# Progress Report on LCC2 (part I)

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SUSY Dark Matter Phone Meeting

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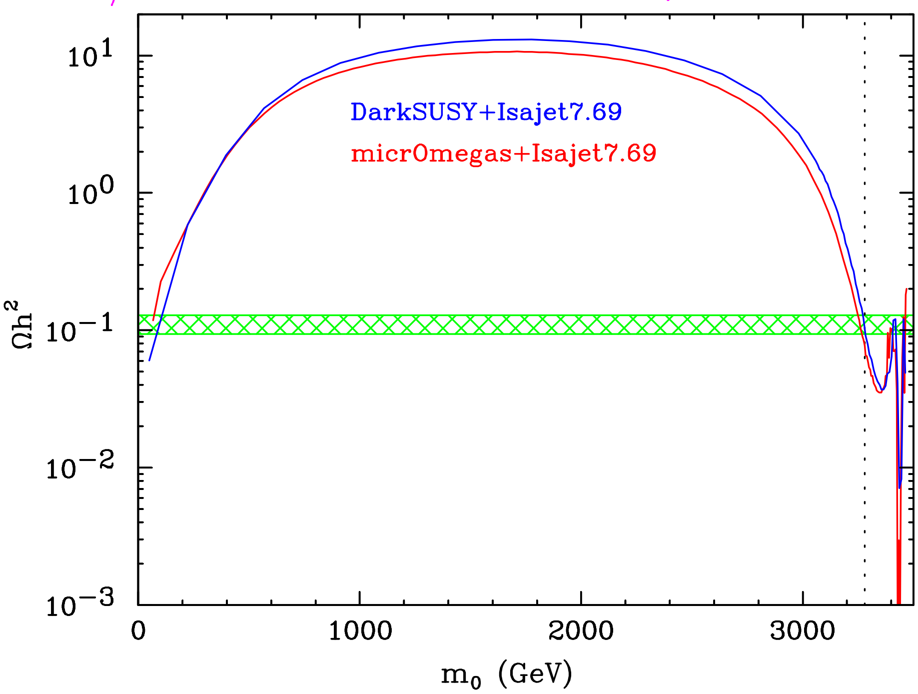
# The Focus Point vs Coannihilation Region

- The neutralino relic density in MSUGRA is typically too large: binos do not annihilate efficiently $\Longrightarrow$ need help:
  - from staus (coannihilation region)
  - from higgsinos (focus point region)

$M_{1/2} = 300,\ A_0 = 0,\ \tan\beta = 10,\ \mu > 0,\ m_t = 175$




- $\tan\beta = 10$ and $M_{1/2} = 300$ GeV as in other benchmark sets.
- For $m_t = 178$ GeV the FP region moves to $m_0 = 7$ TeV.
- Choose a value of $m_0$ which gives $\Omega h^2 \sim 0.1$ (dotted line)

# Uncertainties

- Translation of MSUGRA parameters into a physical spectrum
  - Solution: Isajet 7.69 with `NSTEP` = 10000
- Interfacing to relic density programs.
  - SM input parameters
  - SUSY inputs (soft masses? radiative corrections?)
- Relic density programs

