

Anomaly mediated SUSY breaking and its test in Linear Co dimers

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Based on

D.K. Ghosh, A. Kundu, P. Roy, SR
PR D64 15001 (2001)

2. D.K. Ghosh, P. Roy, SR, JHEP 08 031 (2000)

3. D. Choudhury, D.K. Ghosh, SR
hep-ph/0208240

Conclusions

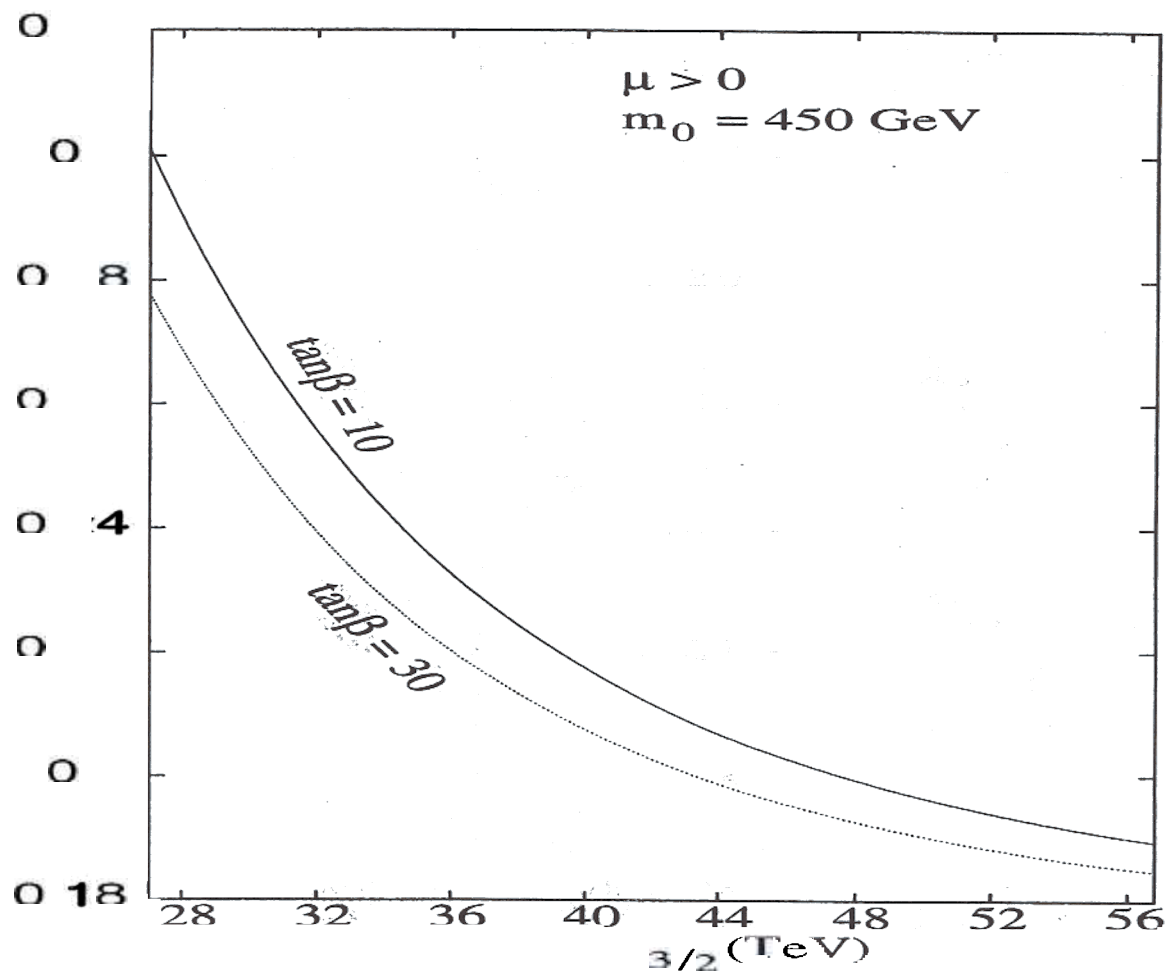
1. AM B is an interesting way to generate gaugino and scalar masses
 2. Many interesting collider signatures
 3. Resolved soft pion + E + lepton trigger an exciting linear collider possibility
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Characteristic features

