Ternary <SU(3)>-group symmetry

and its possible applications in hadron-quark substructure.

Towards a new spinor-fermion structure

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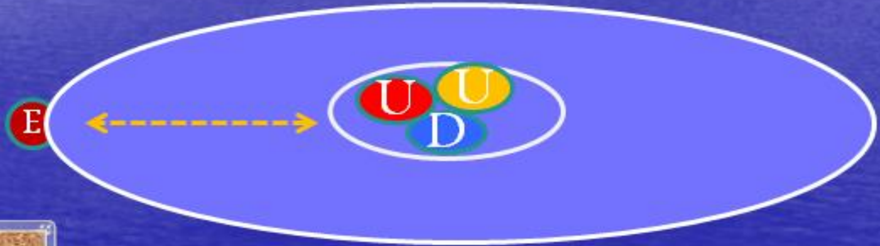
Г. Г. Волков и А.А.Масликов

ПЕТЕРБУРГСКИЙ ИНСТИТУТ ЯДЕРНОЙ ФИЗИКИ НИЦ КИ

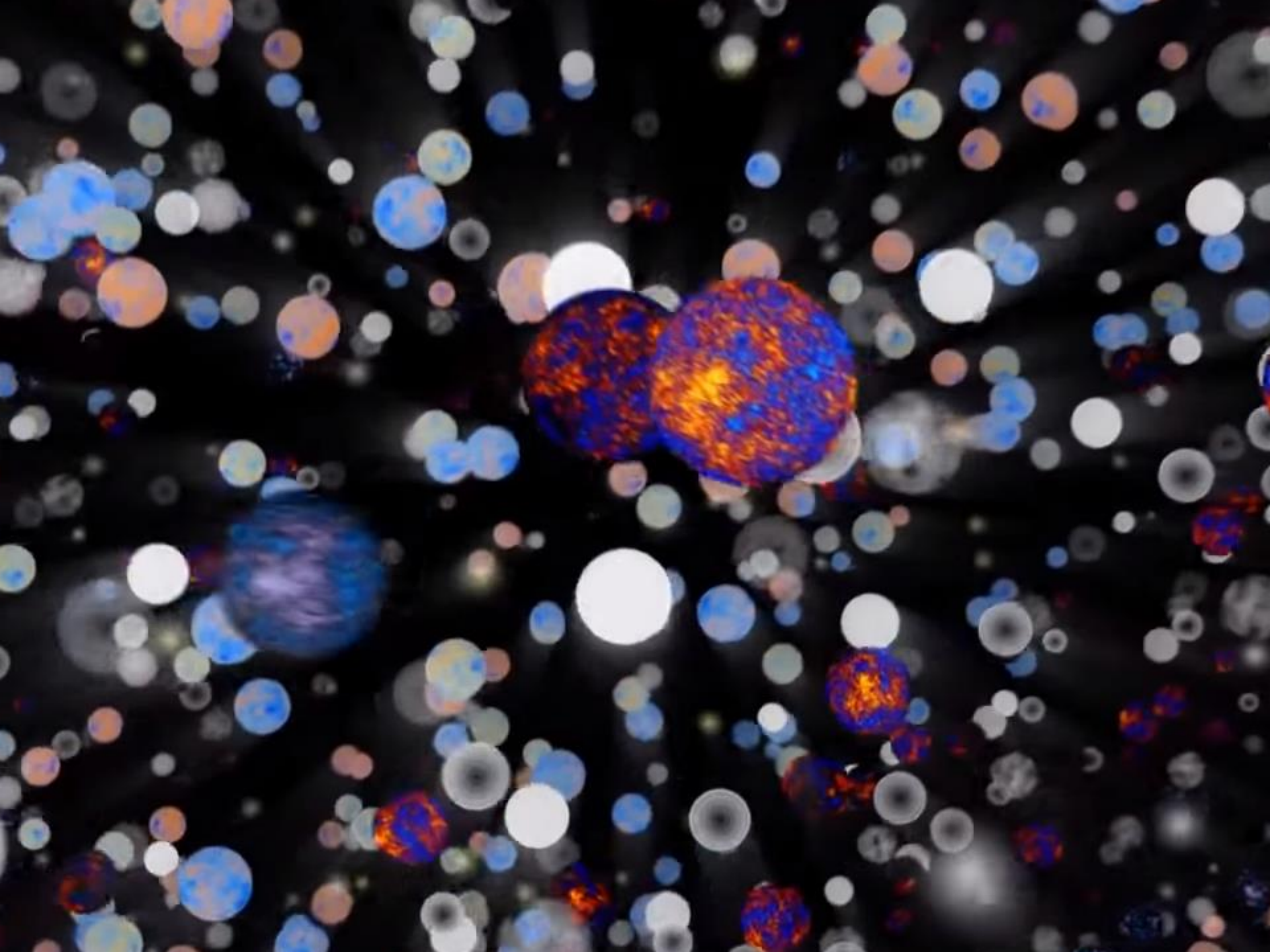
УНИВЕРСИТЕТ ДУБНА ПРОТВИНО ФИЛИАЛ



Атом водорода

	U	D	E	N
спин	1/2	1/2	1/2	1/2
заряд	+2/3	-1/3	-1	0
цвет				0
МэВ	5.5	3.5	0.5	0 ?

Квантовые числа кварков и лептонов



MATTER IN VISIBLE IN UNIVERSE

ФЕРМИОНЫ

ДИРАК-ФЕРМИОНЫ	СПИН J=1/2		
ЛЕПТОНЫ	e	μ	τ

ДИРАК-ФЕРМИОНЫ	СПИН J=1/2		
КВАРКИ	(u, d)	(c, s)	(t, b)
	(u, d)	(c, s)	(t, b)
	(u, d)	(c, s)	(t, b)

МАЙОРАНО-ФЕРМИОНЫ	СПИН J=1/2		
НЕЙТРИНО	$\mathcal{N}(e)$	$\mathcal{N}(\mu)$	$\mathcal{N}(\tau)$

БОЗОНЫ

БОЗОНЫ	СПИН J=1
ФОТОН	A

БОЗОНЫ	СПИН J= 1
ГЛЮОНЫ	G=1,..8

БОЗОНЫ	СПИН J= 1
Weak	W(+),W(-),Z

A LITTLE HISTORY OF THE QUARK CONFINEMENT

- After many years of dramatic and successful development of the atomic project for the country in the late 50s of the last century, the government of the USSR proposed a new project to overcome the backlog in the physics of elementary particles.
- For this purpose, in Protvino was the most powerful proton accelerator for energy at that time, with beam energies up to 70 GeV.
- And one of the central tasks was to open quarks!
- In 1967, the Accelerator was created and the first experiments began.
- But Quarks Have not been found ?!
- What happened
-
- How is this regarded? Failure? Or Discovery!

The quark confinement is confirmed in Europe and USA

- Confirmation of the experiment in Protvino
- on the non-detection of quarks at the accelerators of
- FermiLab:In 1972 a large proton synchrotron went into operation . At first it accelerated protons to 200 GeV, but by 1976 it had reached 500 GeV
- CERN :The SPS became the workhorse of CERN’s particle physics programme when it switched on in 1976/The SPS operated at up to 400-450 GeV
-

Discovery 3-colors
SU(3)- chromodynamics
Color Confinement

- Боголюбов Н.Н., Струмински Б.В.,ТавхелидзеА.Н.
- THE DISCOVERY OF THE **THREE** QUARK COLOR IN DUBNA 1965
- **SU(3c)-gauge group 1973**
- **From 1967 to Color confinement 1974**
- **1968?! ?!?! 50 years – WHY -2018??????**

PROTON QUANTIZATION

- 1) 3-QUARK MODEL G-M-spectroscopy
- 2)Parton model + SU(3-c)-gauge interactions
- See-ocean of quarks
- How to quantize
- Proton ? or (P + N)?
- Origin of isotopic group SU(2)

PROTON QUANTIZATION

(P,N)+Electron

including the new quantum number

FAMILY NUMBER=3

We have Nc = Nf = 3

Or ?

Nc=3(c)+1(El-SU(3c)-singlet)

=Nf=3(SU(3H))+1(SU(3H)-singlet)

Universe

Geometry - Particles Quantum Numbers

EXT Symmetry –INT Symmetry

INTERNAL MATTER INTERACTION -

AMBIENT SPACE-TIME STR

Universe

Particles Quantum Numbers - Geometry

INT Symmetry – EXT Symmetry

INTERNAL MATTER INTERACTION -

AMBIENT SPACE-TIME STR

UNIVERSE

Geometry- Symmetry -Particles QN

TRIALITY

The Creator
began to build the Universe
with Numbers

THEORY of NUMBERS
and
World ---Visible and Invisible

SYMEMTRY
External and Internal Symmetries

HOW TO LINK THESE TWO THEM?

G(INT) and G(EXT)

Special Theory of Relativity

- must based taking into account both symmetries

BEYOND COLEMAN-MANDULA THEOREM

THE WAYS TO GO FURTHER

- 1) The extension of Minkowsy space-time-D>4
- Kaluza-Klein and…
- Compactified and global geometry
- 2)The extension of the symmetry gauge groups –GUTs,SuSy GUTs
- 3)Superstring-D-brain approaches
- included 1) D=4 and D=10,11,12

Our goal –

to find new geometrical symmetries

Our way-

to extend theory of numbers

WAYS TO FIND NEW NON-TRIVIAL SPACES

- 1. HYPER BINARY NUMBERS
- 2.REFLEXIVE PROJECTIVE NUMBERS
- 3 N-ARY NUMBERS-CYCLIC NUMBERS
- 4. N-ARY HYPERNUMBERS
- 5.FINITE GROUPS-NON-ABELIAN CASE
- 6 CLIFFORD ALEBRAS

THEORIES OF N-ary-NUMBERS

If the binary alternative division algebras (real numbers, complex numbers, quaternions, octonions) over the real numbers have the dimensions 2^p, $p = 0, 1, 2, 3, 4, ...,$ the n=3-ary and n=4-ary norm division algebras have the following dimensions n^p, $p = 0, 1, 2, 3,$ respectively:

$$
\begin{array}{ll|ll}
\mathbb{R}: & 2^0 = 1 & \mathbb{R}: & 3^0 = 1 \\
\mathbb{C}: & 2^1 = 1+1 & \mathbb{TC}: & 3^1 = 1+1+1 \\
\mathbb{Q}: & 2^2 = 1+2+1 & \mathbb{TQ}: & 3^2 = 1+2+3+2+1 \\
\mathbb{O}: & 2^3 = 1+3+3+1 & \mathbb{TO}: & 3^3 = 1+3+6+7+6+3+1 \\
\mathbb{S}: & 2^4 = 1+4+6+4+1 & \mathbb{TS}: & 3^4 = 1+4+10+16+19+16+10+4+1
\end{array}
\qquad (36)
$$

$$
\begin{array}{ll}
\mathbb{R}: & 4^0 = 1 \\
\mathbb{N}_4\mathbb{C}: & 4^1 = 1+1+1+1 \\
\mathbb{N}_4\mathbb{Q}: & 4^2 = 1+2+3+4+3+2+1 \\
\mathbb{N}_4\mathbb{O}: & 4^3 = 1+3+6+10+12+12+10+6+3+1 \\
\mathbb{N}_4\mathbb{S}: & 4^4 = 1+4+10+20+31+40+44+40+31+20+10+4+1
\end{array}
\qquad (37)
$$

R^n-COMPLEXIFICATION

- FINITE GROUPS

  Abelian Cyclic C _n- group

- **AUTOMORPHISM R^n**

- Simple cyclic groups $C_n = \{a|a^n = e\}$ of prime order $n = \mathbf{2}, \mathbf{3}, \mathbf{5}, \mathbf{7}, \mathbf{11}, \ldots$

