

## Doctoral School Course 2020

### Title: Quarkonium-Production Phenomenology

#### Teacher :

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**Duration :** 18h overs 3 days.

**Langue du cours:** English

**Prerequisite:** Elementary particle physics

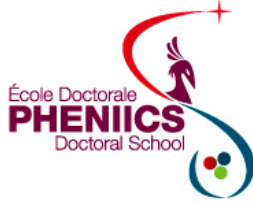
#### Summary

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 – January 27, 2020 (TBC) – Introduction to quarkonium production*

- The November Revolution and the discovery of the charm quark
- What is a quarkonium ?
- Digression about the heavy-quark production
- Introduction to the quarkonium-production models
- Excited states, production modes and decay channels
- Basics of factorisation – introducing PDFs, GPDs, TMDs



**Day 2 – January 28, 2020 (TBC) – Applications I (e.g. nucleon & nuclear structure)**

- 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
- Nuclear effects involved in hard scatterings in proton-nucleus collisions
- Hands on NLOAccess and HELAC-Onia Web

**Day 3 – January 29, 2020 (TBC) – Application II (e.g. nucleus-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)
- Hands on NLOAccess and HELAC-Onia Web

**Schedule (TBC)**

|           |           | 9:30 – 12:30 | 14:00 - 17:00 |
|-----------|-----------|--------------|---------------|
| Monday    | 27/1/2020 |              |               |
| Tuesday   | 28/1/2020 |              |               |
| Wednesday | 29/1/2020 |              |               |

**Location :**

L2I – IJC – Orsay  
Building 100  
Room to be fixed