Search for direct pair production of a chargino and a neutralino decaying to the 125 GeV Higgs boson with 20.3 fb^{-1} of 8 TeV pp collisions using the ATLAS detector

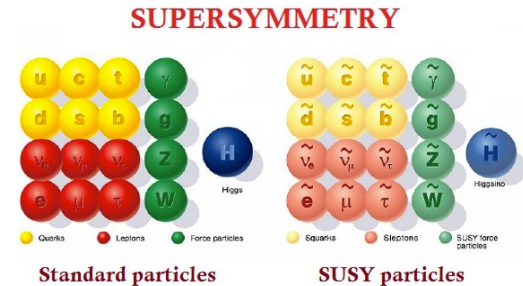February 15th – 21st 2015

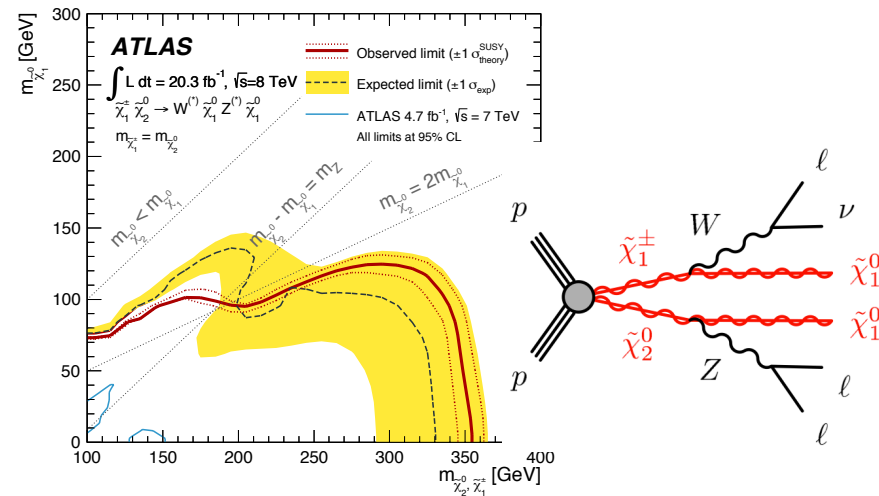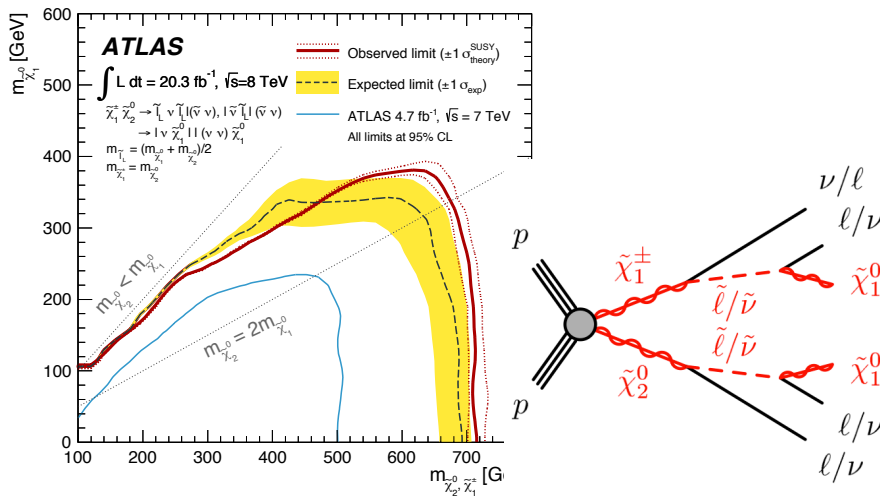Lake Louise Conference

Matthew Gignac

Motivation

- Supersymmetry is the only proposed extension of space-time symmetry
  - Provides a dark matter candidate
  - Unification of forces at the GUT scale
- EWK SUSY remains very promising channel
  - Particles are expected to be light
  - Distinct and clean leptonic final states
- ATLAS has already performed searches for EWK SUSY decaying through sleptons or a Z boson
  - **This poster presents the first search for EWK SUSY decaying through a 125 GeV Standard Model Higgs boson**
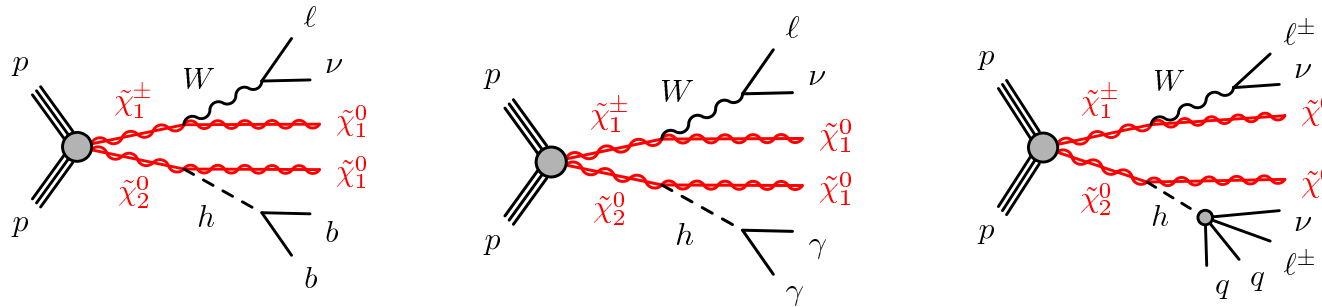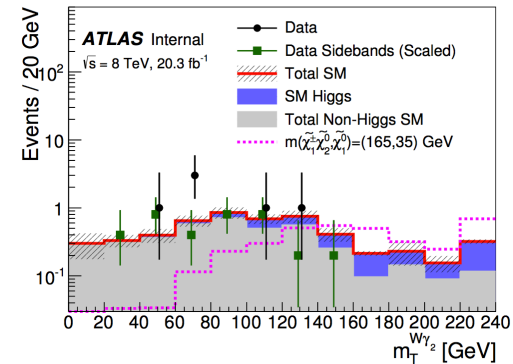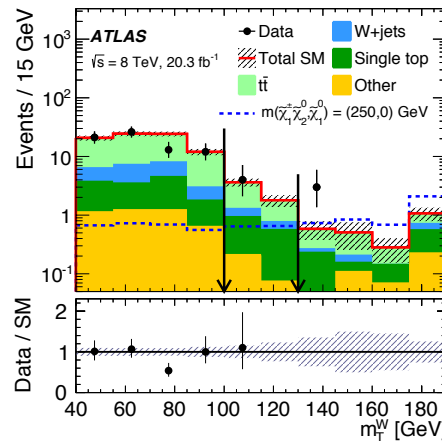
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Searches for SUSY with a Higgs boson

