**Symmetry model E9CS**

by Mag.rer.nat. Kronberger Reinhard  
Email: support@kro4pro.com  
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**Motivation 1:**

Why do we consider the E9 group (more specifically the Coxeter element of this group)?
1) E9 is an affine group and thus has something to do with extension.
2) The extension is flat as the universe.
3) The key Coxeter element of the group produces symmetries involving our current standard model.

The fundamentals here:

https://en.wikipedia.org/wiki/Coxeter_group  
https://de.wikipedia.org/wiki/Wurzelsystem  
http://home.mathematik.uni-freiburg.de/soergel/Skripten/XXSPIEG.pdf

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Symmetries which arise from the Coxeter element of the E9.

\[ E9CS = SU(5) \times SU(3) \times SU(2) \times U(1) \times U(1) \]  
(SU(n) = Special unitary group, U(1) unitary group)

Pronounced E9Coxeter-Symmetry  
Maybe someone find it interesting that the series of the dimension of the Liegroups of E9CS are the first fibonacci numbers 1,1,2,3,5,8,13,....

\[ \text{evidently } SU(5) \times SU(3) \times SU(2) \times U(1) \times U(1) \supset SU(3)c \times SU(2)l \times U(1)r \] (Color charge, isospin, Hyper charge)

Write the symmetry in order to:

\[ E9CS = SU(5)_s \times U(1)_Y2 \times U(1)_Y1 \times SU(2)_L \times SU(3)_c \]  
(=Expansion x actual Standard Model)

Dynkin Diagram E9 (affine one point extension of group E8):

![Dynkin Diagram E9](image)

Derivative of the symmetries of E9CS from the invariants of the Coxeter elements E9:

The Coxeter element is the product of the generating reflections of E9.

\[ \text{Coxeterelement} = e1.e2.e3.e4.e5.e6.e7.e8.e9 \]

The Coxeterpolynom is the characteristic polynomial of Coxeter elements and has the form:

\[ E_9(x) = \frac{x^5 - 1}{x - 1} \times \frac{x^3 - 1}{x - 1} \times \frac{x^2 - 1}{x - 1} \times (x - 1)^2 \]

\[ E9CS = SU(5) \times SU(3) \times SU(2) \times U(1)^2 \]

\[ E_9(x) \ldots \text{characteristical polynom of the coxeterelement of E9} \]
\( E_n(x) \) is a polynomial with terms of cyclotomic factors \( z_n = \frac{x^n - 1}{x - 1} \) for \( n > 1 \) and \( (x-1) \) for \( n = 1 \).
The cyclotomic factors are the characteristic polynomial of the An-1 (which is the Dynkin diagram for the SU(n) Lie group). See more here: https://en.wikipedia.org/wiki/Special_unitary_group.
So finally the symmetry space of the Coxeter element is \( SU(5) \times SU(3) \times SU(2) \times U(1) \times U(1) \).

**Eigenvalues of the Coxeter polynomial**

- \( \zeta_2 = e^{\frac{2\pi i}{5}} \)
- \( \zeta_3 = e^{\frac{2\pi i}{3}} \)
- \( \zeta_4 = e^{\frac{2\pi i}{4}} \)
- \( \zeta_1 = e^{\frac{2\pi i}{3}} \)
- \( \zeta_1 = 1 \)

**Eigenspace of the Coxeter polynomial**

\( \mathbb{C}^4 \times \mathbb{C}^2 \times \mathbb{C}^3 \times \mathbb{C}^3 \)

Maybe someone finds it interesting that:

The 3 exceptional affine Coxeter groups (one point extensions)

<table>
<thead>
<tr>
<th>Dynkin diagram</th>
<th>Symmetry of the Coxeter element</th>
<th>Particles-Generations</th>
</tr>
</thead>
<tbody>
<tr>
<td>E_6</td>
<td>( U(1) \times U(1) \times SU(2) \times SU(3) \times SU(3) )</td>
<td>tau, tau-neutrino, top, bottom quarks</td>
</tr>
<tr>
<td>E_7</td>
<td>( U(1) \times U(1) \times SU(2) \times SU(3) \times SU(4) )</td>
<td>muon, muon-neutrino, charm, strange quarks</td>
</tr>
<tr>
<td>E_8</td>
<td>( U(1) \times U(1) \times SU(2) \times SU(3) \times SU(5) )</td>
<td>electron, electron-neutrino, up, down quarks</td>
</tr>
</tbody>
</table>

This 3 groups have in common the symmetry \( U(1) \times U(1) \times SU(2) \times SU(3) \)
So maybe this is the reason for the 3 Generations of particles.

