



École doctorale PHENIICS
particules, hadrons, énergie, noyau,
instrumentation, imagerie, cosmos et simulation

université
PARIS-SACLAY

GRADUATE SCHOOL
Physique

- **2 twin courses:**

- "Theoretical aspects of heavy-quark and quarkonium production" (J.P.Lansberg, lansberg@in2p3.fr)
- "Experimental aspects of heavy-quark and quarkonium production" (Pr. R. McNulty, ronan.mcnulty@ucd.ie)

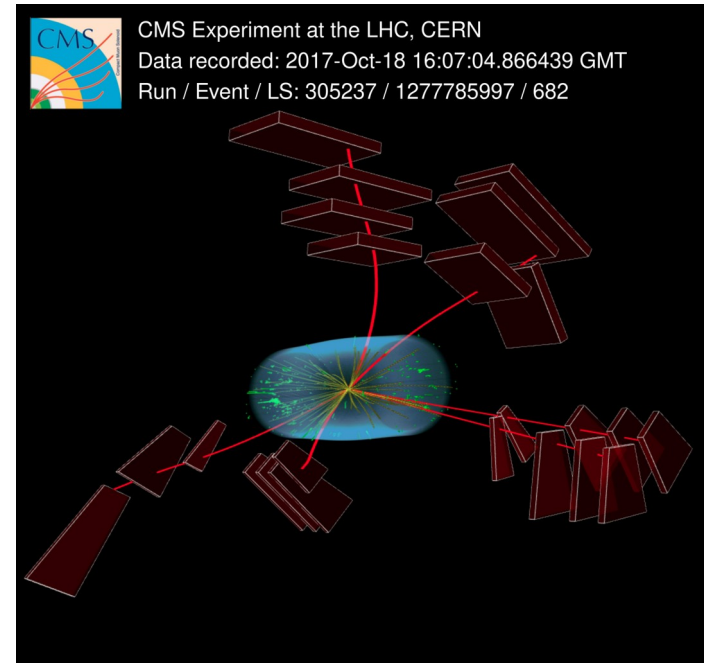
- **Duration** : 30h each (18h lectures + 12h hands on)

- **When:** lectures concentrated on 1 week/month
in February, March, May and June

- We suggest following both but it is *not required*

- **Language** : English

- **Prerequisite:** Elementary particle physics



Some theoretical topics covered:

The November Revolution and the discovery of the charm quark
Light vs heavy quarks
What is a quarkonium ?
Introduction to heavy-quark- and quarkonium-production models
Phenomenology at leading order
QCD radiative corrections
Phenomenology at next-to-leading order
Lessons from the past and understanding theoretical uncertainties
Quarkonia and Parton Distribution Functions
Hadroproduction vs Photoproduction
Double Parton Scattering studies in associated-quarkonium production
Transverse Momentum Distribution studies in inclusive production
Nuclear effects involved in hard scatterings in proton-nucleus collisions
Introduction to the Quark-Gluon Plasma
QGP studies with heavy quark(onia)
Back to proton-nucleus and proton-proton collisions

Hands on HELAC-Onia and Madgraph

Some experimental topics covered:

The LHC accelerator complex
The 4 LHC detectors
Beside and beyond LHC
How heavy quarks and quarkonia are detected
Extraction of signal vs backgrounds
Prompts yields
Various experimental uncertainties and how they arise
Legacy from previous accelerators
Ultra-peripheral collisions; LHC as a photon collider
Inclusive vs exclusive collisions
Generalised Parton Distributions in exclusive production
Monte Carlo code used for experimental studies (Pythia, ...)
Future facilities

Hands on LHC data