Ramon Llull's Art and Structure of Nature

Frank Dodd (Tony) Smith, Jr. - 2016 - viXra 1611.xxxx

Abstract

Around 700 years ago Ramon Llull emerged from a cave in Mount Randa, Majorca, after receiving divine illumination inspiring him to produce a geometric art describing a universal science. The geometry of his art is an elaboration of IFA divination and the I Ching from the ancient past.
Now it is clear that nature is described by General Relativity and the Standard Model, which are unified by E8 geometry in the art of Real Clifford Algebras not only with structure inherited from IFA and the I Ching but also with Llullian art geometry.
Ramon Llull used his geometric art to show the unity of the religions he knew, Judaism, Christianity, and Islam, but he also knew that his art contained further possibilites, such as a unified model of the structure of nature, even though it would take 700 years for experimental and theoretical physics to advance enough to show clearly their relationship to Ramon Llull's geometric art.

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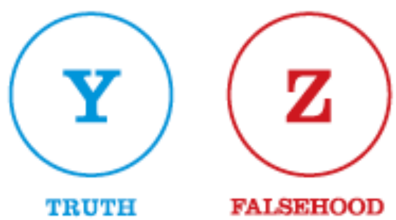
Anthony Bonner in his book The Art and Logic of Ramon Llull (Brill 2007)
(unless otherwise stated illustrations herein are adapted from that book) said:

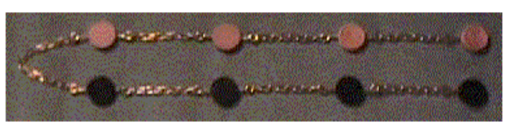
“... Llull wanted to make the Art “general to everyone” ...
“a religiously neutral universal science” ... for Llull the Art is not enclosed in its own shell, but ... can even be adapted to “many other principles of science” ...[and]... is full of further possibilities, of adaptations which the user is invited to try ...
In about 1283 Llull remodeled his system with the Ars demonstrativa
... within a much clearer and better organized format ...
Having lectured ... [on the Ars demonstrativa] in Paris,
and having observed the attitude of the students there,
he returned to Montpellier, where he once again wrote ... a book ... In this book, as well as in all others he wrote from then on, he used only four figures ...
because of the weakness of human intellect which he had witnessed in Paris ...”.

This paper describes how Llull’s original full Art describes the Structure of Nature.

Ramon Llull’s Y and Z Figures



are analagous to the binary structure of IFA



and to Chinese Yin and Yang of the I Ching

(image from www.friesian.com/yinyang.htm)

and can be seen as the basic fundamental elements generating Real Clifford Algebras which are the basis of E8 - Cl(16) physics described in viXra 1602.0319.

Ramon Llull's Figura Universalis has 13 Concentric Rings around a Star of David.

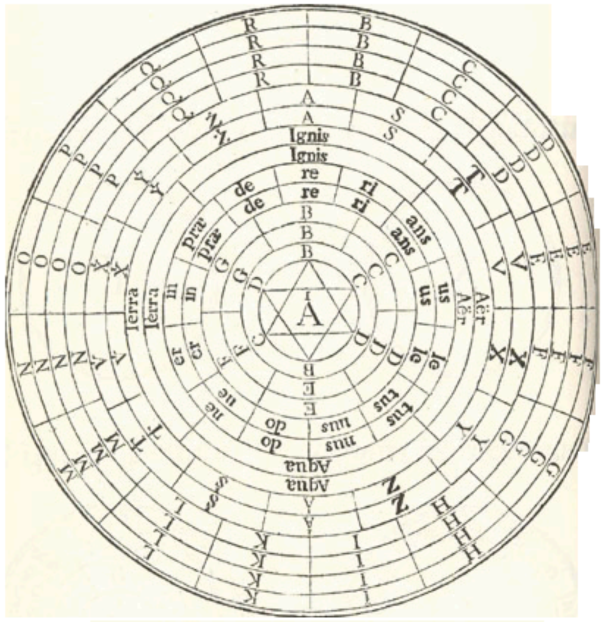


FIGURA UNIVERSALIS

(image from http://quisestlullus.narpan.net/82_figdemo.html)

Llull's 4 Outer Rings (Rings 1, 2, 3, 4) each have 16 subdivisions ...
16 is the dimension of Spinor Space of Cl(8) = M(16,R)
and Real Spinor Repesentation of its D4 BiVector Lie Algebra Spin(8),
and Spinor Space of Cl(2,4) = M(4,Q)
and Quaternionic Spinor Representation of the Conformal Group Spin(2,4) = SU(2,2).

There are 16x16 = 256 possible combinations of elements of 2 of the 4 Outer Rings.
256 = 2^8 = dimension of Real Clifford Algebra Cl(8).
(16 2) = 16x15 / 2 = 120 combinations of 2 distinct elements.

