

Amplitudes and Correlation Functions as Generalised Polytopes

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My Background

- Bachelor degree in Physics at the Università degli Studi di Trieste, Italy.
- Master degree in Theoretical Physics at the Università degli Studi di Trieste, Italy. Thesis on *Monopole deformation in 3D supersymmetric theories through IR dualities*.
- Ongoing Ph.D. in Theoretical Physics at Durham University.

Project Goals

Objectives: The amplituhedron gives a description of planar amplitudes in $N = 4$ SYM as a purely geometrical object [...]. The project will investigate and generalise this geometric structure both for correlators and amplitudes.

The Amplituhedron represents:

- Novel geometrical object
- Efficient tool to compute scattering amplitudes and study their properties

The Correlahedron *Burkhard Eden, Paul Heslop, Lionel Mason (Jan 2, 2017)*

- Amplitudes can be extracted from correlators
- The conjectured geometry for the Correlahedron should be compatible with the Amplituhedron

Short Term Goal

Work to extend and publish our results on the consistency of the conjecture for the MHV amplitude. This represents an important first step towards understanding the Correlahedron geometry.

Schools - Conferences - Workshop:

- *ESR Welcome meeting*, Durham (April 1-2,2019)
- *Amplitudes and Cosmology, Holography and Positive Geometries*, Lecce, (May 27-Jun 1, 2019)
- *Amplitudes 2019*, Dublin, (Jun 1-5 2019)
- *DESY Summer School in Gauge and String Theory*, DESY Hamburg (July 22-26, 2019)
- *1st SAGEX Scientific Workshop*, DESY Hamburg (July 29-August 2, 2019)
- *Wolfram Technology Conference 2019*, Champaign (IL), (Oct 28-31, 2019)

Speaker at:

- *Tree amplitudes and their singularity structure*, Durham University PhD seminars (Jun 10, 2019)
- *Squared amplituhedron and non-maximal flipping number*, Durham University Amplitudes Journal Club (Jul-16, 2019)
- *The surroundings of the amplituhedron*, Northwestern University High-energy Physics Seminar (Oct 14,2019)

Secondment at Wolfram Research Inc.

I've been visiting scientist at WRI from the 6th of August to the 5th of November 2019. Here's a summary of my experience:

Achievements

- Realization of a package for the computation of the inverse Laplace transform that will be possibly included in a future version of Mathematica.
- Publication of an outreach article on the amplituhedron in the Wolfram blog.

Soft Skills

- In-depth knowledge of the Wolfram programming language.
- First experience in a company and in the USA.
- Possibility to visit my mentor J.J. Carrasco at Northwestern University.

Network Experience and Outreach

My experience with the other network members, both ESRs and ESR's supervisors, has been extremely positive. In particular

- Several occasions to interact with the other ESR.
- *Amplitudes 2019* has been a great chance to meet many of the leading scientists in the field.
- Friendly and collaborative atmosphere.
- I had chance to interact both with my second supervisor and my mentor.

Outreach

- Wolfram blog article.
- I've uploaded regularly my videos for the realization of the film.
- I contribute to the exhibition organization as part of the *Symmetry* group.

- Go back to Durham and continue my research on the Correlahedron, concluding the MHV amplitude and start studying the structure of the NMHV amplitude.
- Continue to expand my knowledge of amplitude computations to make now connections between positive geometries and other modern approaches.
- Second SAGEX school and workshop in Berlin.

Thank you for your attention!