INTERNSHIP PROPOSAL

Laboratory name: Department of nuclear physics of IRFU, CEA Saclay
Internship director's surname: Winn
e-mail: michael.winn@cea.fr Phone number: +33 1 69 08 55 86
Web page: https://irfu.cea.fr/en/Phocea/Vie_des_labos/Ast/ast_groupe.php?id_groupe=4190
Internship location: DRF/IRFU/DPhN CEA Saclay, Orme de merisiers, Bât. 703, 91191 Gif sur Yvette

Thesis possibility after internship: NO
Funding: YES If YES, which type of funding: institute budget

Quark Gluon Plasma equation of state

The Quark-Gluon Plasma (QGP) is an exotic state of matter created under extreme temperatures in heavy-ion collisions at the LHC at CERN. It is one of the first stages of matter in the Universe after the Big Bang. The proposed internship consists of a phenomenological study of the QGP equation of state using state-of-the-art relativistic hydrodynamic simulations.

At the Large Hadron Collider (LHC) at Geneva, collisions of lead nuclei are used to create a thermodynamic system described by fluid dynamics under extreme conditions. This state of matter is commonly called Quark-Gluon Plasma. Its time evolution is described by relativistic hydrodynamics. A central equation that describes the thermodynamics of the QGP is the equation of state. Measuring this equation is crucial for having a precise understanding of the thermodynamic medium.

The QGP laboratory inside the department of nuclear physics of CEA Saclay is actively involved at all levels of experimental exploration of the QGP with the ALICE and LHCb experiments at the LHC. The group maintains close collaboration with theoretical physicists from IPhT.
A new method for measuring the QGP equation of state was recently proposed. The goal of this internship is to extend this methodology for environments with non-zero baryochemical potential, providing new observables to the LHC experiments. The work will be based on Monte Carlo simulation tools. Depending on the candidate's interest, phenomenological aspects related to the QGP thermodynamics could be included. The candidate will familiarise himself/herself with the physics of the QGP, detector physics and advanced data analysis techniques using Python.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO Soft Matter and Biological Physics: NO
Quantum Physics: YES Theoretical Physics: YES