**Motivation 2:**

What bring us the additional symmetries?

1. These have the potential to describe new particles.
2. These have the potential to describe the space and time.
3. These have the potential to describe gravity.

Wish to analogously represent Graviton to the photon as a blend (Weinberg angle).
Idea

Light and gravitation just like photon and graviton have something in common. Both are massless and propagate with the speed of light.

We know that light by the symmetry breaking 1: SU(2)xU(1)--> U(1) is described as a mixture. So light is a part of the electro-weak interactions.

we consider analog gravity as a result of a further symmetry breaking

Symmetry breaking 2: SU(5)xU(1)xU(1) --> U(1)xU(1).

Our extended standard model allows us this. Thus gravity then is part of a gravity-superweak interactions.

We will now like to assign our relevant SU(n)'s algebras division (real numbers, complex numbers, ...).

\[ SU(1) \leftrightarrow \mathbb{R} \]
\[ SU(2) \leftrightarrow \mathbb{C} \]
\[ SU(3) \leftrightarrow \mathbb{H} \]
\[ SU(5) \leftrightarrow \mathbb{O} \]

This 4 division algebras (real numbers, complex numbers, quaternions and octonions) develop through the doubling process.

see more at https://de.wikipedia.org/wiki/Verdopplungsverfahren

Considering the dimensions of the SU(2) = 1, SU(3)= 2, SU(5) = 4 then this is double as well.

There appears to be a connection between the division algebras and the SU(n)'s (n = 2,3,5) which I hope is known in analytic geometry or another area.

I assume this connection warrants as simply as given.

Notes but no clear allocation can be found in this direction at Corinne A. Manogue and Tevian Dray, John Baez, etc.

Therefore, we rely analogously on the Higgsfield (2 x complex = doublet)

\[ \phi = \begin{bmatrix} \phi^0 \\ \phi^1 + i \phi^2 \end{bmatrix} \]

\[ \phi = \begin{bmatrix} \phi^0 \\ \phi^1 + i \phi^2 \\ \phi^3 + i \phi^4 \\ \phi^5 + i \phi^6 \end{bmatrix} \]

or written otherwise so that the equivalence to the Higgs field is clear (where i4 is pulled from)

\[ \phi = \begin{bmatrix} \phi^0 \\ \phi^1 + i \phi^2 \\ \phi^3 + i \phi^4 \\ \phi^5 + i \phi^6 \\ \phi^7 + i \phi^8 \end{bmatrix} \]

\[ \phi = \begin{bmatrix} \phi^0 \\ \phi^1 + i \phi^2 \\ \phi^3 + i \phi^4 \\ \phi^5 + i \phi^6 \\ \phi^7 + i \phi^8 \\ \phi^9 + i \phi^{10} \end{bmatrix} \]

Comparison

Oktoquintenfield & Higgsfield

\[ \phi = \begin{bmatrix} \phi^0 \\ \phi^1 + i \phi^2 \end{bmatrix} \]

This provides 40 degrees of freedom.

24 of which will be "spent" for our SU(5) tensor bosons for the 5th longitudinal spin degree of freedom (24 Goldstone bosons swallowed over gauge transformation) thus remain 16 left.

The S, F, R, G and H charges are the 5 charges of the SU (5) analogous to the 3 color charges of SU (3) and the 2 charges (+ .-) of SU (2).

The letters stand for S = See, F = feeling, R=smelling G = Taste and H = Hear

Calling therefore the charges of the SU (5) sense charges.

Note: These charges have (such as the color charges of quarks with color) nothing to do with the senses, but to give a
We now want to look at the 16 (40-24 = 16) remaining degrees of freedom. 

