50th anniversary of String Theory

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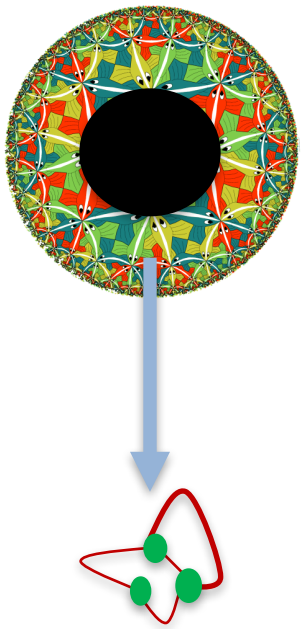
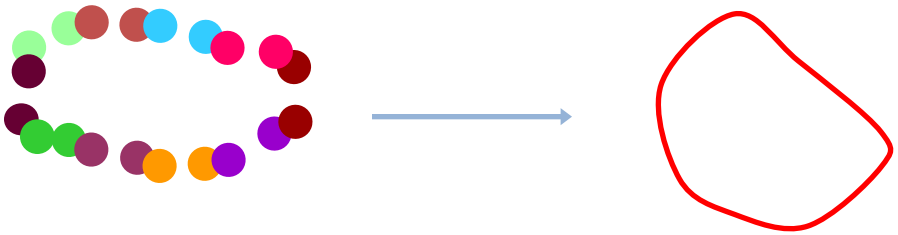
Strings 2018
Japan

Duality era

What have we learned?



- Non perturbative consistency of string theory.
- Black hole entropy from microstate counting.
- Black holes, when viewed from outside, evolve unitarily.
- Precise definition with QM/gravity duals.
- Unification of U(N) strings and fundamental strings. Integrability for N=4 SYM
- Field theory/string theory ``unification''.



Questions ?

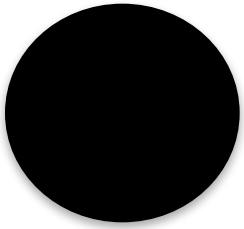
Most interesting question:

Initial singularity

Beginning of time?

Emergence of time?

Into Black holes



How do we describe the interior in the same variables that make unitarity manifest ?

Einstein's happy thought

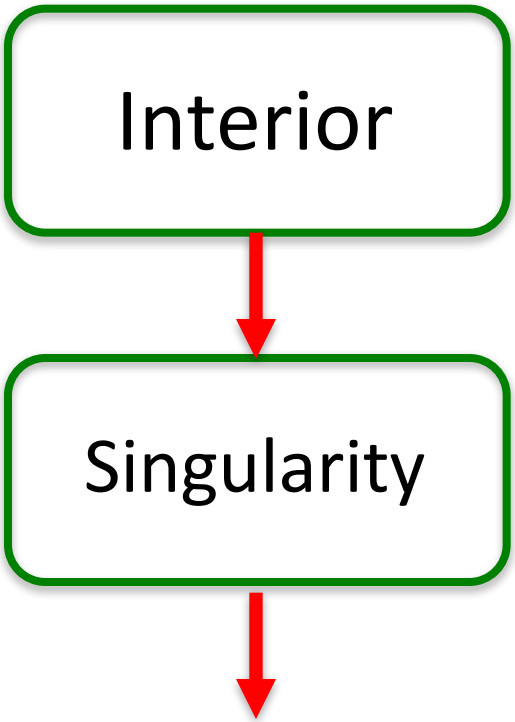
- Gravity ``disappears'' when you are falling.

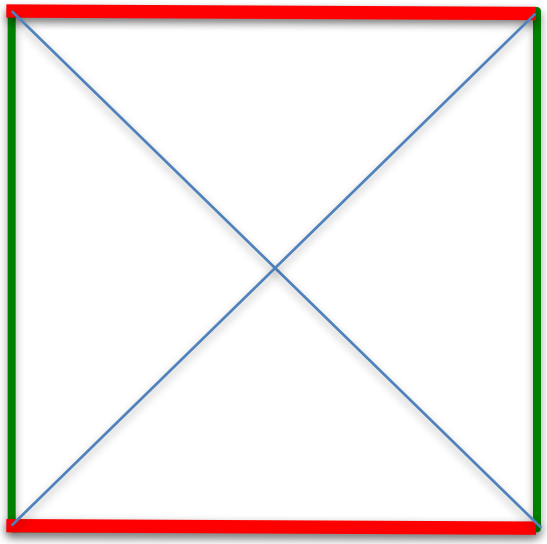
- Quantum version?

Some elements

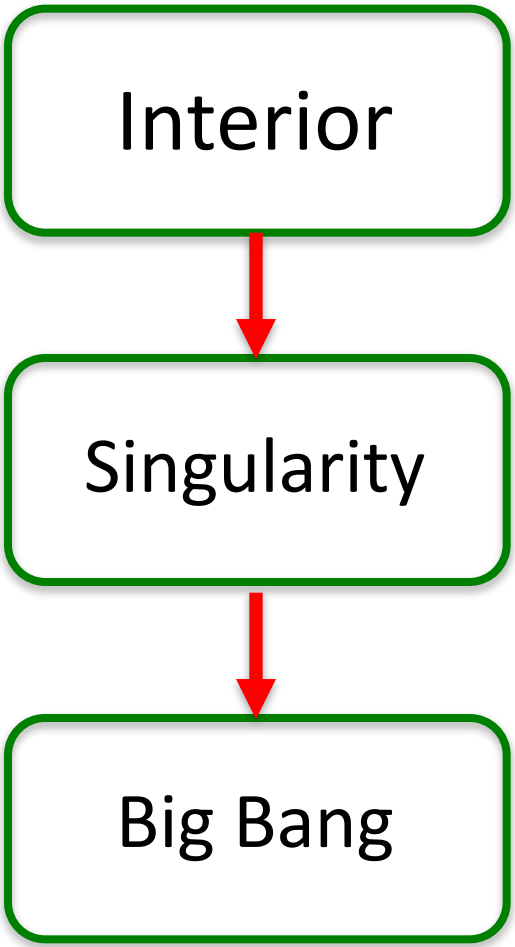
- Emergent Lorentz symmetry involving the radial direction. → emergent causality. Modular Flow ?
- Different notions of entropy:
- - Coarse grained: horizon, outside, 2nd Law.
- - Fine grained: depends on interior (position of RT surface)
- Complexity matters!
- Computation takes time and space.
- Computation makes time and space!
- What is complex is relative to the observer…

Homework





Homework


Interior
Singularity
Big Bang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