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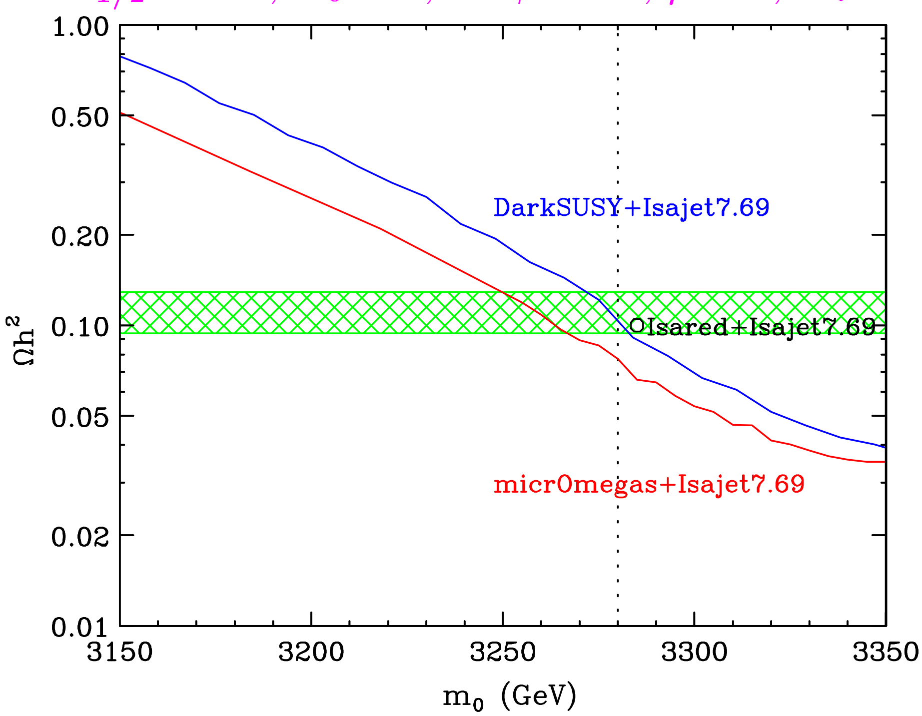


- We chose $m_0 = 3280$ GeV

# $\tilde{\chi}^0/\tilde{\chi}^\pm$ spectrum at LCC2

- $m_{\tilde{\chi}_i^\pm} = \{159.4, 286.6\}$, $m_{\tilde{\chi}_i^0} = \{107.7, 166.3, 190.0, 294.1\}$

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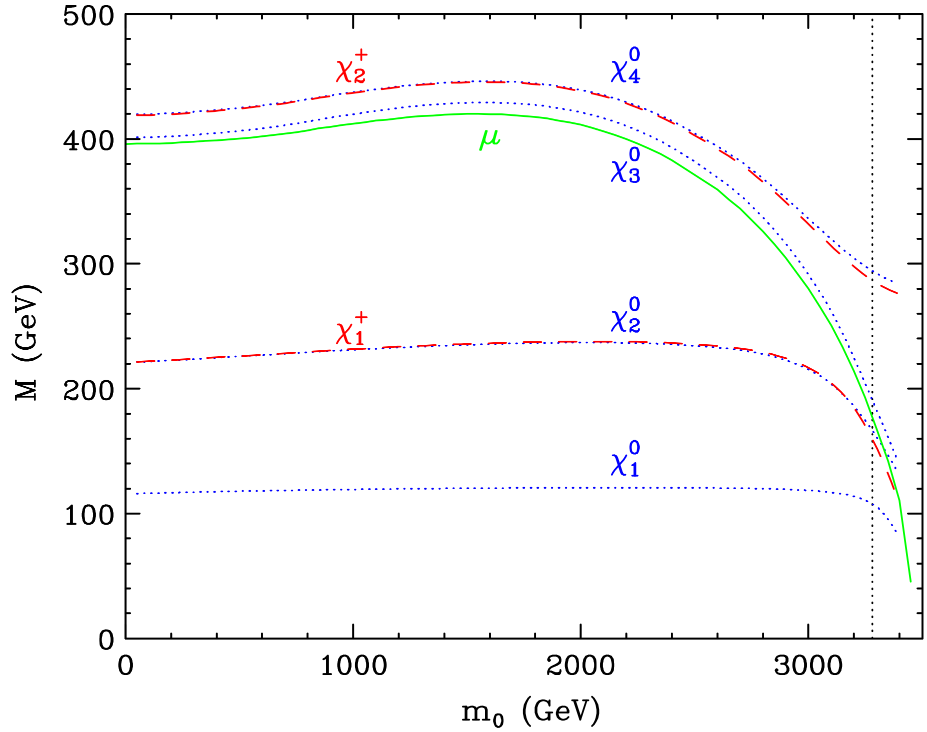


| | $\tilde{b}^0$ | $\tilde{w}^0$ | $\tilde{h}_1^0$ | $\tilde{h}_2^0$ |
|---|---|---|---|---|
| $\tilde{\chi}_1^0$ | 68% | 4% | 8% | 20% |
| $\tilde{\chi}_2^0$ | 30% | 25% | 21% | 24% |
| $\tilde{\chi}_3^0$ | 1% | 1% | 52% | 46% |
| $\tilde{\chi}_4^0$ | 2% | 70% | 19% | 9% |