- **2**: $C_2 = \{a|a^2 = e\}$

- **3**: $C_3 = \{a|a^3 = e\}$

- **4**: $C_4 = \{a|a^4 = e\}$
  $C_2 \times C_2 = \{a, b|a^2 = b^2 = (ab)^2 = e\}$

- **6**: $C_6 = \{a|a^6 = e\}$,
  $C_6 \cong C_3 \times C_2$, $C_3 \times C_2 = \{a, b|a^3 = b^2 = e, aba^{-1}b = e\}$,
  $S_3 \cong C_3 \times] C_2 = \{a, b|a^3 = b^2 = e, aba = b\}$

- **8**: $C_8 = \{a|a^8 = e\}$
  $C_4 \times C_2 = \{a, b|a^4 = b^2 = e, aba^{-1}b = e\}$
  $C_2 \times C_2 \times C_2 = \{a, b, c|a^2 = b^2 = c^2 = e, ab^2, bc^2 = ac^2 = e\}$
  $D_4 = \{a, b|a^4 = b^2 = e, aba = b\}, D_4 = C_4 \times] C_2$,
  $\mathbb{Q}_8 = \{a|a^4 = b^2 = e, b^{(-1)}ab = a^{(-1)}\}$

- **9**: $C_9 = \{a|a^9 = e\}$
  $C_3 \times C_3 = \{a, b|a^3 = b^3 = e, ab = ba\}$

- **10**: $C_{10} = \{a|a^{10} = e\}$,
  $C_5 \times C_2 = \{a|a^5 = b^2 = e, aba^{(-1)}b = e\}$
  $D_5 \cong C_5 \times] C_2 = \{a, b|a^5 = b^2 = e, aba = b\}$

- **12**: $C_{12} = \{a|a^{12} = e\}$,
  $C_6 \times C_2 = \{a, b|a^6 = b^2 = e, aba^{(-1)}a = e\}$, $C_{12} \cong C_3 \times C_2 \times C_2$,
  $D_6 = S_3 \times] C_2 \cong D_3 \times] C_2$
  $T = \{a, b|a^6 = e, a^3 = b^2, aba = b\}$
  $C_3 \times] C_4 = \{a, b|a^4 = b^3 = e, bab = a\}$

(58)

Using the definition of ternary complex conjugation one can check that only terms proportional q_0 are not equal to zero, *i.e.*:

$$F_0(x_0, x_1, x_2) = (x_0^3 + x_1^3 + x_2^3 - 3x_0x_1x_3)q_0. \tag{59}$$

According to table of characters ,what satisfy to the previous constraints, one can introduce two operations of the conjugations in the next form:

$$\tilde{q} = jq, \qquad \tilde{\tilde{q}} = j^2 q, \qquad \tilde{q}^2 = j^2 q^2, \tag{60}$$

where $j = \exp{(2\mathbf{i}\pi)}/3$.

The generators q and q^2 could be represented in the matrix form:

$$q = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & j \\ j^2 & 0 & 0 \end{pmatrix}, \qquad q^2 = \begin{pmatrix} 0 & 0 & j \\ 1 & 0 & 0 \\ 0 & j^2 & 0 \end{pmatrix} \tag{61}$$

where one can introduce the operation of cyclic ternary transposition operations: $1 \to 2 \to 3 \to 1$ ($3 \to 2 \to 1 \to 3$) [104] .

$$\begin{aligned} \langle z \rangle^3 &= (x_0 + x_1 + x_2)_{\{K\}} \cdot [(x_0 - \frac{1}{2}(x_1 + x_2))^2 + (\frac{\sqrt{3}}{2}(x_1 - x_2))^2]_{\{E,I\}}. \\ &= x_0^3 + x_1^3 + x_2^3 - 3x_0x_1x_2 \end{aligned} \tag{67}$$

Outside the singular region one can define $z^{(-1)} = \frac{\tilde{z} \cdot \tilde{\tilde{z}}}{\langle z \rangle^3}$.

Outside the singular region there valid the following pseudo norm division identity

$$\langle z_1 \cdot z_2 \rangle^3 = \langle z_1 \rangle^3 \cdot \langle z_2 \rangle^3, \tag{68}$$

which indicate about a group properties of these $\mathbb{T}_3\mathbb{C}$ numbers.

The surface-Appel sphere-

$$x_0^3 + x_1^3 + x_2^3 - 3x_0x_1x_2 = \rho^3 \tag{69}$$

Using these matrices one can get the ternary Dirac-Weyl equation:

$$Q_1 \frac{\partial \Psi}{\partial x_0} + Q_2 \frac{\partial \Psi}{\partial x_1} + Q_3 \frac{\partial \Psi}{\partial x_2} = 0, \tag{127}$$

where

$$\Psi = (\psi_1, \psi_2, \psi_3), \tag{128}$$

is triplet of the wave functions, *i.e.* we introduced the ternary spin structure in R^3. The next ternary structures can appear in $R^{6,9,12,\cdots}$ spaces.

In order to diagonalize this equation we must act three times with the same operator and we will get the cubic differential equation satisfied by each component ψ_p, $p = 1, 2, 3$.

RESUME
ABELIAN N-ARY COMPLEX NUMBERS

- N-ARY EXTENSION OF LIGHTS

- U(1em) ---- U(1)x…xU(1)
- (N-1)-copies!!!
- For N=3 wecould get A NEW EXOTIC LIGHT

q_n^n	$\tilde{q}_n = e^{(2\pi i/n)} q$	$\langle z z^1 \ldots z^{n-1} \rangle = R_n^n$
$i^2 = -1$	$i = -i$	$x_0^2 + x_1^2 = R^2$
$q_2^2 = 1$	$\tilde{q}_2 = -q_2$	$x_0^2 - x_1^2 = H^2$
$q_3^3 = 1$	$\tilde{q}_3 = e^{(2\pi i/3)} q_3$	$x_0^3 + x_1^3 + x_3^3 - 3x_0x_1x_2 = R^3 = \rho \cdot r^2$
$q_4^4 = 1$	$\tilde{q}_4 = e^{(\pi i/2)} q_4$	$[(x_0 - x_2)^2 + (x_1 - x_3)^2] \cdot [(x_0 + x_2)^2 - (x_1 + x_3)^2] = H_1^2 \cdot H_2^2$
		$[x_3^2 + x_1^2 - 2x_0x_2]^2 - [x_0^2 + x_2^2 - 2x_1x_3]^2 = R_1^4 - R_2^4$
$q_4^4 = -1$	$\tilde{q}_4 = e^{(\pi i/2)} q_4$	$[x_3^2 - x_1^2 + 2x_0x_2]^2 + [x_0^2 - x_2^2 + 2x_1x_3]^2 = R_1^4 + R_2^4 = 1$
$q_5^5 = 1$	$\tilde{q}_5 = e^{(2\pi i/5)} q_5$	$x_0^5 + x_1^5 + x_2^5 + x_3^5 + x_4^5 - 5x_0x_1x_2x_3x_4 -$ $-5\{x_0^3(x_1x_4 + x_2x_3) + x_1^3(x_0x_2 + x_3x_4) + x_2^3(x_1x_3 + x_0x_4)$ $+x_3^3(x_1x_3 + x_0x_4) + x_4^5(x_0x_3 + x_1x_2)\}$ $+5\{x_0(x_1^2x_4^2 + x_2^2x_3^2) + x_1(x_0^2x_2^2 + x_3^2x_4^2)$ $+x_2(x_1^2x_3^2 + x_4^2x_0^2) + x_3(x_2^2x_4^2 + x_0^2x_1^2) + x_4(x_3^2x_0^2 + x_1^2x_2^2\})$
$q_6^6 = 1$	$\tilde{q}_6 = e^{(\pi i/3)} q_6$	$\cdot[(x_0 + x_3)^3 + (x_1 + x_4)^3 + (x_2 + x_5)^3 - 3(x_0 + x_3)(x_1 + x_4)(x_2 + x_5)]$ $\cdot[(x_0 - x_3)^3 + (x_1 - x_4)^3 + (x_2 - x_5)^3 - 3(x_0 - x_3)(x_1 - x_4)(x_2 - x_5)]$ $= [u_0^3 + u_1^3 + u_2^3 - 3u_0u_1u_2] \cdot [v_0^3 + v_1^3 + v_2^3 - 3v_0v_1v_2]$ $= \{F_1\}^3 \cdot \{F_2\}^3 = \rho_1 r_1^2 \cdot \rho_2 r_2^2 = 1$
		$\{[(x_0^3 + x_2^3 + x_4^3 - 3x_0x_2x_4)]$ $-3[x_0(x_3^2 - x_1x_5) + x_2(x_5^2 - x_1x_3) + x_4(x_1^2 - x_3x_5)]\}^2 -$ $-\{[(x_1^3 + x_3^3 + x_5^3 - 3x_1x_3x_5]$ $+3[x_1(x_4^2 - x_0x_2) + x_3(x_0^2 - x_2x_4) + x_5(x_2^2 - x_0x_4)]\}^2$ $= \{F_1^3\}^3 - \{F_2^3\}^2 = 1$
$q_6^6 = -1$	$\tilde{q}_6 = e^{(\pi i/3)} q_6$	$\{[(x_0^3 + x_2^3 - x_4^3 + 3x_0x_2x_4)]$ $-3[x_0(x_3^2 - x_2x_4) + x_2(x_5^2 + x_1x_3) - x_4(x_1^2 + x_3x_5)]\}^2 +$ $+\{[x_1^3 - x_3^3 + x_5^3 + 3x_1x_3x_5]$ $-3[x_1(x_4^2 - x_0x_2)) - x_3(x_0^2 + x_2x_4) + x_5(x_2^2 + x_0x_4)]\}^2$ $= \{\tilde{F}_1^3\}^2 + \{\tilde{F}_2^3\}^2 = 1$

THE NON-ABELIAN N-ARY NUMBERS-

HAMILTONIAN WAY

- TWO N-ARY IMAGINARY NUMBERS
- FOR BINARY CASE-QUATERNIONS:
- q0,q1,q2,q3
- UNIT QUATERNIONS :SU(2)-group !
- Representations of SU(2)- Spins!!!

THE NON-ABELIAN N-ARY NUMBERS

- FOR BINARY CASE- UNIT IMAGINARY QUATERNIONS:
- $q1=i, q2=j, q3=k$
- su(2)-Lie algebra
- Basis for Killing-Cartan-Lie classification

KILLING-CARTAN-LIE GEOMETRY

- “TRIVIAL” CLASSES OF HOMOLOGY
- SIMPLE SET OF THE BETTI-HODGE NUMBERS
- N-dim SPHERES-
- N-dim HYPERBOLOPIDS,…

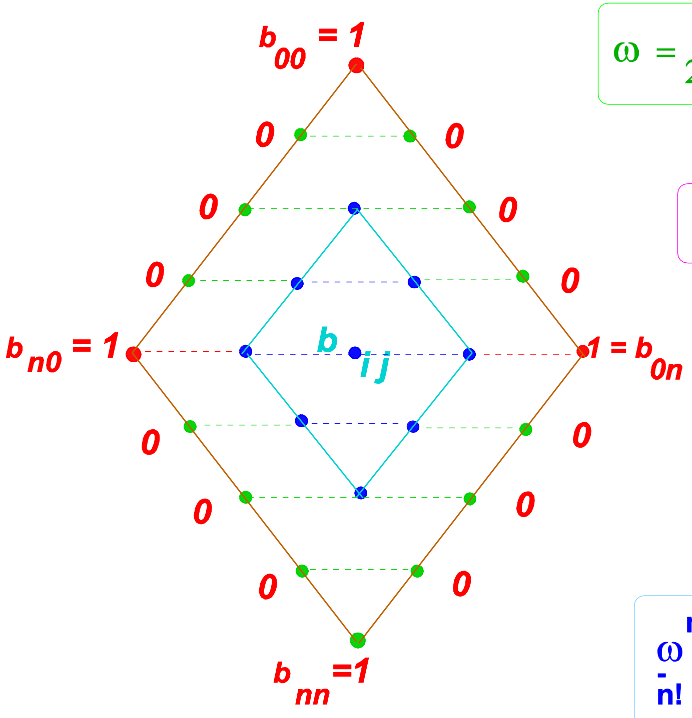
……………………………………………

BERGER-CALABI-YAU SPACES

HODGE DIAMOND

with

HOLONOMY (g) = SU(n)



$$g = (|dz_1|^2 + \dots\dots\dots + |dz_n|^2)$$

Kahler form

$$\omega = \frac{\iota}{2}(dz_1 \Lambda \, d\bar{z}_1 + \dots\dots + dz_n \Lambda \, d\bar{z}_n)$$

