

Vision: Twistors and Holography

Carrollian $\xleftrightarrow{?}$ AdS / dS

π Twistors?!?

Twistors are essentially holographic:

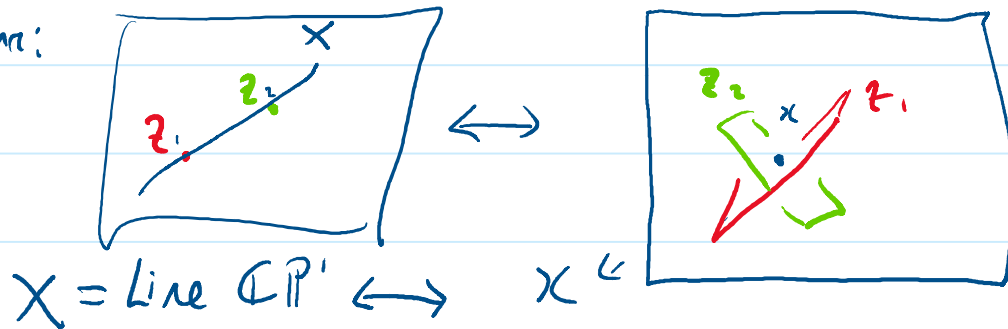
- 3d geometry for 4d physics
- Non-local + conformal.

vision for quantum gravity:

Spacetime emerges from Twistor Space

Geometry: Twistor $\mathbb{CP}^3 = \mathbb{C}^3 \cup \text{plane at } \infty$
 generates space-time = space of $\mathbb{CP}^1 \subset \mathbb{CP}^3$
 Twistor space \mathbb{CP}^3 Space-time \mathbb{M}^4

Picture:
 4a



But; integrability of z -planes too restrictive
 \Leftrightarrow self-duality

Penrose googly problem:

How to incorporate ambidextrous physics?

Holography: twistors intersect boundary in 1-d
(light rays in complex)

No integrability condition

\leadsto \exists twistor space on boundary!

Solves Penrose's googly problem!

So holography is good for twistors!

(cf. Newman good ans at \mathcal{G} Nonlinear graviton)

Physical theories in twistor space:

- Top-down: Twistor-Strings Witten, Berkovits, Skinner ...

→ Explicit worldsheet amplitude formulae

→ Twistor actions ⇔ string field theories (twisted).
holomorphic

B-F / Chern-Simons + defects / Branes

→ MHV formalism for amplitudes, correlators.

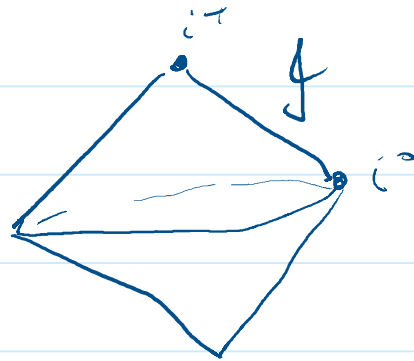
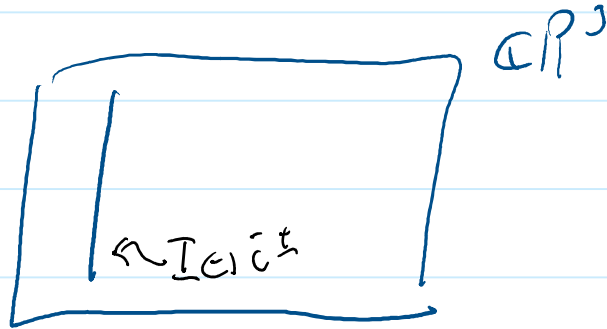
Symmetries:

- Celestial symmetries are gauge transf.
& diffeos on twistor space.

Realized Via:

- Noether arguments for twistor gauge + diff
- Vertex operators on worldsheet.

$\Lambda = 0$ Hologram:



Burns Holography: Stack N D1-branes on I .

\leadsto Gauge theory form factor = Gravity amplitude

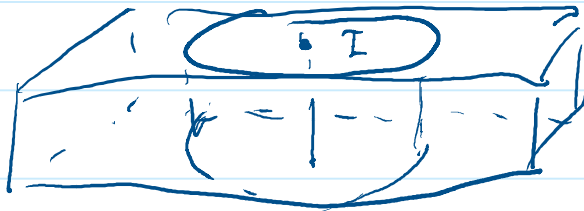
Back reaction \leadsto curved twisted space for Burns space

Questions:

1. Can we go beyond M4U?
2. Deform to $\Lambda \neq 0$?
4. Celestial symmetries ✓
3. Extend to different dimension?
4. Incorporate non-twisted strings?
e.g. $AdS_4 \times CP^3$ ABJM

$\Lambda \rightarrow 0$: Euclidean picture :

$\hookrightarrow P^{-1}g$ $IP\pi$



$\Lambda \rightarrow 0$

$g \rightarrow i$

$P^{-1}g \rightarrow I$

LP

E^4

