3 marca 2011
17:34

(1) How was this found

97 Reisenberg CR, Iwasaki $H \psi = A \psi$

92 Ooguri BF ↔ GR 3d ↔ matrix models.

93 Relation Ooguri ↔ Loops

99 Barrett-Crane vertex ampl

De Pietri Krasnov Freidel CR

doubts

06 Alesci

07 Engle Pereira CR

Livine Speziale

Freidel Krasnov (FK)

EPRL $A \sim e^{iS_{GR}}$

10 : Barrett, Fairbairn, Hellmann, Gomez, Dowdall Pereira

Lewandowski Kaminski Kisielowski

Bianchi Perini Magliaro GFT

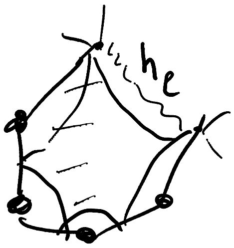
Rovelli, Geloun, Gurau, Magnen, Krajewski.

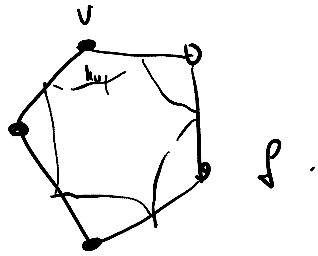
- Fermions: Perini Magliaro Han Bianchi CR
- Λ : Han, Fairbairn Meusburger
  (Bianchi, Krajewski, Vidotto CR)

(2) $\mathcal{H} \supset \mathcal{H}_\Gamma \ni \psi \qquad \overline{W(\psi)} = \langle W | \psi \rangle$

$$W = \lim_{\varepsilon \to 0} Z_\varepsilon \qquad Z_\varepsilon(h_e) \qquad \partial\varepsilon = \Gamma$$

$$\boxed{Z_\varepsilon(h_e) = \int_{SO(3)} dh_{vf} \prod_f \delta(h_f) \prod_v A_v(h_e)}$$





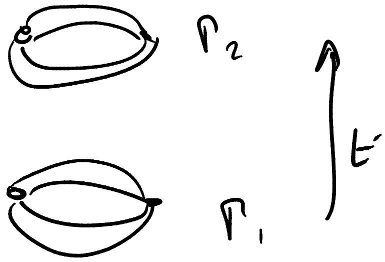
$$h_f = \Big(\prod_v h_{vf}\Big) h_e \qquad \qquad h_f = \prod_{v \in f} h_{vf}$$

b. f   int. f.

$$A_v(h_e)$$

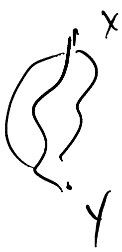
$$\Gamma = \Gamma_1 \cup \Gamma_2 \qquad \psi = \psi_{\Gamma_1} \otimes \psi_{\Gamma_2}$$

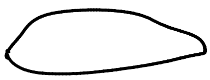
$W(\psi) \leftarrow$ transition ampl.



$$U_T(x,y) = \langle x\, e^{iT\hat{H}}\, y \rangle$$

$$= \int_{\substack{x(0)=y \\ x(T)=x}} Dx(t)\, e^{iS[x]}$$



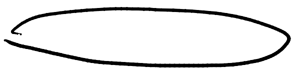


$$\boxed{W(\tilde{g}_3) = \int_{g_{in}\, g_f\, g_\infty} Dg\, e^{iS_{GR}}}$$

$$\boxed{\Psi(\tilde{g}_3) = \int_{\substack{g_{in}\, g_f\, g_\infty \\ g(\bar{x},T)}} Dg\; e^{iS_{GR}}}$$

$t=T$

g_∞ $g(\bar{x},0)$ $t=0$ g_∞



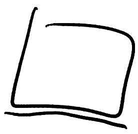
R. Oeckl

$$S = \int \sqrt{g}\, R \qquad e \qquad g_{\mu\nu} = e^I_\mu e^J_\nu \eta_{IJ}$$

$$S(e,\omega) = \int (e\wedge e)^* \wedge F + \frac{1}{\gamma}\int (e\wedge e)\wedge F$$

$$\underline{\text{C.A.}} \quad = \int \left[(e\wedge e)^* + \frac{1}{\gamma}(e\wedge e)\right] \wedge F \qquad F = d\omega + \omega\wedge\omega$$

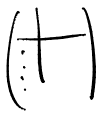
$$\omega\,, \quad \Pi = (e\wedge e)^* + \frac{1}{\gamma}(e\wedge e) \qquad e^I$$



