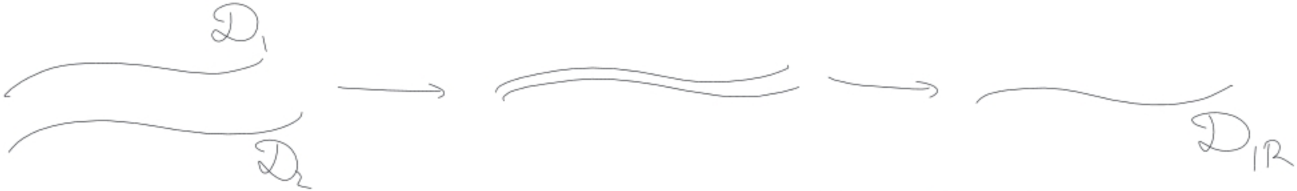
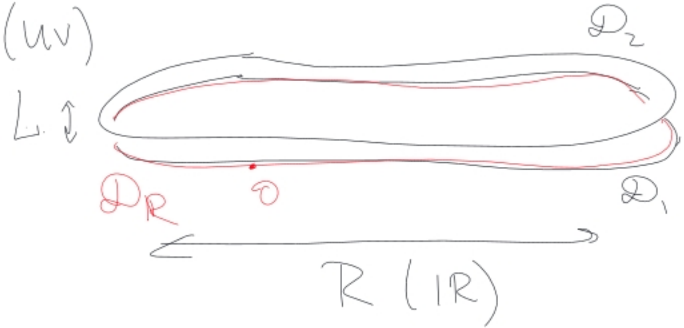
EFT for defect fusion

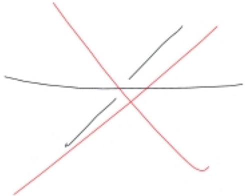
2406.04561 with A. Radcliffe & R. Sinha

(see also 2404.05815 2406.01550 Diatlyk, Khanchandani, Popov, Wang
2406.10186 Cuomo, He, Komargodski)


$\mathcal{O}_1$
$\mathcal{O}_2$
$\approx \sum_k \mathcal{O}_k$


$\mathcal{D}_1$
$\mathcal{D}_2$
$\mathcal{D}_{IR}$





$$\langle \mathcal{D}_1 \mathcal{D}_2 \ldots \rangle \approx \langle \mathcal{D}_{IR}[e^{-S_{eff}}] \ldots \rangle$$

$$S_{eff} = \int dz \left(\lambda_{\mathbb{1}} \mathbb{1} + \sum_{irr} \lambda_O O \right)$$

$n_1\omega(x_1)$ $\quad$ $n_2\omega(x_2)$

$$\mathcal{O}_1(x_1)\,\mathcal{O}_2(x_2) = l(x_1)^{n_1-n_3}\, l(x_2)^{n_2}\, \mathcal{O}_3(x_1)$$

$x_1, x_2 \in \mathcal{M}$ $\qquad$ $n_i = -\Delta_i$

$x_2 \longrightarrow v^\mu \in T_{x_1}\mathcal{M}$ $\qquad$ $l = \sqrt{g_{\mu\nu} v^\mu v^\nu}$

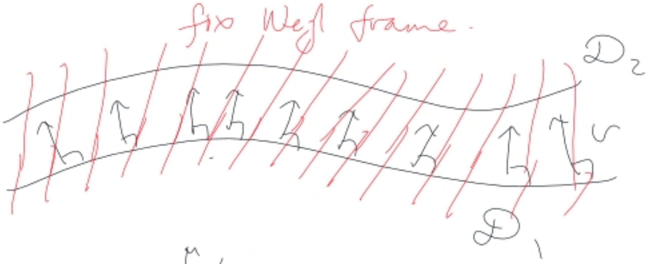
geodesic $\gamma(t)$

$$\gamma(0) = x_1,\ \dot{\gamma}(0) = v,\ \gamma(1) = x_2$$

$$\delta_\omega l = l\,\omega + \frac{1}{2} l \cdot v^\mu \partial_\mu \omega + \dots$$

$$g \to e^{2\omega} g$$

$$l \to e^{\omega + \dots}\, l$$



~~geodesics~~

$\mathcal{D}_1 \sim X_1^\mu(z)$ $\quad$ $\cancel{\gamma_z^\mu(0) = X_1^\mu(z) \qquad \dot{\gamma}_z^\mu(0) = v^\mu(z)}$

