Institut de Physique Nucléaire de Lyon
UMR 5822 Université Lyon 1 CNRS/IN2P3

Internship offer – Year 2014-2015

Internship level:	**M2**
Duration :	**4 months**
For M2 internship:	
	- **Possibility of opening to a thesis : Yes**
	- **Type of funding proposed: ED PHAST Doctoral contract**

Supervisor :	**Stéphane Perries**
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Team coaching :	**Viola Sordini, Anne-Laure Péquegnot**

Title of the internship :

Search for Higgs bosons decaying to top quark pairs with the CMS experiment

Summary of work required :

The Standard Model, the theoretical framework describing the elementary particles and their interactions, exhibits an excellent agreement with the various results obtained by the accelerator experiments since more than forty years. The goal of the CMS experiment at the CERN LHC is to test this model and its limits. The restart of the LHC is foreseen for spring 2015, with a record center of mass energy of 13 TeV. The collected data will in particular allow to study the electroweak symmetry breaking, by which the particles acquire their masses.

After the discovery of a Higgs boson in 2012 by the ATLAS and CMS experiments, the detailed study of the Higgs sector is essential in order to search for signs of new physics beyond the Standard Model and characterize the electroweak symmetry breaking. In many theoretical extensions of the Standard Model, the Higgs sector is extended and additional Higgs bosons are predicted. The quark top, with its large mass, has a privileged link with these new bosons.

The goal of this internship is to study the phenomenology of heavy neutral Higgs bosons decaying to top quark pairs in various extensions of the standard model (supersymmetry, two higgs doublet models, composite higgs …) and to find the most promising scenarios. This study is very innovative since the signal arising from such topologies is not necessarily resonant, and new analysis techniques have to be implemented for its discovery.

The candidate has to be motivated and able to work in a team. A basic knowledge in particle physics is required, and experience in programming will be an advantage.