There are 16x16x16x16 = 256x256 = 65,536 possible combinations for 4 Outer Rings.
65,536 = 2^16 = dimension of Real Clifford Algebra Cl(16) = Cl(8) x Cl(8)
where the tensor factorization of Cl(16) is due to 8-Periodicity of Real Clifford Algebras.
(16 4) = 16x15x14x13 / 2x3x4 = 1,820 combinations of 4 distinct elements.

Llull's Rings 5 and 6 each have two sets of 7 subdivisions.
There are 14x14 = 196 possible combinations
(14 2) = 14x13 / 2 = 91 combinations of 2 distinct elements.

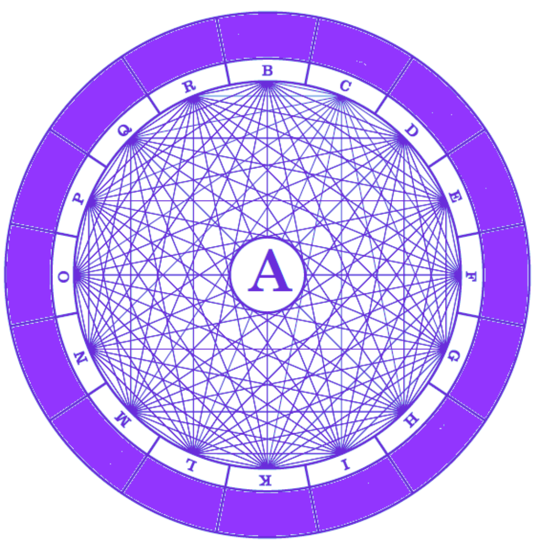
Llull's Rings 7 and 8 each have 4 subdivisions.
There are 4x4 = 16 possible combinations
(4 2) = 4x3 / 2 = 6 combinations of 2 distinct elements.
6 is the dimension of the Lorentz Group Spin(1,3).

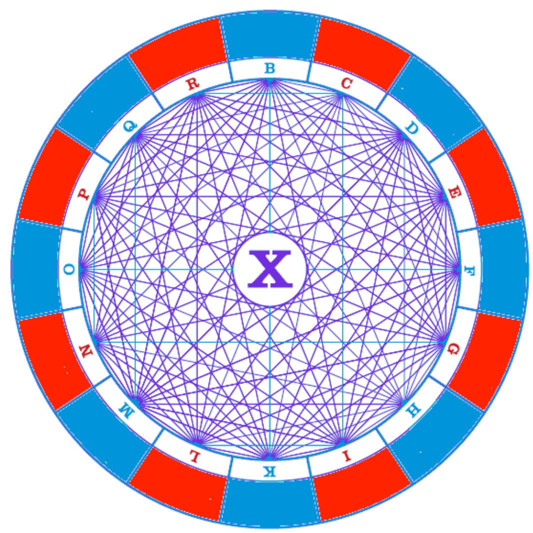
Llull's Rings 9 and 10 each have 13 subdivisions,
corresponding to the 13 Concentric Rings of the Figura Universalis itself.
There are 13x13 = 169 possible combinations
13 2) = 13x12 / 2 = 78 combinations of 2 distinct elements.
78 is the dimension of the exceptional Lie Group E6.

Llull's Rings 11 and 12 each have 6 subdivisions:
3 BDF corresponding to the Yang ∧ triangle of the Star of David
3 CEG corresponding to the Yin ∨ triangle of the Star of David.
The Yin and Yang correspond to Llull's wheels Y and Z.
There are 6x6 = 36 possible combinations
(6 2) = 6x5 / 2 = 15 combinations of 2 distinct elements.
15 is the dimension of the Conformal Group Spin(2,4) = SU(2,2).

Llull's Ring 13 has 6 subdivisions corresponding to the 6 vertices of the Star of David,
which can be seen as two triangles both labelled BCD.

