FiTAL Meeting, Warsaw, 18 June 2010

Instytut Fizyki Teoretycznej UW

P. Chankowski
B. Grządkowski
J. Kalinowski
M. Krawczyk
J. Rosiek
    + magistranci i doktoranci

Adjoint scalars and Dirac gauginos at the ILC

FACULTY OF PHYSICS
WARSAW UNIVERSITY

Supersymmetry – the most elegant and respected proposition for the beyond SM physics

But SUSY must be broken, and the origin of its breaking is still unknown

Phenomenologically add soft SUSY breaking terms to

- ➢ keep unseen superpartners out of experimental reach
- ➢ retaining renormalisability
- ➢ and maintaining perturbatively stable hierarchy of scales

Experimental constraints, mainly from flavor and Higgs physics, limit the allowed parameter space and play an increasingly restrictive role in building models of SUSY breaking

However, successes of supersymmetry do not rest on its minimal realisation

In fact, non-minimal realisations may ameliorate the SUSY flavor problem

for example, Dirac gauginos (in contrast to Majorana in the MSSM) forbid some couplings and often lead to additional suppression in flavor-changing processes from gauginos running in the loops.

Kribs, Poppitz, Weiner 0712.2039
Blechman, Ng 0803.3811

Dirac gauginos offer an attractive alternate formulation with distinct phenomenology

Moreover, gauge-adjoint scalars add a new aspect to the phenomenology

In the MSSM gauginos are Majorana particles with two degrees of freedom to match gauge bosons in a vector super-multiplet.

To provide two additional degrees, the vector super-multiplet can be paired with an additional chiral super-multiplet to a vector hyper-multiplet of N=2 supersymmetry.
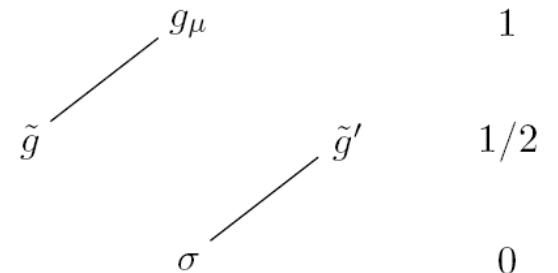
Fayet 1976
Alvarez-Gaume, Hassan hep-ph/9701069
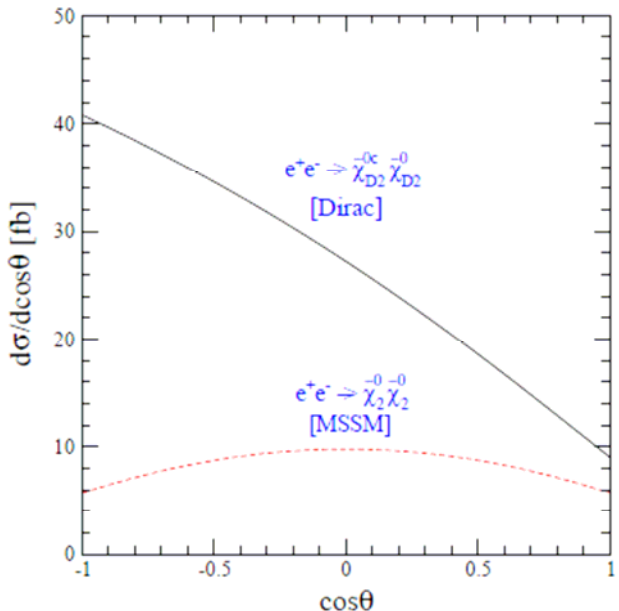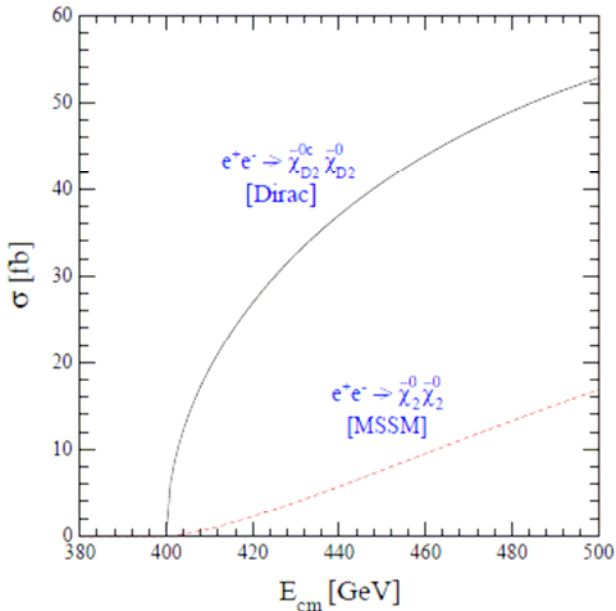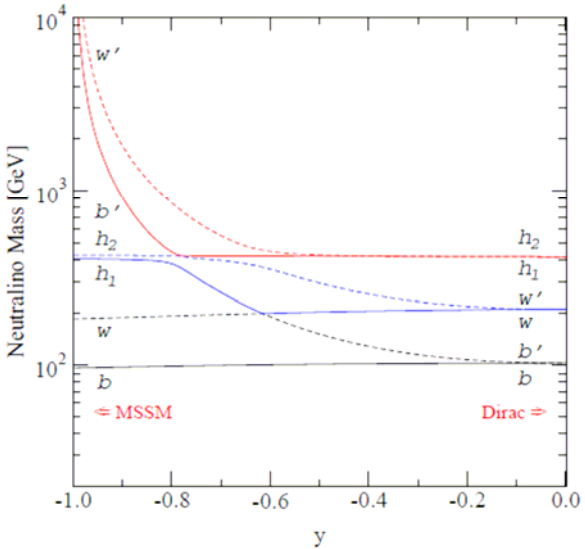Fox, Nelson, Weiner hep-ph/0206102

