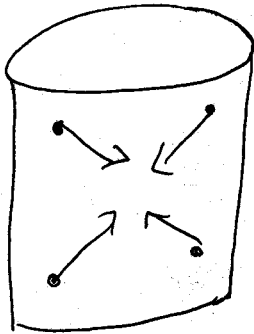


29 July 2011  
J. Polchinski



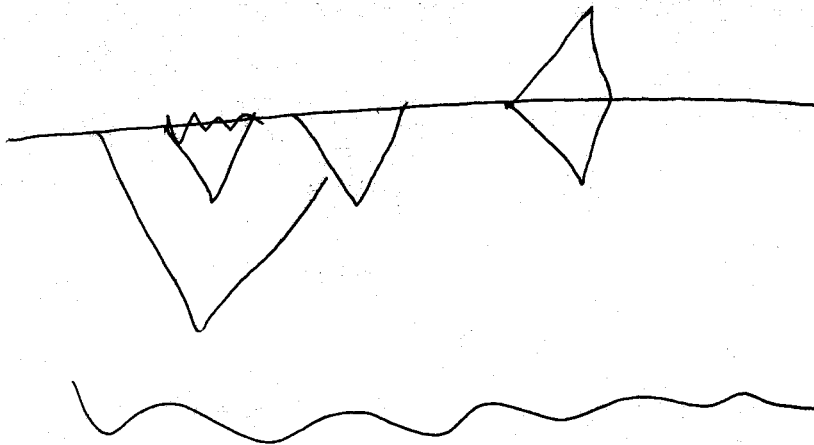
BH: ordinary QM

Lorentz inv.

no Euclidean wormholes

topology change

S-matrix at  $E > M_p$

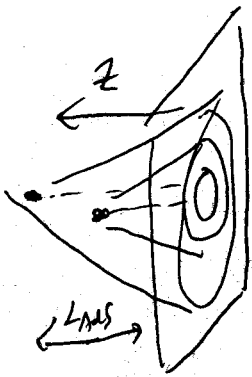


Holography from CFT

Precursors

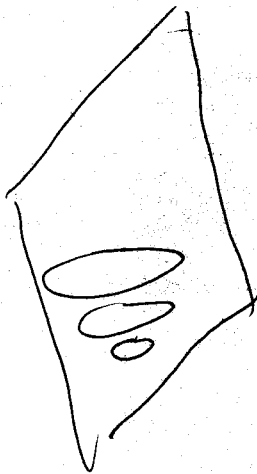
Holo. RG

Wilson loops



locality  $\frac{\delta z}{z} \sim 1$

$$ds^2 = L_{AdS}^2 \frac{dr^2}{r^2}$$

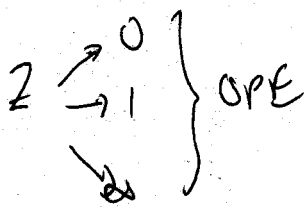


$$L_{AdS} \gg L_p$$

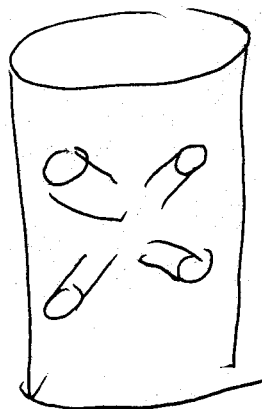
$$L_{AdS} \gg L_s$$

$N \gg 1$   
 $\lambda \gg 1$   
 large gap  
 in spectrum

$$\Delta \sim \frac{L_{AdS}}{L_s}$$



$z = \bar{z}$  in second sheet



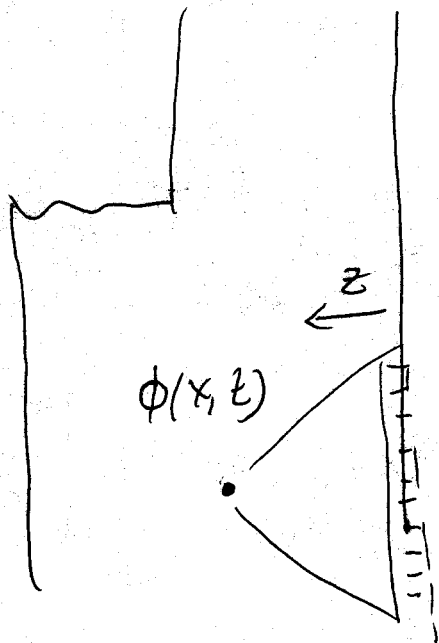
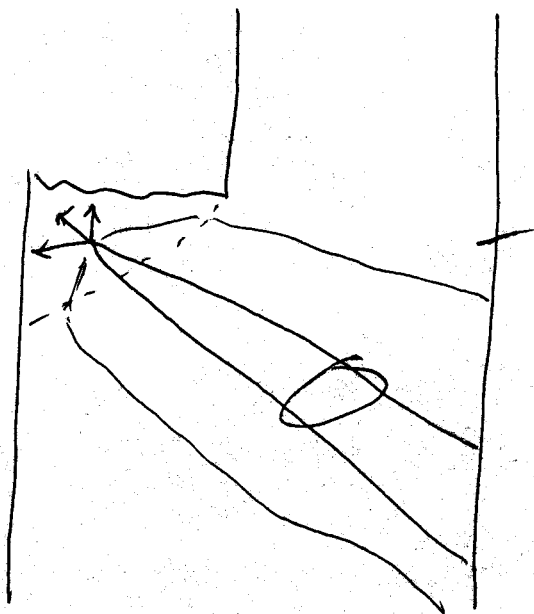
4 pt.