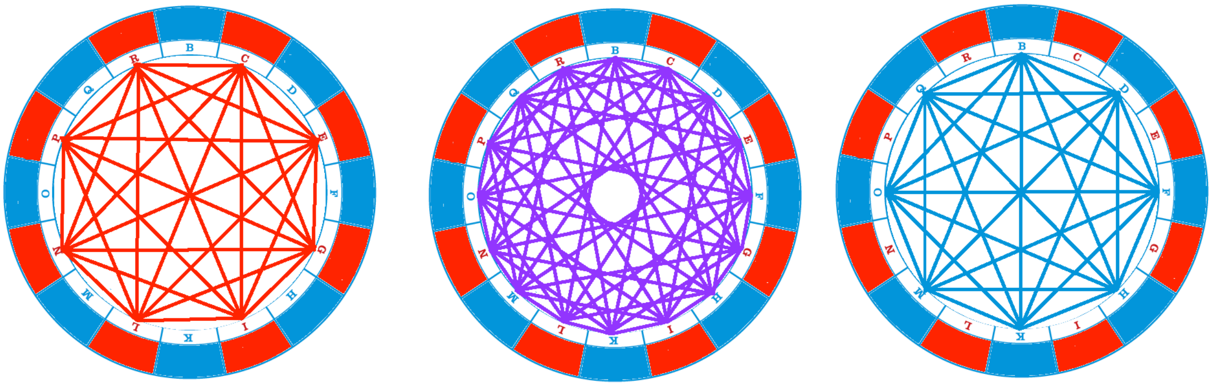
Ramon Llull's Wheels A and X





have 16 vertices and 120 lines connecting pairs of vertices,
corresponding to the 16 vectors of the Real Clifford Algebra Cl(16)
and the 120 bivectors of Cl(16) that generate the 120-dim D8 Lie Algebra.

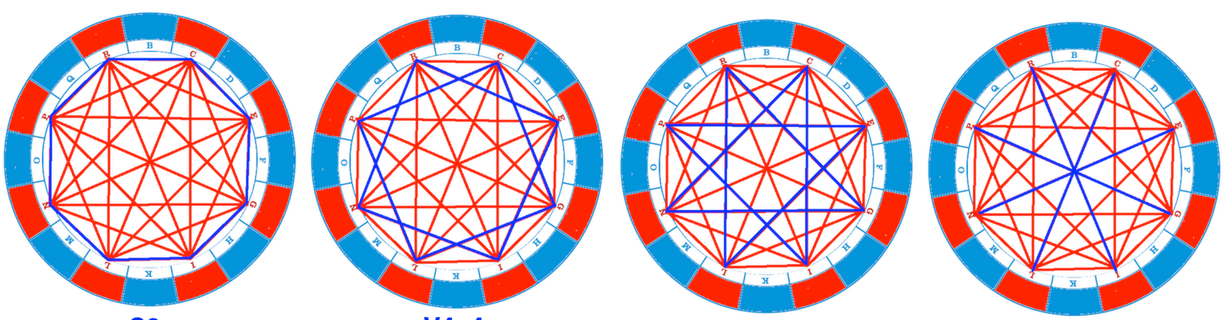
By 8-Periodicity of Real Clifford Algebras Cl(16) = tensor product Cl(8) x Cl(8)
so the 16 vectors of Cl(16) = 1 x 8 + 8 x 1 where 8 = 8 vectors of Cl(8)
and 8 of the 16 Wheel A vertices are the 8 blue vertices of Wheel X
and the other 8 Wheel A vertices are the 8 red vertices of Wheel X.



28 = 1 x 28 of the 120 D8 bivectors connect red vertices with red vertices
and represent the D4 Lie Algebra acting on the 8-dim Cl(8) vector space.
64 = 8 x 8 of the 120 D8 bivectors connect red vertices with blue vertices.
28 = 28 x 1 of the 120 D8 bivectors connect blue vertices with blue vertices
and represent the D4 Lie Algebra acting on the other 8-dim Cl(8) vector space.

The 28 red D4 connecting lines

fall into 4 groups:



S8+ V4+4 S8- T4

8 lines of S8+ = Octagon: 8-dim +half-spinor of D4 = Fermion Particles
4+4 lines of V4+4 = Two Squares: 8-dim vector of D4 = M4xCP2 K-K Spacetime
8 lines of S8- = Octagram: 8-dim -half-spinor of D4 = Fermion AntiParticles

S8+ and V4+4 and S8- are isomorphic by D4 Triality
4 lines of T4 = : 4-dim D4 Cartan Subalgebra
D4 + S8+ + V4+4 + S8- = 52-dim F4
F4 = (4+4)=8-dim Vector + 28-dim BiVector + (8+8)=16-dim Spinor of red Cl(8)

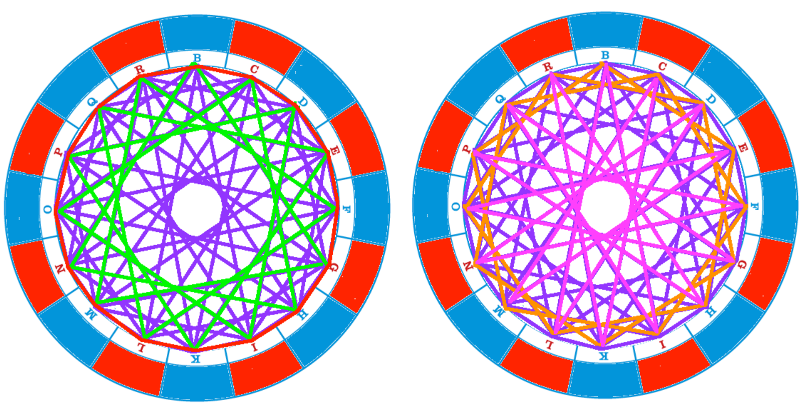
The 28 blue D4 connecting lines have similar structure leading to
F4 = (4+4)=8-dim Vector + 28-dim BiVector + (8+8)=16-dim Spinor of blue Cl(8)

