

PhD PROPOSAL 2024-2027

Charmonia production in pp and PbPb collisions at LHC in ALICE experiment.

keywords: *Quark Gluon plasma, relativistic heavy ion collisions, ALICE, LHC, Quantum Chromodynamics.*

Start of PhD: Oct 2024

Qualifications:

- Master degree in particle physics, hadronic physics or nuclear physics
- Good knowledge in programming (C++ or object oriented language, python)
- Good knowledge in english (writing, speaking)
- Skills in teamwork and communication

Supervision:

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Summary of the PhD subject:

Ultra-relativistic heavy ion collisions delivered by the CERN Large Hadron Collider (LHC) provides extreme conditions of temperature and density of nuclear matter allowing the study of Quark Gluon Plasma, a deconfined state of quarks and gluons, predicted by Quantum Chromodynamics (QCD).

Quarkonia, pairs of heavy quark and anti-quark, are produced very early during an heavy ion collision. Therefore, they are very useful to understand the initial stages of such collision and characterize the QGP evolution and properties. Indeed, they are very sensitive to the temperature of the medium created during the heavy ion collision. If the temperature is high enough, the charmed quark pairs initially produced will be dissolved in the medium. This phenomena is called quarkonia suppression.

The measurements done at LHC during Run 1 and 2 shed a new light on quarkonia production mechanisms. In particular, the J/ψ suppression is not as high as expected in the most central collisions. Indeed, the massive production of charm quarks at the LHC energies allows these quarks, after interaction in QGP, to form a new quarkonia state. This regeneration mechanism could explain the observed production of charmonia.

However, the constraints that such measurement provides on theoretical models are still limited since the measurements are done on inclusive charmonia production. The Run 3 at LHC allows to separate the charmonia directly produced during the collisions from the ones produced by other particle decays such as B meson. The separation of these two components is necessary to understand the production and interaction with the medium of charmonia. This is possible in Run3 with ALICE thanks to the new Muon Forward Tracker detector that has been installed in the experiment.



Laboratoire de physique subatomique et des technologies associées

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The goal of the PhD will be to study the charmonia production in the muon decay channel at forward rapidities using pp and PbPb collision collected during the Run3 ALICE data taking. The candidate will be involved in pp and/or PbPb data analysis on one of the topics of interest currently explored by the group.

The candidate will join the SUBATECH ALICE team (8 permanent physicists, 2 post doc and 2 PhD students. He/she will be involved in the data taking of ALICE experiment, the analysis software developments, and the calibration of the detectors (MFT, Muon spectrometer)

Several stays at CERN (Switzerland) are foreseen.

Results will be presented in collaboration meetings, documented in internal analysis notes and published in scientific journal. At least one talk in international conference is expected during the PhD.

How to apply:

The candidate should fill in his application here : <https://emploi.cnrs.fr/Offres/Doctorant/UMR6457-SOPDEP-046/Default.aspx>