- Gaug no mass parameters

$$M_2 \quad M_3 \quad 28 \quad 1 \quad 71$$

- $\tilde{\chi}_1^\pm$ χ_1^0 a most exclusively W no masses of $\tilde{\chi}_1^\pm$ χ_1^0 very close
- $165 \text{ MeV} \lesssim \Delta M (\tilde{\chi}_1^\pm \chi_1^0) \lesssim 500 \text{ MeV}$
- $\tilde{\chi}_2^0$ a most a B no
- $\tilde{\chi}_1^\pm$ decays slowly and should show heavily ionizing charged track
- $\tilde{\chi}_1^\pm \longrightarrow \tilde{\chi}_1^0 + \text{soft } \pi^\pm$
(dominant decay mode)
- $m_{\tilde{e}_L} \approx m_{\tilde{e}_R}$
- $m_{\tilde{q}} \gg m_{\tilde{l}}$
- mode parameters ($m_{3/2}$ m_0 $\tan\beta$ $\text{sgn}(\mu)$)



AMSB signals at an e^+e^- Linear Collider

at $\sqrt{s} = 1$ TeV

AMSB sparticle spectrum

- spectrum A : $\tilde{\chi}_1^0 (\approx \tilde{\chi}_1^\pm) < \tilde{\nu} < \tilde{e}_R (\approx \tilde{e}_L) < \tilde{\chi}_2^0$
- spectrum B : $\tilde{\chi}_1^0 (\approx \tilde{\chi}_1^\pm) < \tilde{\chi}_2^0 < \tilde{\nu} < \tilde{e}_R (\approx \tilde{e}_L)$

Consider pair production processes

$$e^+e^- \rightarrow \tilde{e}_L \tilde{e}_L, \tilde{e}_R \tilde{e}_R, \tilde{e}_L \tilde{e}_R, \tilde{\nu} \tilde{\nu}, \tilde{\chi}_1^0 \tilde{\chi}_2^0, \tilde{\chi}_2^0 \tilde{\chi}_2^0$$

Signals analyzed comprise

multiple fast charged leptons (trigger)

+ displaced vertices x_D

(heavily ionizing tracks)

and/or soft pions with characteristic

momentum distribution + \cancel{E}

Example : $\tilde{e}_L - \tilde{e}_L$ pair production

$$\rightarrow e + \tilde{\chi}_1^0, \tilde{e}_L \rightarrow \nu + \tilde{\chi}_1^\pm, \tilde{\chi}_1^\pm \rightarrow \tilde{\chi}_1^0 + \pi^\pm$$

fast e^\pm , heavily ionizing track

and/or visible soft π^\pm + \cancel{E}

[Ghosh, P. Roy, S.R. (2000)]