(n,0) parallel form

$$\Omega = dz_1 \Lambda \dots\dots\dots \Lambda \, dz_n$$

$$b_{n0} = b_{0n} = 1$$

$$b_{p0} = b_{0p} = 0$$

$$n > p > 0$$

$$\frac{\omega^n}{n!} = (-1)^{\frac{n(n-1)}{2}} \left(\frac{i}{2}\right)^n \Omega \Lambda \bar{\Omega}$$

TOWARDS TORUS GEOMETRY-

- THE SET OF NON-TRIVIAL BETTI-HODGE NUMBERS
- HOLONOMY GROUPS AND BERGE GEOMETRY
- SPACES WITH SU(2)-GROUP HOLONOMY
- -K3-SPACES
- SPACES WITH SU(3)-GROUP HOLOPNOMY
- CY-spaces

CY_n-SPACES CLASSIFICATION and n-ary algebra of REFLEXIVE PROJECTIVE NUMBERS

- IT WAS THE REASON TO
- GO TO THE N-ARY HYPER NUMBERS
- NEW NUMBERS ---
- NEW SYMMETRIES-
- NEW GEOMETRY+NEW MATTER
- = NEW UNIVERSE

In the new notations we have got the following expression:

$$\begin{aligned} Q &= \left(x_0 + x_7 q_1 q^2 + x_8 q_1^2 q_2\right) + \left(x_1 q_1 + x_2 q_2 + x_3 q_1^2 q_2^2\right) + \left(x_4 q_1^2 + x_5 q_5^2 + x_6 q_1 q_2\right) \\ &\equiv z_0\left(x_0, x_7, x_8\right) + z_1\left(x_1, x_2, x_3\right) + z_2\left(x_4, x_5, x_6\right), \end{aligned} \tag{137}$$

in 9-dimensional space [43, 104]. For this one should calculate the product $\sum_{perm}\{Q\tilde{Q}\tilde{\tilde{Q}}\}$ what in general contains itself $9 \times 9 \times 9 = 729$ terms, *i.e.*

$$Q \times \tilde{Q} \times \tilde{\tilde{Q}} = A_0(x_0, ..., x_8)q_0 + A_1(x_0, ..., x_8)q_1 + \ldots + A_8(x_0, ..., x_8)q_8 \tag{140}$$

In general in this product one can meet inside A_p $(p = 0, 1, ..., 8)$ the following term structures:

$$\begin{aligned} &x_p^3, \qquad p = 0, 1, ..., 8 \\ &x_p^2 x_k, \qquad p \neq r \\ &x_p x_k x_l, \qquad p \neq k \neq l. \end{aligned} \tag{141}$$

For this expansion one can easily see that

$$729 = 9\,(x_p^3 - terms)\, +\, 72 \times 3\,(x_p^2 x_k - terms) + 84 \times 6\,(x_p x_k x_l - terms). \tag{142}$$

Really, following to the articles [43],[104],[103] one can construct the ternary nonion-algebra for $\hat{q}_a$ and introduce the following matrix:

$$\tilde{\hat{Q}}^{T} = \hat{Q}^{\dagger} = \hat{Q}, \qquad Ternary\,Hermitian\,Conjugation \tag{155}$$

$$\hat{Q} = \sum_{a=0}^{a=8}\{x_a\hat{q}_a\} = \begin{pmatrix} x_0 + jqx_7 + j^2q^2x_8 & x_1 + qx_2 + q^2x_3 & x_4 + jqx_5 + j^2q^2x_6 \\ x_4 + qx_5 + q^2x_6 & x_0 + j^2qx_7 + jq^2x_8 & x_1 + jqx_2 + j^2q^2x_3 \\ x_1 + j^2qx_2 + jq^2x_3 & x_4 + j^2qx_5 + jq^2x_6 & x_0 + qx_7 + q^2x_8 \end{pmatrix} \tag{156}$$

where

$$\hat{q}_0 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \qquad \hat{q}_7 = \begin{pmatrix} j & 0 & 0 \\ 0 & j^2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \qquad \hat{q}_8 = q^2 \begin{pmatrix} j^2 & 0 & 0 \\ 0 & j & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\hat{q}_1 = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix} \qquad \hat{q}_2 = q \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & j \\ j^2 & 0 & 0 \end{pmatrix} \qquad \hat{q}_3 = q^2 \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & j^2 \\ j & 0 & 0 \end{pmatrix}$$

$$\hat{q}_4 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix} \qquad \hat{q}_5 = q \begin{pmatrix} 0 & 0 & j \\ 1 & 0 & 0 \\ 0 & j^2 & 0 \end{pmatrix} \qquad \hat{q}_6 = q^2 \begin{pmatrix} 0 & 0 & j^2 \\ 1 & 0 & 0 \\ 0 & j & 0 \end{pmatrix} \tag{157}$$

$$
\begin{aligned}
\hat{Q}=\sum_{a=0}^{a=8}\{x_a\hat{q}_a\} &= \begin{pmatrix} x_0+jqx_7+j^2q^2x_8 & x_1+qx_2+q^2x_3 & x_4+jqx_5+j^2q^2x_6 \\ x_4+qx_5+q^2x_6 & x_0+j^2qx_7+jq^2x_8 & x_1+jqx_2+j^2q^2x_3 \\ x_1+j^2qx_2+jq^2x_3 & x_4+j^2qx_5+jq^2x_6 & x_0+qx_7+q^2x_8 \end{pmatrix} \\
&= \begin{pmatrix} \tilde{z}_0 & z_1 & \tilde{z}_2 \\ z_2 & \tilde{\tilde{z}}_0 & \tilde{z}_1 \\ \tilde{\tilde{z}}_1 & \tilde{\tilde{z}}_2 & z_0 \end{pmatrix}.
\end{aligned} \tag{158}
$$

Then we define the $SL(3,T\mathbb{C})$- invariant norm of the ternary "nonion" numbers:

$$
Det\hat{Q} = \langle z_0\rangle^3 + \langle z_1\rangle^3 + \langle z_2\rangle^3 - (z_0z_1z_2 + \tilde{z}_0\tilde{z}_1\tilde{z}_2 + \tilde{\tilde{z}}_0\tilde{\tilde{z}}_1\tilde{\tilde{z}}_2) \tag{159}
$$

where

$$
\begin{array}{lll}
z_0 = x_0 + x_7q + x_8q^2 & \tilde{z}_0 = x_0 + jx_7q + j^2x_8q^2 & \tilde{\tilde{z}}_0 = x_0 + j^2x_7q + jx_8q^2 \\
z_1 = x_1 + x_2q + x_3q^2 & \tilde{z}_1 = x_1 + jx_2q + j^2x_3q^2 & \tilde{\tilde{z}}_1 = x_1 + j^2x_2q + jx_3q^2 \\
z_2 = x_4 + x_5q + x_6q^2 & \tilde{z}_2 = x_4 + jx_5q + j^2x_6q^2 & \tilde{\tilde{z}}_2 = x_4 + j^2x_5q + jx_6q^2
\end{array} \tag{160}
$$

- 1. C_n- complexification of $\mathbb{R}^n$ Euclidean spaces
- 2. Euler formulas for C^n- cyclic complex numbers
- 3. Pythagoras theorem in $\mathbb{R}^n$
- 4. Infinite series of n-dimensional Abelian invariant hypersurfaces
- 5. Holomophical analysis and Caushi-Riemann equations
- 6. $Dim = n$-Laplace equations
- 7. Linear differential invariant equations for n-spinors
- 8. Cyclic hypercomplex numbers and non-Abelian structure of $AMK - 04$- hypersurface

RESUME
ABELIAN N-ARY COMPLEX NUMBERS

- N-ARY EXTENSION OF LIGHTS

- U(1em) ---- U(1)x…xU(1)
- (N-1)-copies!!!
- For N=3 wecould get A NEW EXOTIC LIGHT

RESUME NON-ABELIAN N-ARY COMPLEX NUMBERS

- N-ARY EXTENSION OF THE
- FERMION-BOSON MATTER
- EXOTIC 1/n SPINOR MATTER-MAARKRIONS
- For N=3 we could get geometrical explanation of the three colors- three families ?!

CONCLUSIONS

- THE WAY TO QUANTIZE
- PROTON+NEUTRON ....
- ON THE NEW 1/N-SPINOR MATTER?
- THIS EXOTIC MATTER RADIATES
- A NEW N-ARY LIGHT??
- WHAT ACCELERATOR COULD CHECK???
- THANKS YOU VERY MUCH!

1. Standard Model and new space-time geometrical structure of the Universe

- The geometrical basis of the modern quantum field theory sucessufully describing the
- $U(1)EM$- electrodynamic processes, the $SU(3c)$-gauge quantum chromodynamics and the
- electroweak interactions based on the $SU(2)WI \times U(1)Y$ - gauge broken symmetry is our
- space-time world what can be represented as a homogeneous and isotropic $D = (3 + 1)$-
- four-dimensional continuum. The symmetry properties of the spatial and temporal continuum
- describe by the Lorentz-Poincar´*e* groups and its representations and some fundamental
- discrete symmetries- *P*,*T*,*C*.

Space-time geometrical structure of the Universe

- This space-time continuum can be immersed into
- much huge comprehensive multidimensional world.
- The modern experimental data derived
- from the elementary particle physics and astrophysics allow us to estimate the sizes
- of the expanding visible part of the continuum
- $\Lambda_{min} \leq \Lambda \leq \Lambda_{max}$.

THE DOWN-UP QUARK MASSES DEPEND ON THE E-M CHARGE AND ON THE NUMBER OF GENERATIONS (NEW CHARGE - ORIGIN FROM D=6?)

$$m_{i_k} \approx (q^u)^{2k} m_0, \qquad k = 0,1,2; \qquad i_0 = u,\ i_1 = c,\ i_2 = t,$$
$$m_{i_k} \approx (q^d)^{2k} m_0, \qquad k = 0,1,2; \qquad i_0 = d,\ i_1 = s,\ i_2 = b, \tag{1}$$

where $q^u = (q^d)^2$, $q^d \approx 4 - 5 \approx 1/\lambda$, $\lambda = \sin\theta_C$.

THE FERMIONS MASSES AND W-Z- BOSONS COULD DEFINED BY THE E-W SCALE

M- EW-SCALE THE PHASE TRANSITION BETWEEN TWO VACUUMS???