- Three channels are explored, decaying through Wh

- 1 lepton + 2 b-tagged jets
  - tt̄ and W+jets dominant backgrounds
  - Backgrounds supressed with mT and mCT
- 1 Lepton + 2 photons
  - Misreconstructed leptons and jets dominant background
  - Data driven background estimation, similar to SM higgs to photons discovery
- 2 same sign leptons + jets
  - WZ and misidentified leptons are the dominant backgrounds
  - Semi data-driven back estimate

$$m_{\mathrm{T}}^{W} = \sqrt{2E_{\mathrm{T}}^{\ell} E_{\mathrm{T}}^{\mathrm{miss}} - 2\mathbf{p}_{\mathrm{T}}^{\ell} \cdot \mathbf{p}_{\mathrm{T}}^{\mathrm{miss}}}$$

$$m_{\mathrm{T}}^{W\gamma_i} = \sqrt{(m_{\mathrm{T}}^{W})^2 + 2E_{\mathrm{T}}^{W} E_{\mathrm{T}}^{\gamma_i} - 2\mathbf{p}_{\mathrm{T}}^{W} \cdot \mathbf{p}_{\mathrm{T}}^{\gamma_i}}$$
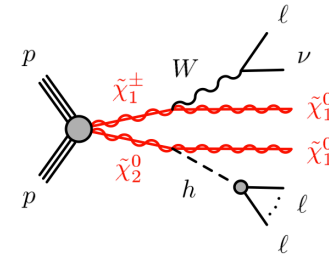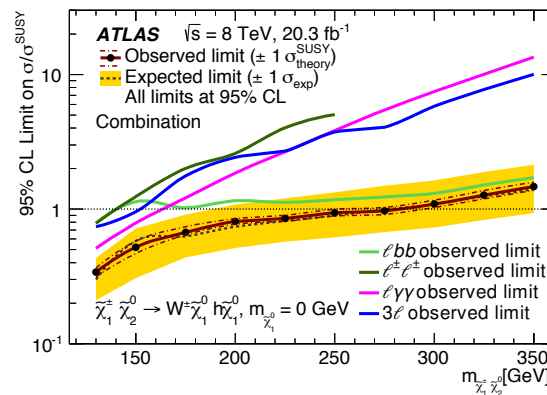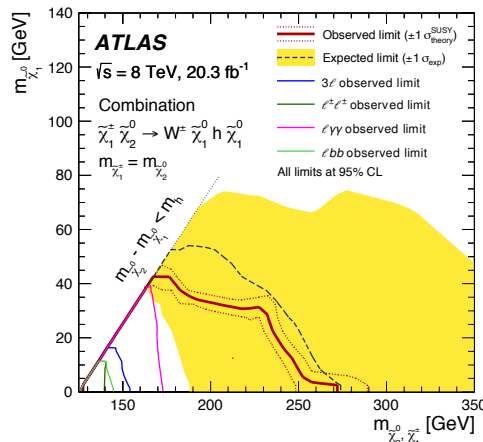
Interpretation of results

- No excess above Standard Model predictions was observed in any channel

- Results are interpreted in the context of simplified SUSY models

  Simplified model assumptions:
  - Wino-like $\tilde{\chi}_1^\pm$ and $\tilde{\chi}_2^0$ and mass degenerate
  - Bino-like $\tilde{\chi}_1^0$, all other particles decoupled
  - 100% BR of $\tilde{\chi}_1^\pm \to W + \tilde{\chi}_1^\pm$ and $\tilde{\chi}_2^0 \to h^0 + \tilde{\chi}_1^\pm$
  - SM-like h BR

  - All three analyses plus the 3L Wh search were statistically combined

  - Limits are set at the 95% CL on the possible masses of charginos and neutralinos

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$\tilde{\chi}_1^\pm$ and $\tilde{\chi}_2^0$ are excluded with masses up to 250 GeV for a massless $\tilde{\chi}_1^0$