Reinterpretation of searches for long-lived particles

Institute: Laboratoire de Physique de Clermont (LPC)
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Supervisors: Louie Dartmoor Corpe (experiment), Andreas Goudelis (theory)
Contacts: l.corpe@cern.ch, andreas.goudelis@clermont.in2p3.fr

Long-lived particles, *i.e.* unstable particles that decay with a macroscopic lifetime, are not only abundant in nature but also a frequent prediction of numerous extensions of the Standard Model of particle physics. Examples of such extensions include models that aim to explain the nature and the abundance of cosmic dark matter, the smallness of neutrino masses or different supersymmetric models. In many of these cases, the predicted long-lived particles can be produced at current high-energy colliders such as the CERN Large Hadron Collider (LHC).

The LHC ATLAS experiment has, especially in recent years, developed a rich research program aiming to detect such long-lived particles and has so far managed to set impressive constraints on many models predicting their existence. The experimental analyses are typically performed with a specific set of theoretical models in mind and the corresponding constraints are presented in terms of a few examples of concrete microscopic models. For this reason, reinterpreting these constraints in terms of other extensions of the Standard Model may require caution. Developing methods in order to perform this “recasting” is currently a key question and a major topic of discussion between the theoretical and the experimental community.

During this internship, which lies at the interface of theoretical and experimental physics, we will consider an existing ATLAS search for long-lived particles (“displaced jets”) and study how the experimental limits obtained in terms of one specific extension of the Standard Model may be reinterpreted in terms of another model. The intern will familiarize oneself with notions in physics beyond the Standard Model, event generation and detector simulation.