Since Cl(16) = red Cl(8) x blue Cl(8) and F4 lives in Cl(8) and E8 lives in Cl(16)
248-dim E8 = 120 D8 BiVectors +128 D8 half-spinors is made up of red F4 x blue F4

As to the 120 D8 BV of E8
and the 8V + 28 BV of F4:
(red V8 x blue V8) + (red 1 x blue BV28) + (red BV28 x 1) = 64 + 28 + 28 = 120 D8 BV

As to the 128 D8 half-spinors of E8
and the 8 +half-spinors (S8+) + 8 -half-spinors (S8-) of F4
(red S8+ x blue S8+) + (red S8+ x blue S8-) +
+ (red S8- x blue S8+) + (red S8- x blue S8-)
Only (red S8+ x blue S8+) and (red S8- x blue S8-) are consistent +/- half-spinors
so they correspond to the 64+ and 64- = 128 D8 half-spinors of E8.

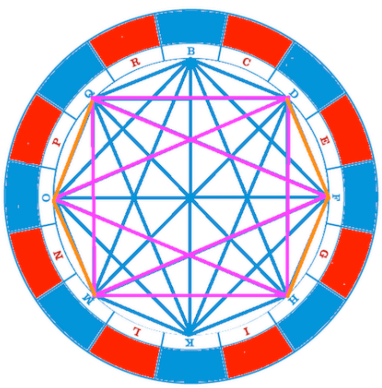
The 64 lines connecting red and blue = red V4+4 x blue V4+4 fall into 4 groups of 16

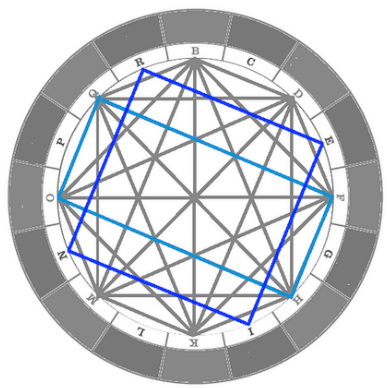


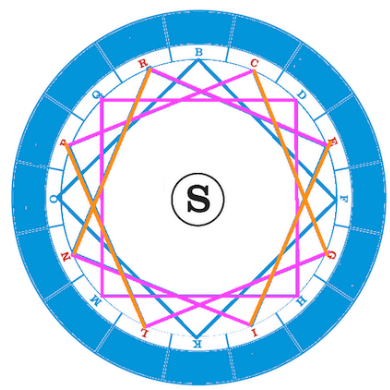
one 16-gon (red) and three 16-stars (orange, green, and magenta)
in which the cycle paths skip 0, 2, 4, 6 vertices, respectively.
so they correspond
individually to the 4x4 = 16-vertex Wheel S of the Standard Model + Translations
(described on the next page)
and collectively to the 4x16 = 64 elements of the Elemental Figure
(described in the last pages of this paper)

As to Ramon Llull’s Wheel S, the 28 blue D4 connecting lines

represent:
12 Standard Model generators - 8 SU(3) (magenta) and 4 U(2) (orange)
15 Gravity-Dark Energy Ghosts and 1 Propagator Phase (blue)





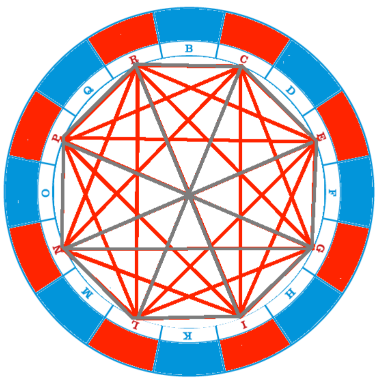


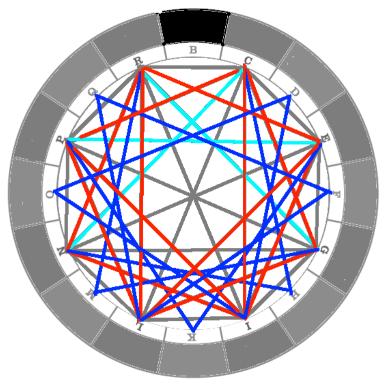
Ramon LLull’s Wheel S is formed by
morphing the 2 rectangles with orange sides into 2 squares whose 8 vertices
are sectors that were red in Wheel X but are changed to blue
so that Wheel S has 16 blue vertices, 12 from the morphed Standard Model lines
and 4 (blue) from the Translation Part of the 15 Gravity-Dark Energy Ghosts.

