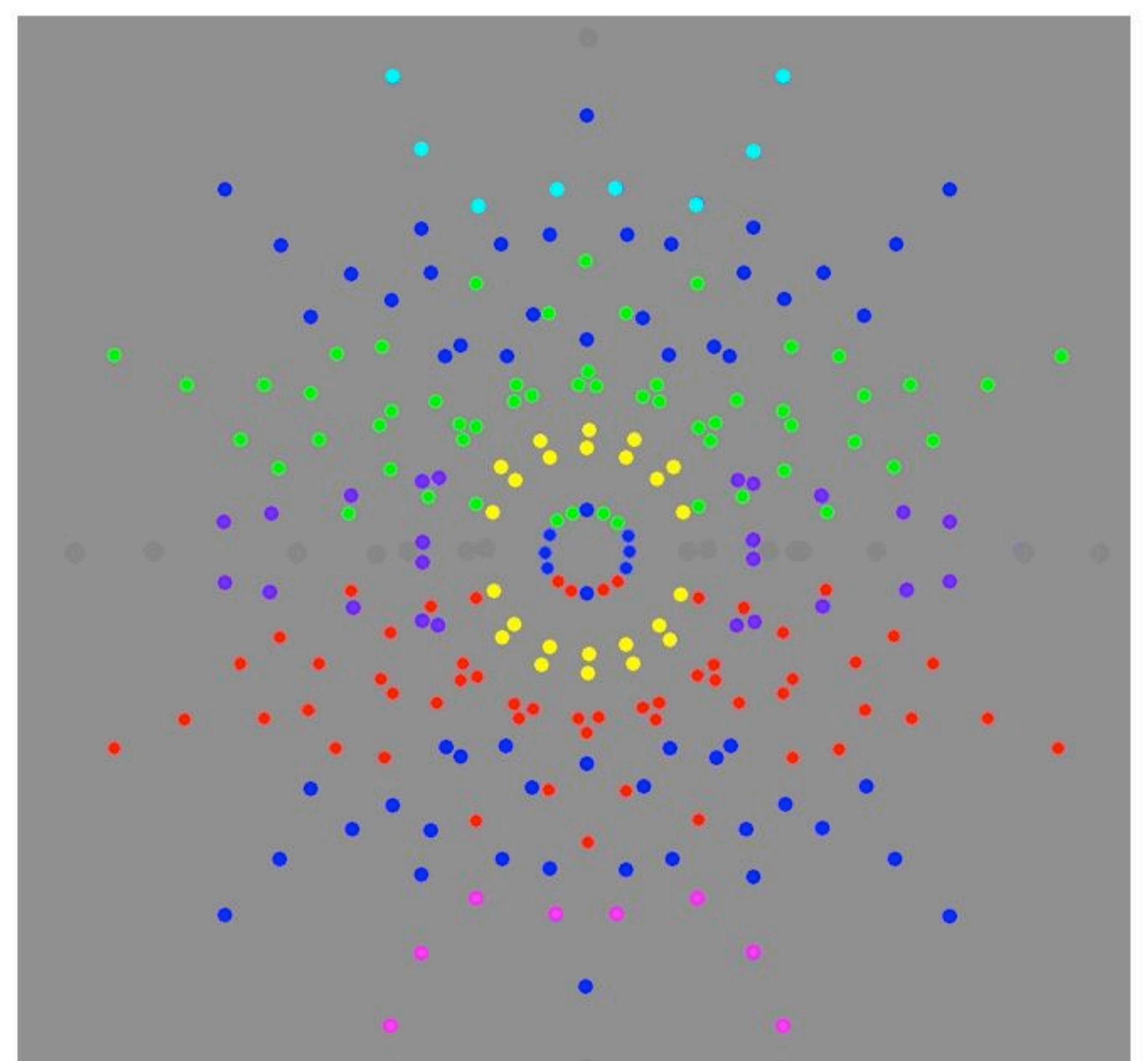
The 64 red-magenta Fermion Particle elements plus the 64 green-cyan Fermion Antiparticle elements form the 128 elements of one Half-Spinor representation of Spin(16).



The 120 elements of the Spin(16) BIVector Lie Algebra plus the 128 elements of a Half-Spinor representation of Spin(16), both of which live in the Clifford Algebra Cl(16) = Cl(8) x Cl(8), combine to form the 120+128 = 248-dimensional E8 Lie Algebra:



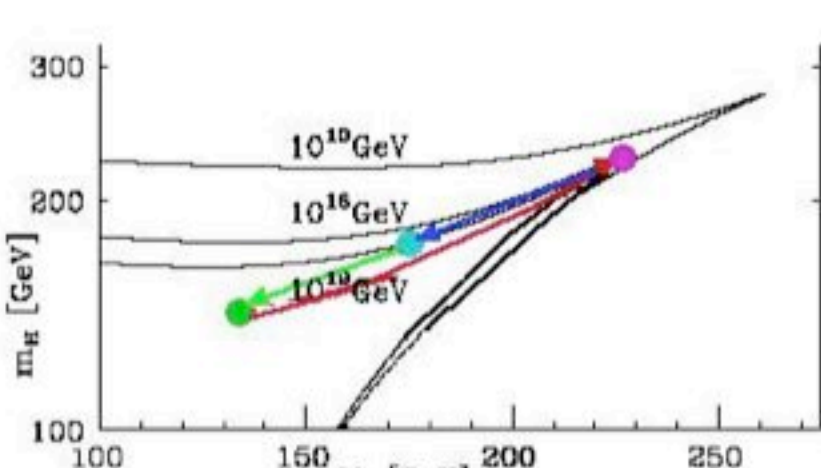
$$8\text{-HyperCube} = 256 \text{ vertices} = 1 + 8 + 28 + 56 + (8+48) + (3+3) + 56 + 28 + 8 + 1$$



