Probing Wino Dark Matter at a Linear Collider

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1 Motivation

SUSY

- Hierarchy Problem
- DM Candidate
- Gauge Unification

Dark Matter

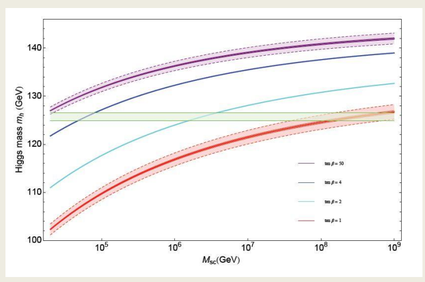
Not So much
Large relic density

DM ∼ 1 TeV ?

Higgs | 126 GeV

MSSM Higgs < Mz
Large Radiative Correction

Sfermion > 100 TeV ?

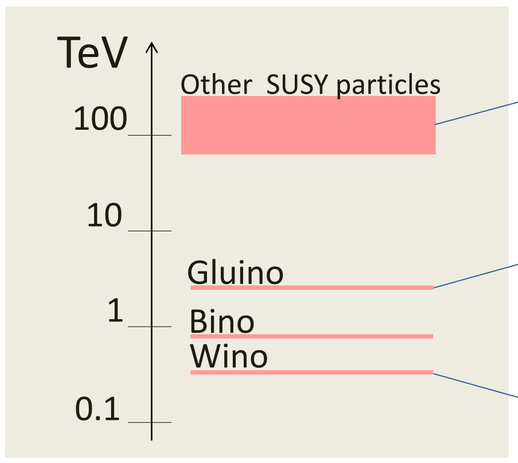


Split Mass Spectrum seems to be favoured

2 Model

AMSB

No Gauge Singlet, ~~SUSY~~ by Gravity



How to probe the Wino at a LC?

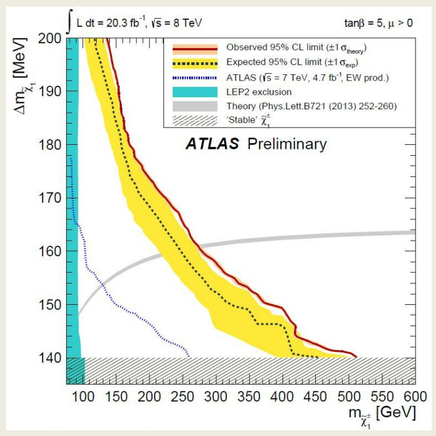
3 Problem

Bound

270 GeV < **Mwino** < **2.7** TeV

Low 270GeV Collider Exp
Upp 2.7TeV DM Abundance

LC...
NR Wino Pair Production
($v/c \lesssim 0.5$ at $\sqrt{s}$ = 1TeV)



Difficulities for Observation

1. NR pair Creation

They decay before detectors

⇒ **Short Missing Track**

2. Mass Degeneracy

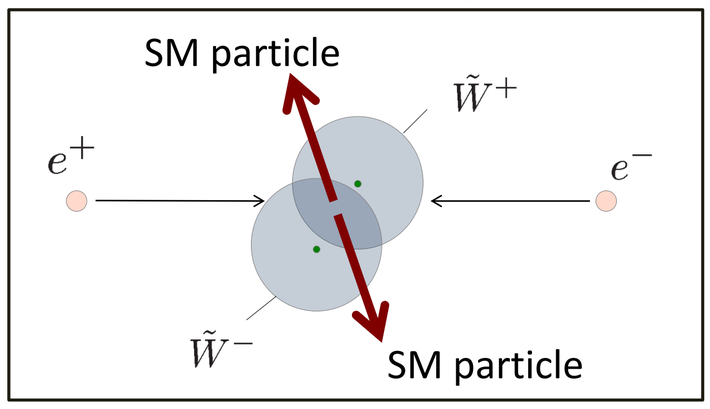
$M_{\tilde{W}^-} - M_{\tilde{W}^0} \sim 165$MeV

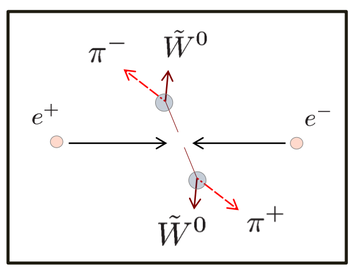
⇒ **Soft Pion Emission**

4 Solution

Annihilation Effect

Most of Created NR Winos **Annihilate** into SM particles
We can probe the Wino signal through this effect





Pair Annihilation
$\Gamma_{anni} \sim 10^{-4}$ GeV $(\sim \sigma_{anni}\, m\, |\varphi(0)|^2)$

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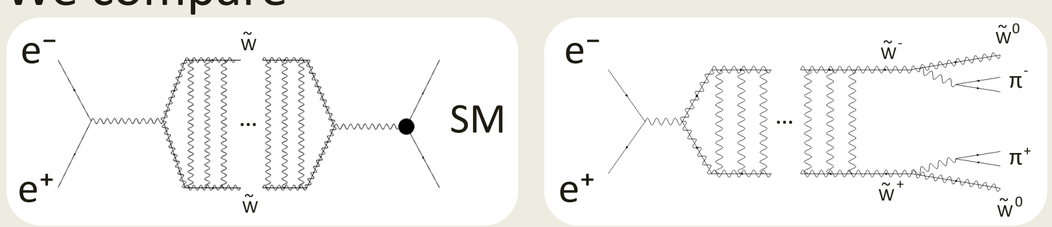
Chargino Decay
$\Gamma_{decay} \sim 10^{-15}$ GeV

5 Annihilation

Approach

In NR limit, Ladder diagram contribution becomes large.

We compare



Note

- Above Threshold, the Wino pair are Created **Non-Relativistically** ($v/c \lesssim 0.5$ at $\sqrt{s}$ = 1TeV)
- Final State SM particles contain the Wino pair creation signal

6 Result

$$e^+e^- \to \tilde{W}^+\tilde{W}^- \to \text{SM particles}$$