[68] ZHUKOVSKII 90 set limit by saying the luminosity of a magnetized neutron star due to massless photino emission by electrons be small compared with its neutrino luminosity.
[69] ABE 89K assumed $m_{\tilde{\gamma}} = 0$.
[70] ADACHI 89 assume only photon and photino exchange and $m_{\tilde{e}_L} = m_{\tilde{e}_R}$. The limit for the nondegenerate case is 26 GeV.
[71] ADEVA 89B look for acoplanar electrons.
[72] ALBAJAR 89 limit applies for $\tilde{e}_L$ when $m_{\tilde{e}_L} = m_{\tilde{\nu}_L}$ and $m_{\tilde{\gamma}} = 0$. See their Fig. 55 for the 90% CL excluded region in the $m_{\tilde{e}_L} - m_{\tilde{\nu}_L}$ plane. For $m_{\tilde{\nu}} = m_{\tilde{\gamma}} = 0$, limit is 50 GeV.
[73] ALBAJAR 89 assume $m_{\tilde{\gamma}} = 0$.
[74] The limit is reduced to 43 GeV if only one $\tilde{e}$ state is produced ($\tilde{e}_L$ or $\tilde{e}_R$ very heavy).
[75] BEHREND 88B limits assume pure photino eigenstate and $m_{\tilde{e}_L} = m_{\tilde{e}_R}$.
[76] The 95% CL limit for BEHREND 88B is 47.5 GeV for $m_{\tilde{\gamma}} = 0$. The limit for $m_{\tilde{e}_L} \gg m_{\tilde{e}_R}$ is 40 GeV at 90% CL.
[77] BEHREND 88B combined their data with those from ASP (HEARTY 87), MAC (FORD 86), and MARK-J (H. Wu, Ph. D. Thesis, University of Hamburg, 1986).

$\tilde{\mu}$ (Smuon) MASS LIMIT

Limits assume $m_{\tilde{\mu}_L} = m_{\tilde{\mu}_R}$ unless otherwise stated.

VALUE (GeV)	CL%	DOCUMENT ID	TECN	COMMENT
>45	95	[78] ADRIANI 93M	L3	$m_{\tilde{\chi}^0_1}$ <40 GeV, $\tilde{\mu}^+\tilde{\mu}^-$
>45	95	[79] DECAMP 92	ALEP	$m_{\tilde{\chi}^0_1}$ <41 GeV, $\tilde{\mu}^+\tilde{\mu}^-$
>43	95	[80] AKRAWY 90D	OPAL	$m_{\tilde{\gamma}}$ < 30 GeV; $\tilde{\mu}^+\tilde{\mu}^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>36	95	ABREU 90G	DLPH	$m_{\tilde{\gamma}}$ < 33 GeV; $\tilde{\mu}^+\tilde{\mu}^-$
>38.1	90	[81] BAER 90	RVUE	$\tilde{\mu}_L$; $\Gamma(Z)$; $\tan\beta > 1$
>42.6	95	[82] DECAMP 90C	ALEP	$m_{\tilde{\gamma}}$ < 34 GeV; $\tilde{\mu}^+\tilde{\mu}^-$
>27	95	SAKAI 90	AMY	$m_{\tilde{\gamma}}$ < 18 GeV; $\tilde{\mu}^+\tilde{\mu}^-$
>24.5	95	TAKETANI 90	VNS	$m_{\tilde{\gamma}}$ < 15 GeV; $\tilde{\mu}^+\tilde{\mu}^-$
>24.5	95	[83] ADACHI 89	TOPZ	$m_{\tilde{\gamma}} \lesssim 0.8 m_{\tilde{\mu}}$; $\tilde{\mu}^+\tilde{\mu}^-$
>41	95	[84] ADEVA 89B	L3	$m_{\tilde{\gamma}}$ < 20 GeV; $\tilde{\mu}^+\tilde{\mu}^-$

