Project Description - A Search For Quirks at the LHC

Minimal extensions to the standard model are fertile ground for new physics. One such extension is the addition of a hidden SU(N) where the fundamental fermions are massive relative to the confinement scale of the QCD-like interaction that binds them together. These fermions have been dubbed quirks by their proponents due to their bizarre and highly variable phenomenology: since the energy stored in the "infracolor" string between quirks is small compared to the quirk masses, bound states of quirk pairs can be macroscopic. This phenomenology makes detection difficult and even though they may already have produced in previous experiments, these signatures would easily have eluded observation. A significant portion of the quirk parameter space is amenable to a search with very early data at the LHC: indeed, this signature is currently the subject of a search for quirks at the Tevetron. This signature requires the development of an algorithm designed specifically to identify tracks with large de/ex in the atlas pixel detector, making it perfectly aligned with the expertise of the SLAC Atlas group.

The experimental reach for quirks increases rapidly with center of mass energy, so that a search at the LHC will exceed the discovery potential of the Tevatron experiments well before the end of the current run in 2011. A generator level Monte Carlo and toy simulation of the dynamics of quirk pairs has been developed in conjunction with Markus Luty and Jared Evans at UC Davis that can be used to develop the trigger and reconstruction strategies that will be required. The first task is to use the output of this simulation to develop the analysis strategy. The second task will be the development of a novel tracking algorithm capable of identifying quirks tracks in the Atlas inner detector.

Please contact Tim Nelson for more information regarding this project.