Σ

$$n_I = (1,0,0,0)$$

gauge fix $\quad n e|_\Sigma = 0$



$$\Pi^{IJ} \qquad K = n\Pi \qquad L = n\Pi^*$$

$$K^i = \Pi^{0i} \qquad L^i = -\frac{1}{2}\epsilon^{ijk}\Pi_{jk}$$

$$K = n\Pi = n(e\wedge e)^*$$

$$L = -\frac{1}{\gamma} n(e\wedge e)^* = -\frac{1}{\gamma} K$$

W. Wieland

$$\boxed{\gamma \vec{L} = - \vec{K}}$$

$$\boxed{\vec{K} + \gamma \vec{L} = 0}$$

$$S[B,\omega] = \int B \wedge F \qquad \underline{F=0}$$

$$A(\psi) = (f_\gamma \psi)(\mathbb{1})$$

ω in flat

$F=0$

$$A_{BF}(\psi) = \psi(\mathbb{1})$$

$$\boxed{\vec{K} = -\gamma \vec{L}}$$

<u>SL2C</u>

<u>Reality condition</u>

complex structure

$$\vec{K}, \vec{L}$$

$$\vec{J}^{\pm} = \vec{K} \pm i \vec{L} \qquad [J^+, J^-] = 0$$

$$J^+ \quad J^- \qquad J^+ = \overline{J^-}$$

(reality conditions $\longrightarrow$ scalar product

$$q \; p \qquad \{q, p\} = 1$$

$$\longrightarrow [\hat{q}, \hat{p}] = i\hbar$$

$$\langle \; | \; \rangle \qquad \hat{q}^+ = \hat{q} \qquad \hat{p}^+ = \hat{p}$$

$$\psi(x) \quad \hat{q} = x \quad \hat{p} = -i \frac{d}{dx}$$

$$\langle \psi | \phi \rangle = \int dx\, \overline{\psi}(x)\, \phi(x)$$
$$=$$

$z = q + ip \qquad \{z, \bar{z}\} = i \qquad \psi(z)$

$\bar{z} = q - ip \qquad [\hat{z}, \hat{\bar{z}}] = \hbar \qquad \hat{z} = z$

$$\hat{\bar{z}} = \frac{d}{dz}$$

$$(\phi\, \psi) \stackrel{?}{=} \int dz\, \overline{\phi(z)}\, \psi(z)\, e^{-\bar{z}z}$$

$$\vec{J}^{\pm} = \vec{K} \pm i\vec{L} \qquad \psi(\rho)$$

$$\{\psi(\rho)\} \supset \mathcal{H}_\gamma$$

$$Y_\gamma : |j m m'\rangle \longmapsto |\gamma j, j; jm, jm'\rangle$$

$$\boxed{\vec{K} = -\gamma \vec{L}}$$

Hilbert $\to L_2[SU(2)^L / SU(2)^N]$

CANON Q. of GR (H.C.)

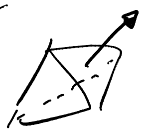
LATTICE

QUAN of SHAPES

Theory

LT

$\mathbb{R}^3$ e

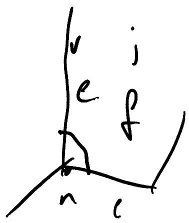
 $\vec{L}_e$ $\quad |\vec{L}_e| = e_e \quad \{L^i_e, L^j_{e'}\} = \delta_{ee'}\,\epsilon^{ij}{}_k L^k_e$

$$\sum_e \vec{L}_e = 0$$

$$\vec{L} \qquad L^i = \tfrac{1}{2}\epsilon^i{}_{jk}\int e^j \wedge e^k = \int n_e E^{ei} = \int_S E^i$$

there are MANY equivalent rewritings of A

$$\boxed{Z_e(j_e, i_n) = \sum_{j_f v_e} \prod_f d_{j_f} \prod_v A_v}$$



$$A_v(j_f, v_e) = A_v(j_e, i_n)$$

$$A_v(j_f, v_c) = \int dg_e \prod_e \langle v_{se} | Y^\dagger_\gamma\, g^{-1}_s g_t\, Y_\gamma | v_{tc}\rangle$$

$j \gg$ limit

$A \sim e^{iS} + e^{-iS} +$ other terms $\qquad$ Euclidean.

$\sim e^{iS} + e^{-iS}$ $\qquad$ Lorentz.

$\sim e^{iS}$ $\qquad$ "holomorphic repres"