Make the following division for the 40 field components of the Oktoquinten field as a physical approach:

Analogeous to the Higgspotential we declare a Potential on the Oktoquintenfield

<3>

Potential Oktoquintenfield
\[ V(\phi) = \frac{\eta^2}{4} |\phi|^6 + \gamma^2 |\phi|^4 + \frac{\mu^2}{4} |\phi|^4 + \frac{\lambda^2}{8} |\phi|^8 \quad \text{with} \quad \phi \in \mathbb{C}^n \]

\[ \eta, \mu \in i\mathbb{R} \text{ (imagineer) and} \]
\[ \gamma, \lambda \in \mathbb{R} \]

Here the graph is drawn with \( \eta = 0 \) otherwise the graph is shifted down.

Top view of rotated function overhead.
Maxima and minima draw 1 point and two cycles.
The SU(5) Bosons couples to the extremumvalue $e_2$ which is tachyonic as shown in the picture above. Then they have imaginary massdensity.

It seems that it is possible that dark matter consists of tachyons.

See the work of Charles Schwartz about "Tachyons in General Relativity"


**A picture of the density and speeds of the SU(5) tachyonic Bosons in a gravitational field (source).**

![Picture of the density and speeds of the SU(5) tachyonic Bosons in a gravitational field](source)

The effect of the speed changing is ordinary the same as a traffic jam and has the shape of a halo. We have a higher density of tachyons near to the source and lower density far from the source.

But we have also think about the graviation which comes from the tachyons (SU(5) Bosons) itself and about the contrary force which comes from the charges of the SU(5) Bosons!

- Slower tachyons (against speed of light), the coloring shows the density of the tachyons which comes from the deceleration of the tachyons near gravitational sources.
- The same effect which arises in traffic jams or in curves.
- High speed tachyons (against infinitely)
Further calculations are with $\eta = 0$

$$V(\phi) = \frac{\eta^2}{2} \left| \phi \right|^2 + \frac{\gamma^2}{2} \left| \phi \right|^2 + \frac{\mu^2}{4} \left| \phi \right|^4 + \frac{\lambda^2}{8} \left| \phi \right|^8$$

$$V(c) = \frac{\eta^2}{2} + \frac{(\mu c^2)^2}{4} + \frac{(\lambda c^4)^2}{8} = (\eta c^2 + (\gamma c^2)^2 + (\mu c^2)^2 + (\lambda c^4)^2 = 0$$

if we interpret

$\eta$ = energy density ...

$\gamma$ = momentum density ...

$\mu$ = imaginary mass density ...

$\lambda$ = spin density ...

then we can write the potential in the form

$$V(c) = E^2 = (c^2 + (p.c)^2 + (m.c)^2 - (h.c)^4)$$

- well known relativistic energy mass momentum relation

$$V(c) = E^2 = E \cdot E = (c + i_1 p.c + i_3 m.c^3 + i_3 h.c^4) \cdot (c - i_1 p.c - i_3 m.c^3 - i_3 h.c^4)$$

with $c, p, m, h \in \mathbb{C}$ ($c, m$ imaginary and $p, h$ real)

$E \in \mathbb{R}$ Quaternions

Further calculations are with $\eta = 0$

The coefficients of the potential comes from self interactions.

Therefore we make the assumption that we have the following relation:

$$C := \frac{-\mu^2}{\lambda^2} = \frac{4}{\mu^2} \lambda^2 > 0; \gamma^2 > 0; \mu^2 < 0$$

To get the maxima, minima and the zeropoints of the potential we have to substitute $z = \phi^2$ it is enough (because of symmetry) to take a look on the positive $\phi$'s.

and solve the cubic equations in the bracket

$$V(\sqrt{z}) = z(\frac{\gamma^2}{2} + \frac{\mu^2}{4} z + \frac{\lambda^2}{8} z^3)$$

$$V'(\sqrt{z}) = \sqrt{z}(\gamma^2 + \mu^2 z + \lambda^2 z^3)$$

We will make it short and write the results.

First the Zeropoints:

$$z_1 = u + v = \sqrt{\frac{-C}{3}} \left( \sqrt{\frac{-27}{32} - i \frac{\sqrt{5}}{4}} + \sqrt{\frac{27}{32} + i \frac{\sqrt{5}}{4}} \right)$$

$$z_2 = \epsilon_1 u + \epsilon_2 v$$

$$z_3 = \epsilon_2 u + \epsilon_1 v$$

Where $\epsilon_1 = \frac{1}{2} + \frac{i}{2} \sqrt{3}$ and $\epsilon_2 = \frac{1}{2} - \frac{i}{2} \sqrt{3}$
\[ z_1 = -0.990839414 \times 2. \sqrt[3]{\frac{C}{3}} \]
\[ z_2 = 0.378466979 \times 2. \sqrt[3]{\frac{C}{3}} \]
\[ z_3 = 0.612372435 \times 2. \sqrt[3]{\frac{C}{3}} \]

then the zeropoints are
\[ \phi_1 = -0.995409169 \times \sqrt[3]{\frac{4C}{3}} \]
\[ \phi_2 = 0.615196699 \times \sqrt[3]{\frac{4C}{3}} \]
\[ \phi_3 = 0.782542290 \times \sqrt[3]{\frac{4C}{3}} \]

