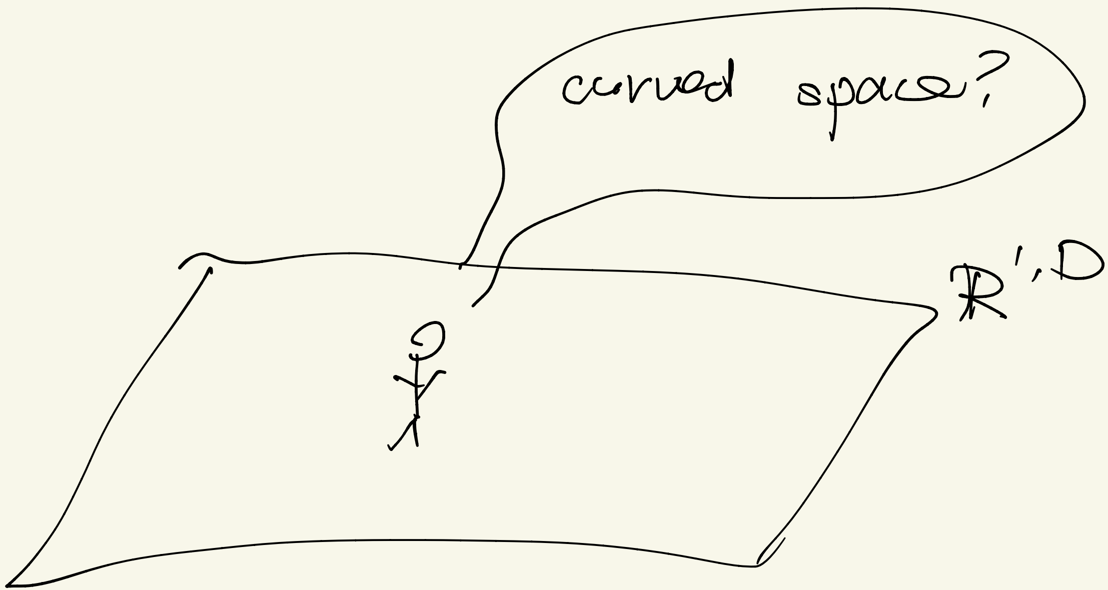
Curved Spaces for Flatlanders

M. Yamazaki
(UTokyo)

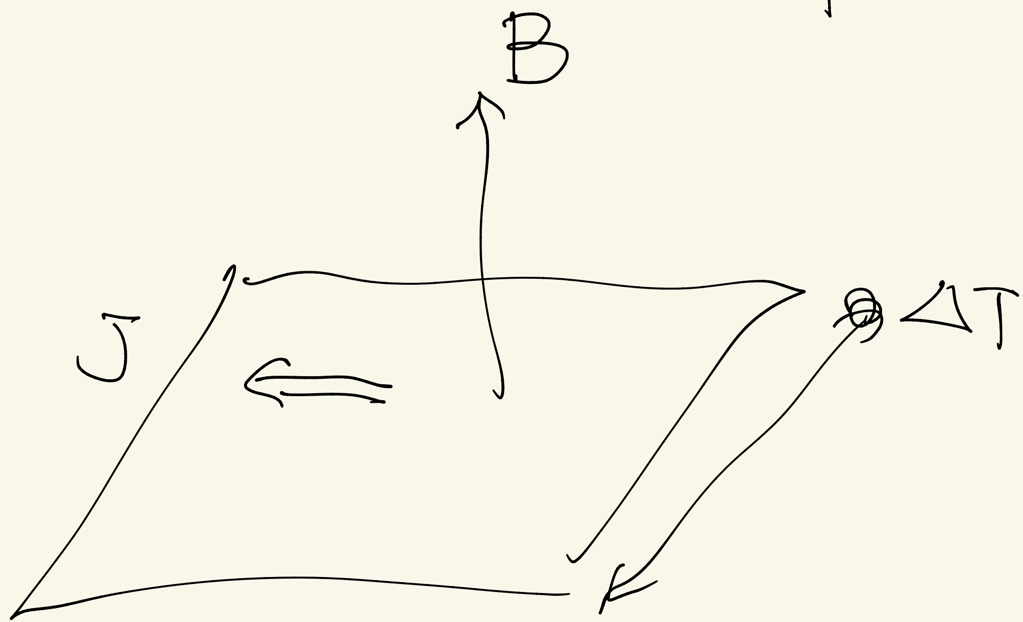
(No refs today)



