"Emergent physics at LHC2"

Director: **Jean-Yves Ollitrault**
(jean-yves.ollitrault@cea.fr; +33169087269; http://ipht.cea.fr/Pisp/jean-yves.ollitrault/).

Type: Stage, These or Stage+These.

Condensed Matter Physics, Macroscopic Physics and complexity, Quantum Physics, Theoretical Physics.

The Large Hadron Collider at CERN is starting again in 2015 after a long shutdown. It accelerates not only protons, but also heavy nuclei (Pb). Data on proton-nucleus and nucleus-nucleus collisions are collected for a few weeks every year. These collisions exhibit "emergent" phenomena, which cannot be extrapolated from observations in proton-proton collisions. While emergent phenomena usually belong to the realm of statistical and condensed matter physics, they appear here -for the first time- in the context of high-energy physics experiments. Specifically, the system formed in the collision exhibits specific liquid-like properties, which are typically expected in macroscopic systems. What happens here is that the huge strength of the strong interaction compensates for the small system size (up to 25000 particles)

The internship is about the theoretical modeling of some of these phenomena. Specifically, it will address the interpretation of a recent result by the ALICE collaboration, one of the 4 large experiments at the LHC. This result was shown for the first time at the Quark Matter conference (which gathered 700 participants in Japan in October 2015) and is yet unexplained. The work will involve simple Monte-Carlo numerical simulations, analytical calculations and, eventually, comparison to experimental data.