

Ricardo Monteiro

Area: QFT and Strings

CERN Theory retreat, Les Houches

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Education

- 2005 – Degree in IST, Lisbon
- 2010 – Master and PhD in DAMTP, Cambridge

Employment

- 2010-13 – Niels Bohr Institute, Copenhagen
- 2013-15 – Mathematical Institute, Oxford
- New fellow at CERN

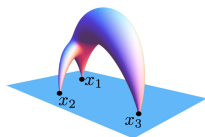
Black holes in GR and string theory

- Thermodynamics, stability, higher dimensions.



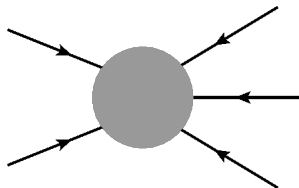
Holographic correspondence

- CFT calculations from semiclassical strings.
- Phases at finite temperature.



Current work

Scattering amplitudes of gauge theory and gravity.



Motivation

- Perturbative gravity, UV behaviour?
- Gravity versus gauge theory?
- Feynman diagrams hard. New formulations of QFT?

Gravity \sim YM²

[with O'Connell, White, ...]

Free fields

- polarisations: $\epsilon_\mu \tilde{\epsilon}_\nu = \epsilon_{\mu\nu}$ (graviton + dilaton + B-field)

Amplitudes

- Einstein-Hilbert action: infinite number of horrible vertices!

- **double copy**

$$\mathcal{A}_{\text{grav}}(\epsilon_i^{\mu\nu}) \sim \mathcal{A}_{\text{YM}}(\epsilon_i^\mu) \times \mathcal{A}_{\text{YM}}(\tilde{\epsilon}_i^\mu) \quad \text{colour stripped}$$

- most efficient using the **colour-kinematics** duality

[Bern, Carrasco, Johansson]

Q: Kinematic algebra? Loop level? Partial success.

Classical solutions

Q: Extends to exact solutions? Yes!

E.g. $\text{Schwarzschild} \sim (\text{Coulomb})^2$, $\text{Taub-NUT} \sim (\text{dyon})^2$.

General map?

Worksheet models of QFTs

[with Geyer, Mason, Tourkine, ...]

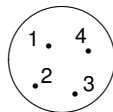
Scattering equations

$$\sum_{j \neq i} \frac{k_j \cdot k_j}{\sigma_i - \sigma_j} = 0, \quad \forall i$$

[Cachazo, He, Yuan]

Map: kinematic invariants (massless) \rightarrow points σ_i on S^2

New formulas $\mathcal{A} = \int d\mu \mathcal{I}(\sigma) = \sum_{\text{solutions } \{\sigma_i\}} A(\sigma_i)$

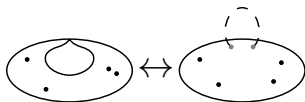


Amplitudes are worldsheet correlators of

ambitwistor string theories [Mason, Skinner]

(upgrade on Witten's twistor string theory)

$$\mathcal{A} = \left\langle \prod_{i=1}^n v_i \right\rangle$$



Q: Loop level? Recent progress!

Q: What class of QFTs?