

Name: Hjalte Frellesvig.

Position: ESR at NCSR-Demokritos, Athens, Greece.

Current supervisor: Prof. Costas Papadopoulos.

PhD Degree: Sept. 2014 from the University of Copenhagen.

I have also previously spent time at 'La Sapienza' in Rome, and at the University of Zurich.

I currently work on several projects relevant for LHC background calculations.



The Higgs discovery and potential future discoveries at LHC all require being able to see the events of interest.

Relevant events will be 'hidden' in a forest of similar looking events.

Knowing the background well is a requisite for identifying the signal.

The required amount of detail on the background events, grows as the new physics become more elusive.

'Amount of detail' equals 'order in the perturbative expansion', which again corresponds to calculations with higher number of 'loops'.



My project title is: *Development of automated NLO (QCD+full EW) and NNLO (QCD) tools (WP3).*

'Work package 3' refers to 'Tools'. Yet my work also fits under WP2: 'Predictions and simulations of signal and background', specifically milestones

- M2.3.2 Better control of theoretical uncertainties.
- M2.1.2 Better control of theoretical uncertainties for the SM-like Higgs boson scenario.
- M2.1.1 Specialised codes for the SM-like Higgs boson scenario.
- M3.1.3 Matrix element techniques for Higgs signals.
- M3.2.1 Automation of NLO calculations.



Specifically my work has focused on:

1) A method for loop amplitude calculations based on 'algebraic geometry'. This was the subject of my PhD Thesis and of papers [arXiv:1202.2019], [arXiv:1207.2976], [arXiv:1310.1051] with Simon Badger, and Yang Zhang.

2) The calculations of two-loop corrections to processes $H \rightarrow Z\gamma$ and $H \rightarrow ggg$. Results in [arXiv:1505.00567] with more forthcoming. Work with Roberto Bonciani, Vittorio del Duca, Johannes Henn, Francesco Moriello, Vladimir Smirnov.

3) The evaluation of a function class called 'Generalized Polylogarithms' $G(x_1, \dots, x_n; x)$. Together with Damiano Tomassini, and Chris Wever. Coming Soon.

Also other projects.



Approaches to calculations in high energy physics range from

Process specific - General(izable)
Numerical - Analytical
Brute force - 'Clever'
Traditional - Modern
and so on.

The problems which one encounter, depends on where the calculation is located on these axes.

A problem with computer power, may force you more numerical, a mathematical problem may force you to be more traditional, etc.

Computer power (software + hardware) along with mathematical and physical insight are always needed.



My plan for the near future consist of finishing the projects listed a few slides ago.

I have plans for a three-month visit to ETH in Zurich, to work with my collaborators Vittorio del Duca and Yang Zhang.

I will have to find a suitable "Private sector secondment".

On a longer timescale I intend to find a good post-doctoral position, to further prepare me for a fruitful career in academia.



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Thank you for listening.