СВОЙСТВА НЕЙТРИНО О МНОГОМЕРНОМ ОБОБЩЕНИИ ТЕОРИИ ОТНОСИТЕЛБНОСТИ

ПРЕДСТАВЛЕНИЯ ГРУППЫ ЛОРЕНЦ- ПУАНКАРЕ

- *1. Спин s=½*
- ***2. Майорано-Вейлевская природа*** *- 2-х компклексные степени свободы*

3. Масса m =O(eV)

ЭЛЕКТРОМАГНИТНАЯ СТЕРИЛЬНОСТЬ

- *4. Заряд Q (EM)= O*
- *5. Магнитный момент Mag=O(0)*

(V – A)- СЛАБАЯ СВЯЗЬ С ЗЛЕКТРОМАГНИТНЫМ МИРОМ

- ***6. Взаимодействие слабое***

1967 ---------- 2017(STO-M(1,3))

- WS-SU(2)XU(1)-Model
- SU(5) and SO(10)—GUT
- Strings + Superstrings
- M11- Superrgravity+Kaluza-Klein Compactifications
- Heterotic SuperstringsE(8)XE(8) Models and K6=CY_3- compactifications
- 4-dim SS with WS Fermions
- D-Membranes
- M11, M12 – and String Duality

ПУТИ РАСШИРЕНИЯ МЕТРИКИ

- **А) стандартный**
- $Ds^2=dx_0^2-dx_1^2-dx_2-\ldots-dx_n^2-\ldots..$
- Lie algebras and groups SO(p,q)n=p+q – space-time groups and double covered Spin(p,q),…
- **B)Non-standard ways…..T_{mnk}…**
- New symmetries ----->new groups and algebras, theory of new numbers…
- New geometry- BCY_n, Group algebra Spaces,…

1 Theories of Numbers in Geometry and in Physics.I

The further progress in modern models of elementary particles and cosmology is related to the searching for new Riemann and tensor structures in multidimensional spaces $D \geq 4$ based on the theories of new hyper-numbers, new algebras and new symmetries. The traditional geometry of Riemann and pseudo-Riemann symmetric homogeneous compact and non-compact spaces was associated to the classification of the Killing-Cartan-Lie algebras, according to the theories of binary hyper-numbers,- the well-known real-$\mathbb{R}$, complex- $\mathbb{C}$, quaternions- $\mathbb{H}$, octonions-$\mathbb{O}$- normed division algebras.

TOWARDS A N-ary MATHEMATICS+PHYSICS

- THE WAYS TO EXTRA WORLD
- 1)BCY- SU(n), G2 - Holonomy Geometry
- 2)Theories of the Cyclic C_n- Complex Numbers
- 3)Finite Group Algebras
- **MASS CHARGE SPIN …???**

9 The n-ary Algebra of Reflexive Projective Numbers and CY-classification

A CY_n space can be realized as an algebraic variety $\mathcal{M}$ in a weighted projective space $\mathrm{CP}^{n-1}(\overrightarrow{k})$ where the weight vector reads $\overrightarrow{k} = (k_1, \ldots, k_n)$. This variety is defined by

$$\mathcal{M} \equiv (\{x_1, \ldots, x_n\} \in \mathrm{CP}^{n-1}(\overrightarrow{k}) : \mathcal{P}(x_1, \ldots, x_n) \equiv \sum_{\overrightarrow{m}} c_{\overrightarrow{m}} x^{\overrightarrow{m}} = 0), \tag{6}$$

i.e., as the zero locus of a quasi–homogeneous polynomial of degree

$$d_k = \sum_{i=1}^{n} k_i, \tag{7}$$

with the monomials being

$$x^{\overrightarrow{m}} \equiv x_1^{m_1} \cdots x_n^{m_n}. \tag{8}$$

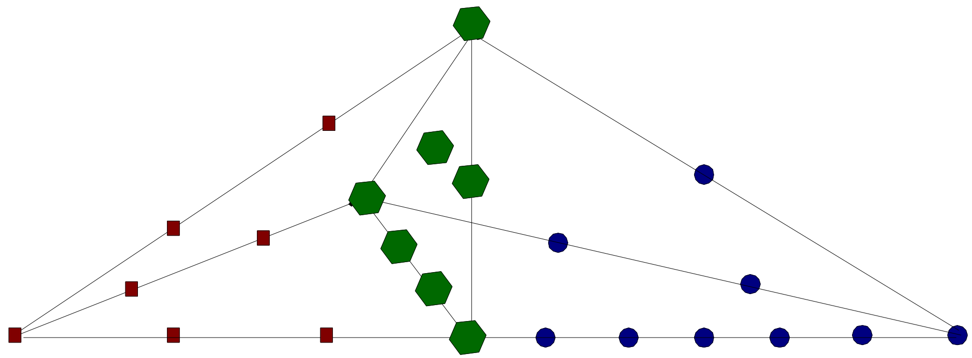
6 Berger classification of non-symmetric Riemann spaces

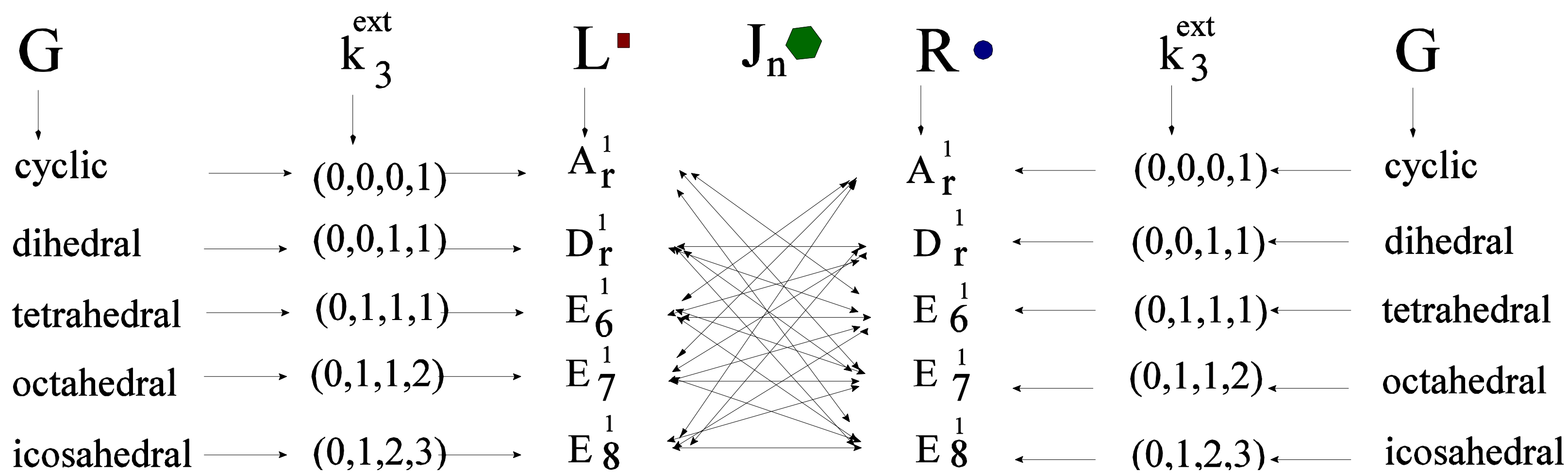
Firstly, in 1955, Berger presented the classification of irreducibly acting matrix Lie groups occur as the holonomy of a torsion free affine connection. The Berger list of non-symmetric irreducible Riemann manifolds with the list of holonomy groups H of M one can see.

Table 2: *The list of Berger classification for non-symmetric Riemannian spaces.*

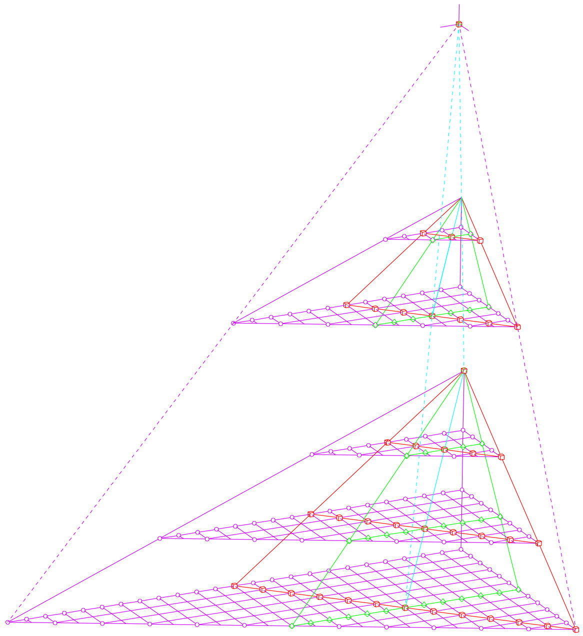
M	G_{ISOM}	H_{Hol}	Dim_R	$metrics$
$General$	$-$	$SO(n)$	n	
$Kahler$	$-$	$U(n) \subset O(2n)$	n	
$Calabi-Yau$	$-$	$SU(n) \subset SO(2n)$	$2n$	
$Hyper-Kahler$	$-$	$Sp(n) \subset SO(4n)$	$4n$	
$quaternion--Kahler$	$-$	$Sp(n) \times Sp(1) \subset SO(4n)$	$4n$	
$exceptional$	$-$	$G(2) \subset SO(7)$	7	
$exceptional$	$-$	$spin(7) \subset SO(8)$	8	

K3-Manifolds (BCY_2)



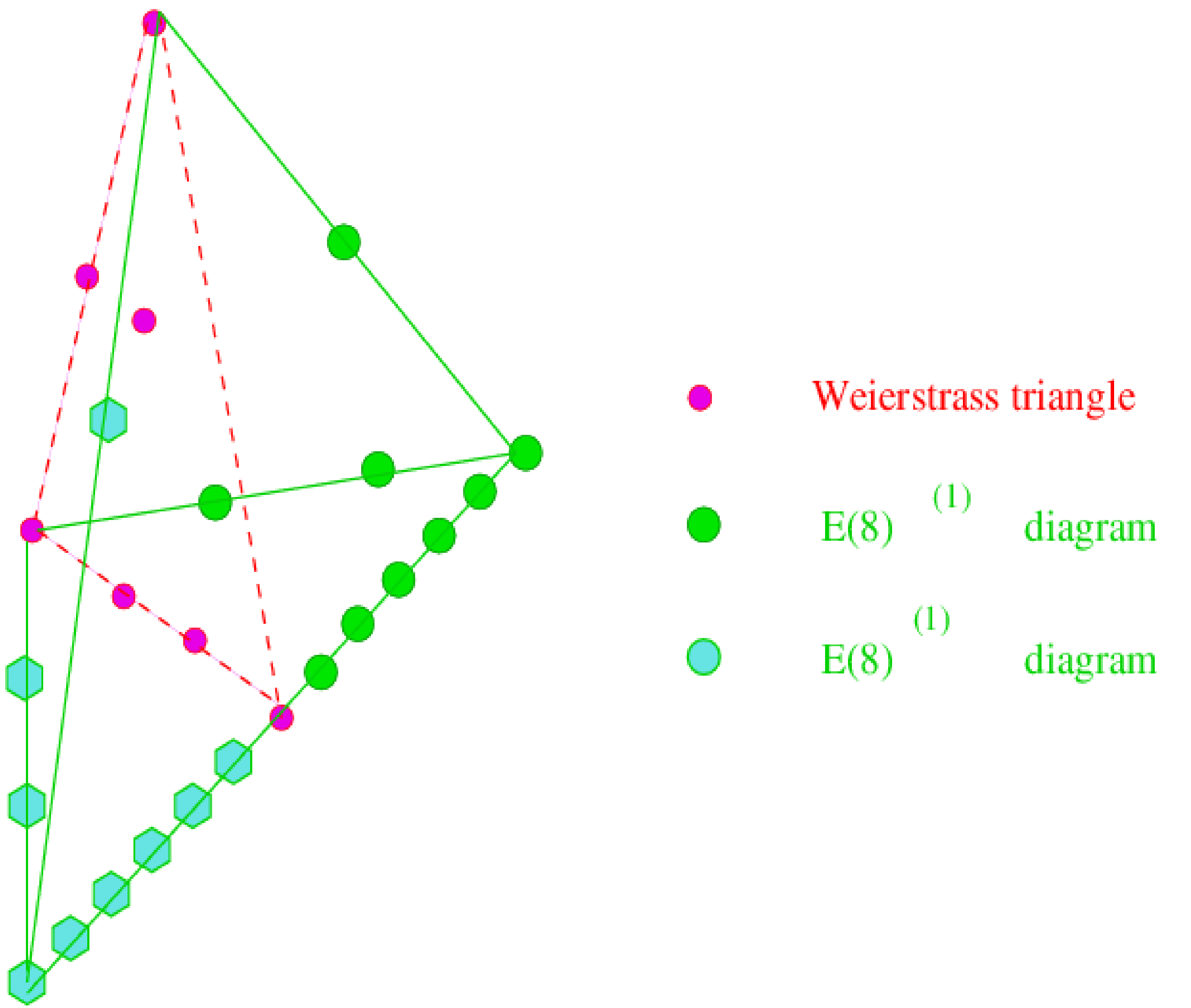


CY3-Newton polyhedron k=(11248)

