

## Doctoral School Course 2022

### Title: Quarkonium-Production Phenomenology

#### Teacher :

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**Duration :** 30h over 5 days (June 27 – July 1, 2022)

**Langue du cours:** English

**Prerequisite:** Elementary particle physics

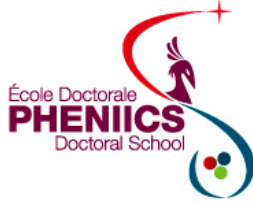
#### Summary

This course will introduce the students to the different models used to describe quarkonium production in different collision systems both in the inclusive and exclusive cases. Then we will address 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, experimental and phenomenological aspects.

#### Provisional Program

##### *Day 1 – Introduction to heavy-quark and quarkonium production*

- The November Revolution and the discovery of the charm quark
- What is a quarkonium ?
- Introduction to heavy-quark production
- Introduction to the quarkonium-production models
- Excited states, production modes and decay channels
- A word on the importance of radiative corrections



### **Day 2 – Applications I (e.g. nucleon structure)**

- Introducing GPDs & TMDs
- Quarkonia, Parton Distribution Functions and Generalised Parton Distributions
- More on TMD studies in inclusive quarkonium production
- More on GPD studies in exclusive quarkonium production
- Double Parton Scattering studies in quarkonium production

### **Day 3 – Application II (e.g. nuclear structure & nucleus-nucleus collisions)**

- Nuclear effects involved in hard scatterings in proton-nucleus collisions
- Introduction to the Quark-Gluon Plasma
- “QGP studies” with quarkonia
- Back to proton-nucleus and proton-proton collisions
- Quarkonium studies in (ultra) peripheral collisions (incl. GPDs)

### **Day 4 – Hands on**

- Hands on MG5aNLO & HELAC-Onia Web via NLOAccess

### **Day 5 – Hands on**

- Hands on MG5aNLO & HELAC-Onia Web via NLOAccess

## **Schedule**

		9:30 – 12:30	14:00 - 17:00
Monday	27/6/2022		
Tuesday	28/6/2022		
Wednesday	29/6/2022		
Thursday	30/6/2022		
Friday	01/7/2022		

## **Location :**

IJCLab – Orsay  
Building TBD  
Room TBD