



Physics Department
Project for MSc/MSci (PH4100)

Search for evidence of extra dimensions at the LHC

Supervisor: Dr Tracey Berry

Brief Description

The aim of the project is to investigate detecting evidence of extra dimensions in proton-proton collisions, using the ATLAS detector at the Large Hadron Collider, LHC.

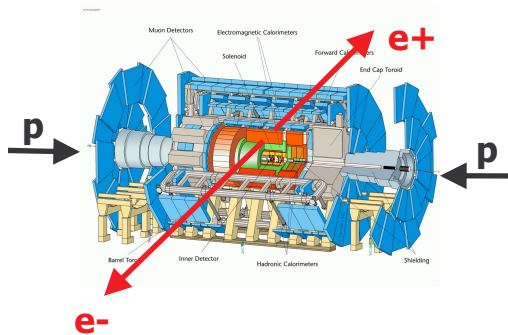


Fig. 1 ATLAS detector.

In particular, the signal to be investigated is Graviton decay to two electrons: $pp(gg,qq) \rightarrow G \rightarrow e^+e^-$, as illustrated in the diagram below.

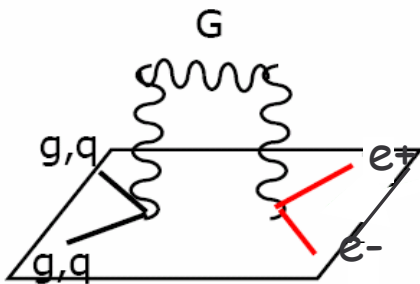


Fig. 2 Schematic of Graviton decay to two electrons.

Phase I

The student will investigate the properties of the electrons produced in the Graviton decay: e.g. angular distributions and transverse momentum spectra. The student will estimate the numbers of events expected for a given graviton mass and also investigate the number of background events to the process.

Phase II

The student will study the identification variables used to detect electrons in the ATLAS detector. In particular, looking into the properties of very high energy electrons.

Extensions/Variations

- The student will make plots of the efficiencies of the identification cuts as a function of energy of the electron.
- The mass of the graviton is unknown. The student will investigate how the width of the resonance formed by the two electrons varies as a function of the graviton mass: both at generator level and after reconstruction in the ATLAS detector. The student will also investigate the angular distribution of the electrons produced in decays of graviton for different masses.

Requirements

This project has a strong computational component. Therefore good programming skills are essential for the successful completion of the project. The analysis of the data will require programming in C++. Some knowledge of the Unix/Linux environment would be an advantage.