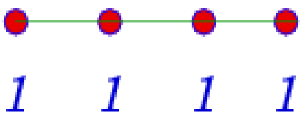


K3 polyhedron

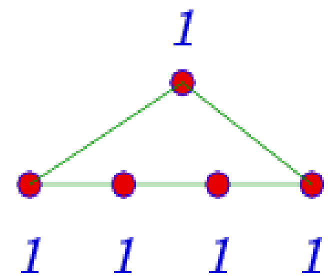
(1,0,2,3) + (0,1,2,3) = (1,1,4,6)[12]

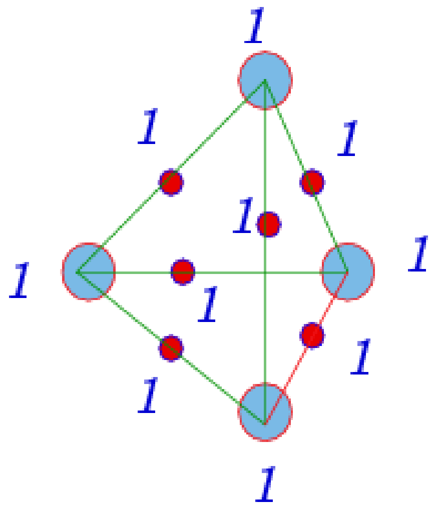


Cartan–Lie Dynkin diagram



Affine Kac–Moody diagram





Affine binary–ternary Berger diagram

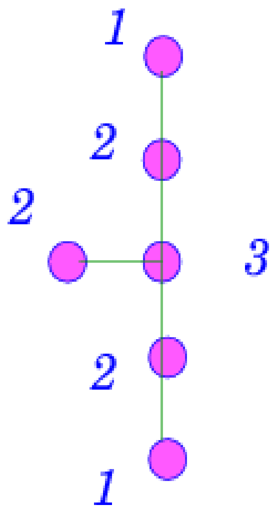
МНОГОМЕРНОЕ РАСШИРЕНИЕ СПЕЦИАЛЬНОЙ ТЕОРИИ ОТНОСИТЕЛЬНОСТИ

- 1Принцип максимальности скорости света будет справедлив только для заряженного вакуума то есть для частиц обладающих электромагнитным зарядом Темная материя и стерильное нейтрино Могут распространяться с гораздо большими скоростями
- 2 Многомерное обобщение группы Лоренца предполагает существование другого буста и возможного раширения понятия времени даже за счет структуры
- 3 принцип относительности также может потребовать расширения

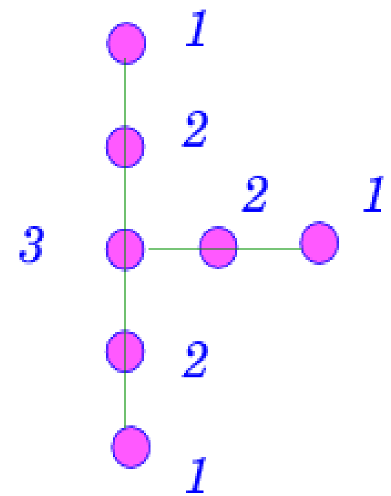
За счет появления новых некомпактифицированых размерностей

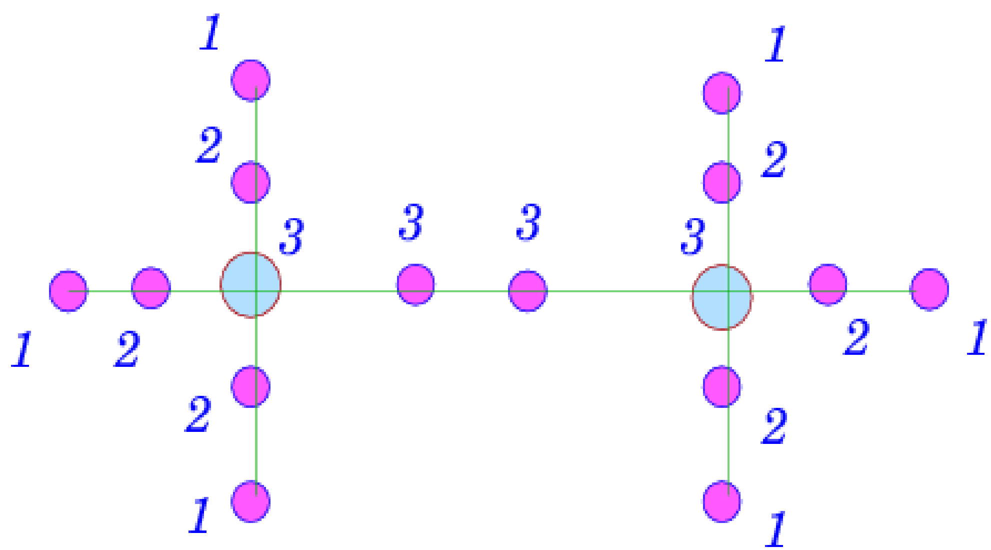
стрелки времени или стрелки пространства. Поэтому появляются несколько возможностей поиска параметра энергии “ветровой”или “температурной”, от которой может зависеть скорость нейтрино и мы привели две схемы экспериментов- это должны решить будущие эксперименты

Cartan–Lie Dynkin diagram



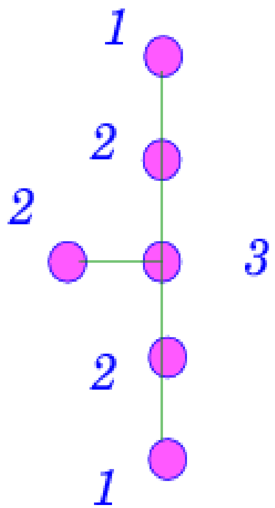
Affine Kac–Moody Dynkin diagra



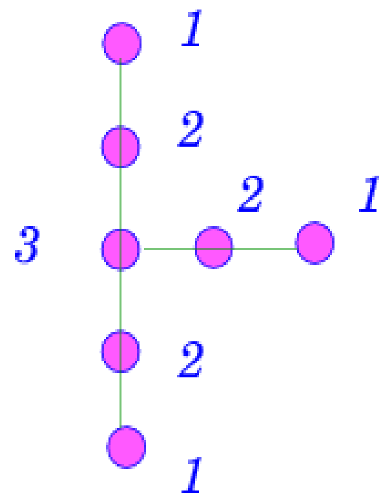


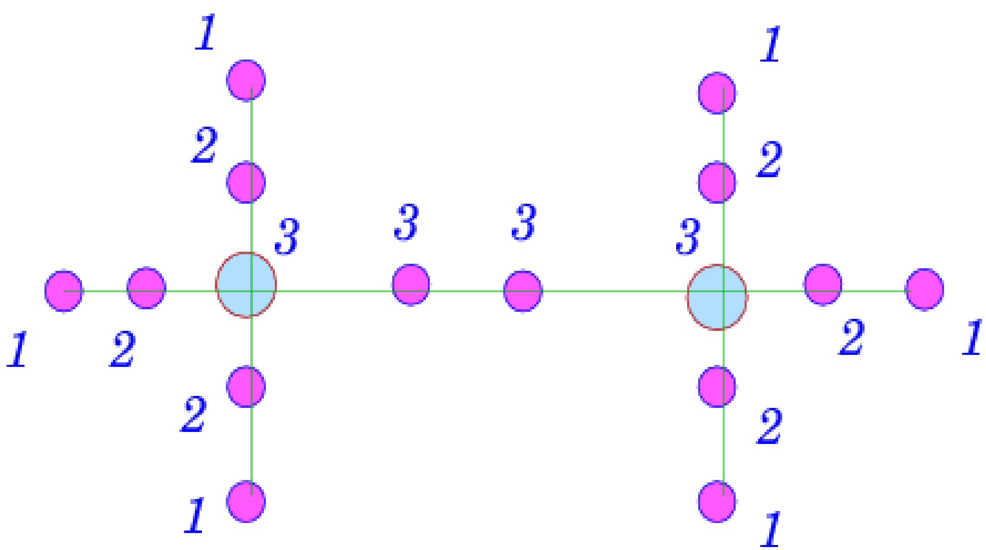
Affine binary–ternary Berger diagram

Cartan–Lie Dynkin diagram



Affine Kac–Moody Dynkin diagram





Affine binary–ternary Berger diagram

COMPLEXIFICATION OF R^n

We will discuss the following themes:

- C^n- hyper-plural division numbers
- C^n- complexification of R^n- spaces, $n = 3, 4, 5, 6, ...,$
- C^n- structure and the invariant surfaces, $n = 3, 4, 5, 6, ...$
- C^n- hyper-holomorphic and hyper-harmonic functions
- The link between C^n-holomorphism and the origin of n-spinors

GEOMETRY OF BINARY HYPER NUMBERS

$$
\begin{aligned}
x^2 &= 1, x \in R, && (44)\\
|\hat{Z}| &= x_0^2 + x_1^2 = 1 \in \mathbb{C}, && (45)\\
|\hat{Q}| &= x_0^2 + x_1^2 + x_2^2 + x_3^2 = |Z_1|^2 + |Z_2|^2 = 1 \in \mathbb{H}, && (46)\\
|\hat{O}| &= x_0^2 + x_1^2 + ... + x_7^2 = |Q_1|^2 + |Q|^2 = 1 \in \mathbb{O}, && (47)\\
& && (48)
\end{aligned}
$$

In the last lines one can see the sedenions which do not produce division algebra. For both cases we have the unit element e_0 and the n basis elements:

$$\begin{aligned} &\mathbb{R} \to \mathbb{TC} \to \mathbb{TQ} \to \mathbb{T}O \to \mathbb{T}S \\ &\mathbb{R} \to \mathbb{N}_4\mathbb{C} \to \mathbb{N}_4\mathbb{Q} \to \mathbb{N}_4\mathbb{O} \to \mathbb{N}_4\mathbb{S} \end{aligned} \tag{51}$$

CONJUGATIONS CLASSESS AND ONE DIMENSIONAL REPRESENTATIONS

C_2	1	i	
$R^{(1)}$	1	1	z
$R^{(2)}$	1	-1	$\bar{z}$

.

The cyclic group C_3 has three conjugation classes, q_0, q and q^2, and, respectively, three one dimensional irreducible representations, $R^{(i)}$, $i = 1, 2, 3$. We write down the table of their characters, $\xi_l^{(i)}$:

$$\left(\begin{array}{c|ccc} - & 1 & q & q^2 \\ \hline \xi^{(1)} & 1 & 1 & 1 \\ \xi^{2)} & 1 & j_3 & j_3^2 \\ \xi^{(3)} & 1 & j_3^2 & j_3 \end{array} \right) \tag{68}$$

for C_3 ($j_3 =\equiv j = \exp\{2\pi\mathbf{i}/3\}$).

CONJUGATIONS CLASSESS AND ONE DIMENSIONAL REPRESENTATIONS

C_2	1	i	
$R^{(1)}$	1	1	z .
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The cyclic group C_3 has three conjugation classes, q_0, q and q^2, and, respectively, three one dimensional irreducible representations, $R^{(i)}$, $i = 1, 2, 3$. We write down the table of their characters, $\xi_l^{(i)}$:

$$\left(\begin{array}{c|ccc} - & 1 & q & q^2 \\ \hline \xi^{(1)} & 1 & 1 & 1 \\ \xi^{2)} & 1 & j_3 & j_3^2 \\ \xi^{(3)} & 1 & j_3^2 & j_3 \end{array}\right) \tag{68}$$

for C_3 ($j_3 =\equiv j = \exp\{2\pi\mathbf{i}/3\}$).

