

SUSY Limits from Monojet and Monophoton Signatures

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2 Simulation

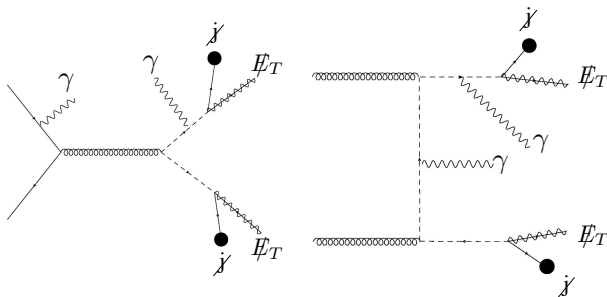
3 Results

Compressed Spectrum

- Typical SUSY searches rely on jets and missing E_T produced in the decays of squarks and gluinos: $\tilde{q} \rightarrow q\chi^0$, $\tilde{g} \rightarrow qq\chi^0$.
- This requires a large mass splitting between the LSP and the squarks: $p_T \sim \Delta m = m_{\tilde{q}} - m_{\chi^0}$.
- In a compressed spectrum scenario, $\Delta m \approx 0$, squark decay produces no hard jets.

Monophoton Signal

- Use the initial or final state radiation to look for compressed spectrum SUSY.
- The signal: single photon and \cancel{E}_T .



The Search for Monophoton and \cancel{E}_T (CMS)

The search¹ uses 5 fb^{-1} of data.

Event Selection:

- A photon with $p_T^\gamma > 145 \text{ GeV}$, $|\eta| < 1.44$.
- $\cancel{E}_T > 130 \text{ GeV}$.
- Veto on jets within $\Delta R < 0.5$ from the photon and any tracks with $p_T > 20 \text{ GeV}$ that are $\Delta R > 0.04$ away from the photon.

¹arXiv:1204.0821

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Simplified Models

The most conservative, model independent limit:

- Only one squark mass eigenstate degenerate with the neutralino.
- All other squarks and the gluino are heavy beyond LHC reach.
- All other neutralinos and charginos are heavy.
- The model is parametrized by $m_{\tilde{q}}$ and $\Delta m = m_{\tilde{q}} - m_{\chi^0}$.

Simplified Models

Two other simplified models:

Degenerate 1st and 2nd generation

- All first and second generation squarks have the same mass $m_{\tilde{q}}$.
- Third generation squarks and the gluino are decoupled.

Degenerate 1st and 2nd generation + gluino

- 1st and 2nd generation squarks are degenerate.
- The gluino is either degenerate with the squarks or has a fixed mass (1 TeV).

Simulation

- MadGraph5 \rightarrow Pythia \rightarrow Delphes.
- Cross section normalization at NLO from Prospino.
- Δm from 1 GeV to 30 GeV \rightarrow The acceptance is reduced $\sim 30\%$.

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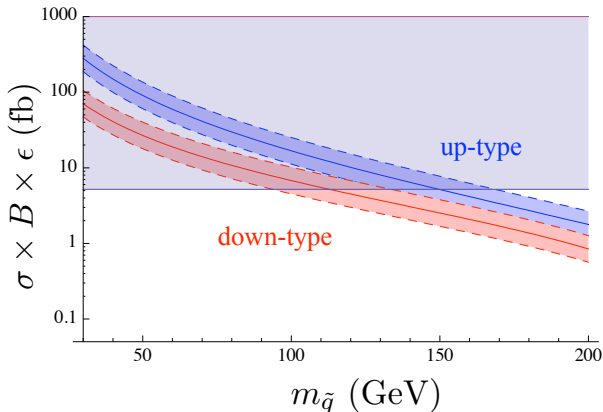
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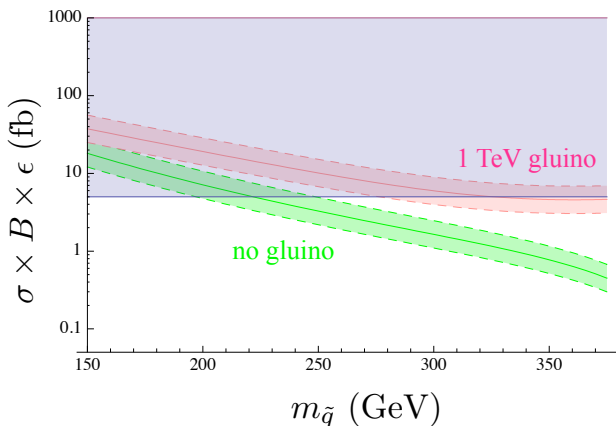
Model Independent Limit

$m_{\tilde{q}} > 110$ (150) GeV for down (up) type squarks.



Degenerate 1st and 2nd Generation

$m_{\tilde{q}} > 220, 330, 496$ GeV for $m_{\tilde{g}} = \infty$, $m_{\tilde{g}} = 1$ TeV, $m_{\tilde{g}} = m_{\tilde{q}}$.



Monojet Search

- Instead of radiated photons, look for initial or final state radiation of jets.
- Much larger cross section, but also larger background.
- Matching of jets generated by matrix element calculation (MadGraph) and parton showering (Pythia).
- Work in progress, limits will go up compared to Monophoton.