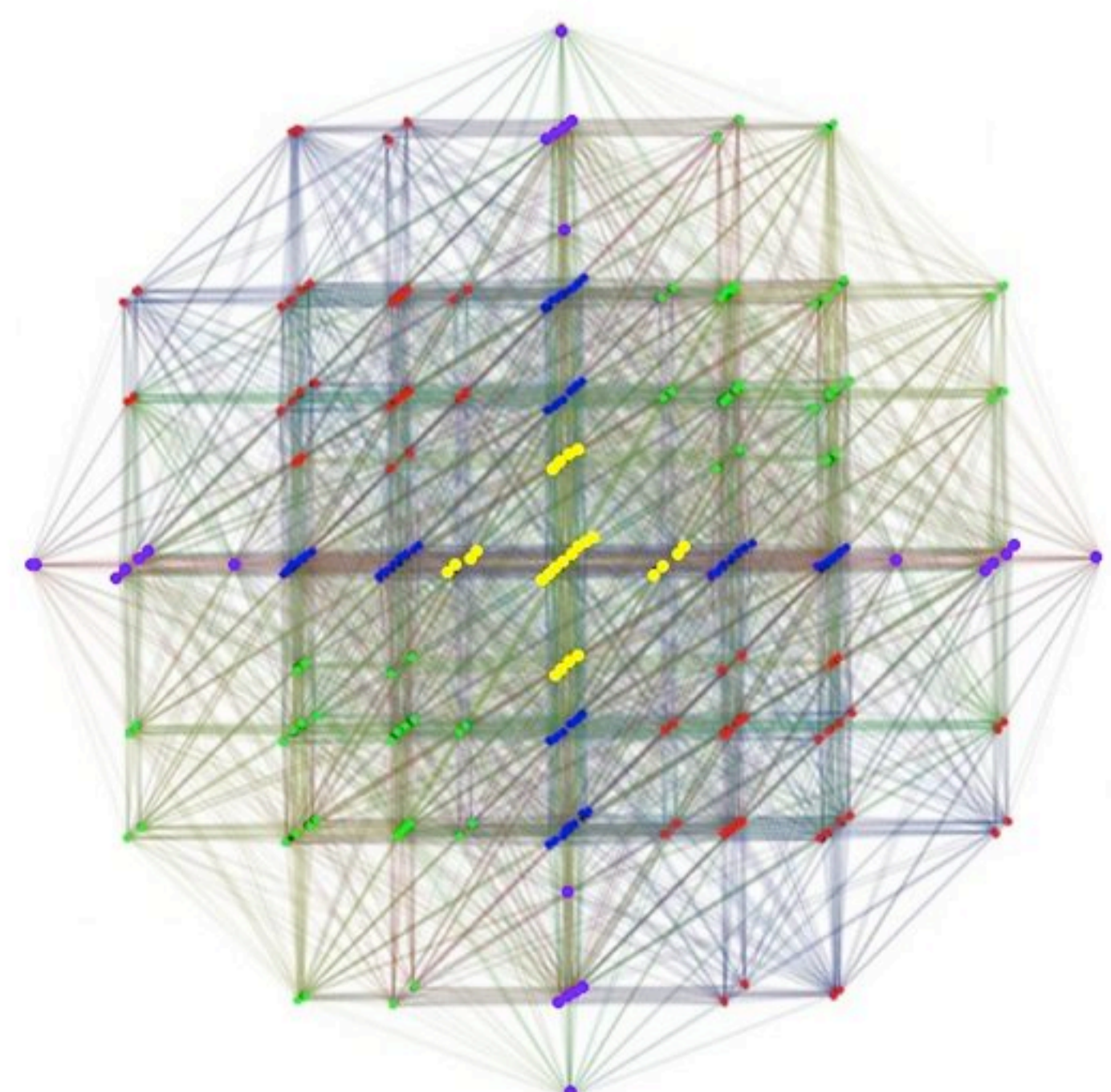
$$E8 \text{ Lie Algebra} = 120+128 = 248 \text{ vertices} = 8 + 28 + 56 + (28+8+28) + 56 + 28 + 8$$

E8 Physics

- The resulting E8 Physics Model has:
- EPR structure similar to that of Joy Christian;
- E8 structure modified from that of Garrett Lisi;
- Cl(16) = Cl(8)xCl(8) Clifford Algebra structure anticipated by Ramon Llull;
- Higgs mechanism produced by formation of M4 x CP2 spacetime as shown by work of Meinhard Mayer;
- Standard Model Gauge Groups produced therein as shown by work of N. A. Batakis;
- Conformal Gravity produced as in the MacDowell-Mansouri mechanism;
- Dark Energy : Dark Matter : Ordinary Matter ratio 75 : 21 : 4 produced by conformal structures similar to those of Irving Ezra Segal;
- Force Strength and Particle Mass calculations done using the Work of Hua Luogeng, particularly work on the Geometry of Complex Domains;
- T-quark composite Higgs model based on the work of Yamawaki et al, resulting in a 3-state T-quark - Higgs system;



and Algebraic Quantum Field Theory (AQFT) constructed from a Clifford Real-Periodicity-8 hyperfinite II1 von Neumann algebra factor.



$$E8 \text{ Root Vectors} = 112+128 = 240 = 8 + 28 + 56 + (24+8+24) + 56 + 28 + 8$$