Implications of Improved Limits on $\mu \longrightarrow e\gamma$ and $\tau \longrightarrow \mu\gamma$

J. Swain[1] w/ M. Gómez[2], H. Goldberg[1], and L. Taylor[1]

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[1] Northeastern University, Boston, USA
[2] University of Thessaloniki, Greece

Introduction

A reminder that there are good reasons to look for $\tau \rightarrow \mu\gamma$.

- **Long history (even a textbook example: Cheng and Li, 1984)***
- **Obviously lepton flavour violating**
- **Generically expected with massive neutrinos**
- **In SUSY theories, SUSY scale parameters can replace m_ν**

$$^*\mathrm{BR}(\mu \rightarrow e\gamma) = \frac{3\alpha}{32\pi}\left|\sum_{neutrino\,j} U^*_{ej} U_{j\mu} \frac{m^2_{\nu_i}}{M^2_W}\right|^2$$

Squared again!

Together with searches for $\mu \rightarrow e\gamma$, this is a good place to constrain SUSY-GUT models!

Current Limits

Experiment	BR($\tau \to e\gamma$)	BR($\tau \to \mu\gamma$)	# of tau pairs	$\int \mathcal{L}dt$
ARGUS	$< 1.2 \times 10^{-4}$	$< 3.4 \times 10^{-5}$	374,300	387 pb^{-1}
CLEO	$< 2.7 \times 10^{-6}$	$< 3.0 \times 10^{-6}$	4.24×10^{6}	4.68 fb^{-1}
DELPHI	$< 1.1 \times 10^{-4}$	$< 6.2 \times 10^{-5}$	81,000	70 pb^{-1}
τcF (est.)	$< 2.7 \times 10^{-7}$	$< 3.0 \times 10^{-7}$	5×10^{7}	100 fb^{-1} (10 yr)

Table 1: Existing limits on $\tau \to (e/\mu)\gamma$ at 90% CL.

maybe ee ?

- Current best limit on BR($\mu \to e\gamma$) $< 4.9 \times 10^{-11}$ (LAMPF)
- Hoped for: 4.9 replaced by 3.6
- $\sim 10^{-13}$ or 10^{-14} at PSI?

An SO(10) SUSY-GUT Model Calculation

i.e. Goldberg and Gómez, PRD 53 (1996) 5244.

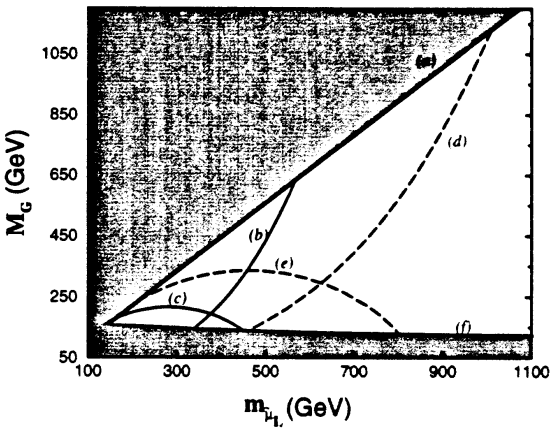

Figure 1: $(M_G, m_{\tilde{\mu}_L})$ parameter space excluded by present and (possible) future data (all curves are for $\tan\beta = 3, \mu > 0, A_0 = 1$). Area below line (f) is excluded by direct chargino search at the M_Z pole. Area above line (a) is excluded by the R-G analysis. Area between lines (a) and (b) is excluded by present upper limit on $BR(\mu \rightarrow e\gamma)$. Area between line (c) ($x = 0.5$) and axes is excluded by present upper limit on $\tau \rightarrow \mu\gamma$. Lines (d) and (e) show the range of parameters excluded if current limits were decreased by a factor of 10.

(g-2) exclusions ?

T. Rizzo

Conclusions

- **A tau-charm factory can dramatically improve our knowledge of $\tau \rightarrow \mu\gamma$**
- **Together with $\mu \rightarrow e\gamma$, this is a good place to look for $\sim$TeV-scale SUSY signatures.**
- **This is one of many examples where a τcF fits into a larger picture, supplying data complementary to that from other facilities.**