[78] ADRIANI 93M limit is for $m_{\tilde{\mu}_L} \gg m_{\tilde{\mu}_R}$ using acolinear di-lepton events.
[79] DECAMP 92 limit is for $m_{\tilde{\mu}_L} \gg m_{\tilde{\mu}_R}$; for equal masses the limit would improve. They looked for acoplanar muons.
[80] AKRAWY 90D look for acoplanar muons. For $m_{\tilde{\mu}_L} \gg m_{\tilde{\mu}_R}$, limit is 41.0 GeV, for $m_{\tilde{\gamma}} < 30$ GeV.
[81] BAER 90 limit from $\Delta\Gamma(Z)$ (nonhadronic) < 53 MeV. Independent of decay modes. Mininal supersymmetry and $\tan\beta > 1$ assumed.
[82] DECAMP 90C look for acoplanar muons. For $m_{\tilde{\mu}_L} \gg m_{\tilde{\mu}_R}$ limit is 40 GeV, for $m_{\tilde{\gamma}} <$ 30 GeV.
[83] ADACHI 89 assume only photon exchange, which gives a conservative limit. $m_{\tilde{\mu}_L} = m_{\tilde{\mu}_R}$ assumed. The limit for nondegenerate case is 22 GeV.
[84] ADEVA 89B look for acoplanar muons.

$\tilde{\tau}$ (Stau) MASS LIMIT

Limits assume $m_{\tilde{\tau}_L} = m_{\tilde{\tau}_R}$ unless otherwise stated.

VALUE (GeV)	CL%	DOCUMENT ID	TECN	COMMENT
>44	95	[85] ADRIANI 93M	L3	$m_{\tilde{\chi}^0_1}$ <38 GeV, $\tilde{\tau}^+\tilde{\tau}^-$
>45	95	[86] DECAMP 92	ALEP	$m_{\tilde{\chi}^0_1}$ <38 GeV, $\tilde{\tau}^+\tilde{\tau}^-$
>43.0	95	[87] AKRAWY 90D	OPAL	$m_{\tilde{\gamma}}$ < 23 GeV; $\tilde{\tau}^+\tilde{\tau}^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>35	95	ABREU 90G	DLPH	$m_{\tilde{\gamma}}$ < 25 GeV; $\tilde{\tau}^+\tilde{\tau}^-$
>38.1	90	[88] BAER 90	RVUE	$\tilde{\tau}_L$; $\Gamma(Z)$; $\tan\beta > 1$
>40.4	95	[89] DECAMP 90C	ALEP	$m_{\tilde{\gamma}}$ < 15 GeV; $\tilde{\tau}^+\tilde{\tau}^-$
>25	95	SAKAI 90	AMY	$m_{\tilde{\gamma}}$ < 10 GeV; $\tilde{\tau}^+\tilde{\tau}^-$
>25.5	95	TAKETANI 90	VNS	$m_{\tilde{\gamma}}$ < 15 GeV; $\tilde{\tau}^+\tilde{\tau}^-$
>21.7	95	[90] ADACHI 89	TOPZ	$m_{\tilde{\gamma}}$=0; $\tilde{\tau}^+\tilde{\tau}^-$

[85] ADRIANI 93M limit is for $m_{\tilde{\tau}_L} \gg m_{\tilde{\tau}_R}$.
[86] DECAMP 92 limit is for $m_{\tilde{\tau}_L} \gg m_{\tilde{\tau}_R}$; for equal masses the limit would improve. They looked for acoplanar particles.
[87] AKRAWY 90D look for acoplanar particles. For $m_{\tilde{\tau}_L} \gg m_{\tilde{\tau}_R}$, limit is 41.0 GeV, for $m_{\tilde{\gamma}} < 23$ GeV.
[88] BAER 90 limit from $\Delta\Gamma(Z)$ (nonhadronic) < 53 MeV. Independent of decay modes. Mininal supersymmetry and $\tan\beta > 1$ assumed.
[89] DECAMP 90C look for acoplanar charged particle pairs. Limit is for $m_{\tilde{\tau}_L} = m_{\tilde{\tau}_R}$. For $m_{\tilde{\gamma}} \leq 24$ GeV, the limit is 37 GeV. For $m_{\tilde{\tau}_L} \gg m_{\tilde{\tau}_R}$ and $m_{\tilde{\gamma}} < 15$ GeV, the limit is 33 GeV.
[90] ADACHI 89 assume only photon exchange, which gives a conservative limit. $m_{\tilde{\tau}_L} = m_{\tilde{\tau}_R}$ assumed.