Ternary hyper-numbers

One can introduce the following basis forms:

$$\begin{aligned} K &= \frac{1}{3}(1 + q + q^2), \\ E &= \frac{1}{3}(2 - q - q^2), \\ I &= \frac{1}{\sqrt{3}}(q - q^2). \end{aligned} \tag{74}$$

Reversely

$$\begin{aligned} q_0 &= K + E, \\ q &= K - \frac{1}{2}E + \frac{\sqrt{3}}{2}I, \\ q^2 &= K - \frac{1}{2}E - \frac{\sqrt{3}}{2}I. \end{aligned} \tag{75}$$

Ternary hyper-numbers

The surface

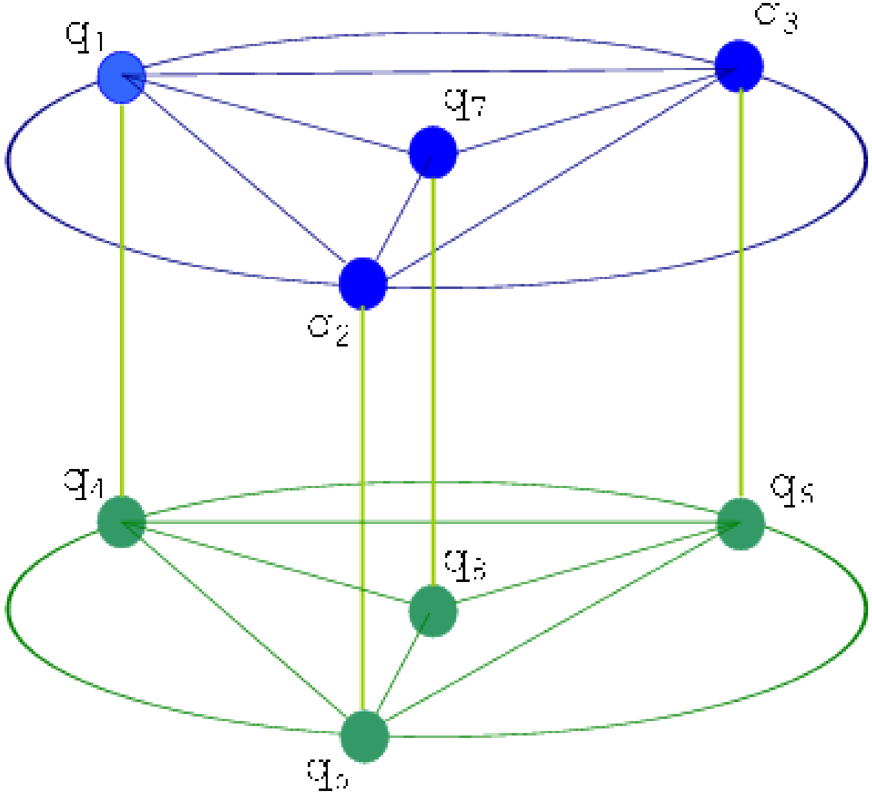
$$x_0^3 + x_1^3 + x_2^3 - 3x_0x_1x_2 = \rho^3 \tag{82}$$

(see figure ??) is a ternary analogue of the S^1 circle and it is related with the ternary Abelian group, $TU(1)$.

From the above figure one can see, that this surface approaches asymptotically the plane $x_0+x_1+x_2=0$ and the line $x_0 = x_1 = x_2$ orthogonal to it. In $\mathbb{T}_3\mathbb{C}$ they correspond to the ideals I_2 and I_1, respectively. The latter line will be called the "trisectrice".

One can compare this cubic surface to the quadratic surface -cylinder- what can be consider as equation $x_1^2 + x_2^2 = 1$ in the $\mathbb{C} \otimes \mathbb{R}$-space. This fact could be accepted as the first success of the ternary complex numbers of binary complex numbers what can be embedded only into even dimensional $\mathbb{R}^{2n}$ space.

$q_a^3 = q_0$ $a = 1,2,\ldots,8$ $j = \exp(\tfrac{2}{3}\pi i)$



$q_7\, q_1 = q_2$
$q_7\, q_2 = q_3$
$q_7\, q_3 = q_1$

$q_1\, q_7 = j\, q_2$
$q_2\, q_7 = j\, q_3$
$q_3\, q_7 = j\, q_1$

$q_1^2 = q_4$
$q_2^2 = q_5$
$q_3^2 = q_6$
$q_7^2 = q_8$

$q_1\, q_2\, q_3 = j^2\, q_0$ $q_2\, q_1\, q_3 = j\, q_0$

$q_4\, q_5\, q_6 = j^2\, q_0$ $q_5\, q_4\, q_6 = j\, q_0$

TOWARDS THE D+5,6- DIMENSIONAL EXTENSION OF LORENTZ GROUP

$$(x_0{}^2 - x_1{}^2 - x_2{}^2 - x_3{}^2) f(x_5,\ldots)$$

$$(x_0{}^2 - x_1{}^2 - x_2{}^2 - x_3{}^2)(x_5{}^2 - x_6{}^2)$$

R^n-COMPLEXIFICATION WITH FINITE GROUPS

Abelian Cyclic C _n- groups and Non-Abelian Groups

ABELIAN CYCLIC GROUPS

A representation of the group G is a homomorphism of this group into the multiplicative group $GL_m(\Lambda)$ of nonsingular matrices over the field Λ, where $\Lambda = \mathbb{R}, \mathbb{C}$ or etc. The degree of representation is defined by the size of the ring of matrices. If degree is equal one the representation is linear. For Abelian cyclic group C_n one can easily find the character table, which is $n \times n$ square matrix whose rows correspond to the different characters for a particular conjugation class, q^α, $\alpha = 0, 1, .., n-1$. For cyclic groups C_n the n irreducible representations are one dimensional (see Table):

$$\left(\begin{array}{c|cccccc} - & 1 & q & ... & q^\alpha & ... & q^{n-1} \\ \hline \xi^{(1)} & 1 & 1 & ... & 1 & ... & 1 \\ \xi^{(2)} & 1 & \xi_2^{(2)} & ... & \xi_\alpha^{(2)} & ... & \xi_n^{(2)} \\ ... & .... & ... & ... & ... & ... & \\ \xi^{(k)} & 1 & \xi_2^{(k)} & ... & \xi_\alpha^{(k)} & ... & \xi_n^{(k)} \\ ... & .... & ... & ... & ... & ... & \\ \xi^{(N)} & 1 & \xi_2^{(n)} & ... & \xi_\alpha^{(n)} & ... & \xi_n^{(n)} \end{array} \right) \qquad (66)$$

where the characters can be defined through n-th root of unity. For example, if the character table for C_n can be summarized as

$$\xi^\alpha_k = \xi^\alpha_1 \exp\{(2\pi i(k-1)(\alpha-1))/n\} \qquad (k, \alpha = 1, 1, 2, ..., n) \qquad (67)$$

The Q_k operators with $k = 0, 1, 2, ..., 8$ satisfy to the following ternary S_3 commutation relations:

N	$\{klm\} \to \{n\}$	f_{klm}^{n}	N	$\{klm\} \to \{n\}$	f_{klm}^{n}	N	$\{klm\} \to \{n\}$	f_{klm}^{n}
1	$\{0,1,2\} \to \{6\}$	$\frac{1}{\sqrt{3}}$	29	$\{1,2,3\} \to \{0\}$	$\sqrt{3}$	57	$\{2,4,7\} \to \emptyset$	0
2	$\{0,1,3\} \to \{5\}$	$-\frac{1}{\sqrt{3}}$	30	$\{1,2,4\} \to \{2\}$	1	58	$\{2,4,8\} \to \emptyset$	0
3	$\{0,1,4\} \to \{0,7,8\}$	$\left\{0, 0, \sqrt{\frac{2}{3}}\right\}$	31	$\{1,2,5\} \to \{1\}$	1	59	$\{2,5,6\} \to \{6\}$	-1
4	$\{0,1,5\} \to \emptyset$	0	32	$\{1,2,6\} \to \emptyset$	0	60	$\{2,5,7\} \to \{0,7,8\}$	$\left\{\frac{3}{\sqrt{2}}, -1, -\frac{2}{\sqrt{3}}\right\}$
5	$\{0,1,6\} \to \emptyset$	0	33	$\{1,2,7\} \to \{6\}$	$-\sqrt{\frac{2}{3}}$	61	$\{2,5,8\} \to \{0,7,8\}$	$\left\{-\sqrt{\frac{3}{2}}, 0, 1\right\}$
6	$\{0,1,7\} \to \emptyset$	0	34	$\{1,2,8\} \to \{6\}$	$\sqrt{2}$	62	$\{2,6,7\} \to \emptyset$	0
7	$\{0,1,8\} \to \{1\}$	$-\sqrt{\frac{2}{3}}$	35	$\{1,3,4\} \to \{3\}$	-1	63	$\{2,6,8\} \to \emptyset$	0
8	$\{0,2,3\} \to \{4\}$	$\frac{1}{\sqrt{3}}$	36	$\{1,3,5\} \to \emptyset$	0	64	$\{2,7,8\} \to \{2\}$	$\frac{1}{\sqrt{3}}$
9	$\{0,2,4\} \to \emptyset$	0	37	$\{1,3,6\} \to \{1\}$	-1	65	$\{3,4,5\} \to \emptyset$	0
10	$\{0,2,5\} \to \{0,7,8\}$	$\left\{0, \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{6}}\right\}$	38	$\{1,3,7\} \to \{5\}$	$\sqrt{\frac{2}{3}}$	66	$\{3,4,6\} \to \{4\}$	1
11	$\{0,2,6\} \to \emptyset$	0	39	$\{1,3,8\} \to \{5\}$	$\sqrt{2}$	67	$\{3,4,7\} \to \emptyset$	0
12	$\{0,2,7\} \to \{2\}$	$-\frac{1}{\sqrt{2}}$	40	$\{1,4,5\} \to \{5\}$	-1	68	$\{3,4,8\} \to \emptyset$	0
13	$\{0,2,8\} \to \{2\}$	$\frac{1}{\sqrt{6}}$	41	$\{1,4,6\} \to \{6\}$	1	69	$\{3,5,6\} \to \{5\}$	-1
14	$\{0,3,4\} \to \emptyset$	0	42	$\{1,4,7\} \to \{0,7,8\}$	$\left\{0, 0, \frac{1}{\sqrt{3}}\right\}$	70	$\{3,5,7\} \to \emptyset$	0
15	$\{0,3,5\} \to \emptyset$	0	43	$\{1,4,8\} \to \{0,7,8\}$	$\left\{\sqrt{6}, \sqrt{3}, 0\right\}$	71	$\{3,5,8\} \to \emptyset$	0
16	$\{0,3,6\} \to \{0,7,8\}$	$\left\{0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{6}}\right\}$	44	$\{1,5,6\} \to \emptyset$	0	72	$\{3,6,7\} \to \{0,7,8\}$	$\left\{-\frac{3}{\sqrt{2}}, 1, -\frac{2}{\sqrt{3}}\right\}$
17	$\{0,3,7\} \to \{3\}$	$\frac{1}{\sqrt{2}}$	45	$\{1,5,7\} \to \emptyset$	0	73	$\{3,6,8\} \to \{0,7,8\}$	$\left\{-\sqrt{\frac{3}{2}}, 0, -1\right\}$
18	$\{0,3,8\} \to \{3\}$	$\frac{1}{\sqrt{6}}$	46	$\{1,5,8\} \to \emptyset$	0	74	$\{3,7,8\} \to \{3\}$	$\frac{1}{\sqrt{3}}$
19	$\{0,4,5\} \to \{3\}$	$-\frac{1}{\sqrt{3}}$	47	$\{1,6,7\} \to \emptyset$	0	75	$\{4,5,6\} \to \{0\}$	$-\sqrt{3}$
20	$\{0,4,6\} \to \{2\}$	$\frac{1}{\sqrt{3}}$	48	$\{1,6,8\} \to \emptyset$	0	76	$\{4,5,7\} \to \{3\}$	$\sqrt{\frac{2}{3}}$
21	$\{0,4,7\} \to \emptyset$	0	49	$\{1,7,8\} \to \{1\}$	$\frac{1}{\sqrt{3}}$	77	$\{4,5,8\} \to \{3\}$	$-\sqrt{2}$
22	$\{0,4,8\} \to \{4\}$	$\sqrt{\frac{2}{3}}$	50	$\{2,3,4\} \to \emptyset$	0	78	$\{4,6,7\} \to \{2\}$	$-\sqrt{\frac{2}{3}}$
23	$\{0,5,6\} \to \{1\}$	$-\frac{1}{\sqrt{3}}$	51	$\{2,3,5\} \to \{3\}$	1	79	$\{4,6,8\} \to \{2\}$	$-\sqrt{2}$
24	$\{0,5,7\} \to \{5\}$	$\frac{1}{\sqrt{2}}$	52	$\{2,3,6\} \to \{2\}$	1	80	$\{4,7,8\} \to \{4\}$	$-\frac{1}{\sqrt{3}}$
25	$\{0,5,8\} \to \{5\}$	$-\frac{1}{\sqrt{6}}$	53	$\{2,3,7\} \to \{4\}$	$2\sqrt{\frac{2}{3}}$	81	$\{5,6,7\} \to \{1\}$	$-2\sqrt{\frac{2}{3}}$
26	$\{0,6,7\} \to \{6\}$	$-\frac{1}{\sqrt{2}}$	54	$\{2,3,8\} \to \emptyset$	0	82	$\{5,6,8\} \to \emptyset$	0
27	$\{0,6,8\} \to \{6\}$	$-\frac{1}{\sqrt{6}}$	55	$\{2,4,5\} \to \{4\}$	-1	83	$\{5,7,8\} \to \{5\}$	$-\frac{1}{\sqrt{3}}$
28	$\{0,7,8\} \to \emptyset$	0	56	$\{2,4,6\} \to \emptyset$	0	84	$\{6,7,8\} \to \{6\}$	$-\frac{1}{\sqrt{3}}$

