

# PhD in experimental hadronic physics in ALICE experiment at LHC

**Title:** Measurement of the prompt and non-prompt charmonia production in Pb-Pb collisions with the ALICE experiment at LHC.

## Short description of the PhD project

A PhD is proposed to measure the prompt and non-prompt charmonia production in Pb-Pb collisions with the ALICE experiment at LHC.

Ultra-relativistic heavy ion collisions, delivered by the Large Hadron Collider (LHC) at CERN (Switzerland) allows to reach extreme temperature and density conditions to study matter properties and in particular a deconfined state of quarks and gluons (Quark Gluon Plasma – QGP) predicted by Quantum Chromodynamics (QCD).

The heavy quarks (charm and beauty) are produced during the early stages of the heavy ion collision. The study of the charm—anti-charm and beauty—anti-beauty states, called quarkonia, allows to study the initial state of a collision and to characterize experimentally the QGP properties and evolution. Quarkonia are very sensitive to the medium temperature and should be more suppressed as temperature increases.

The quarkonia measurements during LHC Run 1 and 2 data taking, shed new light on the suppression and production mechanisms, especially for  $J/\psi$  (charm—anti-charm). The energy available in lead-to-lead collisions at LHC is such that a  $J/\psi$  suppression greater than or equal to the one measured at RHIC was expected. However, a lower suppression was measured. Indeed, the amount of charmed quarks produced by collision at the LHC is very important. Thus, despite the dissociation of related states, a (re)generation of charmonia can be ascertained by statistical combination of charmed quarks and antiquarks. This is the phenomenon of recombination which may explain the less important suppression observed for  $J/\psi$  at LHC. However, the constraints these measurements are performed for inclusive  $J/\psi$  and therefore bring limited constraints to theoretical models. LHC Run 3 (starting in 2022) will allow separation of charmonia produced directly during the collision from those produced by the disintegration of other particles such as the B meson. This separation is a necessary step in the understanding of the production mechanisms and in medium quarkonia interactions. This will be achieved thanks to the recent installation of the Muon Forward Tracker (MFT) in the ALICE experiment for LHC Run 3.

The objective of the thesis will be the study of the charmonia production in the muon channel using PbPb data collected during the LHC Run 3 with ALICE.

## Work Context

During the thesis, the PhD student will be a member of the SUBATECH ALICE team. The team consists of 8 permanent researchers, 1 post-doctoral students and 2 PhD students. He/she will participate in the data collection of the ALICE experiment, in the development of the analysis programs, and detector calibration (MFT, muon spectrometer).

The candidate will have to make regular stays at CERN (Switzerland).  
The candidate must regularly present his/her work to the ALICE collaboration (English mandatory) and in international conferences.

## Additional information

To apply candidate should produce

- 1 CV
- 1 motivation letter

See portal for instructions to apply:

<https://emploi.cnrs.fr/Offres/Doctorant/UMR6457-MARGER-002/Default.aspx?lang=EN>

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