Effective Field Theories interpretation in ttHH events at the ATLAS experiment

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Description of the internship

After many centuries of experimental and theoretical research, the combined work of thousands of physicists led to the Standard Model of particle physics. Unfortunately, but very interestingly, astronomical and cosmological observations lead to a contradiction with the model and to a brutal conclusion: the model does not describe everything we see, and therefore must be incomplete. This suggests the existence of a new more fundamental pattern: numerous extensions of the Standard Model have emerged in an attempt to explain these phenomena.

Effective Field Theories (EFT) are parametric extensions of the model in its most general form which permit to extend the Standard Model without the need to make any assumption on any specific additional model. EFT have phenomenological implications in an energy regime beyond the reach of the Large Hadron Collider (LHC), but also and foremost in the energy regime already covered by the LHC, therefore offering a new degree of freedom enabling the possibility to constrain their different parameters with processes already studied at the LHC.

This internship will focus on the EFT interpretation of an analysis ttHH events at the ATLAS experiment. These events, which contains two top quarks and two Higgs boson in their final state, are very rare and permits to set limits on some EFT parameters. In particular, the Standard Model does not predict a vertex coupling between the two Higgs bosons and two top quarks, but the parametric approach of EFT permits it. The studied process is also a very good candidate to study the Higgs self-coupling ans the top quark Yukawa coupling, which is are key parameters of the Standard Model, and very important parameters to measure in order to understand the Higgs potential. The successful applicant will have the opportunity to join an existing ATLAS analysis and to contribute to the interpretation of the results in terms of EFT parameters and in the measurement of the Higgs self-coupling.

The successful candidate is expected to have basic knowledge in particle physics and prior experience with `C++` and `Python`.

How to apply?

The application should include the following documents and sent by email to both supervisors :

- Marks from previous year, as well as marks already known by the applicant for the ongoing academic year.
- Short cover letter.
- If the applicant already have prior research experience: a scientific report.
- Any additional document the applicant finds useful.

To receive full consideration, the applications should be send **before Wed. 26, Nov. 2025**. Any application received after this deadline will **not** be considered.