$$T_{\mu\nu} = \frac{1}{\sqrt{-g}} \frac{\delta \mathcal{L}}{\delta g_{\mu\nu}} \bigg|_{g_{\mu\nu} = \eta_{\mu\nu}}$$

thermall HE

$$\frac{\Delta T}{T} \propto \Delta \Phi$$



2D $\qquad \langle T_\mu{}^\mu \rangle \propto c\, R$

4D $\qquad \langle T_\mu{}^\mu \rangle \propto c\,(\mathrm{Weyl})^2 + \underbrace{a}_{\substack{\text{DOF} \\ \text{monotone} \\ \text{under RG}}}(\mathrm{Euler})$

Q: $\underbrace{\langle T\, T \cdots T \rangle}_{n}$

Q: $D=3$?

$$Z[S^3_b] = \int \left(\text{finite dim integral}\right)$$

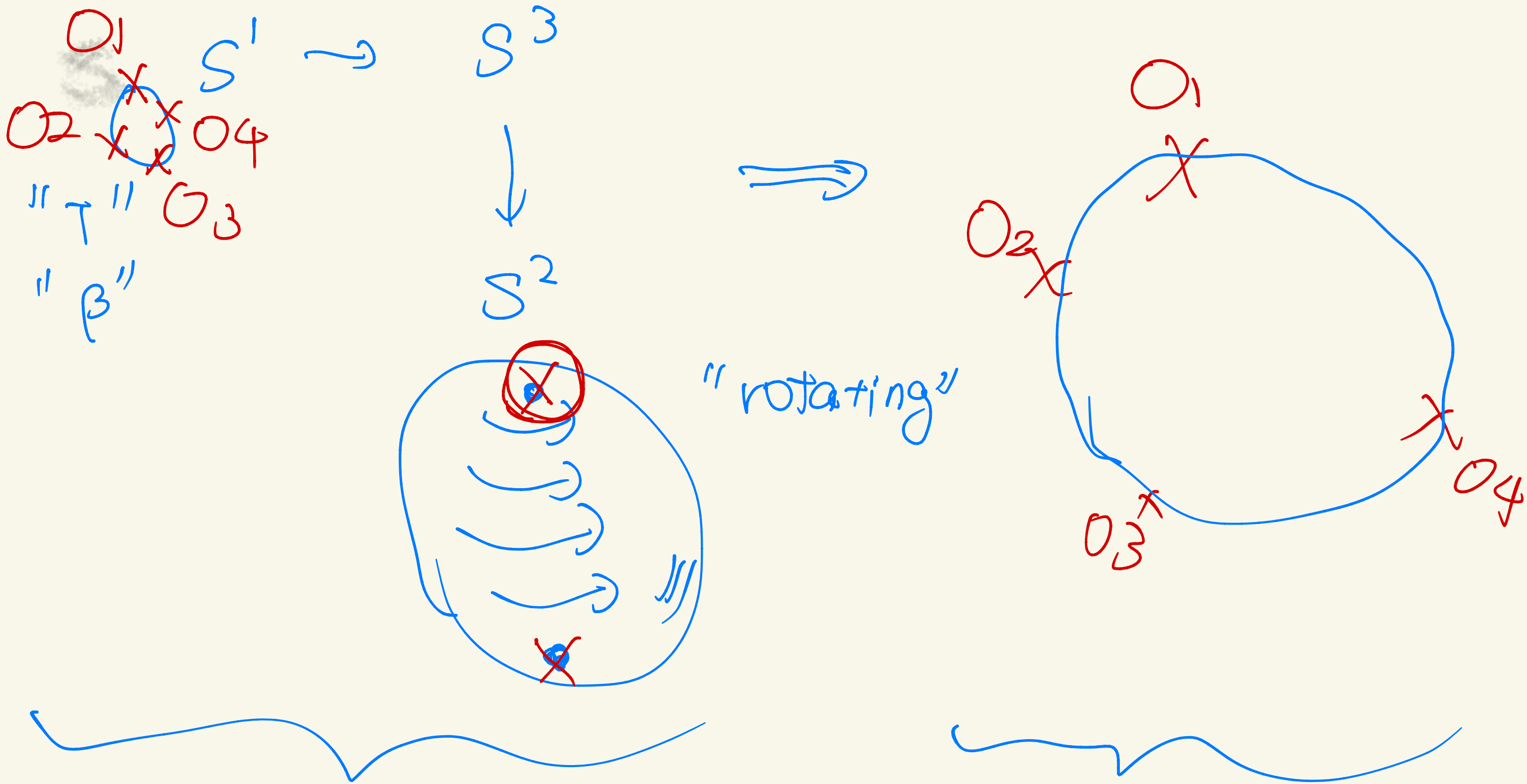
"RM"