Schematically, the N=2 QCD hyper-multiplet can be decomposed into the usual N=1 color-octet:

➢ gluon/gluino $\hat{g} = \{g_\mu, \tilde{g}\}$
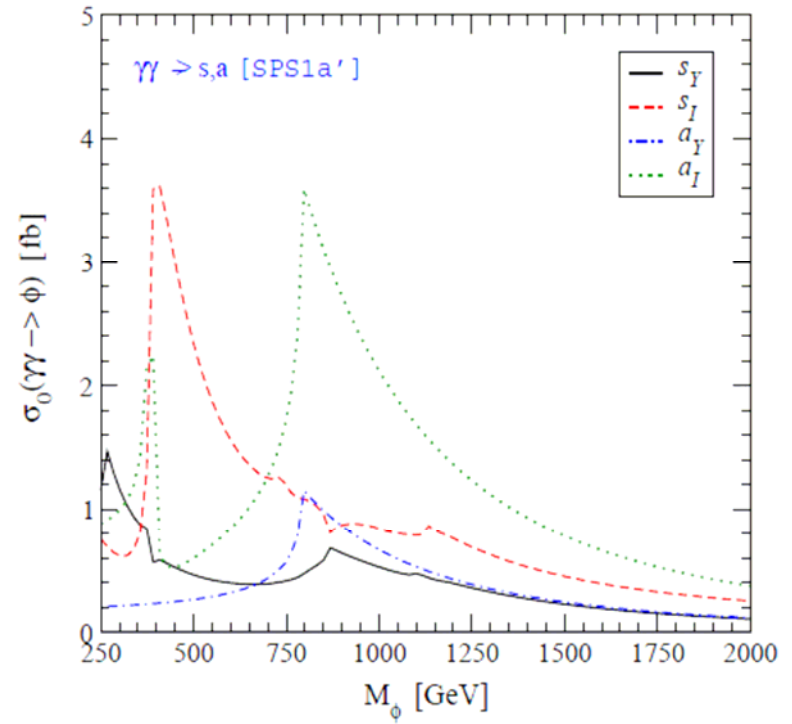