We have got 84 commutations relations. One commutation relation, $\{Q_0, Q_7, Q_8\}_{S_3} = 0$, provide the Cartan subalgebra. Let separate the rest 83 commutation relations on the 5 groups$(18+18+27+18+2)$. The first group contains itself the following 18 commutation

ТЕМЫ

ДЛЯ НАУЧНО-ПРАКТИЧЕСКИХ РАБОТ СТУДЕНТОВ И АСПИРАНТОВ ,

УЧИТЫВАЮЩИХ НАУЧНЫЕ НАПРАВЛЕНИЯ ИССЛЕДОВАНИЙ. ПРОВОДИМЫХ В НИУ-6

1.ПРАМАТЕРИЯ И ОБРАЗОВАНИЕ ВСЕЛЕННОЙ.

НЕСТАБИЛЬНОСТЬ ПРОТОНА И ПОСТ – ЯДЕРНАЯ ЭНЕРГЕТИКА .

ЦВЕТОВАЯ КВАРКОВАЯ МОДЕЛЬ НУКЛОНОВ – ДОСТИЖЕНИЯ И ПРОБЛЕМЫ ЗАПИРАНИЯ ЦВЕТА

ПРОБЛЕМЫ ЯДЕРНОЙ ФИЗИКИ - КВАНТОВАНИЕ НУКЛОНОВ – ПРОТОН + НЕЙТРОН .

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СТРУКТУРА ЭЛЕКТРОНА.

ПРАМАТЕРИЯ И ЕДИНАЯ МОДЕЛЬ НУКЛОНОВ И ЭЛЕКТРОНА (P,N,E).

РОЛЬ ПРАМАТЕРИИ В ПРОЦЕССАХ ОБРАЗОВАНИЯ ЭЛЕКТРОМАГНИТНО -ЗАРЯЖЕННОЙ ЯДЕРНОЙ И ЛЕПТОННОЙ МАТЕРИИ.

ПРОБЛЕМА АНТИ - ВЕЩЕСТВА.

ПРОБЛЕМЫ ПОСТРОЕНИЯ ГЕОМЕТРИИ ВСЕЛЕННОЙ: ДОПОЛНИТЕЛЬНЫЕ ПРОСТРАНСТВЕННЫЕ ИЗМЕРЕНИЯ И ВТОРОЕ ВРЕМЯ

РАСШИРЕНИЕ ТЕОРИИ ОТНОСИТЕЛЬНОСТИ И НОВЫЕ ВИДЫ ЭНЕРГИИ.

ТЕОРИЯ И ПРАКТИЧЕСКИЕ ПРИМЕНЕНИЯ.

- of light in Minkowsky (D = 3 + 1) space-time. Absence of singularities in such a spacetime
- allows you to enter the gauge invariance in a region, which can connect two kinds of
- matter: the matter substance and radiation. The substance described by the fundamental
- fermion fields with spin 1/2[4], G.Weyl,[11], and radiation - gauge fields with spin 1. The
- question of maintaining gauge invariance may depend on the existence of singularities in
- this space-time, which can be a source of symmetry breaking. This option is actually
- a violation of gauge symmetry associated with the existence of space-time singularities
- at small or large distances. Note that the existence of singularities at small distances
- can lead to a change of the Riemann metric and, therefore, to a dynamical violation of
- space-time Lorentz symmetry (see for example, [7]).

- Thus the formalism of quantum field theory includes the geometric foundation
- of space-time picture of the ”visible ”world and the operator-functional methods of describing
- a matter moving and interacting in this environment. But now some phenomena
- in physics of elementary particles pose the question the need to expand our notions of
- space and time?! In this case the first question arises of dimension and signature of a
- new hypothetical world. In our opinion, now modern science close to understanding to
- the origin of the visible part of universe defined by a D=(3+1)-dimensional space-time
- continuum, obeying to the laws of absolutism speed of light, and the observable fermion
- matter of which has the ”unified” electromagnetic nature. In articles [2] , [19] it was
- suggested that only the Dirac fermion matter can satisfy to the laws of absolutism speed

LIE algebras SO(3,1) and SL(2C)

- The Lie algebra of Lorentz group $SO(3, 1)$ is isomorphic to the algebra of its double covering
- ***Spin*(3, 1) = *SL*(2*C*)-**group
- the irreducible representations of what can
- be defined by two integer or semi-integer numbers (μ, v) of the finite-dimensional representations of the $SU(2) \times SU(2)$ group.
- The minimal representations of this group are
- Scalar (0, 0) representation
- Weyl spinors , (1/2, 0)L- and (0, 1/2)R-representations
- what are related by P -parity operation (and complex conjugation):
- $x0 \to x0,\ \vec{x} \to -\vec{x},\ (1/2, 0) \to (0, 1/2).$

НАЧАЛО SU(2)_SWxU(1)_Y

- To describe the *I_*- charged weak currents
- and combine them to the EM- currents in Weinberg-Salam model $SU(2)WI \times U(1)Y$ it
- was used the ideas of the Heisenberg $SU(2)I$ - isotopic group and the following relation
- $Q(EM) = I\_3 + Y/2.$

- As one of the main result of a such model it was predicted the neutral
- weak interactions what was experimentally confirmed in GARGAMELLE CERN neutrino
- experiments in 1974 year. In this model the P- violation (C-violation) was constructed by
- hands taking the left- and right handed fermions in different $SU(2)WI$ - representations.
- For breaking the gauge symmetry in Weinberg- Salam model it was used the mechanism
- in the internal sector of the model what predicted the existence of a new fundamental
- scalar particle- Higgs boson.

- . Mechanism of the appearance of
- the masses of gauge bosons and fermions is enough formal and it is not clear its link to
- structural changes of the space-time. At least , in spite of preliminary of strong indications
- and a lot of discussions CERN plans to continue these experiments for the future cycle
- of LHC-collider work with planing to get much more the energy of the proton beams.
- Fermilab also resumed the work on the improvement of the Tevatron to finally clarify the

- nature of signals detected at CERN collider at energy of 125 Gev. One can propose that
- the role of the weak sector of the Standard Model is the way to understand the origin
- of the visible universe. More suppressed processes going to the CP- violation may be
- associated with an unknown dynamics at the more smaller distances $\sim 10^{-16-17}$cm. In
- addressing this issue again we faced with the dilemma of the mechanism of these phenomena:
- defects of the space-time geometry or/and a new dynamics related to the new
- interactions ? Obviously the issue is closely related to another important problem - the
- existence of three quark-lepton families. All experimental information on three family
- mixing and CP-violation can be encoded into the Cabibbo-Kobajashi-Maskawa (CKM)-
- matrix parameters which also requires explanation!

- The 3- family mixing explanation is
- completely going into the mass origin problem. In the second case one should again to
- study the problem related to the local gauge symmetry breaking - ”Higgsology” or unknown
- a space-time singularity structure. In the depths of this phenomenology is waiting
- for us very rich physics what can shed light on the production the visible part of Universe!

Towards a new spinor-fermion structure

- we do not define the fermion matter that fills the space-time continuum should have a universal property, *i.e.* Dirac half-one fermions[2].
- [GV],[AV].
- It means that we can imagine the existence of exotic fermion matter , for example,
- having another spin $1/n$, $n \geq 3$ and without an electromagnetic (color) charge
- nature. In this picture our visible Dirac Universe forming a topological cycle could be
- embedded into Meta - Universe having much more reach the space-time topology

- . As a
- messenger between the cycles we suggested neutrinos with Dirac mass equal to zero.
- To construct the spin 1/*n* fermion theories first one should find out the examples of
- the geometrical spaces having such a spinor structure [19],[20],[22]. Taking into account
- a possibility to imply the spaces with arbitrary spin structure in formulation of the basic
- principles of the string theory one could significantly expand the assumption touching
- the D- dimensional pseudo-Lorentz space, in which the string is moving . We think that
- in this case the string and superstrings theories could considerably extend the set of
- predictions for modern physics of elementary particles. In according to such geometrical
- objects one can search for new symmetries, what we already started to study in the class
- of n-ary symmetries with corresponding n-ary algebras what already have been discussed
- in literature, for example, [6],[22], and reference there.

РАСШИРЕНИЕ СИММЕТРИИ ЛОРЕНЦА.

