

Laboratory/research team

Laboratoire Leprince-Ringuet, École polytechnique / LHCb heavy ions

Title

Testing color screening in a quark gluon plasma with LHCb.

Overview of the research:

At the end of 2015, the LHCb collaboration will record the first collisions induced by the LHC lead beams on a gaseous target. This will permit a thorough test, for the first time, of the color screening mechanism, a prediction of lattice QCD, experimentally accessible when producing a quark gluon plasma in heavy ion collisions.

The LHCb detector is optimized for heavy flavor measurements. In particular, it allows extremely accurate measurements of bound states such as D mesons, J/ψ , ψ' and χ_c considered as very sensitive probes for quark gluon plasma studies (see CERN-SPSC-2012-031 for more details on the physics case).

Thanks to the LHCb SMOG system (System for Measuring Overlap with Gas), initially intended for luminosity measurement, noble gases such as He, Ne, Ar, ... can be injected inside the vertex detector VELO (Vertex Locator). Acting as "fixed targets", they give access to nucleus-nucleus collisions at optimum energy to study the phase transition. In 2015, LHCb will record 21 days of data in Pb-Ar collisions at $\sqrt{s} \sim 70$ GeV. This is the first campaign of this type.

Thesis project

The proposed thesis will be the first performed on such data. The student will participate in the analysis of the data recorded during the 2015 runs (p-Ar and Pb-Ar collisions). We will first study J/ψ and ψ' production (via their dimuon decay channel) and D^0 and \overline{D}^0 mesons (via their πK decay channel). The student will also lead the analysis of χ_c production which will require more effort due to the larger background (χ_c measurement via the $J/\psi + \gamma$ channel). Finally, the student will participate in the 2016 run data taking and analysis.

The interpretation of these data in the context of phenomenological work in close relationships with theorists may, depending on the tastes of the student, be an important part of the thesis project. Finally, the PhD student will participate in the dissemination of these results in publications and international conferences.

Master and doctoral school

- Master 2 in particle physics
- PHENIICS doctoral school – Université Paris-Saclay

Local team

experimentalists : Francesco Bossu (LAL), Frédéric Fleuret (LLR), Giulia Manca (LAL), Laure Massacrié (LAL), Patrick Robbe (LAL), Yanxi Zhanj (LAL).

Theorist : François Arleo (LLR)

Contact

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