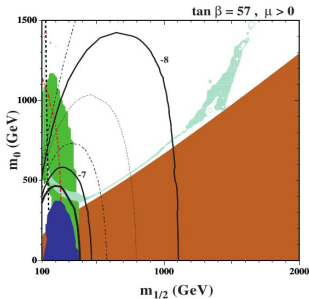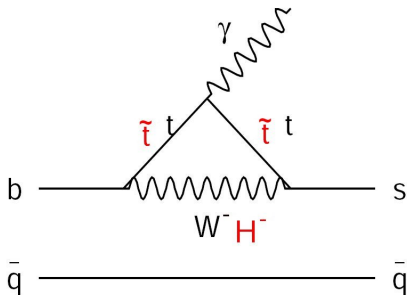# SUSY-Constraints from B-Decays

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How can we constrain SUSY with todays data?

1. Direct searches (LEP, Tevatron)
2. Virtual SUSY Particles $\rightarrow$ Indirect searches
   - B-decays: Effects on Amplitudes/BR
     ($B_{s/d} \rightarrow \mu\mu$, $B \rightarrow \tau\nu_\tau$, $b \rightarrow s\gamma$)
   - B-decays: Effects on phases (B_s mixing phase Φ_S)
   - Electroweak precision tests: Effect on $g - 2$

- SUSY-particles can give additional penguin diagrams
- Problematic at hadron machines $\to$ Super B-Factory
- SM: $B(b \to s\gamma)^{SM} = (357 \pm 30) \cdot 10^{-6}$
- HFAG (exp. world average):
  $B(b \to s\gamma)^{exp.} = (355 \pm 24^{+9}_{-10} \pm 3) \cdot 10^{-6}$
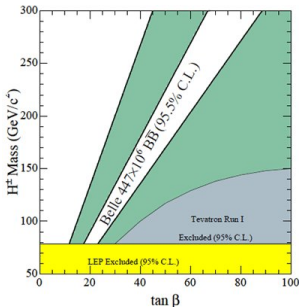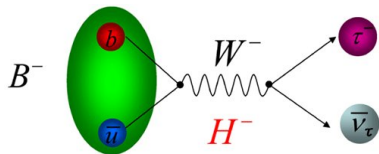
- Experimentally challenging: $2\nu s$
- Fully reconstruct 2nd B-Meson
- Theory: $\frac{B(B \rightarrow \tau \nu)}{B(B \rightarrow \tau \nu)^{SM}} = (1 - tan^2\beta \frac{m_B^2}{m_{H^+}^2})^2$
- SM: $B(B^+ \rightarrow \tau^+\nu_\tau)^{SM} = (1.50 \pm 0.40) \cdot 10^{-4}$
- HFAG: $B(B^+ \rightarrow \tau^+\nu_\tau)^{exp.} = (1.41^{+0.42}_{-0.43}) \cdot 10^{-4}$
  consistent with SM expectation

Next Talk

Clean channel for hadron machines
Theoretically clean (Leptons in final state)
SUSY: $B(B_s \rightarrow \mu\mu) \propto tan^6(\beta)$
SM: $B(B_s \rightarrow \mu\mu) = (3.4 \pm 0.5) \cdot 10^{-9}$
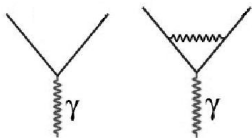$B(B_d \rightarrow \mu\mu) = (1.00 \pm 0.14) \cdot 10^{-10}$
HFAG:
$B(B_s \rightarrow \mu\mu) < 4.7 \cdot 10^{-8}$
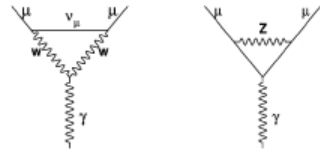$B(B_d \rightarrow \mu\mu) < 1.5 \cdot 10^{-8}$

Magnetic moment $\mu = g \mu_B s$, with $\mu_B = \frac{eh}{2mc}$
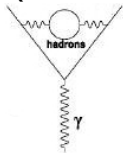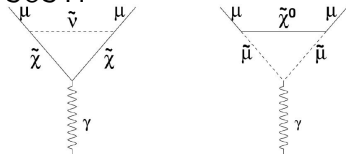
QED:

WEAK:

QCD:

SUSY:

$\alpha_\mu = \frac{g-2}{2}$

$\alpha_\mu^{SM} = \alpha_\mu^{QED} + \alpha_\mu^{WEAK} + \alpha_\mu^{QCD}$

$\alpha_\mu^{exp} - \alpha_\mu^{SM} = 43(16) \cdot 10^{-10}$

Due to SUSY?

$a_\mu^{SUSY} \propto tan\beta f(M_0)/M_{1/2}^2$