-
- $[S_i, S_j] = i\varepsilon_{ijk}S_k, \ \sigma_i^2 = \hat{1}_2 = \sigma_0$
- $S_j = \frac{1}{2}\sigma_j, j = 1,2,3$
- $\sigma_0 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \sigma_1 = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \sigma_1 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \sigma_3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$
- $[Q_a, Q_b] = 0, Q_a^3 = \hat{1}_3 = Q_0$
-
- $Q_0 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}, Q_1 = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix}, Q_2 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$

GROUP ALGEBRAS -GEOMETRY

- $\Lambda_{ia} = S_i \otimes Q_a = \left(\frac{1}{2}\sigma_i\right) \otimes Q_a,$ i=0,1,2,3;a=0,1,2
- $\hat{\Lambda} = \left\{\sum_{k=0}^{k=3} x_k S_k\right\} \otimes \left\{\sum_{c=0}^{2} y_c Q_c\right\}$
-
- $\hat{\Lambda}$

$$= \frac{1}{2}\begin{pmatrix} (x_0+x_3)y_0 & (x_0+x_3)y_1 & (x_0+x_3)y_2 & (x_1-ix_2)y_0 & (x_1-ix_2)y_1 & (x_1-ix_2)y_2 \\ (x_0+x_3)y_2 & (x_0+x_3)y_0 & (x_0+x_3)y_1 & (x_1-ix_2)y_2 & (x_1-ix_2)y_0 & (x_1-ix_2)y_1 \\ (x_0+x_3)y_1 & (x_0+x_3)y_2 & (x_0+x_3)y_0 & (x_1-ix_2)y_1 & (x_1-ix_2)y_2 & (x_1-ix_2)y_0 \\ (x_1+ix_2)y_0 & (x_1+ix_2)y_1 & (x_1+ix_2)y_2 & (x_0-x_3)y_0 & (x_0-x_3)y_1 & (x_0-x_3)y_2 \\ (x_1+ix_2)y_2 & (x_1+ix_2)y_0 & (x_1+ix_2)y_1 & (x_0-x_3)y_2 & (x_0-x_3)y_0 & (x_0-x_3)y_1 \\ (x_1+ix_2)y_1 & (x_1+ix_2)y_2 & (x_1+ix_2)y_0 & (x_0-x_3)y_1 & (x_0-x_3)y_2 & (x_0-x_3)y_0 \end{pmatrix}$$

GROUP ALGEBRAS -GEOMETRY

- $\Lambda_{ai}^{T} = Q_a \otimes S_i = Q_a \otimes \left(\frac{1}{2}\sigma_i\right)$, i=0,1,2,3;a=0,1,2
- $Q_0 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}, Q_1 = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix}, Q_2 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$
- $\hat{\Lambda}^{T} = \{\sum_{c=0}^{2} y_c Q_c\} \otimes \{\sum_{k=0}^{k=3} x_k S_k\}$
- $= \{\sum_{c=0}^{2} y_c Q_c\} \otimes \left\{\frac{1}{2}\sum_{i=0}^{3} x_i \sigma_i\right\}$

GROUP ALGEBRAS -GEOMETRY

- $\Lambda_{ai}^{T} = Q_a \otimes S_i = Q_a \otimes \left(\frac{1}{2}\sigma_i\right)$, i=0,1,2,3;a=0,1,2
- $Q_0 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}, Q_1 = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix}, Q_2 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$
- $\hat{\Lambda}^{T} = \{\sum_{c=0}^{2} y_c Q_c\} \otimes \{\sum_{k=0}^{k=3} x_k S_k\} = \{\sum_{c=0}^{2} y_c Q_c\} \otimes \left\{\frac{1}{2}\sum_{i=0}^{3} x_i \sigma_i\right\}$

GROUP ALGEBRAS -GEOMETRY

-
- $\hat{\Lambda}^T(SU(2Q) = \frac{1}{2}\begin{pmatrix} y_0 & y_1 & y_2 \\ y_2 & y_0 & y_1 \\ y_1 & y_2 & y_0 \end{pmatrix} \otimes \begin{pmatrix} x3 & x_1 - ix_2 \\ x_1 + ix_2 & -x_3 \end{pmatrix} =$
-
- $= \frac{1}{2}\begin{pmatrix} x_3y_0 & (x_1{-}ix_2)y_0 & x_3y_1 & (x_1{-}ix_2)y_1 & x_3y_2 & (x_1{-}ix_2)y_2 \\ (x_1 + ix_2)y_0 & -x_3y_0 & (x_1 + ix_2)y_1 & -x_3y_1 & (x_1 + ix_2)y_2 & -x_3y_2 \\ x_3y_2 & (x_1{-}ix_2)y_2 & x_3y_0 & (x_1{-}ix_2)y_0 & x_3y_1 & (x_1{-}ix_2)y_1 \\ (x_1 + ix_2)y_2 & -x_3y_2 & (x_1 + ix_2)y_0 & -x_3y_0 & (x_1 + ix_2)y_1 & -x_3y_1 \\ x_3y_1 & (x_1{-}ix_2)y_1 & x_3y_2 & (x_1{-}ix_2)y_2 & x_3y_0 & (x_1{-}ix_2)y_0 \\ (x_1 + ix_2)y_1 & -x_3y_1 & (x_1 + ix_2)y_2 & -x_3y_2 & (x_1 + ix_2)y_0 & -x_3y_0 \end{pmatrix}$

SU(2Q)-ALGEBRA

- $\hat{\Lambda} = \left\{\sum_{k=0}^{k=3} x_k S_k\right\} \otimes \{\sum_{c=0}^{2} y_c Q_c\}$
-
- $\left[\Lambda_{ia}, \Lambda_{jb}\right] = i\varepsilon_{ijk}\eta_c\Lambda_{kc},$
- $\Lambda_{kc} = S_k \otimes Q_c, Q_c = Q_a Q_b = \eta_{abc} Q_c$
- $\left[S_i \otimes Q_a, S_j \otimes Q_b\right] = S_i \cdot S_j \otimes Q_a \cdot Q_b - S_j \cdot S_i \otimes Q_b \cdot Q_a = \left(S_i \cdot S_j - S_j \cdot S_i\right) \otimes Q_a Q_b =$
- $= i\varepsilon_{ijk} S_k \otimes \eta_{abc} Q_c = i\varepsilon_{ijk} S_k \otimes Q_a Q_b = i\varepsilon_{ijk} S_k \otimes \eta_{abc} Q_c$

SU(2Q)-ALGEBRA

- $\hat{\Lambda}(SU(2Q))$
$= \frac{1}{2}\begin{pmatrix} x_3y_0 & x_3y_1 & x_3y_2 & (x_1-ix_2)y_0 & (x_1-ix_2)y_1 & (x_1-ix_2)y_2 \\ x_3y_2 & x_3y_0 & x_3y_1 & (x_1-ix_2)y_2 & (x_1-ix_2)y_0 & (x_1-ix_2)y_1 \\ x_3y_1 & x_3y_2 & x_3y_0 & (x_1-ix_2)y_1 & (x_1-ix_2)y_2 & (x_1-ix_2)y_0 \\ (x_1+ix_2)y_0 & (x_1+ix_2)y_1 & (x_1+ix_2)y_2 & -x_3y_0 & -x_3y_1 & -x_3y_2 \\ (x_1+ix_2)y_2 & (x_1+ix_2)y_0 & (x_1+ix_2)y_1 & -x_3y_2 & -x_3y_0 & -x_3y_1 \\ (x_1+ix_2)y_1 & (x_1+ix_2)y_2 & (x_1+ix_2)y_0 & -x_3y_1 & -x_3y_2 & -x_3y_0 \end{pmatrix}$
-

SU(3^c)XU(1)XSU(2)XU(1)xSU(3H)XU(1H)
4-dimsuperstrings
With World-Sheet Fermions(1992Padova)

Table 2: **The list of quantum numbers of the states. Model 1.**

N^o	$b_1, b_2, b_3, b_4, b_5, b_6$	SO_{hid}	$U(5)^I$	$U(3)^I$	$U(5)^{II}$	$U(3)^{II}$	Y_5^I	Y_3^I	Y_5^{II}	Y_3^{II}
1	RNS		5	$\bar{3}$	1	1	–1	–1	0	0
			1	1	5	$\bar{3}$	0	0	–1	–1
	0 2 0 1 2(6) 0		5	1	5	1	–1	0	–1	0
$\hat{\Phi}$			1	3	1	3	0	1	0	1
			5	1	1	3	–1	0	0	1
			1	3	5	1	0	1	–1	0
2	0 1 0 0 0 0		1	3	1	1	5/2	–1/2	0	0
			$\bar{5}$	3	1	1	–3/2	–1/2	0	0
			10	1	1	1	1/2	3/2	0	0
$\hat{\Psi}$	0 3 0 0 0 0		1	1	1	1	5/2	3/2	0	0
			$\bar{5}$	1	1	1	–3/2	3/2	0	0
			10	3	1	1	1/2	–1/2	0	0
3	0 0 1 1 3 0	$-_1 \pm_2$	1	1	1	3	0	–3/2	0	–1/2
	0 0 1 1 7 0	$-_1 \pm_2$	1	$\bar{3}$	1	1	0	1/2	0	3/2
$\hat{\Psi}^H$	0 2 1 1 3 0	$+_1 \pm_2$	1	$\bar{3}$	1	3	0	1/2	0	–1/2
	0 2 1 1 7 0	$+_1 \pm_2$	1	1	1	1	0	–3/2	0	3/2
4	1 1 1 0 1 1	$\mp_1 \pm_3$	1	1	1	$\bar{3}$	0	–3/2	0	1/2
	1 1 1 0 5 1	$\mp_1 \pm_3$	1	$\bar{3}$	1	1	0	1/2	0	–3/2
$\hat{\Phi}^H$	1 3 1 0 1 1	$\pm_1 \pm_3$	1	$\bar{3}$	1	$\bar{3}$	0	1/2	0	1/2
	1 3 1 0 5 1	$\pm_1 \pm_3$	1	1	1	1	0	–3/2	0	–3/2
5	0 1(3) 1 0 2(6) 1	$-_1 \pm_3$	1	$3(\bar{3})$	1	1	$\pm 5/4$	$\pm 1/4$	$\pm 5/4$	$\mp 3/4$
		$+_1 \pm_3$	$5(\bar{5})$	1	1	1	$\pm 1/4$	$\mp 3/4$	$\pm 5/4$	$\mp 3/4$
$\hat{\phi}$	0 1(3) 1 0 4 1	$-_1 \pm_3$	1	1	1	$3(\bar{3})$	$\pm 5/4$	$\mp 3/4$	$\pm 5/4$	$\pm 1/4$
		$+_1 \pm_3$	1	1	$5(\bar{5})$	1	$\pm 5/4$	$\mp 3/4$	$\pm 1/4$	$\mp 3/4$
6	1 2 0 0 3(5) 1	$\pm_1 -_4$	1	1	1	1	$\pm 5/4$	$\pm 3/4$	$\mp 5/4$	$\mp 3/4$
	1 1(3) 0 1 5(3) 1	$+_1 \mp_4$	1	1	1	1	$\pm 5/4$	$\pm 3/4$	$\pm 5/4$	$\pm 3/4$
$\hat{\sigma}$	0 0 1 0 2(6) 0	$\mp_3 +_4$	1	1	1	1	$\pm 5/4$	$\mp 3/4$	$\pm 5/4$	$\mp 3/4$

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Can Neutrinos Probe Extra Dimensions?

V. Ammosov[b] and G. Volkov[a, b]

[a] *Universita di Padova, Dipartimento di Fisica Galileo Galilei, INFN, Padova , Italy.*
[b] *Institute for High Energy Physics, Protvino, Russia.*

СВОЙСТВА НЕЙТРИНО О МНОГОМЕРНОМ ОБОБЩЕНИИ ТЕОРИИ ОТНОСИТЕЛБНОСТИ

ПРЕДСТАВЛЕНИЯ ГРУППЫ ЛОРЕНЦ- ПУАНКАРЕ

- *1. Спин s=½*
- ***2. Майорано-Вейлевская природа*** *- 2-х компклексные степени свободы*

3. Масса m =O(eV)

ЭЛЕКТРОМАГНИТНАЯ СТЕРИЛЬНОСТЬ

- *4. Заряд Q (EM)= O*
- *5. Магнитный момент Mag=O(0)*

(V – A)- СЛАБАЯ СВЯЗЬ С ЗЛЕКТРОМАГНИТНЫМ МИРОМ

- ***6. Взаимодействие слабое***

Letter of Intent

Measurement of Neutrino Velocities at the CERN WANF using Bare Target Neutrino Beams

F. Dydak, J. Ellis, V. Falaleev, J. Gareyte
CERN, CH-1211, Geneva 23, Switzerland

V. Ammosov, G. Gapienko, G. Volkov
Institute for High Energy Physics
RU-142284 Protvino, Moscow region, Russia

Abstract

String/D-branes theories might establish the connection between the geometrical properties of the gauge forces, the associated vacuum and the role of the "sterile" particles. It was pointed out that the speed of a "sterile" particle can be differ from standard expectations of the Special Theory of Relativity.

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