**PHENIICS doctoral school** **PhD thesis subject proposal 2017**

## Laboratory/research team

Laboratoire Leprince-Ringuet, École polytechnique

## Title

Jet quenching in the Quark-Gluon Plasma with the CMS experiment at the LHC

## Overview of the research:

High-energy nuclear collisions provided by the LHC create a state in which hadronic matter melts into a plasma of quark and gluons. Our group studies a number of signatures of this Quark-Gluon Plasma in heavy-ion collisions, including quarkonia, weak bosons and jets. Energetic jets produced in such collisions are quenched, a phenomenon that has been studied in detail during the first Run of the LHC (2010-2013). With the larger data samples that will be available from the ongoing Run 2 (2015-2018), we will measure the quenching of jets from heavy quarks (charm and bottom), which is expected to clarify the underlying mechanism of the jet quenching effect. For further information, refer to our recent first measurement of heavy-quark jets[1], as well as the accompanying review article for a somewhat more general audience[2]. Results from the CMS heavy-ion group are collected here[3].

## Thesis project

The thesis student will play a leading role in the analysis of heavy quark jets using data from the upcoming 2018 Run. In particular we plan to measure the momentum imbalance of pairs of heavy quark jets, as well as to analyze the substructure of such jets. This data will benefit from the upgraded four-layer pixel detector that will be installed in 2017. The student will prepare for the data-taking, by developing and optimizing the charged particle tracking algorithms for this new detector, as well as developing dedicated triggering algorithms for heavy flavor jets to select interesting events online. There is also the possibility of related phenomenological work in conjunction with a local theorist (François Arleo), as well as a contribution to the planned upgrade of the CMS endcap calorimeter (the High Granularity Calorimeter) with the local CMS-HEP group. The exact scope of the thesis work will be decided with the student based on his/her interest, as well as external factors such as the overall timing of the project.

**The thesis project is fully financed by the Agence Nationale de la Recherche.**

## Master and doctoral school

PHENIICS doctoral school – Université Paris-Saclay

## Local team

The group studying heavy-ion collisions with CMS at the Laboratoire Leprince-Ringuet consists of two experimentalists, Matthew Nguyen and Raphaël Granier de Cassagnac. A theorist, François Arleo, is also associated to the project. At the moment there are 5 post-doctoral researchers and 2 doctoral students in the group.

## Contact

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[1] http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.113.132301
[2] https://physics.aps.org/articles/pdf/10.1103/Physics.7.97
[3] https://twiki.cern.ch/twiki/bin/view/CMSPublic/PhysicsResultsHIN