Then the Maxima and the Minima:

\[ z_1 = u + v = -\sqrt[3]{\frac{C}{2.3}} \left( i \sqrt[3]{\frac{\sqrt{37} - i \sqrt{27}}{\sqrt{64}}} + i \sqrt[3]{\frac{\sqrt{37} + i \sqrt{27}}{\sqrt{64}}} \right) \]
\[ z_2 = \zeta_1 u + \zeta_2 v \]
\[ z_3 = \zeta_3 u + \zeta_1 v \]

Finally we have two positive results:
\[ z_{\text{max}} = 0.233475630 \times 2. \sqrt[3]{\frac{C}{2.3}} \text{ and} \]
\[ z_{\text{min}} = 0.725359244 \times 2. \sqrt[3]{\frac{C}{2.3}} \]

and one negative
\[ z_3 = -(z_{\text{max}} + z_{\text{min}}) \]

Then because of \( z = \phi^3 \)
\[ \phi_{\text{max}} = 0.483193160 \times \sqrt[3]{\frac{2C}{3}} \text{ and} \]
\[ \phi_{\text{min}} = 0.8516765489 \times \sqrt[3]{\frac{2C}{3}} \]

In cubic equations the real zeropoints comes from the cos(\( \alpha \)) or from sin(90-\( \alpha \)) of angles (see https://en.wikipedia.org/wiki/Cubic_function).

Then for \( \phi_{\text{max}} \) we get an angle \( \alpha_{\text{max}} \):
\[ \phi_{\text{max}} = 0.483193160 \times \sqrt[3]{\frac{2C}{3}} = \sin(28, 894160846) \times \sqrt[3]{\frac{2C}{3}} \]
\[ \alpha_{\text{max}} = 28, 894160846 \text{ degrees is very near to the Weinberg angle} \]
\[ \sin^2(\alpha_{\text{max}}) = \sin^2(28, 894160846) = 0.233475630 \]

and for \( \phi_{\text{min}} \) we get an angle
\[ \phi_{\text{min}} = 0.8516765489 \times \sqrt[3]{\frac{2C}{3}} = \sin(121, 605508985) \times \sqrt[3]{\frac{2C}{3}} \]
\[ \alpha_{\text{min}} = 121, 605508985 \text{ degrees} \]
$\phi_{\text{max}} = 0.483193160 \times \sqrt[3]{\frac{2C}{3}}$ and
$\phi_{\text{min}} = 0.8516765489 \times \sqrt[3]{\frac{2C}{3}}$

In cubic equations the real zeropoints comes from the $\cos(\alpha)$ or from $\sin(90-\alpha)$ of angles (see https://en.wikipedia.org/wiki/Cubic_function).

Our second extreme value $L_1$ is at $\phi_1$.
With the relation above we can calculate the third extreme value $L_2$.

$\phi_{\text{min}} = 1.762600... \times \phi_1$

**Geometric interpretation of the roots (zeropoints) in cubic equations with 3 real zeropoints**

![Diagram of geometric interpretation](image)

By knowing the zeropoints you know up to a constant the whole polynomial.
The form of the polynomial of degree 3 is:

$P(z) = C.(z - z_1).(z - z_2).(z - z_3)$ with $z_0, z_1, z_3$ zeropoints

Then in our case the derivation of the potential has the form:

$V'(\sqrt{z}) = \sqrt{z}.(\gamma^2 + \mu^2.z + \lambda^2.z^3)$
$= C.\sqrt{z}.(z - z_{\text{max}}).(z - z_{\text{min}}).z(z_{\text{max}} + z_{\text{min}})$

