

# Scattering Amplitudes in Three Dimensions

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Based on work in progress with L. Mason

# 3d Gauge Theories

- Yang-Mills:

$$\frac{1}{g^2} \text{tr} (F_{\mu\nu} F^{\mu\nu})$$

- Chern-Simons:

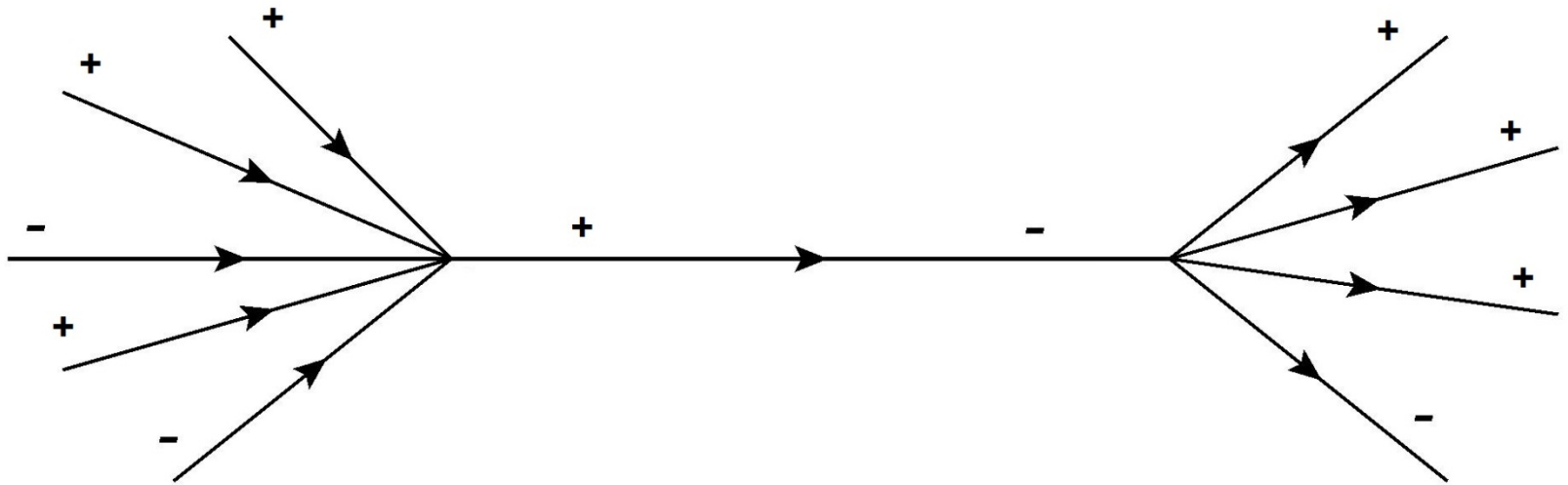
$$\frac{k}{4\pi} \text{tr} \left( A_\mu \partial_\nu A_\rho + \frac{2}{3} A_\mu A_\nu A_\rho \right)$$

# 3d Twistors

- Twistor:  $\xi^m = \begin{pmatrix} \lambda^\alpha \\ \mu_\beta \end{pmatrix} \quad \mu^\alpha = x^{\alpha\beta} \lambda_\beta$
- Minitwistor:  $\xi^m = \begin{pmatrix} \lambda^\alpha \\ \mu \end{pmatrix} \quad \mu = x^{\alpha\beta} \lambda_\alpha \lambda_\beta$

# 3d MHV Formalism

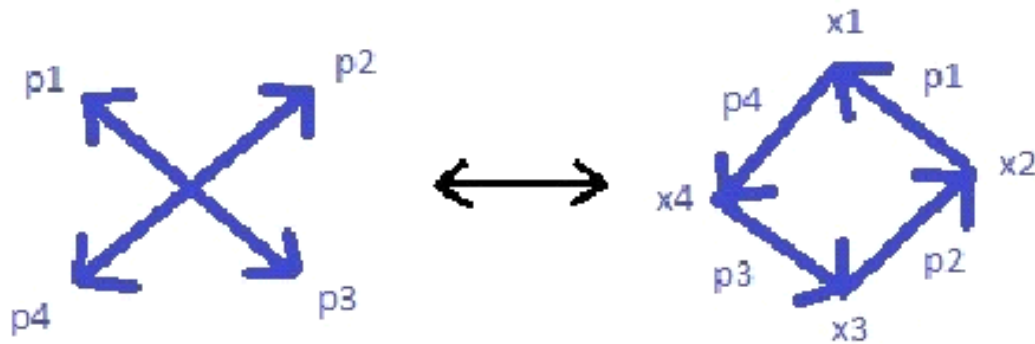
Action for maximal 3d sYM in minitwistor space implies 3d MHV formalism:



# Dual Conformal Covariance

- Dual variables:

$$x_i - x_{i+1} = p_i$$



- Amplitudes transform covariantly when

$$x_i \rightarrow x_i^{-1}$$

# 1-loop Amplitudes

- Using dim reg, for maximal 3d sYM,

$$\text{1-loop MHV} = 0$$

$$\text{1-loop non-MHV} = \text{finite}$$

- Resembles loop corrections in ABJM...

# Summary

Amplitudes of 3d YM:

- have many interesting properties which do not follow trivially from dimensional reduction
- provide new insights into 3d Chern-Simons theories