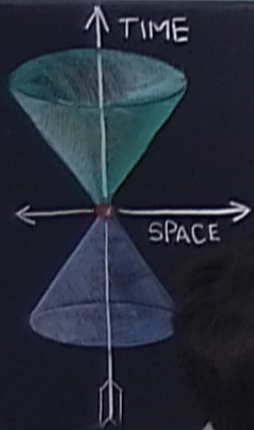


Title: The standard model of particle physics as a non-commutative differential graded algebra

Date: Sep 12, 2015 12:15 PM

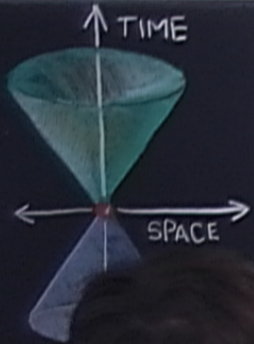
URL: <http://pirsa.org/15090059>

Abstract:



- 1) What is NCG (M, g)
- 2) Why?

$\{\textcircled{A}, D, H\}$

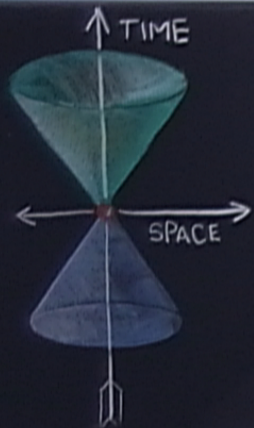


1) What is NCG (M, g)

2) Why? SM!

1) $SU(3) \times SU(2) \times U(1)$

$\{\textcircled{A}, D, H\}$



1) What is NCG (M, g)

$\{\textcircled{A}, D, H\}$

2) Why? SM!

NCG

1)

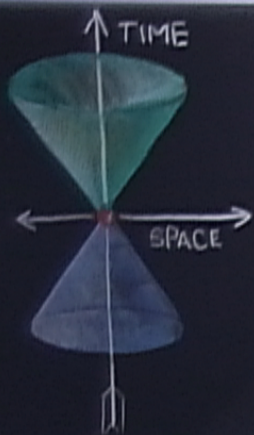
	$SU(3)$	$SU(2)$	$U(1)$
q_L	3	2	$1/6$

2)

u_R	3	1	$2/3$
d_R	3	1	$-1/3$
l_L	1	2	$-1/2$
ν_R	1	1	0
e_R	1	1	-1

3)

h	1	2	$1/2$
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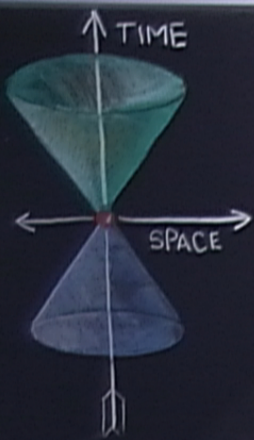
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1) NCG
 $\mathbb{C} \oplus \mathbb{H} \oplus M_3(\mathbb{C})$



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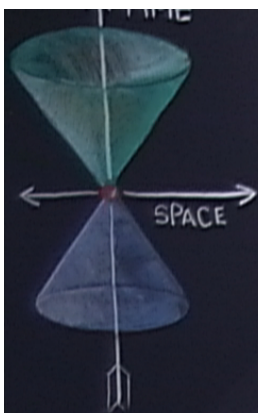
$\{\underline{A}, D, H\}$

NCG

$$\mathbb{C} \oplus \mathbb{H} \oplus M_3(\mathbb{C}) \ni (\lambda, q, m)$$

1)
2)

()



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3)

$\{\underline{A}, D, H\}$

NCG

1) $\mathbb{C} \oplus H \oplus M_3(\mathbb{C}) \ni (\lambda, q, m)$

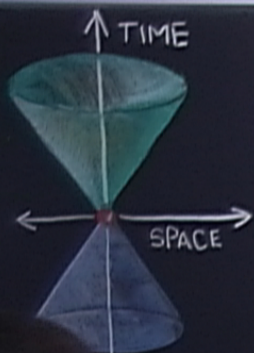
2)

$$\begin{pmatrix} q_1 & q_2 & \dots & q_n \\ q_2 & q_3 & \dots & q_{n+1} \\ \vdots & \vdots & \ddots & \vdots \\ q_n & q_{n+1} & \dots & q_{n+2} \end{pmatrix} \begin{pmatrix} 1 \\ \vdots \\ 1 \end{pmatrix}$$

