2014

SANTA BARBARA

GRAVITY

WORKSHOP II

March 17-19

BLACK HOLES , QUANTUM INFORMATION,
GRAVITATIONAL SCATTERING, COSMOLOGY
and EMERGENT SPACETIME

Does AdS/CFT coarse grain?

$M : \mathcal{H}_B \to \mathcal{H}_\partial$ 1-1, unitary, onto?

If so: $U_B = M^\dagger U M$

QG ✓

Alternatives: e.g. many $\longrightarrow$ 1

coarse graining suggested/ explored:

hep-th/9907129

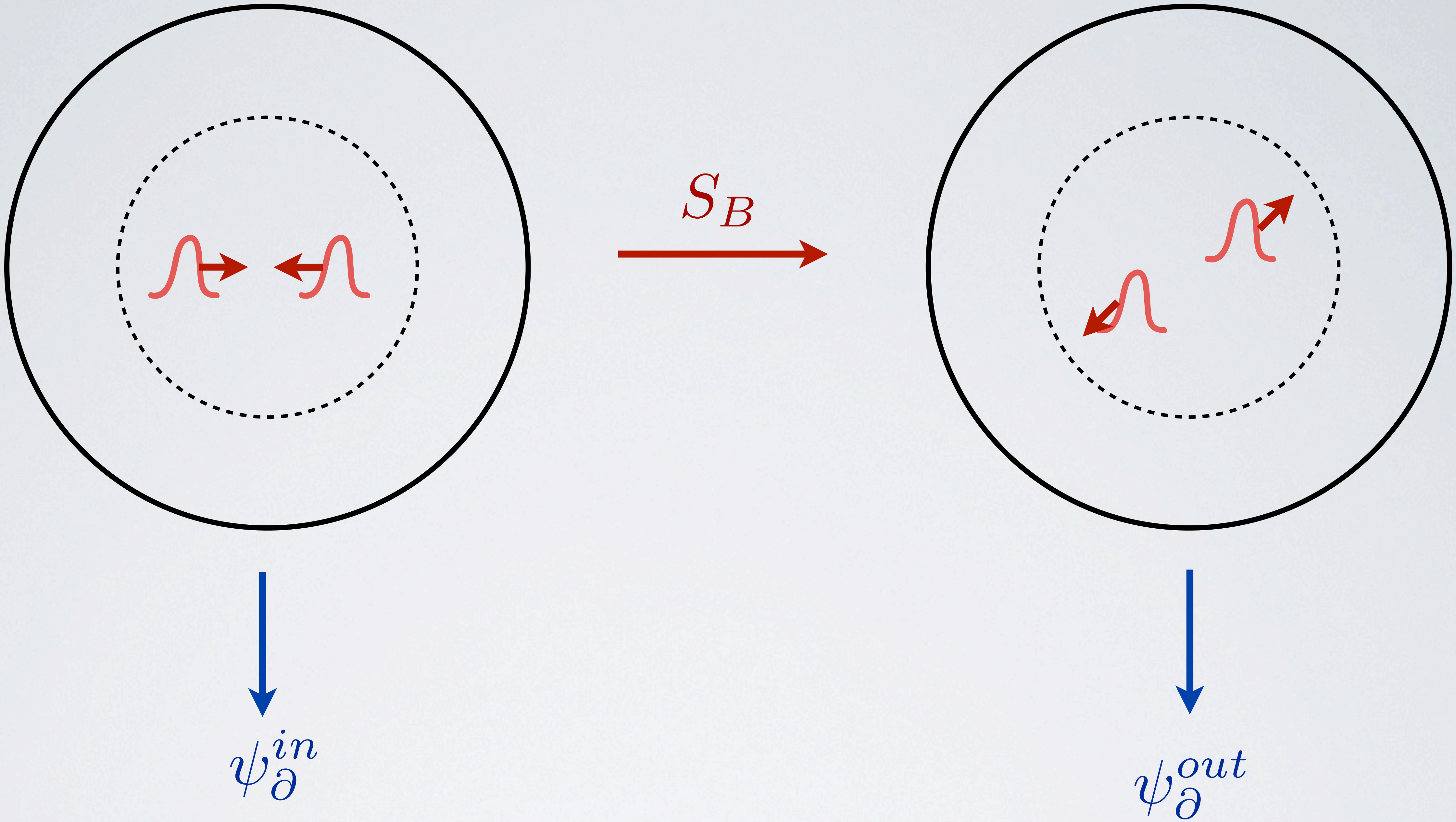
hep-th/0103231 w/ Lippert

work w/ M. Gary

Tests: ~local bulk observables

flat S-matrix

E.g.



