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

Doctoral School Course 2023

Title: Phenomenology of heavy-quark and quarkonium production

Teacher :
Jean-Philippe Lansberg
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Contact : Jean-Philippe.Lansberg@in2p3.fr

Duration : 30h (18h+12h) over 2 weeks (June 12-16, 2023 & June 19-23, 2023)

Language : English

Prerequisite: Elementary particle physics

Summary
This course will introduce the students to the phenomenology of heavy-quark and quarkonium production in different collision systems both in the inclusive and exclusive regimes. We will discuss how they can be used to learn about the nucleon and nucleus structure including their spin content, about the strongly-interacting matter produced in ultra-relativistic nucleus-nucleus collisions and more generally about the interface between the perturbative and non-perturbative aspects of QCD. The course will cover the corresponding relevant theoretical and experimental aspects. Hands-on using *NLOAccess* will be proposed.

V1: 25/03/2023

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Tentative Programme

Tentative Schedule:

Green : lectures - Q&A
Blue: Hands-on

WEEK 1	10:30 – 12:30 Lectures	14:30 -16:30 Lectures - Q&A
Monday 12/6/2022		
Tuesday 13/6/2022		
Wednesday 14/6/2022		
Thursday 15/6/2022		
Friday 16/7/2022		

WEEK 2	10:30 – 12:30 Lectures- Q&A	14:30 -16:30 Hands-on
Monday 19/6/2022		
Tuesday 20/6/2022		
Wednesday 21/6/2022		
Thursday 22/6/2022		
Friday 23/6/2022		

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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
- Excited states, production modes and decay channels
- 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
- Ultra-peripheral collisions
- Double Parton Scattering studies in associated-quarkonium production
- Transverse Momentum Distribution studies in inclusive production
- Generalised Parton Distributions studies in exclusive 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

Location :

IJCLab – Orsay
Building 100