On the asymptotic behaviour of the Two-Point Correlation Functions

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Motivation

- Recent papers published by M. Bochicchio suggest that all the scalar glueball correlators presently computed in the literature on the basis of the AdS/CFT correspondence, disagree with any asymptotically-free QCD-like theory[1]

[1] arXiv:1409.5149

The asymptotically-free bootstrap

Key ingredients:

- Conformal Bootstrap + Operator Product Expansion
- Asymptotic theorem + Kallen-Lehmann representation

How do we evalute a correlation function in AdS/CFT?

- find a gravitational description of a gauge theory in the appropriate regime
- subtract divergent terms through "holographic renormalization"
- take the functional derivative of the gravitational generating functional with respect to the sources of the fields

$$\langle \mathcal{O}_1 \cdots \mathcal{O}_n \rangle_{gauge} \sim \frac{\delta^n}{\delta\phi_1^0 \cdots \delta\phi_n^0} Z_{gravity} \tag{1}$$

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The contrasting results are:

Background	AdS/CFT	Asymptotic Bootstrap
Hard Wall	$k^4 \log(k^2)$	$\frac{k^4}{\log(k^2)}$
Klebanov-Strassler	$k^4 \log^3 k$	$\frac{k^4}{\log(k^2)}$

Table shows the leading asymptotic behaviour of the two-point correlation functions for 4-dimensional operators in momentum space for both methods.

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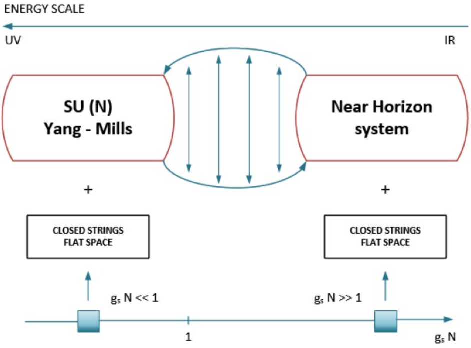
A possible explanation...



The gravity side of the correspondence is in fact strongly coupled in the UV, and therefore it cannot describe the UV of any confining asymptotically-free gauge theory.

Future plans

- Construct an effective background taking into account the asymptotic freedom in the UV and confinement in the IR
- Better understand the interplay of IR and UV in QCD. How confinement determines the way the theory approaches to the asymptotically free limit?