

## Ecole Doctorale des Sciences Fondamentales

**Title of the thesis: Measurement of the Z-boson production cross section in p-Pb/Pb-p collisions at  $\sqrt{s_{NN}} = 8,16$  TeV with ALICE**

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### Summary :

The aim of ultra-relativistic heavy-ion collisions is to pin down the nuclear equation of state by studying the properties of nuclear matter under extreme conditions of temperature and pressure. The ultimate goal is to study the deconfinement of the hadron constituents in the so-called Quark-Gluon Plasma (QGP). This phase of matter is believed to have constituted the universe a few micro-seconds after the Big-Bang. A Large Ion Collider Experiment (ALICE) is one of four major experiments installed at the Large Hadron Collider (LHC) at CERN (European Organization for Nuclear Research). It is mainly dedicated to the study of the matter produced in ultra-relativistic heavy-ion collisions.

Measurements in proton-nucleus collisions can serve as references for nucleus-nucleus collisions and be used as inputs for the determination of nuclear parton distribution functions (nPDF). Indeed, PDF are expected to be modified for nucleons inside a nucleus compared to those of free nucleons. nPDFs for high energy scale  $Q^2$  and small  $x$  ( $x$  being the momentum fraction of the nucleon carried by the parton) have either no or only weak direct constraints from data.

Electroweak bosons and their lepton decay products are unaffected by the hot and dense strongly-interacting matter formed in ultra-relativistic heavy-ion collisions and offer a unique opportunity to study the nPDF. In addition, the W and Z boson production occurs in hard scattering processes at the initial stage of the collision, and is expected to scale with the number of binary nucleon-nucleon collisions.

The PhD will be devoted to the measurement of the Z boson production cross section in p-Pb/Pb-p collisions at a nucleon-nucleon center of mass energy of 8.16 TeV. The Z bosons will be reconstructed in the muonic decay channel using the ALICE Muon Spectrometer covering the pseudo-rapidity range  $-4 < \eta < -2.5$ . A second analysis on Z production in pp collisions at 8 TeV will allow us to extract the nuclear modification factor of the Z bosons and will be a unique measurement from LHC experiments at the rapidity range covered by the ALICE muon spectrometer.

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In addition of the analysis work, the PhD student will have to cover a general service task for the ALICE collaboration, contributing to the future developments of the experiment in view of data to be collected during the LHC RUN 3.