of $\tilde{\chi}_1^\pm > 3 \text{ cm}$ could be observable

$< 3 \text{ cm}$ track may not be seen

Spectrum	Signals	Parent Channels
A	$e\pi + \cancel{E}$	$\tilde{\nu}\tilde{\nu}, \tilde{e}_L\tilde{e}_L, \tilde{e}_L\tilde{e}_R, \tilde{\chi}_1^0\tilde{\chi}_2^0, \tilde{\chi}_2^0\tilde{\chi}_2^0$
	$\mu\pi + \cancel{E}$	$\tilde{\nu}\tilde{\nu}, \tilde{\chi}_1^0\tilde{\chi}_2^0, \tilde{\chi}_2^0\tilde{\chi}_2^0$
	$ee l\pi + \cancel{E}$	$\tilde{e}_R\tilde{e}_R, \tilde{e}_L\tilde{e}_R, \tilde{\chi}_1^0\tilde{\chi}_2^0, \tilde{\chi}_2^0\tilde{\chi}_2^0$
	$\mu\mu l\pi + \cancel{E}$	$\tilde{\chi}_1^0\tilde{\chi}_2^0, \tilde{\chi}_2^0\tilde{\chi}_2^0$
	$ll l_2 l_2 l_3 \pi + \cancel{E}$	$\tilde{\chi}_2^0\tilde{\chi}_2^0$
B	$e\pi + \cancel{E}$	$\tilde{\nu}\tilde{\nu}, \tilde{e}_L\tilde{e}_L, \tilde{e}_L\tilde{e}_R, \tilde{\chi}_1^0\tilde{\chi}_2^0, \tilde{\chi}_2^0\tilde{\chi}_2^0$
	$\mu\pi + \cancel{E}$	$\tilde{\nu}\tilde{\nu}, \tilde{e}_L\tilde{e}_L, \tilde{\chi}_1^0\tilde{\chi}_2^0, \tilde{\chi}_2^0\tilde{\chi}_2^0$
	$el l_2 \pi + \cancel{E}$	$\tilde{e}_L\tilde{e}_R, \tilde{e}_R\tilde{e}_R, \tilde{e}_L\tilde{e}_L, \tilde{\nu}\tilde{\nu}, \tilde{\chi}_2^0\tilde{\chi}_2^0$
	$\mu\mu\mu\pi + \cancel{E}$	$\tilde{\chi}_2^0\tilde{\chi}_2^0, \tilde{\nu}\tilde{\nu}$
	$ee l_1 l_1 l_2 \pi + \cancel{E}$	$\tilde{e}_L\tilde{e}_L, \tilde{e}_R\tilde{e}_R, \tilde{e}_L\tilde{e}_R$

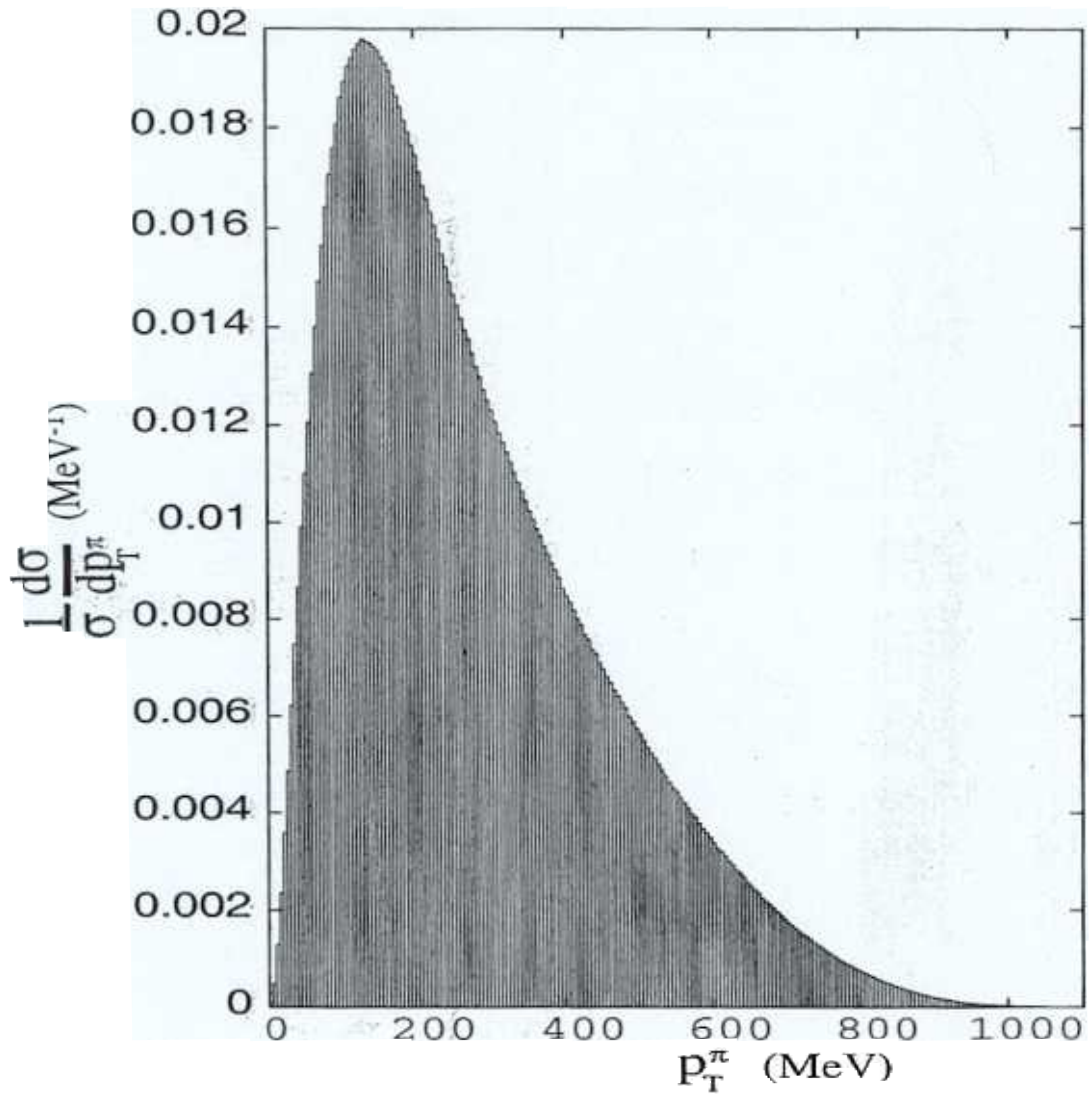
[D.K. Ghosh, A. Kundu P Roy S.R. 200)]