- free $\leftarrow$ weakly coupled
- 3d $\mathcal{N}=2$ SUSY — confining

- $F = -\log|Z[S^3_{b=1}]|$: DOF / RG monotone

- $$\left.\frac{\partial^n Z[S^3_b]}{\partial b^n}\right|_{b=1} = \int dx_1 \cdots dx_n \langle T(x_1) \cdots T(x_n) \rangle$$

$$S^1_b \to S^3 \to S^2_{b^{-1}}$$



3d $S^1 \to S^3$

$\downarrow$

S^2

1d QM

6d

4D $\mathcal{N}=1$

$S^1 \times (S^3/\mathbb{Z}_k)$

$$Z[S^1 \times S^3] = \mathrm{Tr}_{\mathcal{H}_{S^3}} (-1)^F e^{-\beta(H + \mu_1 J_1 + \mu_2 J_2)}$$

3D $\mathcal{N}=2$

$$Z[S^3_b] \qquad b^2 \propto \frac{\mu_1}{\mu_2}$$

T^3

$S^1 \times S^2$

2D chiral CFT

1D QM

What about dynamical gravity? QG?

Holography

N finite BH

$\Rightarrow$ quantum BH?

$$\mathcal{N}=4 \qquad\qquad 10D \quad QG$$

$$4D \longleftrightarrow AdS_5 \times S_5$$

$$SU(N) \qquad G_N \sim \frac{1}{N^2}$$

$$N \to \infty$$

$$R \times S^3 \Longleftarrow \partial(AdS_5)$$

$$\uparrow$$

$$Z[S^1 \times S^3] \longleftrightarrow Z[AdS_5 \times S^5]$$

confine / deconfine in 4D

thermal AdS / AdS BH in AdS_5

$$\mathrm{Tr}\,(-1)^F e^{-\beta H}$$

HP transition

$$\| $$

$$Z[S^1 \times S^3] \xrightarrow{\quad \times \quad} \text{AdS BH entropy}$$

$N \to \infty$

analytic cont in μ_1, μ_2

can take
$N \to \infty$

DOF $\longrightarrow$ monotone

for index

fortuitous (exists for $N \leq N_*$)

important for BH entropy

"baryon"

$\underbrace{q \cdots q}_{N}$

"$q\bar{q}$ meson"

$$Z[S^1 \times S^3] = e^{\cdots}\left(1 + p + 6q + \cdots\right)$$

Casimir energy

$\propto a , c$