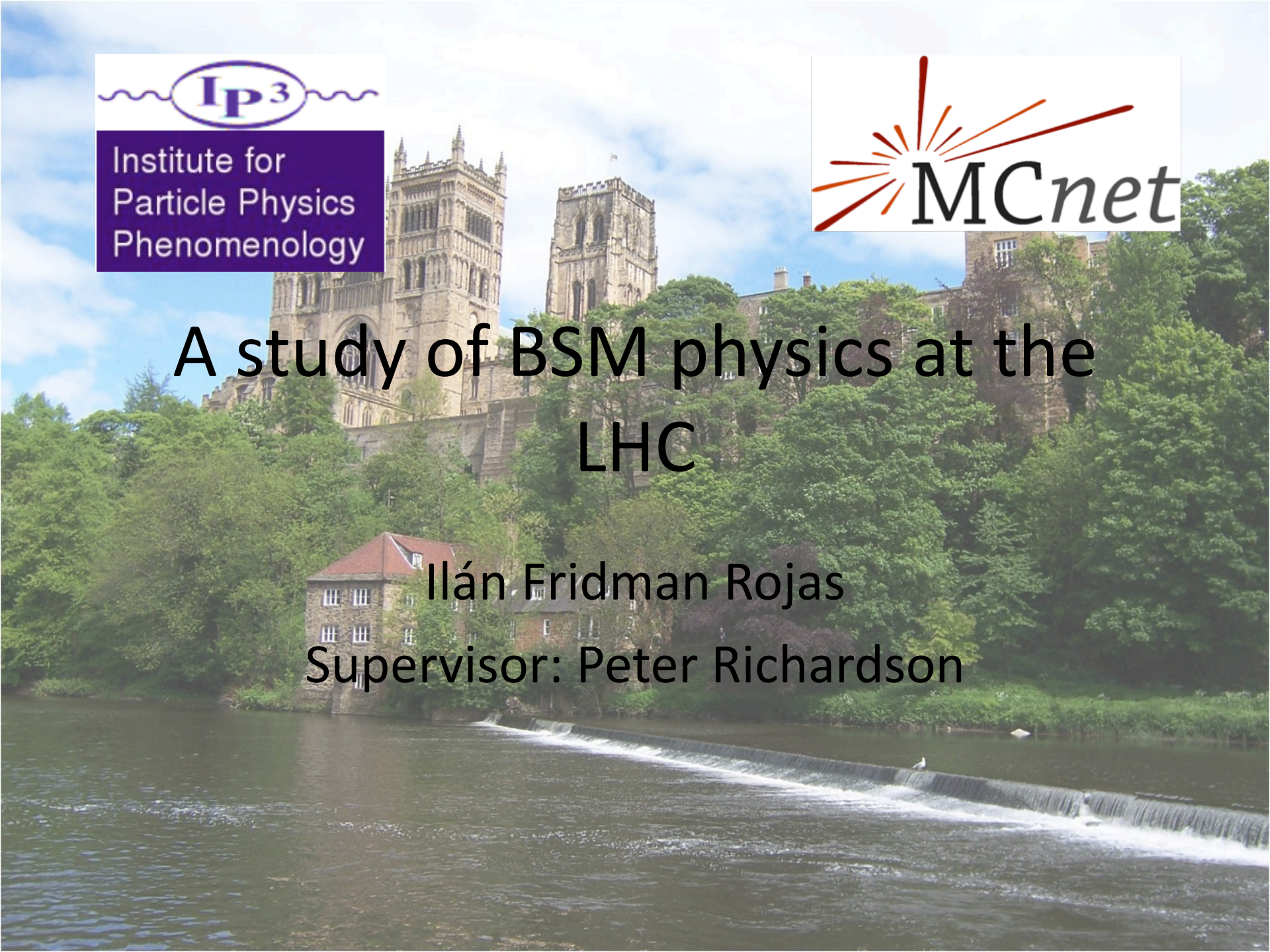


A study of BSM physics at the LHC

Ilán Fridman Rojas

Supervisor: Peter Richardson

My Background

- International Undergraduate Summer School (IUSS) on Particle Physics and Astronomy, 2006.
- MPhys from the University of Manchester, 2008.
- University of Durham Institute for Particle Physics Phenomenology, 2009.
- Working with Dr. Peter Richardson.

Previous Research

- Neutrinos, microscopic black holes and CPT violation (IUSS 2006), with Dr. Dean Morgan (Sheffield).
- Beam simulations for the ILC, with Dr. Rob Appleby (Manchester).

Current Research

- Learning the basics of new heavy gauge (Z') bosons.
- Learning to program in C++.
- Learning to implement new models in Herwig++.