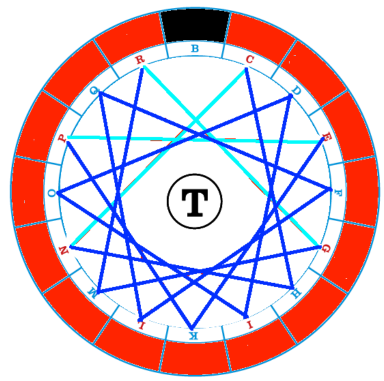
As Anthony Bonner says in his book, “... there were similarities of structure (both figures consist of four squares) and function between the Elemental Figure and Figure S ...
he says that “the Elemental Figure . . . is the mirror and image of S and its powers” ...”.

As to Ramon Llull’s Wheel T, the 28 red D4 connecting lines

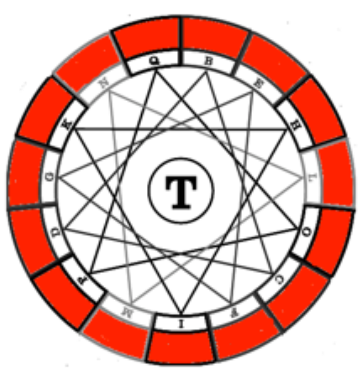
represent:
15 Gravity-Dark Energy generators
1 Propagator Phase + 12 Standard Model Ghosts (gray)



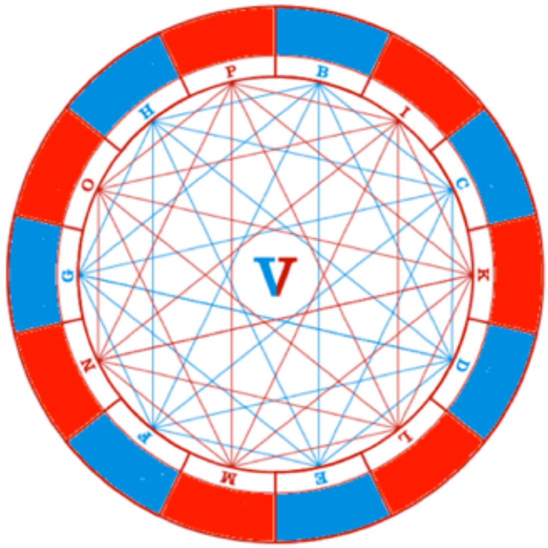




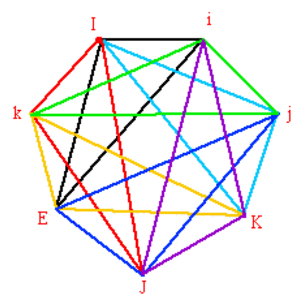
Ramon LLull’s Wheel T is formed by
keeping the 3 cyan lines as is and replacing the 12 red lines
with 12 blue lines connecting to blue vertices which are changed to red
and
by deleting the black vertex, leaving 15 red vertices for Wheel T.



Ramon Llull's Wheels A, X, and S have 16 vertices. Wheel T has 15 vertices.
Wheel V has 14 vertices: 7 red vertices and 7 blue vertices:



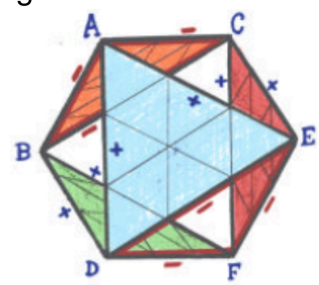
Each set of 7 vertices corresponds to the 7 Imaginary Octonion Basis Elements whose multiplication rules determine the 480 different Octonion Products.
Start with the 7 imaginary octonions i, j, k, E, I, J, K.
This includes 1, since ii = jj = ... = -1.
You have 2^7 = 128 sign changes.
You have 7! = 2x3x4x5x6x7 permutation changes.
However, all 128 x 7! changes do NOT give different multiplication tables.
Of the 128 sign changes,
the 2^3 = 8 changes of i, j, and E do NOT give a different multiplication.
Of the 7! permutation changes,
those preserving the group PSL(2,7) = SL(3,2) do NOT give a different multiplication.
The order of PSL(2,7) is 2^3 x 3 x 7 = 168.
It is the group of linear fractional transformations of the vertices of a heptagon



The number of different multiplications due to sign changes and permutations is:
128 x 2 x 3 x 4 x 5 x 6 x 7 / 8 x 2 x 2 x 2 x 3 x 7 = 16 x 5 x 6 = 480
The 480 multiplications are made up of two sets of 240 each,
a product in one set being found in the reverse order in the other set.