Stable $\tilde{\ell}$ (Slepton) MASS LIMIT

Limits on scalar leptons which leave detector before decaying. Limits from Z decays are independent of lepton flavor. Limits from continuum e^+e^- annihilation are also independent of flavor for smuons and staus. However, selectron limits from continuum e^+e^- annihilation depend on flavor because there is an additional contribution from neutralino exchange that in general yields stronger limits. All limits assume $m_{\tilde{\ell}_L} = m_{\tilde{\ell}_R}$ unless otherwise stated.

VALUE (GeV)	CL%	DOCUMENT ID	TECN	COMMENT
>40	95	ABREU 90G	DLPH	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>26.3	95	ADACHI 90C	TOPZ	$\tilde{\mu}$, $\tilde{\tau}$
>38.8	95	AKRAWY 90O	OPAL	$\tilde{\ell}_R$
>27.1	95	[91] SAKAI 90	AMY	
>32.6	95	SODERSTROM 90	MRK2	
>24.5	95	[92] ADACHI 89	TOPZ	

[91] SAKAI 90 limit improves to 30.1 GeV for $\tilde{e}$ if $m_{\tilde{\gamma}} \approx m_{\tilde{e}}$.
[92] ADACHI 89 assume only photon (and photino for $\tilde{e}$) exchange. The limit for $\tilde{e}$ improves to 26 GeV for $m_{\tilde{\gamma}} \approx m_{\tilde{e}}$.

$\tilde{q}$ (Squark) MASS LIMIT

For $m_{\tilde{q}} > 60$–70 GeV, it is expected that squarks would undergo a cascade decay via a number of neutralinos and/or charginos rather than undergo a direct decay to photinos as assumed by some papers. When direct decay is assumed, realistic limits would be somewhat lower. The limits from Z decay do not assume GUT relations and are more model independent.

