

Thoughts on Holography and Supersymmetric Localization

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Basic idea

Fact: Holography posits the following identity

$$Z_{\text{CFT}}[J] = Z_{\text{string/M}}[\phi].$$

Idea: Calculate physical observables for holographic QFTs beyond the leading order at large N and large coupling to access quantum corrections in string/M-theory.

Tool: Employ supersymmetric localization as a powerful tool for computing (some) exact QFT observables.

Some open questions

1. Compute new M-theory or type II HD couplings not known before?
2. Other methods to compute these string/M-theory corrections? Amplitudes? S-duality? Pure spinors? Something else?
3. Consistent truncations with HD terms? Holographic observables?
4. Systematic applications to black hole thermodynamics? OSV in AdS?
5. Localization in gauged supergravity?

Homework problem

Take a 4d $\mathcal{N} = 2$ holography SCFT and put it on $S^1 \times \mathcal{M}_3$ with a partial topological twist on \mathcal{M}_3 using the $SU(2)_R$ R-symmetry.

There is a dual static AdS_5 black hole with an AdS_2 near horizon region that preserves 2 supercharges (2 Q 's+2 S 's emerging in the AdS_2 region) and has the following entropy

$$S_{\text{BH}} = \frac{\text{vol}\mathcal{M}_3}{\pi} a_{4d}.$$

Three easy pieces

- ▶ Find a suitable index of the 4d $\mathcal{N} = 2$ SCFT.
- ▶ Calculate it in the large N limit and reproduce the BH entropy.
- ▶ Study subleading corrections both in the QFT and in supergravity.