The twins of gravity from gauge theory

Michele Zoccali

Imperial College London

mz2313@ic.ac.uk

A. Anastasiou, L. Borsten, M. Duff, M. Hughes, A. Marrani, S. Nagy

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- Gauge theories and gravity
  - AdS/CFT
  - Gauging spacetime groups gives gravity

- KLT relations - only tree level

- BCJ or color-kinematic duality
  $\rightarrow$ BCJ double copy

- Supergravity is the theory of gauged supersymmetry

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- Supergravity is the theory of gauged supersymmetry

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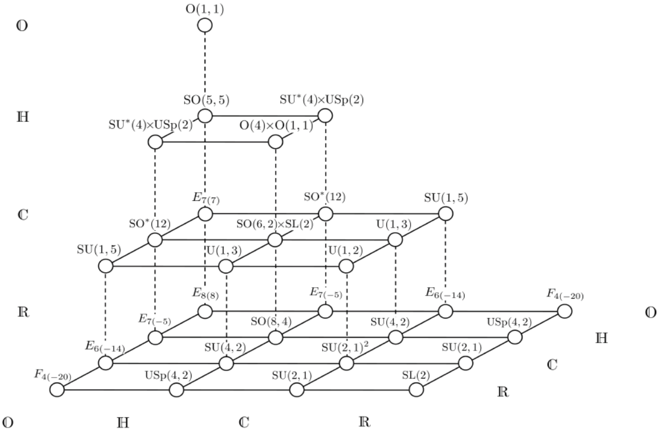
- We can have a collection of supergravities, depending on $D, \mathcal{N}$, coupled matter
- They possess local as well as global symmetries

Squaring Yang-Mills leads to interpreting

- Global $=$ internal $\times$ internal



- Many supergravity theories are classified according as their global symmetries via the coset group G/H, parametrised by the scalar degrees of freedom present

- It turns out there exist pairs of theories with identical cosets, but different $\mathcal{N}$ and matter couplings!

- In D=3, all bosonic dof are dualised to scalars, so the theory is uniquely characterised by the scalar geometry

$(\mathcal{N}_+, \mathcal{N}_-)$	$\mathcal{M}_{scalar}$	D_{max}
$(4,2)$	$\frac{SU(2,p)}{SU(2)\times U(p)} \times \frac{SU(2,q)}{SU(2)\times U(q)}$	4
$(6,2)$	$\frac{SU(4,p)}{SU(4)\times U(p)}$	4
$(8,2)$	$\frac{SO(8,2)}{SO(8)\times SO(2)}$	4
$(10,2)$	$\frac{E_{6(-14)}}{SO(10)\times SO(2)}$	4
$(5,4)$	$\frac{Sp(2,1)}{Sp(2)\times Sp(1)}$	3
$(8,4)$	$\frac{SO(8,4)}{SO(8)\times SO(4)}$	6
$(12,4)$	$\frac{E_{7(-5)}}{SO(12)\times SO(3)}$	6

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Find:

$$\hat{G} \supset G \times SU(2), \qquad \hat{H} \supset H \times SU(2)$$

such that H is the maximal compact subgroup of G, the truncations correspond to

T_+ :	keep	$(-1)^{F_{SU(2)}} = 1$
T_- :	keep	$(-1)^{F_{SU(2)}}(-1)^{F_{spacetime}} = 1$

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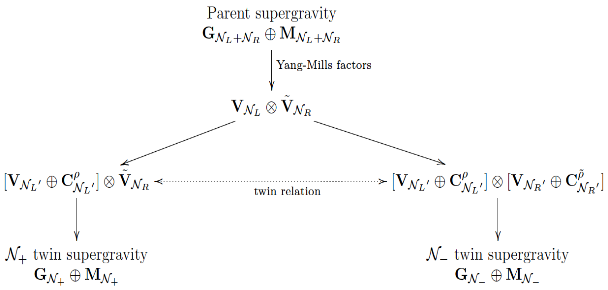
YES!



Thank you!

1. BCJ duality

For some gauge theory amplitudes there exists a rearrangement of the kinematic factors such that they obey the same Jacobi-like identity as the color factors of the same diagram.

$$\mathcal{A}_n = \sum_{diags.i} \frac{n_i c_i}{\prod s_{\alpha_i}}$$

$$c_i + c_j + c_k = 0 \quad \Rightarrow \quad n_i + n_j + n_k = 0$$

[0805.3993v2]

1. BCJ double copy

If such a set of n_i can be found, one can construct gravitational amplitudes as the double copy of gauge theory ones

Given two gauge theory amplitudes

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there is a gravity amplitude given by

$$-i\mathcal{M}_n = \sum_{diags.i} \frac{n_i \tilde{n}_i}{\prod s_{\alpha_i}}$$