Z' Models

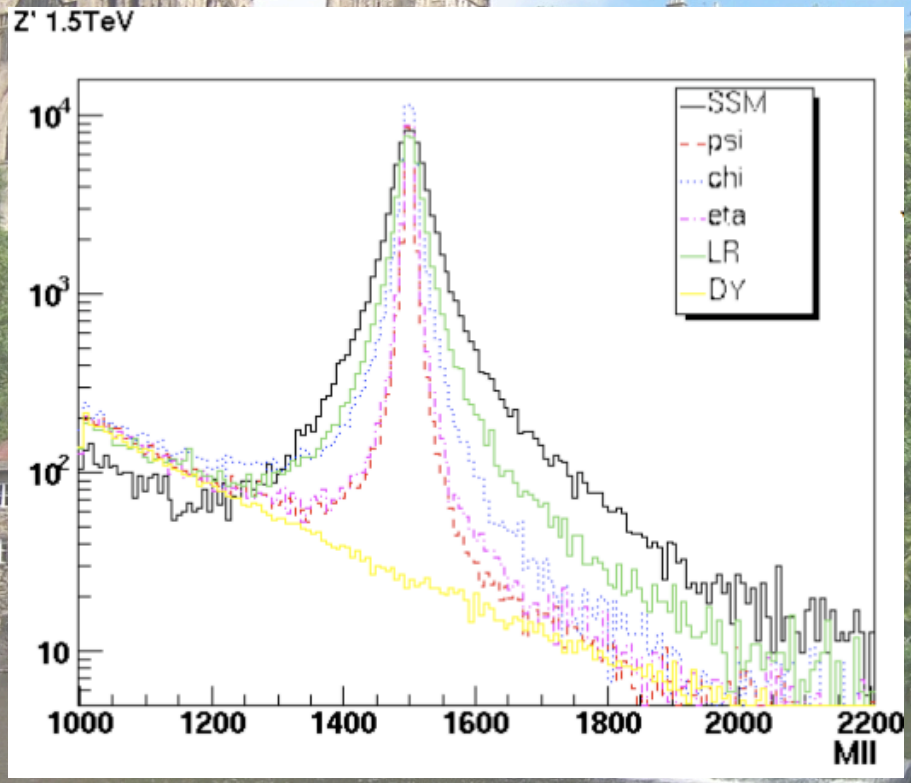
- Motivation: It's the simplest extension to SM gauge groups.
- Theoretical framework:
  - GUT
    - Effective Rank 5 Models (ER5M)
    - Left-Right Symmetric Models (LRM)
  - Non-GUT
    - Little Higgs
    - A Heavy SM-like Z' (SSM)
    - The Light and Heavy Generations Model

Relevance

- A Z’ with mass 1.3 - 1.5 TeV (for all of the most common Z' models) is definitely within reach using 100fb^{-1} at the LHC (S. Godfrey arXiv:hep-ph/0201093v1).
- Using a Forward- Backward asymmetry measurement (and assuming $M_{Z'} < 2$ TeV) the LHC should be able to determine the spin of the Z’ and at least constrain its couplings to the SM.
- It’s unclear how well we will be able to determine the Z’ couplings using LHC data. The ILC will determine them completely.

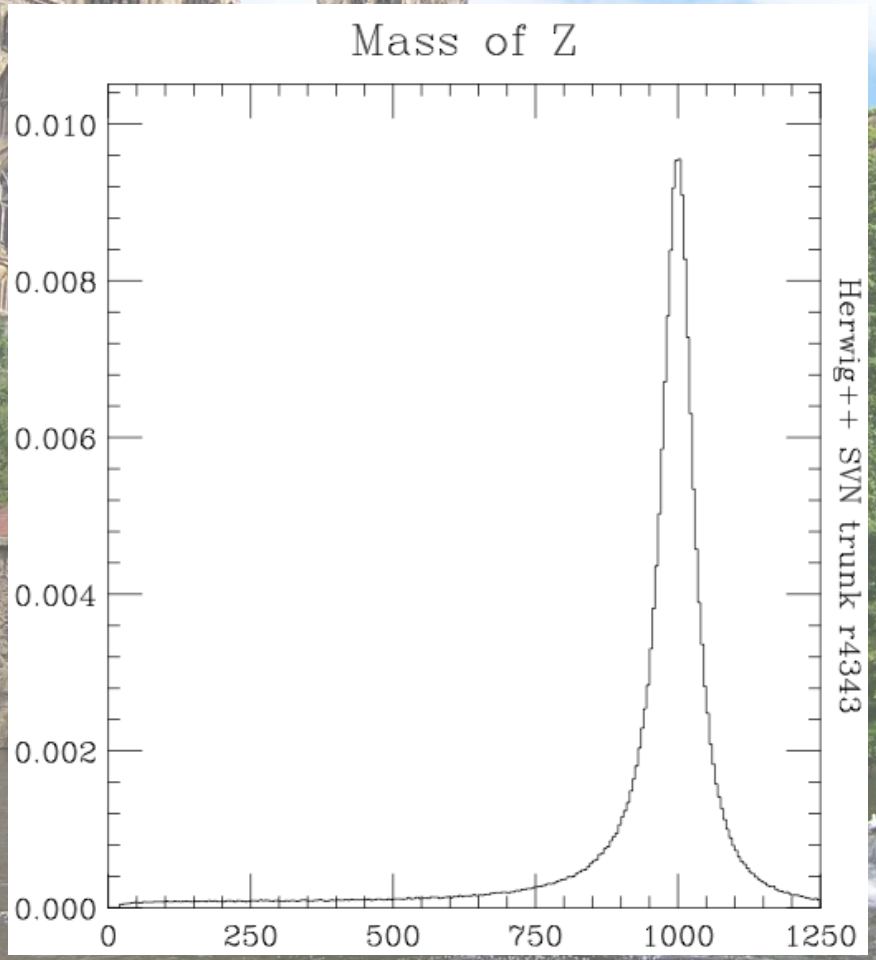
Effective Rank-5 Models

$$E_6 \rightarrow SO(10) \times U(1)_\psi \rightarrow SU(5) \times U(1)_\chi \times U(1)_\psi \rightarrow SM \times U(1)_\beta$$



T. Rizzo (arXiv:hep-ph/0610104v1)

Herwig++ implementation



Plans

- Finish learning how to implement simple SM extensions in Herwig++ (i.e. finish implementing a generic Z' boson).
- Look at other interesting possibilities, such as how to model the effects of the quantum mechanical interference between two nearby particle resonances (e.g. hep-ph/0906.3417) in a Monte Carlo event generator.