Holographic R-symmetric flows and the au_U -conjecture

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SISSA

SUSY 2013



Credits

Based on:

M. Bertolini, L. Di Pietro and FP

• arXiv:1304.1481

Intro & Motivations

- Buican's conjecture: in a 4d R-symmetric QFT one can define a quantity, τ_U , which decreases along the RG-flow. This puts a bound on the amount of accidental symmetries. [Buican'11]
- Via holography monotonic quantities are expected to correspond to monotonic functions of the extra coordinate in 'domain wall' geometries.
- Our aim is to explore the existence of a *monotonically decreasing* function in the context of 5d SUGRA, both to test the conjecture and to refine the holographic dictionary outside the conformal regime.

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In such theories one can always define an R-multiplet and often a Ferrara-Zumino multiplet

$$\bar{D}^{\dot{\alpha}} \mathcal{R}_{\alpha \dot{\alpha}} = \chi_{\alpha}$$

$$\bar{D}_{\dot{\alpha}} \chi_{\alpha} = D^{\alpha} \chi_{\alpha} - \bar{D}_{\dot{\alpha}} \bar{\chi}^{\dot{\alpha}} = 0$$

$$\bar{D}^{\dot{\alpha}} \mathcal{J}_{\alpha \dot{\alpha}} = D_{\alpha} X$$
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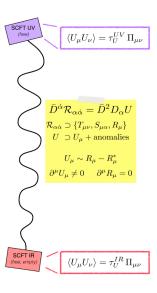
When the theory is superconformal

- There is a special conserved R-current R^*_μ that can be found by a-maximization.
- U becomes linear $D^2 U = \bar{D}^2 U = 0$: contains a conserved flavor current U_{μ} .
- $\bullet \ U_{\mu}=R_{\mu}-R_{\mu}^*$
- 2-point fns of conserved currents are fixed by Cl up to a positive definite hermitian matrix

$$\left\langle J_{\mu}^{I}J_{\nu}^{J}\right
angle =\mathbf{ au}^{IJ}\,\Pi_{\mu\nu}$$



The QFT conjecture



- **SCFT UV**: $U = R R_{UV}^*$ is conserved.
- UV + deformation: R_{IIV}^* and U are broken. One picks a particular R performing a-maximization within the subset of preserved R-symmetries.

• SCFT IR: $U = R - R_{IR}^*$ conserved. There can be accidental symmetries, if there are none $U = R - R_{IR}^* = 0$.

Dictionary

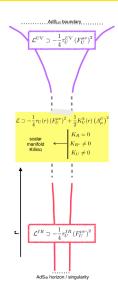
| Boundary: $\mathscr{N}=1$ 4d QFT | Bulk: $\mathcal{N} = 2$ 5d SUGRA |
|-------------------------------------|--|
| $\mathscr{R}_{lpha\dot{lpha}}^{st}$ | $\{g,\Psi,A^*\}$ gravity multiplet |
| U | $\{q,\zeta\}\!+\!\{A,\lambda, ho\}$ hyper+vector |
| currents J_{μ} | gauge fields A_{μ} |
| $	au_{IJ}$ | gauge kinetic terms @ AdS cp's |

Holographic picture

• near boundary: A^*, A^U massless gauge fields.

• bulk: A^U gets an r-dependent mass. Gauge kinetics terms also acquire a dependence on the extra coordinate.

• near horizon: A^U becomes again massless.

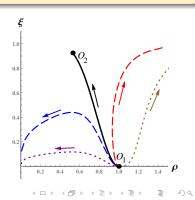


Flavio Porri (SISSA)

$\mathcal{N}=2$ 5d SUGRA with $U(1)\times U(1)_R$ gauging

The model

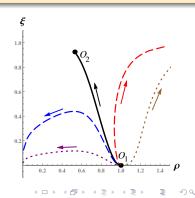
- $\mathcal{N} = 2$ SUGRA coupled to 1 hyper + 1 vector multiplets.
- Admits a two-parameter family of smooth AdS-to-AdS solns in addition to a large class of singular solns.
- All solutions have the same near
- singular solns of 2 kinds:
 - dual to confining gauge
 - run into bad



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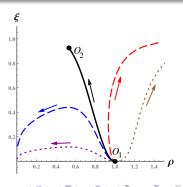


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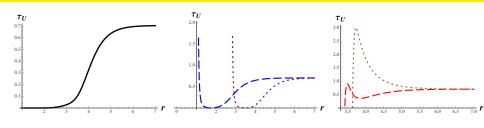
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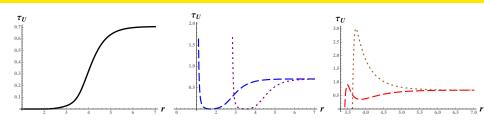
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 - run into bad singularity

[Gubser '00]



Results





Ads-to-Ads

 τ_U decreases monotonically to zero. As expected for the dual of RG-flow without emergent symmetries.

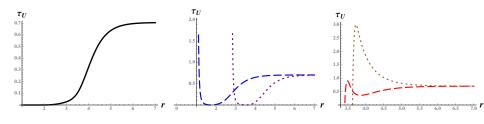
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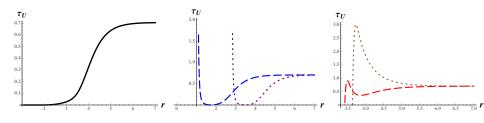
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- Found general consequences of the presence of an R-symmetry in the dual solns.
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Thank you!

