

Title: Focus Lecture

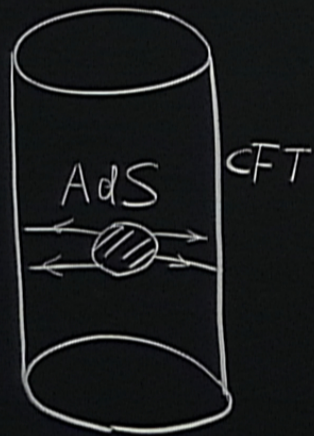
Date: Jul 25, 2016 05:00 PM

URL: <http://pirsa.org/16070038>

Abstract:

# A Primer on Bulk Reconstruction

(Part 1)



$AdS_{d+1}$	$CFT_d$
Isometry	Conformal $O(d,2)$
Gauge sym	Global sym
BH states	thermal states
bulk fields	single-trace ops
boundary cond	sources

• emergent gravity

$$CFT \sim SU(N)$$

$$\Phi \in \text{adj}$$

$$\text{Tr}(\Phi^\dagger \Phi)$$

$$[\text{Tr}(\Phi^\dagger \Phi)]^2$$



Correlators:

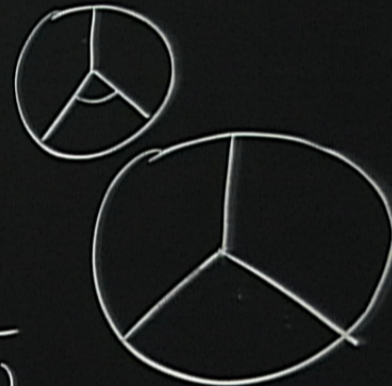
1) Differentiate dictionary (GKPW)

$$Z_{\text{CFT}}[\phi_0] = Z_{\text{grav}}[\phi_0]$$

$$\int \mathcal{D}\Phi e^{-S + \int_x \phi_0 \mathcal{O}}$$

$$\langle \mathcal{O}(x_1) \dots \mathcal{O}(x_n) \rangle = \frac{\delta^n Z_{\text{grav}}}{\delta \phi_0(x_1) \dots \delta \phi_0(x_n)}$$

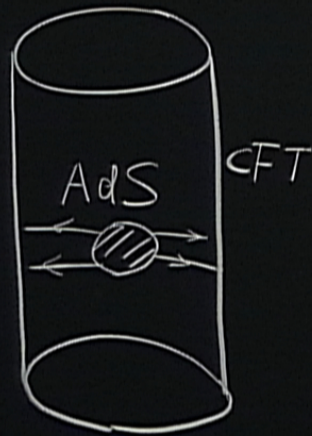
2) Extrapolate dictionary (BDHM)





# A Primer on Bulk Reconstruction

(Part 1)



$AdS_{d+1}$

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Gauge sym  
BH states  
bulk fields  
boundary cond

$CFT_d$

Conformal  $O(d,2)$   
Global sym  
thermal states  
Single-trace ops  
sources

emergent gravity

$CFT \sim SU(N)$

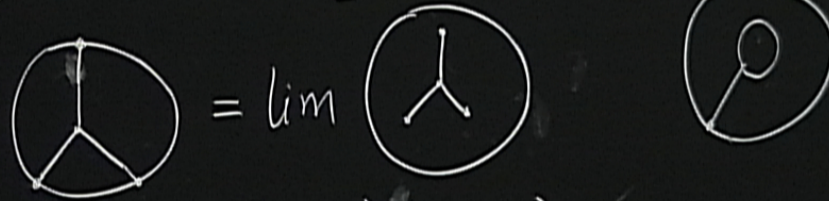
$\Phi \in \text{adj}$

$\text{Tr}(\Phi^\dagger \Phi)$

$[\text{Tr}(\Phi^\dagger \Phi)]^2$



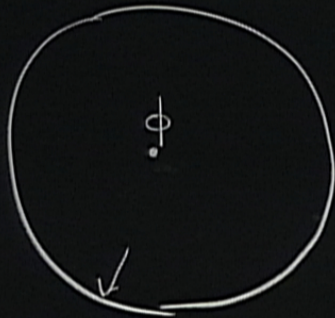
$$\langle \mathcal{O}(x_1) \dots \mathcal{O}(x_n) \rangle = \lim_{z \rightarrow 0} z^{-n\Delta} \langle \phi(x_1, z) \dots \phi(x_n, z) \rangle$$



$$\mathcal{O}(x) = \lim_{z \rightarrow 0} z^{-\Delta} \phi(x, z)$$

$$\phi(x, z) = ? \text{ from CFT}$$





HKLL

hep-th/0506118

0606141

$\lambda\phi^2$

$$(\nabla^2 - m^2)\phi(x, z) = 0, \quad \lim_{z \rightarrow 0} z^{-\Delta} \phi(x, z) = \mathcal{O}(x)$$

$$\phi(x, z) = \int dx' K(x, z; x') \mathcal{O}(x')$$

K

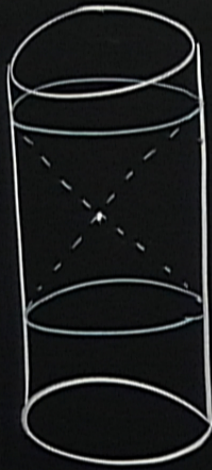
K

Witten

Evolves  $\mathcal{O}$  to AdS  
 $z \rightarrow 0: \sim z^{\Delta} \delta(x-x')$

Evolves  $\phi_0$  to AdS  
 $\sim z^{d-\Delta} \delta(x-x')$





$\exists K$

$\text{support}(K) = \text{band}$

$\exists K, \text{support}(K) = D[A]$   
 $\forall \phi \in \text{WR}[A]$

AdS-Rindler

$D[A] = \text{WR}[A] \cap \mathcal{I}_{\text{AdS}}$

$\langle [\phi_x, \phi_{x'}] 0 \cdot 0 \rangle = 0$   
 $x - x' = \text{spacelike}$



CAUTION  
All doors are locked after business hours.  
When locked, do not attempt to force entry.  
If you have a key, please use it.  
Thank you for your cooperation.

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