OPE,  
 cont,  
 crossing

Solve for 4 pt fn of 4 scalars  $g_{ij}$  to leads  $\leftarrow$  connected  $\frac{1}{N}$   
 Solutions are 1-1 correspondence  
 with local bulk interactions

$N = Z, N_f = 2N_c$

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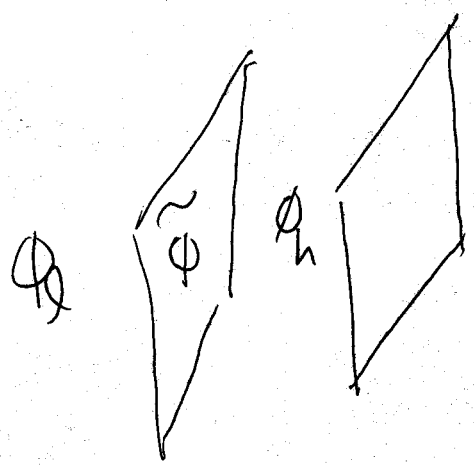


$$\phi(x, z) = \int d^d x' T(x'; z, x) \phi_{x'} + \dots$$

KLL

$$\int_{\text{CFT}} DA \dots \xrightarrow{\text{Conv.}} \int_{\text{bulk}} \mathcal{D} g_{\mu\nu}$$

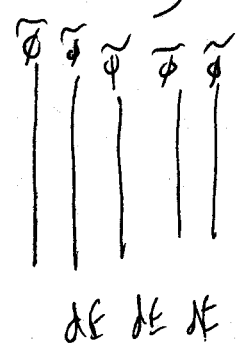
$$\int dA_g |dA_h|^{\wedge \sim \frac{1}{2}} e^{-S(A_g, A_h)} \underbrace{\hspace{10em}}_{e^{-S_{\text{eff}}(A_h)}}$$



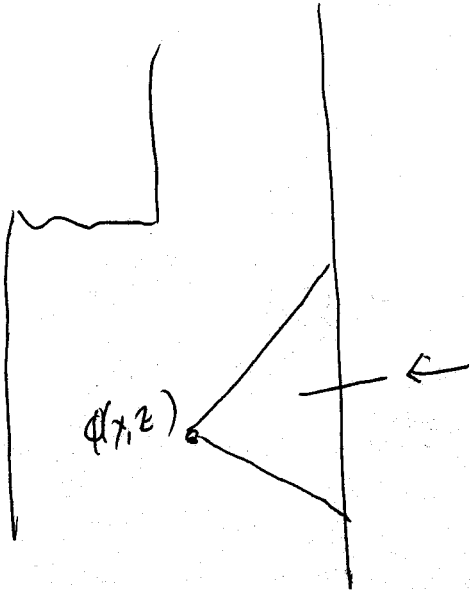
$$\underbrace{\int d\phi_g e^{-S(\phi_g)}}_{\text{CFT: cut off at } \frac{1}{2}} \mathcal{D}\tilde{\phi} \overbrace{\mathcal{D}\phi_h e^{-S(\phi_h)}}^{e^{-W_{UV}(\tilde{\phi})}}$$

CFT: cut off at  $\frac{1}{2}$   
 action  $S = \sum \tilde{\phi}_i \phi_i$

CFT with action  $\int \mathcal{D}\tilde{\phi} e^{-W_{UV}(\tilde{\phi}) + \sum \tilde{\phi}_i \phi_i}$



single trace  $\xrightarrow{\text{int. cut}}$  multi-trace  $\xrightarrow{\text{aux fields}}$   $\phi \rightarrow$  single



$$\phi \leftrightarrow \varphi$$
$$* \Psi[C, \varphi] \leftrightarrow W[C]$$