Substituting $\phi^2 = z$ results in

$V'(\phi) = \phi.(\gamma^2 + \mu^2.\phi^2 + \lambda^2.\phi^3)$ and

$V'(\phi) = C.\phi.(\phi^2 - e_1^2).(\phi^2 - 1.762600...e_1^2)(\phi^2 + e_1^2(1 + 1.762600...^2))$

Define the factor as $1.762600...^2 =: \varsigma$
Comparison of the coefficients leads to

\[ \gamma^2 = C \cdot e_1 \cdot (1 + \varsigma) \]
\[ \mu^2 = -C \cdot e_1^4 \cdot (1 + \varsigma \cdot (1 + \varsigma)) \]
\[ \lambda^2 = C \]

Then our potential has the form

\[ V(\phi) = \frac{\gamma^2}{2} |\phi|^2 + \frac{\mu^2}{4} |\phi|^4 + \frac{\lambda^2}{8} |\phi|^8 \]
\[ V(\phi) = C \cdot \left( e_1 \cdot (1 + \varsigma) \right) |\phi|^2 - \left( e_1^4 \cdot (1 + \varsigma \cdot (1 + \varsigma)) \right) |\phi|^4 + \frac{1}{8} |\phi|^8 \]

\[ C \ldots \text{constant} \]

with the zero point and the maximum point it follows
\[ e_1 = c \times 0,6604642002662940290244296815477 \quad c \ldots \text{speed of light} \]

With \( V(e_1) = \left( \frac{\Lambda e_1^4}{8\pi G} \right)^2 \) we can calculate the constant \( C \) and the coefficients \( \gamma, \mu, \lambda \) of the Oktoquinetpotential.

\[ C \approx \left( \frac{3\Lambda}{8\pi G} \right)^2 \]
\[ \lambda \approx \pm \left( \frac{3\Lambda}{8\pi G} \right) \]
\[ \mu \approx \pm i \cdot \frac{1.62\Lambda}{8\pi G} c^2 \]
\[ \gamma \approx \pm \frac{1.03\Lambda}{8\pi G} c^3 \]
\[ c \ldots \text{speed of light} \]
\[ G \ldots \text{Gravitation constant} \]
\[ \Lambda \ldots \text{cosmological constant} \]

**ENERGY-MOMENTUM TENSOR from the Oktoquinenfield**
Now we want to show the form of the Graviton

As mentioned in <1> we believe that we have a second symmetribreaking $SU(5) \times U(1) \times U(1) \rightarrow U(1) \times U(1)$

Analogeous to the light which is described as a mixture (rotation) of the neutral generator of $SU(2)$ $W_0$ and the generator of $U(1)$ $B_0$.

Symmetribreaking $SU(2) \times U(1) \rightarrow U(1)$

$$\begin{bmatrix} \gamma \\ Z_0 \end{bmatrix} = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} \cdot \begin{bmatrix} D_0 \\ W_0 \end{bmatrix}$$

We want to describe the graviton as a mixture (2 rotations) of the neutral generators $W_0, W_1, W_2, W_3$ of $SU(5)$ and the generators of $U(1) \times U(1)$ $B_0$ and $B_1$. 
\[
\begin{pmatrix}
\Gamma_0 \\
\Gamma_1 \\
Z_0 \\
Z_1 \\
Z_2 \\
Z_3
\end{pmatrix} = \left(\text{Rotationmatrix 2}\right) \cdot \left(\text{Rotationmatrix 1}\right) \cdot 
\begin{pmatrix}
B_0 \\
B_1 \\
W_0 \\
W_1 \\
W_2 \\
W_3
\end{pmatrix}
\]

We have two rotationmatrices because we have two \(U(1)\). The first is mixing the \(\{W_0, W_1, W_2, W_3\}\) with \(B_0\) and the second is mixing \(\{W_0, W_1, W_2, W_3\}\) with \(B_1\).

