The University of Birmingham
Fully funded PhD studentship to work the ALICE experiment at the CERN LHC
Starting date: September 2020 (Open to UK and EU candidates)

ALICE is one of the four main experiments at the Large Hadron Collider (LHC) at CERN. It is a general purpose heavy-ion experiment aimed at studying QCD under extreme conditions of energy density. In particular, it is designed to study a state of matter consisting of deconfined quarks and gluons known as a Quark-Gluon Plasma (QGP). Such a state of matter is thought to have existed up to about ten microseconds after the Big Bang. ALICE records data from lead-lead, proton-lead, and proton-proton collisions at the LHC and the Birmingham group analyse data from all these collision systems. The fundamental questions ALICE tries to address include:

- What are the phases of strongly interacting matter and what is the nature of the quark-gluon plasma?
- How do the properties of hadrons and the quark-gluon plasma emerge from fundamental interactions?
- How do hadron properties relate to large scale structures of matter under extreme conditions, such as neutron stars, black hole formation or matter during the early evolution of the Universe?
- What is the origin of hadronic mass?
- How does the quark and gluon structure of nucleons and nuclei evolve with energy and is there evidence of gluon saturation in high energy nuclear collisions?
- What is the mechanism for confining quarks and gluons in strongly interacting particles?

The Birmingham group is a founding member of the ALICE collaboration and plays central roles within it, including representation on the Management Board. We are solely responsible for the design, construction, and maintenance of the ALICE Central Trigger Processor (CTP) and play leading roles in three areas of ALICE analysis: strange and multi-strange particle production in small systems (e.g. p-p and p-Pb collisions), ultra-peripheral Pb-Pb and p-Pb collisions, and the study of jet sub-structures.

Research students work closely with their supervisors, but also with other academic and research staff, participating fully in the life of the group. In addition to a number of short visits to CERN, students may spend one to one and a half years at CERN on Long Term Attachment (LTA) if they wish and usually present their results at an international conference.

Funding

For UK and EU citizens, full fees are paid as well as a tax-free maintenance allowance of **£15,285 per year** for 3.5 years. Students on LTA at CERN will have their accommodation paid for and receive an additional allowance to cover the higher cost of living in Geneva.

Requirements

A first class UK Masters honours degree in physics (or international equivalent), some knowledge of high energy physics, and some computing experience.

The PhD Research Project – Looking for evidence of QGP formation in high particle multiplicity p-Pb and p-p collisions.

The energy densities formed in Pb-Pb collisions at LHC energies exceed the predicted value for QGP formation by over an order of magnitude, making it the ideal environment for studying the properties of the QGP in detail. The systems produced in proton-proton and proton-lead collisions were considered too small and hence short-lived for QGP formation to take place, and were studied as a reference. However, recent results from ALICE have shown QGP-like behaviour in the p-p and p-Pb collisions that produce a large number of charged particles in the final state (high-multiplicity events). The order of magnitude increase in statistics and improved detector for LHC Run 3 will provide a unique opportunity to study high-multiplicity events in small systems to unprecedented precision and help determine the mechanisms behind such behaviour.

For more information, please contact:

Professor David Evans

d.evans@bham.ac.uk