Two sets of 7 vertices, as in Wheel 7, describe 16-dim Sedenion Products.
Sedenions have Zero Divisors with geometry discussed by Robert de Marrais.

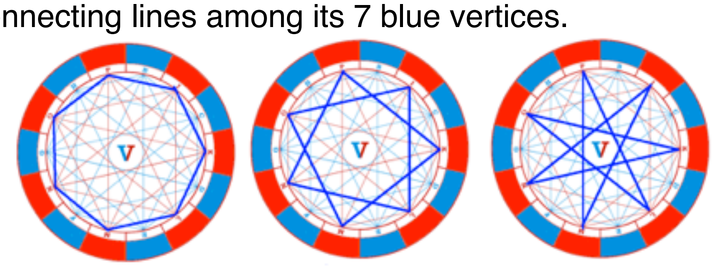
Robert de Marrais said in math/0011260 The 42 Assessors ...
Diagonal Axis-Pair Systems of Zero-Divisors in the Sedenions’ 16 Dimensions:
“... the “42 Assessors” of the Egyptian Book of the Dead ...
sit in two rows of 21 along opposite walls of the Hall of Judgement ...
the Tibetan Book of the Dead’s “42 Peaceful Buddhas.” ...
In math/0207003 Robert de Marrais said
“... All points on the pairs of diagonal line elements of ... planes ... the “42 Assessors” ...



Strut Const	Assessors at Box-Kite Vertices A	B	C	D	E	F
1	3, 10	6, 15	5, 12	4, 13	7, 14	2, 11
2	1, 11	7, 13	6, 12	4, 14	5, 15	3, 9
3	2, 9	5, 14	7, 12	4, 15	6, 13	1, 10
4	1, 13	2, 14	3, 15	7, 11	6, 10	5, 9
5	2, 15	4, 9	6, 11	3, 14	1, 12	7, 10
6	3, 13	4, 10	7, 9	1, 15	2, 12	5, 11
7	1, 14	4, 11	5, 10	2, 13	3, 12	6, 9

... in Sedenion space mutually zero-divide all other such points on certain other such diagonals ... any combination of a pure Octonion (index < 8), and a pure Sedenion (index > 8) which was not the XOR of the Octonion with 8, yielded one of 7 x 6 = 42 possible axis-pairs to span Assessor planes. Representing each such plane by a unique vertex, on one of 7 isomorphic octahedral lattices, resulted in a set of “box-kites” whose 8 triangular faces represented either 4 “sails” sharing vertices with each other but no edges, or 4 empty “vents” in the remaining 4 faces ... each of the 7 is uniquely associated with the one Octonion which does not appear among its 6 vertices. ...”.

The two rows of 21 of the 42 Assessors are in Wheel V
as the 21 red connecting lines among its 7 red vertices
and the 21 blue connecting lines among its 7 blue vertices.



Each set of 21 lines is a 7-gon and two 7-stars corresponding to S7 of the Octonions.

Each set of 21 lines plus its 7 vertices represents the 21+7 = 28-dim D4 Lie Algebra

28-dim D4 / 21-dim B3 = 7-dim Vector S7 of Cl(7)

21-dim B3 / 14-dim G2 = 7-dim Spinor S7 of Cl(7)

Ian Porteous in his book "Clifford Algebras and the Classical Groups" (Cambridge 1995) shows that there are three 21-dim B3 subgroups of D4 denoted as H0 , H1, and H2 all related by Triality and having a common subgroup G2.
H0 has the standard embedding in Spin(8) due to S7 = Spin(8) / Spin(7).
H1 and H2 have the Clifford embedding in Spin(8) due to S7 = Spin(7) / G2.
There are 2 Clifford embeddings, corresponding to + and - half-spinors of Spin(8).

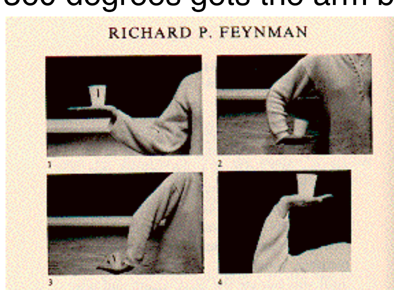
Physically, D4 / H1 and D4 / H2 represent
7 of the 8 +half-spinor first-generation fermion particles

i = Red Up Quark
j = Green Up Quark
k = Blue Up Quark
E = Electron
I = Red Down Quark
J = Green Down Quark
K = Blue Down Quark

and the corresponding 7 of 8 -half-spinor fermion antiparticles.
The tree-level-massless Neutrino and AntiNeutrino
are represented by 1 and not by Imaginary Octonion basis elements.

