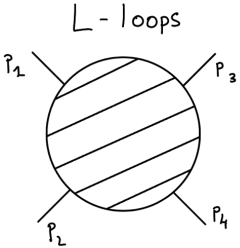
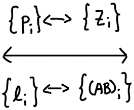
# The deformed Amplituhedron

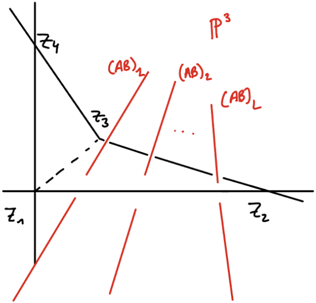
Melvyn Nabavi, Prof. Jaroslav Trnka
UC Davis

November 8, 2025

## **Planar** $\mathcal{N} = 4$ SYM and the Amplituhedron



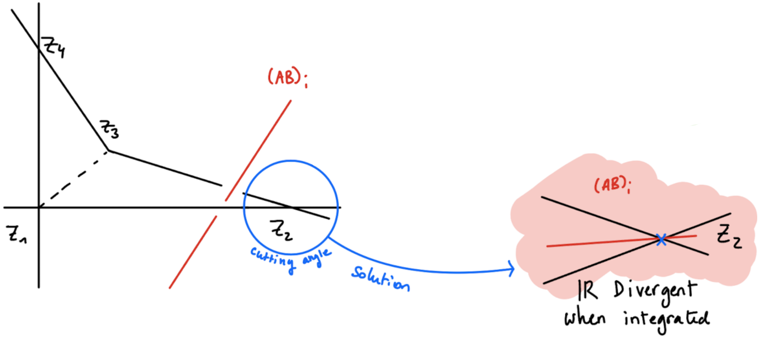

4-pt $L$-loop Amplituhedron $(\det(\ldots) \equiv \langle \ldots \rangle)$:

$$\langle (AB)_i Z_j Z_{j+1} \rangle > 0 \qquad \langle (AB)_i (AB)_j \rangle > 0$$

$L$-Loop amplitude integrand = **"logarithmic form"** of $L$-loop Amplituhedron

## IR divergences in the Amplituhedron

- $(AB)_i$ cuts a line $\leftrightarrow$ taking a residue on the **"logarithmic form"**




Cut line $(Z_1 Z_2)$ and $(Z_2 Z_3)$

$\Longrightarrow$ Loop lines can access IR divergences (collinear regimes): $l_i \propto p_2$

# Solution: deforming the geometry

- Deforming with $\{\alpha_i\}$:

$$\langle (AB)_i Z_k Z_{k+1} \rangle > 0 \rightarrow \langle (AB)_i \widehat{Z_k Z}_{k+1} \rangle > 0$$

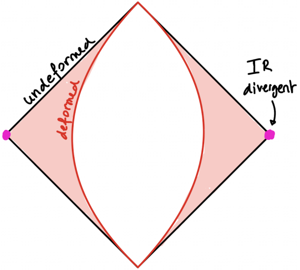
with

$$\widehat{Z_k Z}_{k+1} = Z_k Z_{k+1} - \alpha_i Z_{k+2} Z_{k+3}$$

- Conjecture:

**"Logarithmic form"** of **D**Amplituhedron = Amplitude integrand on the **Coulomb Branch**

[Arkani-Hamed, Flieger, Henn, Schreiber, Trnka]

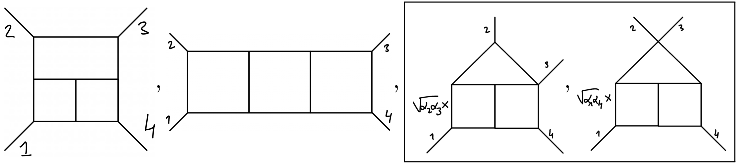


## Main properties of the integrand

- Result known at 1, 2 and 3 loops (using cut equations).
- Amplitude integrand stays **planar**.
- *e.g* three loops:

$\Omega_3 \supset$

$\propto$ deformation parameters



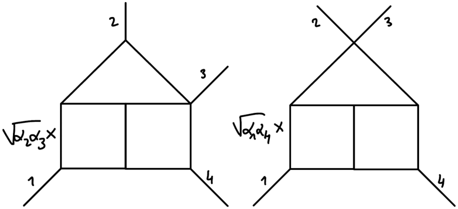

Can be excluded !

exactly like undeformed case but with massive propagators.

# Current questions

- Is planarity preserved at all loops? How does the geometry know?

- All new planar contributions excluded at all loops? Generalized dual conformal symmetry?



Thank you for your attention!