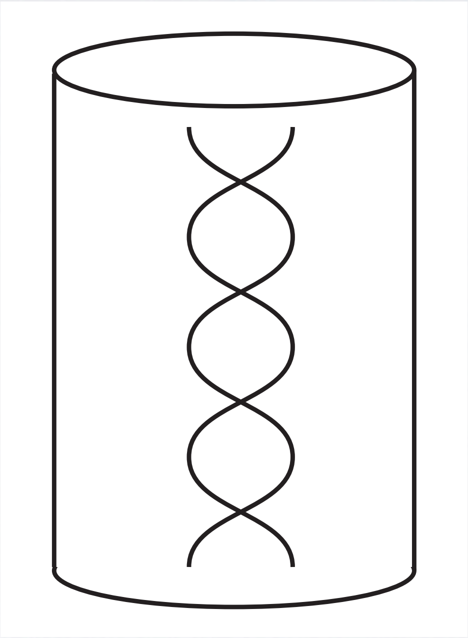
~ LSZ for AdS

Would give S (need basis of scatt. states)

Describing scattering states:

- Trivial in the non-interacting theory
- Difficulties w/interactions

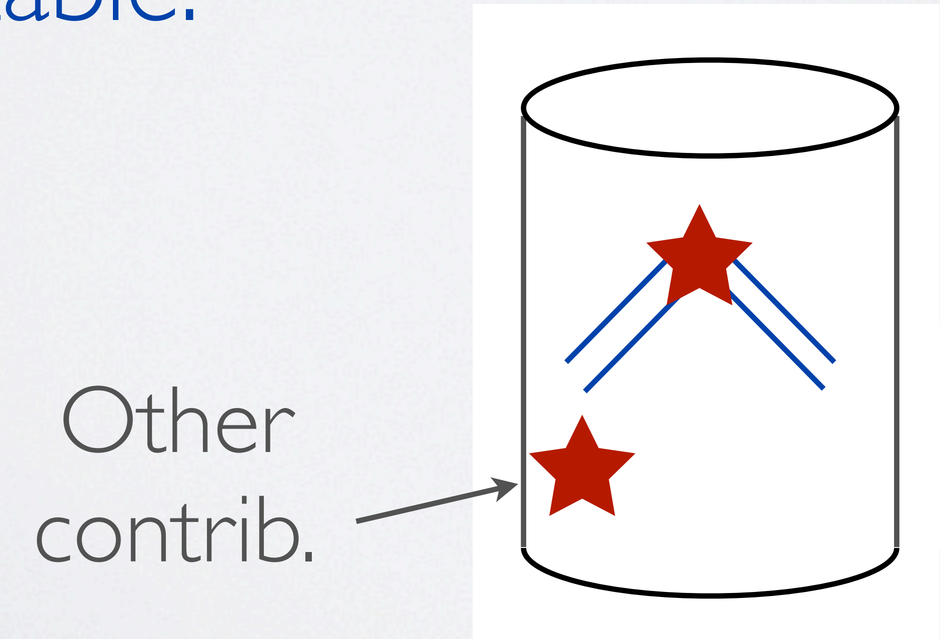
1) Normalizable construction:



even for g<<1:

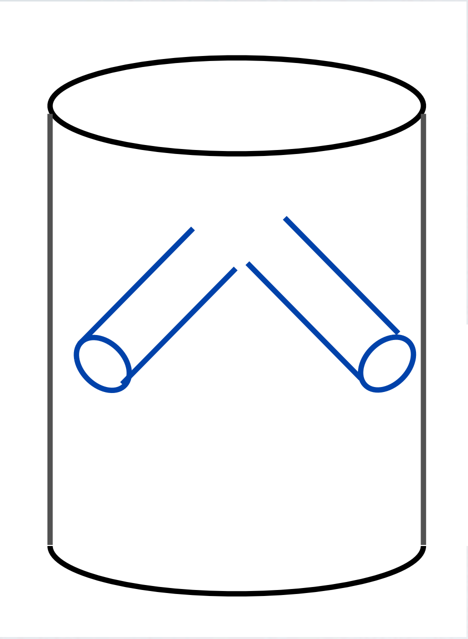
- ∞ interactions
- BHs!

2) Non-normalizable:



$$\int \psi_{NN}\psi_{NN}G_B$$

3) Boundary compact:



- can't get arbitrary wavepackets
  limits on sharpness/tails
- e.g. op. at point spreads

- challenge to get arbitrary
  multipart. states

Possible alternative:

Full fine-grained $\mathcal{H}_B$ not described by $\mathcal{H}_\partial$

Other, subsequent, indications for coarse-graining

Marolf/Wall; also, AMPS??

How to settle?

(How) Does the gauge theory describe bulk physics in AdS/CFT?

What are necess/suff conditions for extracting $S_B \approx S_{QFT}$?

Concretely: what is a general, precise prescription

$$\langle \mathcal{O}\mathcal{O}\mathcal{O}\cdots\rangle \to S_{\psi_1\psi_2\to\psi_3\cdots}$$

Do we have a suitable construction of ~local bulk observables? (KLL, etc.)

or, possible issues (similar?)