$q_\lambda = \begin{pmatrix} \lambda & 0 \\ 0 & \bar{\lambda} \end{pmatrix}$

3)





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NCG

1) $\mathbb{C} \oplus \mathbb{H} \oplus M_3(\mathbb{C}) \ni (\lambda, q, m)$

2)

$$\begin{pmatrix} q_\lambda & q_\lambda & \dots & q_\lambda \\ q_\lambda & q_\lambda & \dots & q_\lambda \\ \vdots & \vdots & \ddots & \vdots \\ q_\lambda & q_\lambda & \dots & q_\lambda \end{pmatrix} \begin{pmatrix} 1 \\ \vdots \\ 1 \end{pmatrix}$$

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3) ~~X~~

3)

v_R	1	1	0
e_R	1	1	-1
h	1	2	$1/2$

3)

A $\ast$ -algebra, assoc.

H

3) D $D^\dagger = D$

4) J

5) γ

γ_5

$$\psi \rightarrow i\gamma \psi^\dagger = J\psi$$

1) A $*$ -algebra, assoc.

2) H

3) D $D^\dagger = D$

4) J

5) 0

$$\psi \rightarrow i\mathcal{R}\psi^* = J\psi$$

6) L_a on H

7) R_a on H

8) $[L_a, R_a] = 0$ "order zero"

9) $R_a = J L_a J^{-1}$

10) $d[a]$ $L_{d[a]} = [D, L_a]$

11) $J^2 = \epsilon$ ($\epsilon = \pm 1$)

12) $J D = \epsilon' D J$

13) $J \chi = \epsilon'' \chi J$ ($\epsilon'' = \pm 1$)

14) $\{\chi, D\} = 0$

15) $[\chi, L_a] = [\chi, R_a] = 0$

A, Lie, Jordan, (), Octonions

Eilenberg $B_0 = A \oplus H$

$ah \in H \quad ha \in H$

$b = a + h$

$$b b' = (a + h)(a' + h') = \underline{aa'} + \underline{ah'} + \underline{ha'} + \underline{hh'} \rightarrow 0$$

$B_0 \rightarrow \text{assoc.}$

$$[a, b, c] = (ab)c - a(bc)$$

$$[a, a', a''] = 0$$

$$[a, h, a'] = 0$$

$$[a, a', h] = 0$$

$$[h, a, a'] = 0$$

$$[a, a', h]$$

$$[h, a, a'] = 0$$

$$A, \Omega A \quad B = \Omega A \oplus H \quad \Omega A = \underbrace{\Omega^0 A}_A + \oplus \Omega^2 A \quad A = \sum_n A_n$$

$$a_n a_m = a_{n+m}$$

$$d[a] \quad d^2 = 0$$

$$a_1 d[a_2] a_3 d[a_4]$$

$$d(a_m) \rightarrow a_{m+1}$$

$$d(a_m a_n) = d(a_m) a_n + (-1)^m a_m d(a_n)$$

$$[a, a', h]$$

$$[h, a, a'] = 0$$

$$A, \Omega A \quad B = \Omega A \oplus H$$

$$(\underline{M} \times \underline{F})$$

Brouder, Bizi, Besnard

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$$A, \Omega A \quad B = \Omega A \oplus H$$

$$\textcircled{M} \times \textcircled{F}$$

Brouder, Bizi, Besnard

$$[L_a, R_{a'}] = 0$$

"order 0"

$$[L_a, R_{d[a]}] = 0$$

"... 1"

$$[L_{d[a]}, R_{d[a]}] = 0$$

"... 2"

mod
junk

$$\Omega A = \Omega^0 A + \oplus \Omega^2 A \quad A = \sum_n A_n$$

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