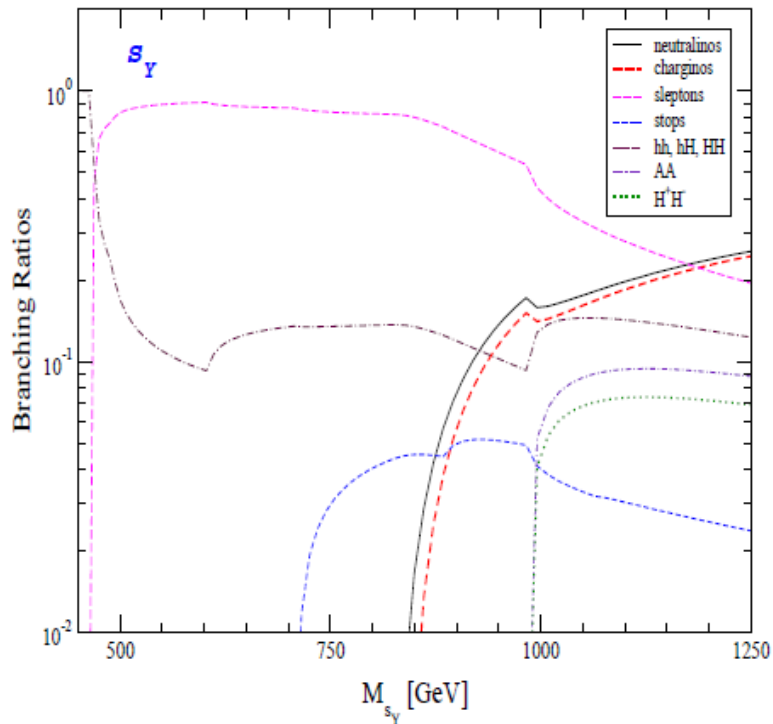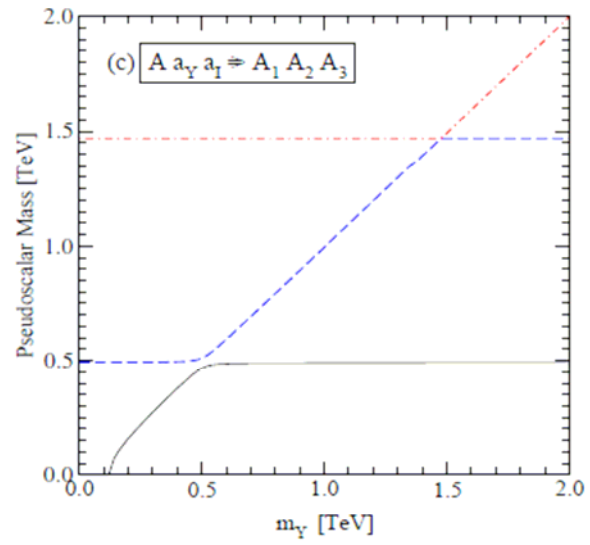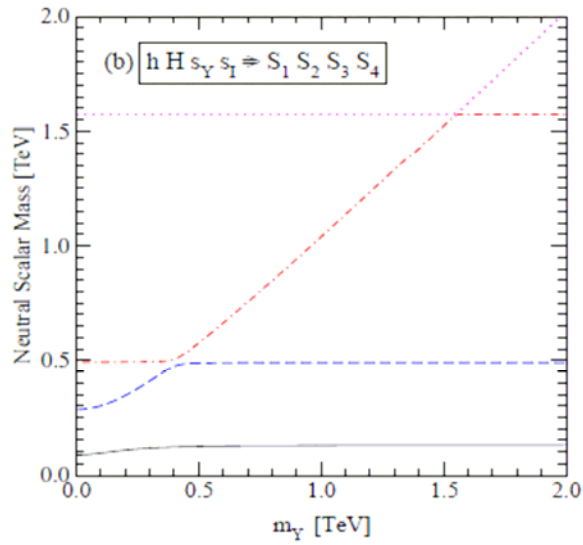➢ gluino'/sgluon $\hat{g}' = \{\tilde{g}', \sigma\}$

