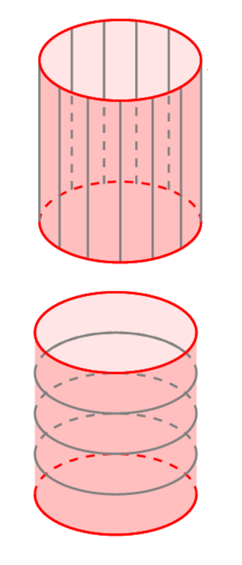

Spectrum of Boundary states in Symmetric Orbifolds

Work with Alexandre Belin and James Sully
arXiv: 2110.05491

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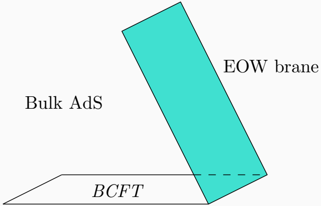
Motivations

- What does a typical conformal boundary condition look like for a *holographic* BCFT? Does it give rise to a bulk AdS cut off by an **EOW brane**?



- We try to get some intuition by studying symmetric product orbifold BCFTs $\mathsf{C}_{\mathsf{orb}} = \mathsf{C}_{\mathsf{seed}}^{\otimes \mathsf{N}}/\mathsf{S}_{\mathsf{N}}$ in the large N limit; central charge $c_{orb} = Nc_{\text{seed}} \sim N$
- The above picture is valid if the boundary entropy scales as $c \sim N$.

Boundary states

We impose conformal boundary condition *within* each copy i

$$L_n^{(i)} = \bar{L}_{-n}^{(i)}.$$

Let's do an example for $N = 3$. Label the seed theory boundary states $|a\rangle, |b\rangle, |c\rangle, |d\rangle \ldots$ etc. For $N = 3$ we have
all three seed states with same label: $\rightarrow |aaa\rangle$ type;
two with same label $\rightarrow |aab\rangle$ type;
all different $\rightarrow |abc\rangle$ type.
Let's look at $|aaa\rangle$ type states for simplicity.

$N = 3$ Example

In orbifold theory, we find three valid states

$$\left|aaa^{tri}\right\rangle = \frac{1}{\sqrt{6}}\left(1\left|a_{(1)}\right\rangle\left|a_{(2)}\right\rangle\left|a_{(3)}\right\rangle + 1\left|a\right\rangle_2 + 1\left|a\right\rangle_3\right) ,$$

$$\left|aaa^{sgn}\right\rangle = \frac{1}{\sqrt{6}}\left(1\left|a_{(1)}\right\rangle\left|a_{(2)}\right\rangle\left|a_{(3)}\right\rangle - 1\left|a\right\rangle_2 + 1\left|a\right\rangle_3\right) ,$$

$$\left|aaa^{2}\right\rangle = \frac{1}{\sqrt{6}}\left(2\left|a_{(1)}\right\rangle\left|a_{(2)}\right\rangle\left|a_{(3)}\right\rangle + 0\left|a\right\rangle_2 - 1\left|a\right\rangle_3\right)$$

with $\left|a\right\rangle_2 \equiv \left(\left|a_{(1)}\right\rangle\left|a_{(23)}\right\rangle + \left|a_{(2)}\right\rangle\left|a_{(13)}\right\rangle + \left|a_{(3)}\right\rangle\left|a_{(12)}\right\rangle\right)$, $\left|a\right\rangle_3 \equiv \left(\left|a_{(123)}\right\rangle + \left|a_{(132)}\right\rangle\right)$.

	(1)	(12)	(123)
χ_{tri}	1	1	1
χ_{sgn}	1	-1	1
χ_2	2	0	-1

Character table of S_3

Boundary States for Orbifold BCFT

One can also work out the $|aab\rangle$, $|abc\rangle$ type states.
For the choice of our boundary condition, we found a set of Cardy- consistent boundary states for symmtric orbifold BCFT

$$|\vec{n},\vec{r}\rangle = \frac{1}{\sqrt{N!}} \sum_{h\in S_N} \prod_{i=1}^{n_b} \left(\sum_{g_i \in S_{n_i}(N_i)} \frac{\chi^{r_i}(g_i)}{n_i!} |(a_i)_{hg_ih^{-1}}\rangle \right) ,$$

where the χ^{r_i} are characters of the symmetric group

Typical States and Holography

In the large N limit with respect to the **Plancherel measure**, for the typical state

$$\text{Finite } n_b : \begin{cases} g_{\text{bdy}} & \sim N \\ \langle O \rangle_{\text{untw}} & \sim \sqrt{N} \\ \langle O \rangle_{\text{tw}} & \sim N^0 \end{cases} \qquad \text{Infinite } n_b : \begin{cases} g_{\text{bdy}} & \sim N \log N \\ \langle O \rangle_{\text{untw}} & \sim \sqrt{N} \\ \langle O \rangle_{\text{tw}} & = 0\,. \end{cases}$$

Infinite (e.g. irrational) seed BCFTs do not appear to have a nice bulk dual. For finite seed theories (e.g. a minimal model), the boundary entropies and one-point functions are consistent with having a macroscopic bulk dual.

Thank you!