One can also look at two soft pions and two charged leptons

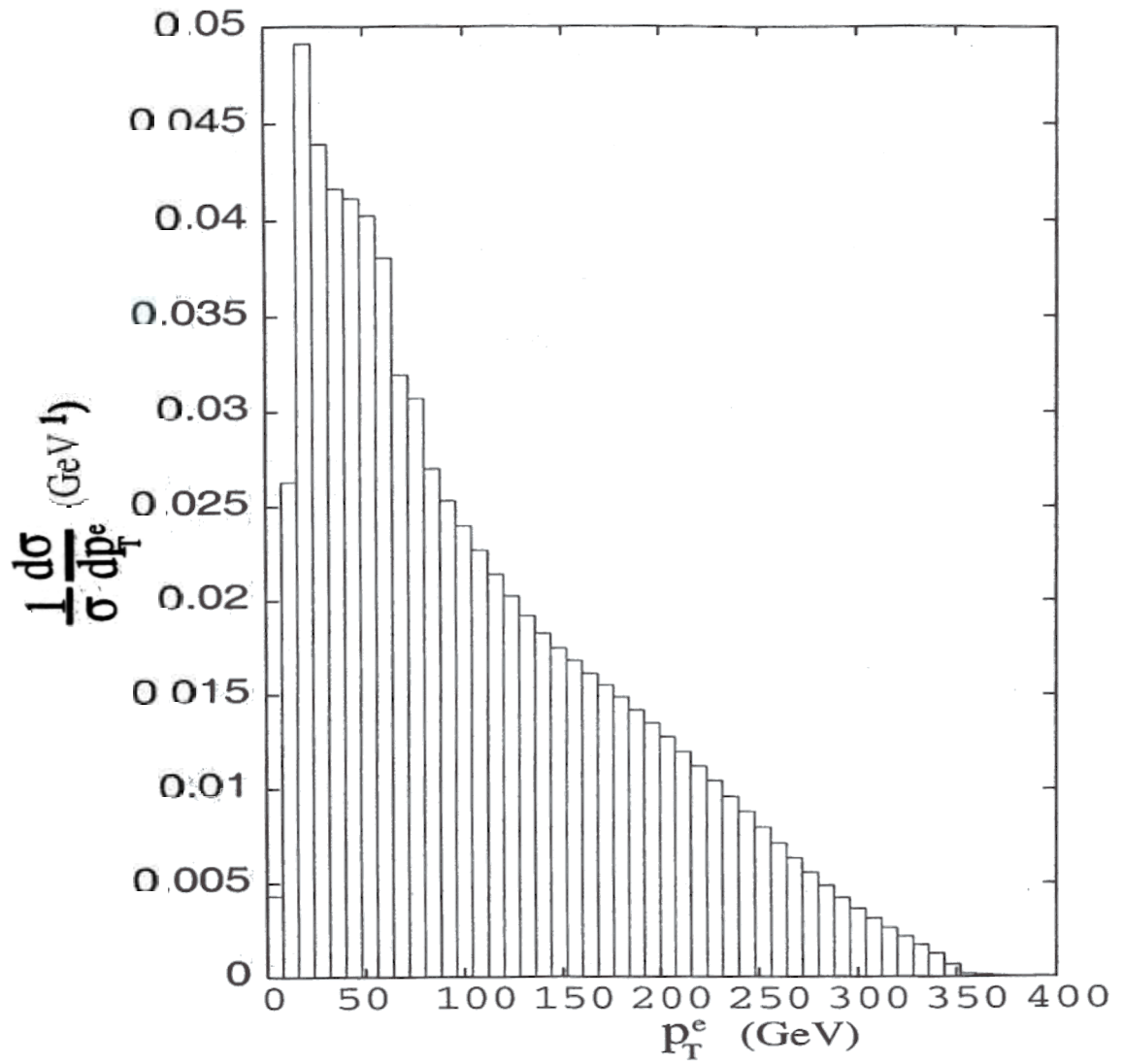
The process $e^+e^- \rightarrow \tilde{\chi}_1^+ \tilde{\chi}_1^- \gamma$ has also been studied [A Datta, S Maity 2001]

