Generalized Symmetries and Deformations of Symmetric Product Orbifolds

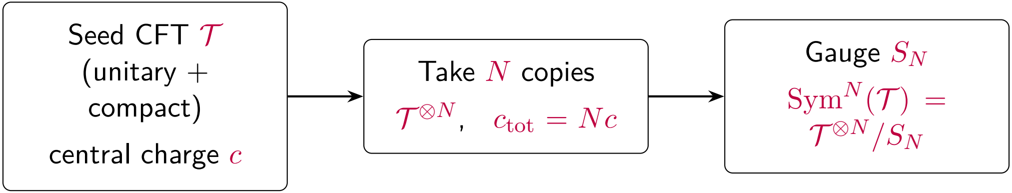
Dikshant Rathore (UCLA)

Based on:

2509.12180 with N. Benjamin, S. Bintanja, Y.-J. Chen, M. Gutperle, C. Luo

2405.15693 and 2406.10967 with M. Gutperle, Y.-Y. Li, K. Roumpedakis

Symmetric Product Orbifolds



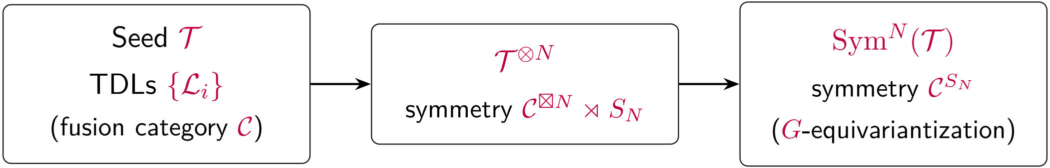
These theories have certain universal features:

- Untwisted sector characterized by states invariant under S_N.
- Twisted sectors labeled by conjugacy classes of $S_N \leftrightarrow$ partitions $N = \sum_w w\, m_w$.
- Large-N factorization of correlation functions.
- Hagedorn growth of light states at large N.

Dual description corresponds to a tensionless string theory.

Symmetries of Symmetric Product Orbifolds

In 2d, symmetry generators are topological defect lines (TDLs). We can study the most general TDLs of $\mathrm{Sym}^N(\mathcal{T})$ using G-equivariantization:



TDLs of $\mathrm{Sym}^N(\mathcal{T})$ are labeled by pairs (X, R):

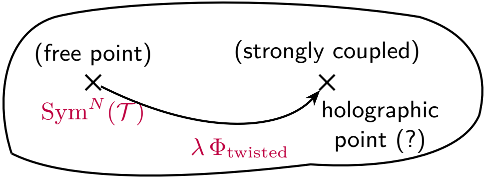
- X: orbit of seed TDLs under S_N permutations, $\quad X \in \mathrm{Irr}(\mathcal{C})/S_N$
- R: irreducible representation of the stabilizer $G_X \subseteq S_N$

Choosing $\mathcal{L}_i = \mathbb{1}$ (trivial seed line) for all copies gives TDLs that exist in every $\mathrm{Sym}^N(\mathcal{T})$ regardless of the seed (universal defects). These are labeled purely by irreps R of S_N. The symmetry is denoted by $Rep(S_N)$:

$$I_R = \sum \chi_R([g])\, P_{[g]} \bar{P}_{[g]}$$

A TDL $\mathcal{L}$ survives deformation by Φ iff

$$\mathcal{L} \cdot \Phi = \langle \mathcal{L} \rangle \, \Phi$$



Main result: the only TDLs that commute with any twisted-sector deformation must be:

- Totally symmetric: $X = (\mathcal{L}, \ldots, \mathcal{L})$
- Invertible seed TDL: $\mathcal{L} \otimes \bar{\mathcal{L}} = \mathbb{1}$
- 1-dimensional S_N rep: $R = \mathbb{1}$ or sign

$\Rightarrow$ **All non-invertible symmetries are broken.**
Exception: $N = 4$, the $(2,2)$ cycle admits a non-invertible survivor with $R = (2,2)$ of S_4.

Open questions:

- What does the surviving sign rep correspond to in the bulk? A $\mathbb{Z}_2$ symmetry?
- At the tensionless point, what does $Rep(S_\infty)$ look like?

Thank you!