Master 1 Internship Proposal

Title

Study of the χ_c mesons in PbPb collisions at $\sqrt{s_{NN}}$ =5 TeV with the LHCb detector at the LHC.

Physics motivations

In our everyday life, matter is made of protons and neutrons, particles that are themselves composed of quarks and gluons. In current nuclear matter, at low temperature, quarks and gluons are confined within hadrons. However, at very high temperature (or equivalently high energy density), of the order of 10^{12} K, an exotic state of matter can be created where quarks and gluons are no longer confined. This state, called Quark Gluon Plasma (QGP), tests the boundaries of our knowledge of matter under extreme conditions. Moreover its characterization is expected to provide decisive information on our understanding of the early universe (few micro-seconds after the Big Bang) when deconfined quarks and gluons bound together leading eventually to the current structure of matter.

Droplets of QGP are created for few femtosecond in high-energy PbPb collisions at LHC. Among the golden probes, the study of the χ_c meson production should provide decisive information on the medium properties. Such measurement, because of experimental limitation, has never been done so far in nucleus-nucleus collisions.

Internship project

χ_c can be studied for the first time at LHCb in PbPb collisions thanks to a large data sample recorded in 2018. The candidate will contribute to this analysis which will serve as a baseline for further studies.

On technical aspect, the candidate will develop skills in data processing and data analysis using the ROOT software. Knowledges in programming language in Python and C++ are required.

Laboratory

Laboratoire Leprince-Ringuet, École polytechnique / LHCb heavy ions group

Local team

Experimentalists : Heavy ions
Benjamin Audurier (LLR, postdoc), Frédéric Fleuret (LLR), Felipe Garcia (LLR, PhD student), Émilie Maurice (LLR), Élisabeth Niel (LAL, PhD student), Patrick Robbe (LAL)

Luminosity
Vlasdislav Balagura (LLR)

Theorist
François Arleo (LLR)

Contact person

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