Rotations in \(\mathbb{R}^3\) spaces are defined by the rotation of the chosen plane. The plane is defined by two basis vectors \(g_1\) and \(g_2\). In our case, the first plane is defined by

\[
P_1 = g_1 \times g_2 = \left(0, 0, 0, 0, 0, 0\right) \times \frac{1}{2} \left(0, 0, 1, 1, 1, 1\right)
\]

\[
P_1 = \left([-B_0, 0, 0, 0, 0, 0, 0, [W_0], [W_1], [W_2], [W_3]]\right)
\]

and the second plane by

\[
P_2 = g_1 \times g_2 = \left(0, 0, 0, 0, 0, 0\right) \times \frac{1}{2} \left(0, 0, 1, 1, 1, 1\right)
\]

\[
P_2 = \left([B_1, 0, 0, 0, 0, 0, 0, [W_0], [W_1], [W_2], [W_3]]\right)
\]

Details here: \(\text{https://de.wikipedia.org/wiki/Drehmatrix}\)

It follows that the rotations have the form

\[
Rotation_1 = 
\begin{pmatrix}
\cos(\alpha_1) & 0 & \frac{1}{2}\sin(\alpha_1) & \frac{1}{2}\sin(\alpha_1) & \frac{1}{2}\sin(\alpha_1) & \frac{1}{2}\sin(\alpha_1) \\
0 & 1 & 0 & 0 & 0 & 0 \\
-\frac{1}{2}\sin(\alpha_1) & 0 & \frac{1}{2}(3 + \cos(\alpha_1)) & \frac{1}{2}(1 - \cos(\alpha_1)) & \frac{1}{2}(1 - \cos(\alpha_1)) & \frac{1}{2}(1 - \cos(\alpha_1)) \\
-\frac{1}{2}\sin(\alpha_1) & 0 & \frac{1}{2}(1 - \cos(\alpha_1)) & \frac{1}{2}(3 + \cos(\alpha_1)) & \frac{1}{2}(1 - \cos(\alpha_1)) & \frac{1}{2}(1 - \cos(\alpha_1)) \\
-\frac{1}{2}\sin(\alpha_1) & 0 & \frac{1}{2}(1 - \cos(\alpha_1)) & \frac{1}{2}(1 - \cos(\alpha_1)) & \frac{1}{2}(3 + \cos(\alpha_1)) & \frac{1}{2}(1 - \cos(\alpha_1)) \\
-\frac{1}{2}\sin(\alpha_1) & 0 & \frac{1}{2}(1 - \cos(\alpha_1)) & \frac{1}{2}(1 - \cos(\alpha_1)) & \frac{1}{2}(1 - \cos(\alpha_1)) & \frac{1}{2}(3 + \cos(\alpha_1))
\end{pmatrix}
\]

and

\[
Rotation_2 = 
\begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 \\
0 & \cos(\alpha_2) & \frac{1}{2}\sin(\alpha_2) & \frac{1}{2}\sin(\alpha_2) & \frac{1}{2}\sin(\alpha_2) & \frac{1}{2}\sin(\alpha_2) \\
0 & \frac{1}{2}\sin(\alpha_2) & \frac{1}{4}(3 + \cos(\alpha_2)) & \frac{1}{4}(1 - \cos(\alpha_2)) & \frac{1}{4}(1 - \cos(\alpha_2)) & \frac{1}{4}(1 - \cos(\alpha_2)) \\
0 & \frac{1}{2}\sin(\alpha_2) & \frac{1}{4}(1 - \cos(\alpha_2)) & \frac{1}{4}(3 + \cos(\alpha_2)) & \frac{1}{4}(1 - \cos(\alpha_2)) & \frac{1}{4}(1 - \cos(\alpha_2)) \\
0 & \frac{1}{2}\sin(\alpha_2) & \frac{1}{4}(1 - \cos(\alpha_2)) & \frac{1}{4}(1 - \cos(\alpha_2)) & \frac{1}{4}(3 + \cos(\alpha_2)) & \frac{1}{4}(1 - \cos(\alpha_2)) \\
0 & \frac{1}{2}\sin(\alpha_2) & \frac{1}{4}(1 - \cos(\alpha_2)) & \frac{1}{4}(1 - \cos(\alpha_2)) & \frac{1}{4}(1 - \cos(\alpha_2)) & \frac{1}{4}(3 + \cos(\alpha_2))
\end{pmatrix}
\]

then it follows that the Graviton has the form

\[
\Gamma = \begin{pmatrix}
\Gamma_0 \\
\Gamma_1
\end{pmatrix} = \begin{pmatrix}
B_0 \cdot \cos(\alpha_1) + (W_0 + W_1 + W_2 + W_3) \frac{1}{2}\sin(\alpha_1)
B_1 \cdot \cos(\alpha_2) - B_0 \cdot \sin(\alpha_1) \cdot \sin(\alpha_2) + (W_0 + W_1 + W_2 + W_3) \frac{1}{2}\sin(\alpha_2) \cdot (3 - \cos(\alpha_1))
\end{pmatrix}
\]

\[
\alpha_1 = \alpha_{\text{max}} = 28, 894160846 \text{ degrees } \text{ near to the measured Weinberg angle}
\]

and

\[
\alpha_2 = \alpha_{\text{min}} = 121, 605508985 \text{ degrees}
\]