The different handednesses of the + and - half-spinor particles and antiparticles are due to different connections with their ambient 8-dim spacetimes as described mathematically by their different G2 Octonion Automorphism subgroups of D4.

A 3-space-dimensional example of Spin-Connection-With-Surroundings shows a cup held by a dancer in one hand. Rotating the cup by 360 degrees gets the arm twisted, but turning the cup another 360 degrees gets the arm back straight:



(image from Feynman's 1986 Dirac Memorial Lecture)

Ramon Llull's Elemental Figure is not Circular, but has 4x4x4 Cube Structure:

The Figure of Fire (heat)

fire	air	water	earth
air	fire	earth	water
water	earth	fire	air
earth	water	air	fire

The Figure of Air (moisture)

air	fire	water	earth
fire	air	earth	water
water	earth	air	fire
earth	water	fire	air

The Figure of Water (cold)

water	earth	air	fire
earth	water	fire	air
air	fire	water	earth
fire	air	earth	water

The Figure of Earth (dryness)

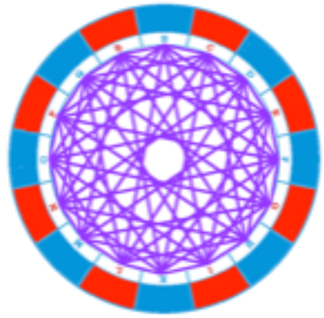
earth	water	air	fire
water	earth	fire	air
air	fire	earth	water
fire	air	water	earth

Elemental Figure

As Anthony Bonner says in his book, "... there were similarities of structure (both figures consist of four squares) and function between the Elemental Figure and Figure S ... he says that "the Elemental Figure . . . is the mirror and image of S and its powers" ... This Elemental Figure is of primary importance to the Art, for by means of it the artist is led to knowledge of the other figures. ...".

Three copies of the 64-element Elementary Figure represent components of E8
that are related by Triality:

64 of the 120 generators of the D8 Lie Subalgebra of E8



which correspond to 64-dim U(8) which is the central part of E8 Maximal Contraction
generalized Heisenberg Algebra h92 x A7 = 28 + 64 + (SL(8,R)+1) + 64 + 28
whose SL(8,R) describes Unimodular Gravity in Octonionic 8-dim Spacetime.

64+ and **64**- of the 64+64 = 128 D8 half-spinors of E8 describe
8 components of 8 Fermion particles + 8 components of 8 Fermion AntiParticles
with each of 64+ and 64- represented by the 64-dim Elementary Figure

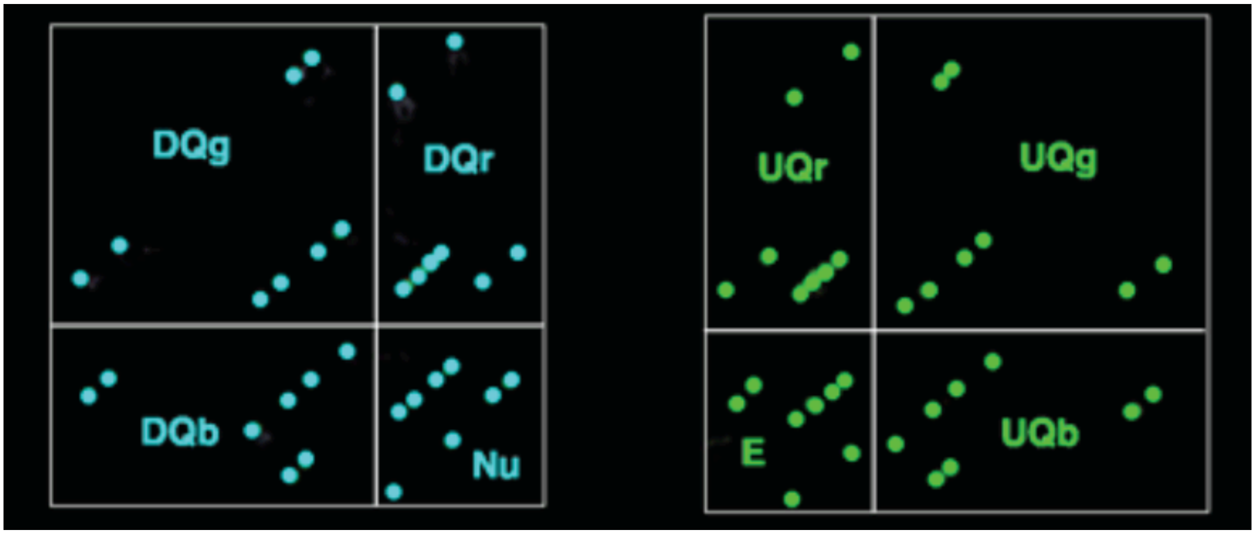
Since Cl(16) = red Cl(8) x blue Cl(8) and F4 lives in Cl(8) and E8 lives in Cl(16)
E8 contains 128 D8 half-spinors made up of red F4 x blue F4
Consider the 8 +half-spinors (S8+) + 8 -half-spinors (S8-) of red F4 and blue F4
(red S8+ x blue S8+) + (red S8+ x blue S8-) +
+ (red S8- x blue S8+) + (red S8- x blue S8-)
Only (**red S8+ x blue S8+**) and (**red S8- x blue S8-**) are consistent +/- half-spinors
so they correspond to the 64+ and 64- = 128 D8 half-spinors of E8.

