Sebastian Buchta (ESR)

Start date: 16.01.2011

End date: 30.11.2011

Home Country: Germany

Now: Spain

Education Background:

- Diplom (≈Master) in Physics
  "Twistor Methods in Quantum Field Theory"

Sebastian Buchta (ESR)

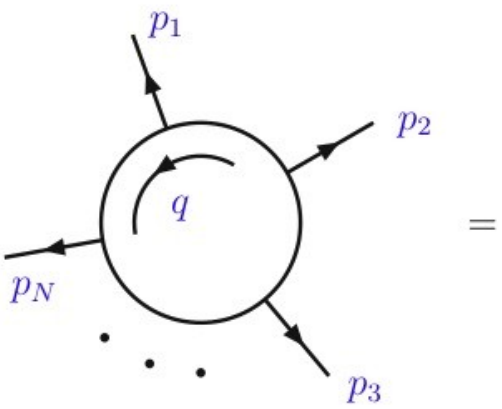
Present Status:

- Institute: Instituto de Física Corpuscular (IFIC)
- Project: Numerical implementation of the loop-tree duality at one loop
- Supervisor: Germán Rodrigo
- University: Universidad de Valencia

Project Overview

- Motivation: Precision predictions for background and signal multi-particle hard scattering processes.
  Therefore it is necessary to find ways to efficiently calculate the corresponding higher order amplitudes.
- Method: The "duality method" is a powerful tool to accomplish that task.

The Duality Method at one-loop



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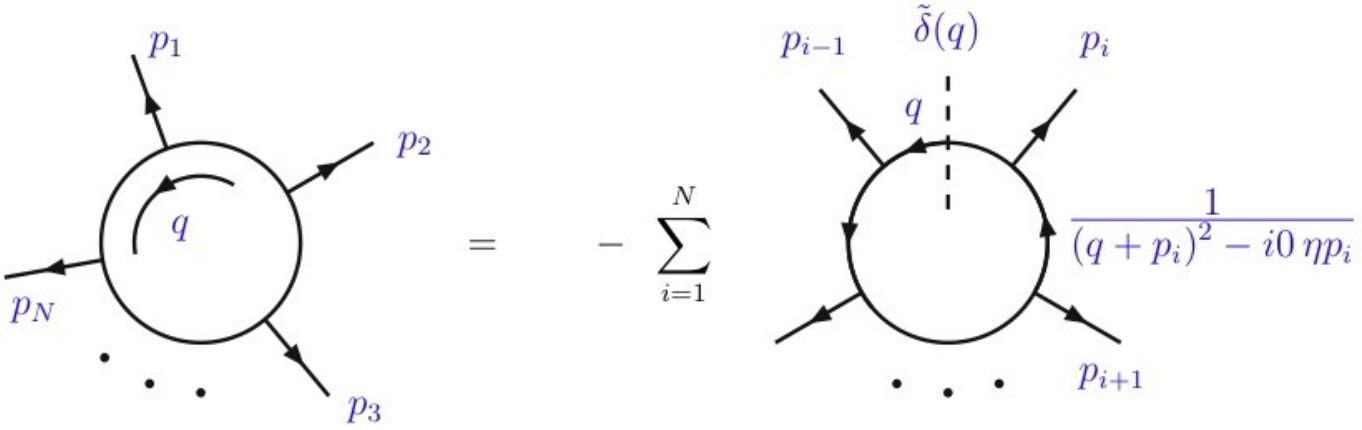
The Duality Method at one-loop



"Maps loops to trees"

Advantage:

- Recasts the virtual corrections in a form that closely resembles the contribution of the real radiative corrections

Properties

- Unlike the Feynman Tree Theorem (→Unitarity Methods) it contains only single poles at the price of introducing a modified i0 prescription
- The singularities of the loop diagram appear as singularities of the Dual Integral
- Feynman graphs are treated in the same way since the duality operation only works on propagators
- Relies strictly on having only simple poles involved. At one-loop this is the only type of pole that may appear

Extension to multiple loops/poles

More loops?

- Apply Duality iteratively to a multi-loop diagram. Each application introduces an extra cut opening up the loop diagram to a tree diagram step by step

Multiple Poles?

- Make use of integration by parts relations (IBPs) to reduce higher order poles to simple poles. Then proceed as usual.

Overview of training stages

Within the Network:

- Kick-Off Meeting (Feb 2011, Valencia, Spain)
- School of Analytic Computing in Theoretical High-Energy Physics (Oct 2011, Atrani, Italy)
- LHCPhenoNet Winter School 2012 (Jan 2012, Ascona, Switzerland)

Outside the Network:

- Initial Meeting of the Working Group on Electroweak precision measurements at the LHC (Apr 2011, CERN)
- ICTP Summer School on Particle Physics (Jun 2011, Trieste, Italy)
- Workshop on High-Energy QCD after the start of the LHC (Sept 2011, Firenze, Italy)

Other:

- PhD course on perturbative QCD

Talks and Publications

Talks

- "The MHV-Lagrangian for electroweak gauge bosons" given at the Kick-Off Meeting and in the IFIC seminar

Publications

- I.Bierenbaum, S.Buchta, S.Catani, P.Draggiotis, I. Malamos, G.Rodrigo "Tree-Loop Duality Realtion beyond single poles", LPN12-57

Integration into a foreign country

Languagewise

- Courses: Don't like beginner courses because they are often very slow
- Not necessary: Grammar book and basic vocabulary do the same job
- Critical thing is whether you really want to learn the language or not
- Once you have a good level of understanding, take a course to refine your skills
- Local people do accept you more, if you speak their language

Habits

- You should try to integrate into the foreign society in order to have some additional benefit