# $\tilde{\chi}^0/\tilde{\chi}^\pm$ production processes

- In FP region, more states are accessible at $E_{CM} = 500$ GeV

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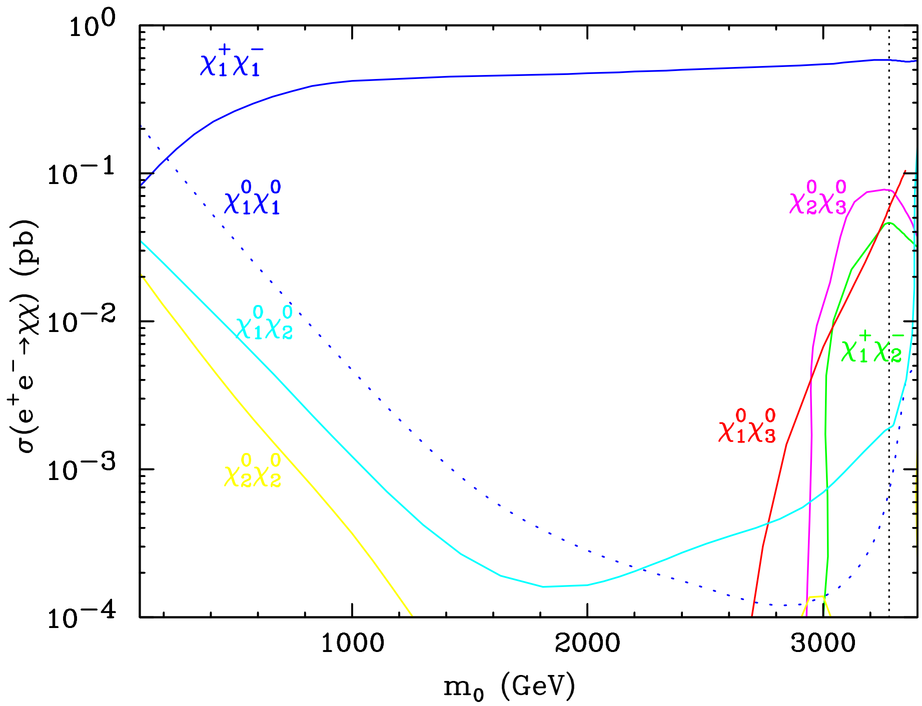


- $\tilde{\chi}_1^+\tilde{\chi}_1^-$ is dominant
  - Destructive interference, $\tilde{e}$ diagram decouples
  - $m_{\tilde{\chi}_1^\pm}$ decreases in FP region
- All decays are three-body (except for $\tilde{\chi}_2^\pm$)
- The branching fractions are $W$ and $Z$-like

## Organization

- We formed teams according to the main production processes
  - Team A: $\tilde{\chi}_1^+\tilde{\chi}_1^-$. Modes: $2j + \ell + \not{E}$, $2\ell + \not{E}$, $4j + \not{E}$.
  - Team B: $\tilde{\chi}_2^0\tilde{\chi}_3^0$. Modes: $2j + 2\ell + \not{E}$, $4\ell + \not{E}$, $4j + \not{E}$.
  - Team C: $\tilde{\chi}_1^0\tilde{\chi}_3^0$. Modes: $2j + \not{E}$, $2\ell + \not{E}$.
  - Team D: $\tilde{\chi}_1^+\tilde{\chi}_2^-$. Modes: $6j + \not{E}$, $4j + 2\ell + \not{E}$. $(W, Z)$
- Questions to address
  - Can we establish the additional production processes?
  - How well can we measure the masses?
  - How well can we measure the $\tilde{\chi}$ composition?

## Why did we choose Isajet over PYTHIA?

- Advantages of Isajet regarding sparticle spectrum will be lost when interfacing to PYTHIA
- Superior handling of
  - cross-sections
  - branching fractions
  - decay distributions
- Ease of implementation of beamstrahlung/bremstrahlung and polarization.