Cl(16) = Cl(8) x Cl(8) = M(16x16,R) = M(256,R) = 256x256 Real Matrices
whose spinors are (128+128) = 256-dim
248-dim E8 = 120-dim D8 BiVectors of Cl(16) + 128-dim half-spinors of Cl(16)
128-dim half-spinors of Cl(16) = 64 + 64 = 8x8 + 8x8 = 4x4x4 + 4x4x4

Reducing Octonionic to Quaternionic Structure reduces 8-dim Octonionic Spacetime
to (4+4)-dim Kaluza-Klein M4 x CP2 Spacetime
in which 4-dim M4 Physical Spacetime is acted on by Cl(2,4) of the Conformal Group
and CP2 = SU(3) / U(2) is related to SU(4) = D3 = BiVector Algebra of Cl(6,0).

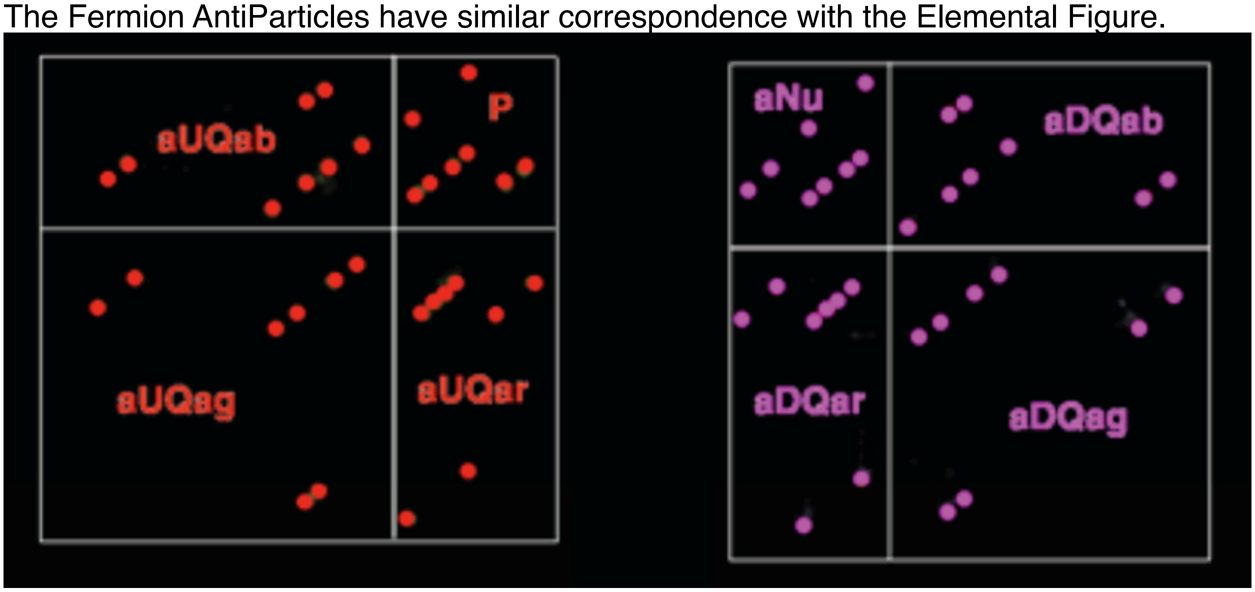
In E8 - Cl(16) physics (see viXra 1602.0319 for details) each Fermion
has 8 components with respect to 4+4 dim Kaluza-Klein M4 x CP2 Spacetime.

The E8 Root Vector Pattern for the 8 fundamental Fermion Particles



where 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
falls into a 2 x 4 pattern with each of the 8 cells having 4+4 components of its Fermion.
If you split each of the 8 cells into 4 M4 components and 4 CP2 components.
Since both M4 and CP2 have Quaternionic 4-dim structure,
you have a Quaternionic set of four 4x4 cells corresponding to the 4x4x4 structure
of the Elemental Figure and M(4,Q) = 4x4 Quaternionic Matrices of Cl(2,4) and Cl(6,0).

The Fermion AntiParticles have similar correspondence with the Elemental Figure.



where 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