Spectrum	Parameter set	m_0 (GeV)	$m_{3/2}$ (TeV)	$\tan\beta$
A	1	340	44	10
	2	450	47	30
B	1	330	32	10
	2	510	47	30

Spectrum	Signal	Cross Section (fb)	No. of events with $L = 100 \text{ fb}^{-1}$
A	$e\pi + \cancel{e}$	79.8 26.3	7980 2630
	$ee\mu\pi + \cancel{e}$	2.01 0.008	201 —
	$ee\pi\pi + \cancel{e}$	35.16 14.48	3516 1448
B	$e\pi + \cancel{e}$	108.41 5.82	10841 582
	$ee\mu\pi + \cancel{e}$	0.68 0.066	68 6
	$ee\pi\pi + \cancel{e}$	63.81 4.23	6381 423



Distribution of the p_T of charged pion



Distribution of the p_T of charged
lepton

AMSB signal in an $e^- \gamma$ collider

consider the process

$$e^- \gamma \rightarrow \tilde{\nu} \tilde{\chi}_1^-$$

$$\tilde{\nu} \rightarrow e^- + \tilde{\chi}_1^+, \quad \tilde{\chi}_1^\pm \rightarrow \tilde{\chi}_1^0 + \pi^\pm$$

signal :

a fast e^- trigger
+ two heavily ionizing charged tracks
and or two π^\pm (soft) with opposite
charges + \cancel{K}_T

[D. Choudhury, D.K. Ghosh, S.R., hep-ph/0208240]

Selection Criteria

- $p_T^e > 20 \text{ GeV}$
- $p_T^\pi > 0.2 \text{ GeV}$
- $E^\pi < 2 \text{ GeV}$
- $|\eta^{e, \pi}| < 2$
- $\Delta R \equiv \sqrt{(\Delta\eta)^2 + (\Delta\phi)^2} > 0.4$
- $\cancel{K}_T > 20 \text{ GeV}$

