PHYSICS BEYOND THE STANDARD MODEL

Exercise Sheet 9

Exercise 1: Gluinos and Squarks at the LHC

Consider the figure "Gluino and Squark Reach at LHC" in the lecture notes. The plot is for $\tan(\beta) = 2, A_0 = 0, \mu < 0$.

- Which values of m_0, $m_{1/2}$ are optimal for finding SUSY particles?
- What is the dependence of the masses of the charginos, neutralinos, sfermions and gauginos on m_0 and $m_{1/2}$? How would the plot look for $\tan(\beta) = 5$?
- Draw one Feynman diagram for each of the following processes:
  - 4ℓ
  - 3ℓ
  - 2ℓSS
  - 2ℓOS
  - 1ℓ

  How would these processes show up in the detector?

Excerise 2: Slepton searches

Consider the following process:

$$p\,p \to \tilde{\ell}\,\tilde{\ell} \to \ell\,\tilde{\chi_0}\,\ell\,\tilde{\chi_0}$$

- Draw the Feynman diagram for this process.
- What is the signature for the process?
- What are the backgrounds (there are 3 important ones)?
- Which variables would you cut on in order to reduce the backgrounds?
- What would change for a e^+e^- collider ?