$\mathcal{D}_2 \sim X_2^\mu(\varphi(z)) = \gamma_z^\mu(1)$

Can make v^μ completely Weyl-invariant

$$l(z) = \sqrt{g_{\mu\nu} v^\mu v^\nu} \longrightarrow l(x) \quad x \in M$$

We have $\ell(x)$ $x \in \mathcal{M}$ close to $\mathcal{D}_1$

$$\ell(x) \to e^{\omega(x)} \ell(x)$$

$$\hat{g}_{\mu\nu}(x) = \ell^{-2}(x)\, g_{\mu\nu}(x)$$

"fusion metric"

$$v^\mu v^\nu \hat{g}_{\mu\nu} = 1$$

$$\hat{\Pi}^\mu = 0$$

$$\hat{P}_{\mu\nu} = 0$$

μ & ν are normal to $\mathcal{D}_1$

$$S_{eff} = -a_0 \int d^p z \sqrt{\gamma} + \dots$$

$\hat{\Pi}^{\mu}_{ab} \quad \hat{\nabla}^{\perp}_a v^{\mu}.$

$d > 3$

no ∂^1 terms

$$= -a_0 \int d^p z \sqrt{\gamma}\, \ell^{-p} + \dots$$

line defects:

$$+ \int d^{\cancel{p}\,1} z \sqrt{\gamma} \Big(a_{2,1} (\hat{\nabla}^{\perp}_t v)^2 + a_{2,2} \hat{R} + \cancel{i a_{2,3} \hat{P}_{t,v}}$$

$$+ \cancel{a_{2,4} W_{vtvt}} + \cancel{a_{2,5} \tilde{W}_{v,t,v,t}} \Big)$$

Displacement op D_μ $\qquad v^\mu$

$$+\int d^pz\,\sqrt{g}\,\underbrace{\left(\lambda^{(0)}_D\, v^\mu + \dots\right)}_{\lambda^\mu} D_\mu\, e^\#$$

$$\delta_\omega \lambda = \#\omega\lambda + \cancel{\partial^n \lambda^{n+1}}$$

"conformal circle equation"

$l^2 = v^2$

$X(z,t)$

$\nabla_t^2 X(z,t) = \dots \Pi^\mu \dots + \dots \partial_a (v^2)$

$X(z,0) = X_1(z)$

$\dot{X}(z,0) = v(z)$

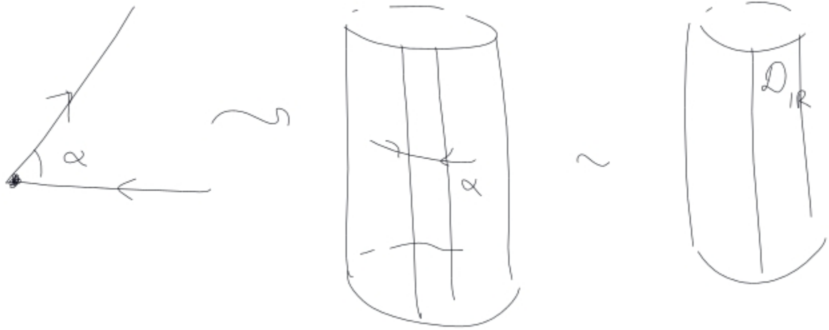
$\int_W \Pi^\mu$ ~ normal der. of W ~ $\underline{\partial W}$

$\Pi^\mu = 0$ $\quad v^2 = \text{const}$ along $\mathcal{D}_1$

$$\langle \bigcirc \;\; \bigcirc \rangle = \sum_{\mathcal{O}} \langle \cdot\mathcal{O} \;\; \cdot\mathcal{O} \rangle = \sum a_{\mathcal{O}}^2$$

fusion

$$a_{\mathcal{O}} = \langle \overset{\mathcal{O}}{\cdot} \; \bigcirc \rangle$$



$\mathcal{D}_{IR} + \int dt\,(\mathcal{O} \dots)$