VALUE (GeV)	CL%	DOCUMENT ID	TECN	COMMENT
> 90	90	[93] ABE 92L	CDF	Any $m_{\tilde{g}}$ <410 GeV; with cascade decay
> 218	90	[93] ABE 92L	CDF	$m_{\tilde{g}} = m_{\tilde{q}}$; with cascade decay
> 180	90	[93] ABE 92L	CDF	$m_{\tilde{g}} < m_{\tilde{q}}$; with cascade decay
• • • We do not use the following data for averages, fits, limits, etc. • • •				
> 35.3	95	[94] ADRIANI 93M	L3	$Z \rightarrow \tilde{u}\overline{\tilde{u}}$, $\Gamma(Z)$
> 36.8	95	[94] ADRIANI 93M	L3	$Z \rightarrow \tilde{d}\overline{\tilde{d}}$, $\Gamma(Z)$
> 100		[95] ROY 92	RVUE	$p\overline{p} \rightarrow \tilde{q}\overline{\tilde{q}}$; R-parity violating
		[96] BAER 91B	RVUE	$\tilde{t}$
		[97] NOJIRI 91	COSM	
> 45	95	[98] ABREU 90F	DLPH	$Z \rightarrow \tilde{q}\overline{\tilde{q}}$, $m_{\tilde{\gamma}}$ < 20 GeV
> 43	95	[99] ABREU 90F	DLPH	$Z \rightarrow \tilde{d}\overline{\tilde{d}}$, $m_{\tilde{\gamma}}$ < 20 GeV
> 42	95	[100] ABREU 90F	DLPH	$Z \rightarrow \tilde{u}\overline{\tilde{u}}$, $m_{\tilde{\gamma}}$ < 20 GeV
> 27.0	95	ADACHI 90C	TOPZ	Stable $\tilde{u}$, $\tilde{u}\overline{\tilde{u}}$
> 74	90	[101] ALITTI 90	UA2	Any $m_{\tilde{q}}$; B($\tilde{q} \rightarrow q\tilde{g}$ or $q\tilde{\gamma}$) = 1
> 106	90	[101] ALITTI 90	UA2	$m_{\tilde{q}} = m_{\tilde{g}}$; B($\tilde{q} \rightarrow q\tilde{\gamma}$) = 1
> 39.2	90	[102] BAER 90	RVUE	$\tilde{d}_L$; $\Gamma(Z)$
> 45	95	[103,104] BARKLOW 90	MRK2	$Z \rightarrow \tilde{q}\overline{\tilde{q}}$
> 40	95	[103,105] BARKLOW 90	MRK2	$Z \rightarrow \tilde{d}\overline{\tilde{d}}$
> 39	95	[103,106] BARKLOW 90	MRK2	$Z \rightarrow \tilde{u}\overline{\tilde{u}}$
		[107] DREES 90	RVUE	$\tilde{t}$
>1100		GRIFOLS 90	ASTR	$m_{\tilde{\gamma}}$ < 1 MeV
> 24	95	SAKAI 90	AMY	$e^+e^- \rightarrow \tilde{d}\overline{\tilde{d}} \rightarrow d\overline{d}\tilde{\gamma}\tilde{\gamma}$; $m_{\tilde{\gamma}}$ < 10 GeV
> 26	95	SAKAI 90	AMY	$e^+e^- \rightarrow \tilde{u}\overline{\tilde{u}} \rightarrow u\overline{u}\tilde{\gamma}\tilde{\gamma}$; $m_{\tilde{\gamma}}$ < 10 GeV
> 26.3	95	[108] ADACHI 89	TOPZ	$e^+e^- \rightarrow \tilde{q}\overline{\tilde{q}} \rightarrow q\overline{q}\tilde{\gamma}\tilde{\gamma}$
		[109] NATH 88	THEO	$\tau(p \rightarrow \nu K)$ in supergravity GUT
> 45	90	[110] ALBAJAR 87D	UA1	Any $m_{\tilde{g}} > m_{\tilde{q}}$
> 75	90	[110] ALBAJAR 87D	UA1	$m_{\tilde{g}} = m_{\tilde{q}}$

[93] ABE 92L assume five degenerate squark flavors and $m_{\tilde{q}_L} = m_{\tilde{q}_R}$. ABE 92L includes the effect of cascade decay, for a particular choice of parameters, $\mu = -250$ GeV, $\tan\beta = 2$. Results are weakly sensitive to these parameters over much of parameter space. No limit for $m_{\tilde{q}} \leq 50$ GeV (but other experiments rule out that region). Limits are 10–20 GeV higher if B($\tilde{q} \rightarrow q\tilde{\gamma}$) = 1. Limit assumes GUT relations between gaugino masses and the gauge coupling; in particular that for $|\mu|$ not small, $m_{\tilde{\chi}^0_1} \approx m_{\tilde{g}}/6$. This last relation implies that as $m_{\tilde{g}}$ increases, the mass of $\tilde{\chi}^0_1$ will eventually exceed $m_{\tilde{q}}$ so that no decay is possible. Even before that occurs, the signal will disappear; in particular no bounds can be obtained for $m_{\tilde{g}}$ >410 GeV.
[94] ADRIANI 93M limit from $\Delta\Gamma(Z)$< 35.1 MeV and assumes $m_{\tilde{q}_L} \gg m_{\tilde{q}_R}$.
[95] ROY 92 reanalyzed CDF limits on di-lepton events to obtain limits on squark production in R-parity violating models. The 100% decay $\tilde{q} \rightarrow q\tilde{\chi}$ where $\tilde{\chi}$ is the LSP, and the LSP decays either into $\ell q \overline{d}$ or $\ell\ell\overline{e}$ is assumed.
[96] BAER 91B argue that a top squark as light as 45 GeV may have escaped detection at the CDF detector at the Tevatron Collider (45 GeV is the limit from LEP experiments).