<5> The mass(density) of the Bosons after Symmetrybreaking
Symmetry breaking 1 Electro-weak (Light)

\[ SU(2) \times U(1) \rightarrow U(1) \quad \text{Symmetry breaking} \]

**Mixing angles**
- \( \alpha_0 = \alpha_1 = \text{Weinberg angle} \)
- \( \alpha_1 = 28.89^\circ \)
- \( \alpha_2 = 121.11^\circ \)

We suspect that \( \alpha_0 = \alpha_1 = \text{Weinberg angle} \)
If it is true then the Weinberg angle comes from the theory and must not be measured.

**Coupling constants** \( g_1, g_2 \)

\[ m_W = \phi_{\min} g_2 \quad \text{Mass } W - \text{Bosons} \]

\[ m_Z = \phi_{\min} \sqrt{g_1^2 + g_2^2} \quad \text{Mass } Z - \text{Boson} \]

\( \phi_{\min} = \text{Minimum in Higgs potential} \)

Symmetry breaking 2 Gravity-superweak (Gravitation)

\[ SU(5) \times U(1) \times U(1) \rightarrow U(1) \times U(1) \quad \text{Symmetry breaking} \]
To understand and interpret what happened by the second symmetry break, we have to take a look on the Oktoquintenfield and its potential.

First we want to make a comparison of Higgs field and Oktoquintenfield. Some comparisons we have already shown in $<2>$.

The two rotations are together one rotation with angle $\alpha_3$.

Then we have the $\text{SU}(5)$ coupling constant $g_5$ and the $\text{U}(1) \times \text{U}(1)$ coupling constant $g_{1 \times 1}$.

Mixing angle $\alpha_3$

By easy trigonometrical calculation we get

\[
\tan(\alpha_3) = \frac{g_{1 \times 1}}{g_5} = -\sqrt{\frac{1 - \cos(\alpha_1)^2 \cos(\alpha_2)^2}{\cos(\alpha_1)^2 \cos(\alpha_2)^2}}
\]

Then

\[\alpha_3 \approx 117.311543417^\circ\]
Now if we consequently follow the results of the Higgspotential where we get a Higgsboson (Scalarboson) then we get from the Oktoquintenpotential also a particle.

\[ V(\phi) = \frac{\mu^2}{2} |\phi|^2 + \frac{\lambda}{4} |\phi|^4 \]

\[ i.m_H = \mu \]

consequently
Conclusions

Dark Energy comes from the Oktoquintenpotential.

Dark Matter could be the W- and Z-Bosons of the SU(5) Symmetry which couples on the Oktoquintenfield and gets its (imaginär) massdensity from it (=> Tachyons).

The W- and Z-Bosons have charges and interact with itself which is in common with some observations of dark matter.

So for the charged SU(5) Spin= 2 Bosons we have a balance of the 2 forces which acts on them.

First the gravitation which acts attractive between the SU(5) Bosons and Second the charge (we named it sincharges) which acts attractive if the charge is equal and repulsive for different charges because of Spin=2.

<7> In Work

Lagrangedensity of the Oktoquintenfield/Oktoquintenpotential

SU(5) GENERATORS

We write the charged SU (5) generators in the form of 4 x 5 as described above in the Oktoquinen field.
Then we can get our $W^{+/−}$ once again as in the SU(2) by which two generators which belong together add / subtract. So in the 1, 2, 3, 4 or 5th column, the first 2 or last 2 generators add / subtract.

Example:

Thereby preserve our massive W bosons which occur in reality.

Name the charge gravity-superweak charge.

Analogous to the electroweak theory, we want to talk about a gravito super weak theory here. The electroweak theory brings together the electrical with the weak interactions. The gravito-superweak theory brings together the gravitational with the super weak interactions. Possible candidates for dark matter are the SU(5) Bosons.