1407.3844

AdS_3 + higher spin $\longleftrightarrow$ CFT_2 + higher spin

$S_{CFT} + \int d^2z\, \mu_s W^s + \ldots$ $\qquad$ $S + \int A_\mu J^\mu + \ldots$

$\delta\mu_s = \bar\partial \varepsilon_s + \ldots$ $\qquad$ $\delta A_\mu = \partial_\mu \varepsilon + \ldots$

$\Downarrow$

$\sum \mu_s^0 W_0^s$

GGE's

$\int \mu T$

$\downarrow$

$\int h_{\alpha\beta} T^{\alpha\beta}$

CFT_2

$\bar\partial W_s = 0$ $\qquad$ $\partial^\mu j_\mu = 0$

$\delta_{W_s} S = \int \varepsilon^s \bar\partial W_s$ $\qquad$ $\delta_\varepsilon S = \int \varepsilon \partial^\mu j_\mu$

$$S = S_0 + \int d^2z\, \mu_s W^s + \int d^2z\, \bar{\mu}_s \bar{W}^s + \ldots$$

$$H = H_0 + \oint d\sigma\, \mu_s W^s + \oint d\sigma\, \bar{\mu}_s \bar{W}^s$$

<u>W^s : closed algebra</u>

$$\langle \partial\phi\,\partial\phi(z)\,\bar{\partial}\phi\,\bar{\partial}\phi(w) \rangle$$

$$Z_{CAN} = \mathrm{tr}_H \left(e^{2\pi i \left[\tau (L_0 - \frac{c}{24}) - \bar{\tau} (\bar{L}_0 - \frac{c}{24}) + \sum (\alpha_s W^0_s - \bar{\alpha}_s \bar{W}^0_s) \right]} \right)$$

$$\parallel$$

$$Z_{CAN} = \int D\phi Dp\, e^{\int_{T^2_\tau} d^2z \left[-p\dot{\phi} - H_0 + \sum \mu_s W_s(p,\phi) + \sum \bar{\mu}_s \bar{W}_s(p,\phi) \right]}$$

$$\mu_s = i\alpha_s/\beta \qquad \beta = 2\pi\, \mathrm{Im}(\tau)$$

$$Z_{LAG} = \int D\phi\, e^{-\int_{T^2_\tau} d^2z \left[S_0(\phi) + \sum \mu_s W_s(\phi) + \sum \bar{\mu}_s \bar{W}_s(\phi) \right]}$$

$$+ \ldots$$

Ward identities with anomalous terms

Solve i) rewrite as flatness conditions for a 2d gauge field!

CAN $\langle \partial_- T - \mu_2 \partial_\sigma T - 2T \partial_\sigma \mu_2 - \frac{c}{12} \partial_\sigma^3 \mu_2 \rangle = 0$

LAG same but $\partial_\sigma \to \partial_+$

2) $\delta^{\text{on-shell}} S_{CS} = \int \delta\mu_s \langle W^s \rangle$

$$\begin{cases} \text{CAN} \Rightarrow & a_z + a_{\bar z} = \Lambda^+ + W, \quad a_{\bar z} = M + \ldots \quad (\sim a_z) \\ \text{LAG} \Rightarrow & a_z = \Lambda^+ + W, \quad a_{\bar z} = M + \ldots \end{cases}$$

higher spin algebra $\leftrightarrow$ hamiltonian reduction

$$(sl_2 \hookrightarrow \mathfrak{g})$$

$$a_1 = \begin{pmatrix} 0 & 1 & 0 \\ T & 0 & 1 \\ W & T & 0 \end{pmatrix} \quad a_2 = \begin{pmatrix} * & \mu_2 + * & \mu_3 \\ * & * & \mu_2 - * \\ * & * & * \end{pmatrix}$$

$$\Lambda^+$$

$F(a_1, a_2) = 0 \Leftarrow$ Ward-identities V

CAN $\Leftrightarrow$ $S_{CS} + k\int_{\partial M} \mathrm{Tr}\left((a_z + a_{\bar z} - 2\Lambda^+)\, a_{\bar z} \right)$

$\delta S = \int \delta\mu_s \langle w_s \rangle$

LAG $\Leftrightarrow$ $S_{CS} + k\int_{\partial M} \mathrm{Tr}\left((a_z - 2\Lambda^+)\, a_{\bar z} \right)$

any sol'n of CS $\longrightarrow$ Ward id's.

$\oint_A A \oint_B A + S_{BDY}$

Free energy $\begin{cases} F_{CAN} \\ F_{LAG} \end{cases} \longrightarrow S = \text{same!}$

entropy.

$F_{CAN} \xrightarrow{\text{field redef.}} F_{GK}?$

?

mod. Frob's
are easy in
LAG

- No FIELD REDEF

- entropy is nice in CAN $\begin{pmatrix} 0 & 1 & 0 \\ b & 0 & 1 \\ w_0 & b_0 & 0 \end{pmatrix}$