Spin

g_μ 1

$\tilde{g}$ $\tilde{g}'$ 1/2

σ 0

N=2 mirror (s)fermions are assumed to be heavy to avoid chirality problems

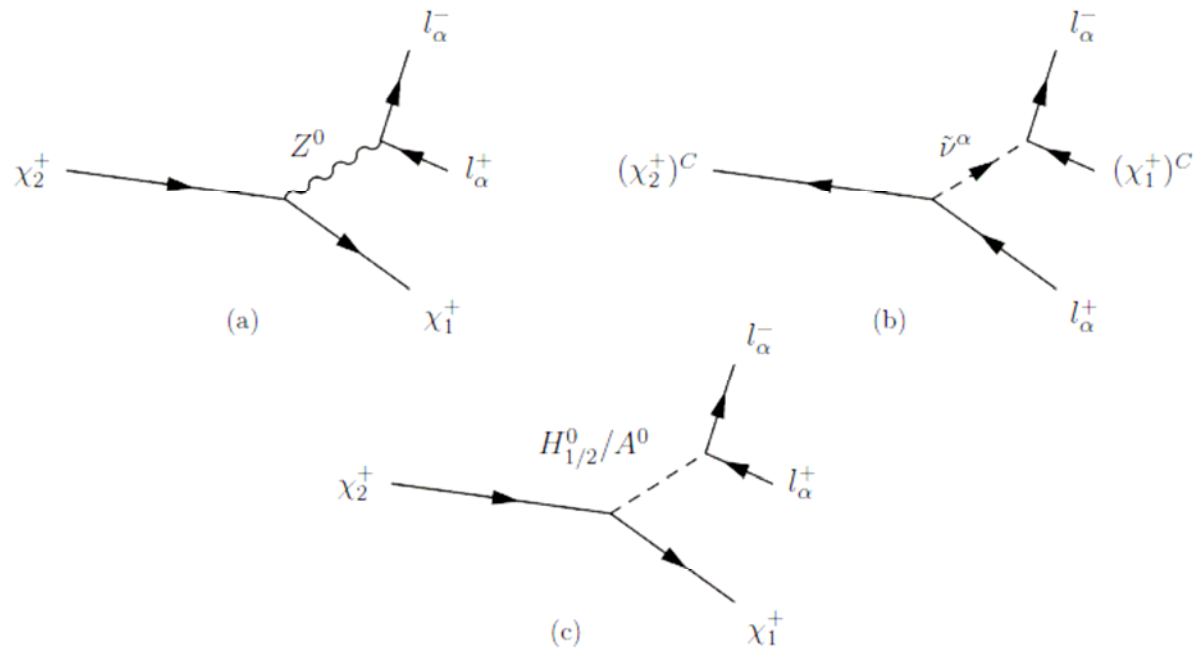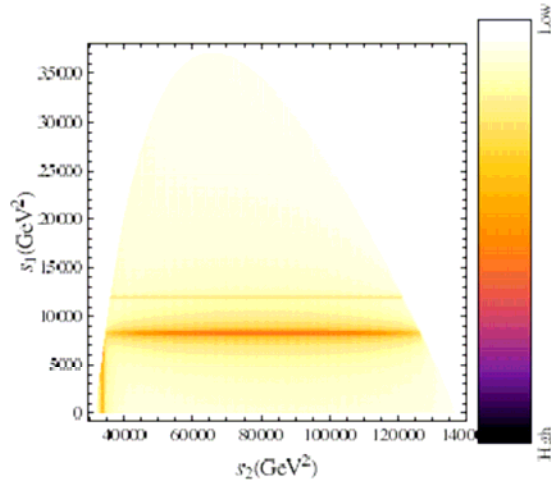# Dirac neutralinos: characteristically different from Majorana, e.g.
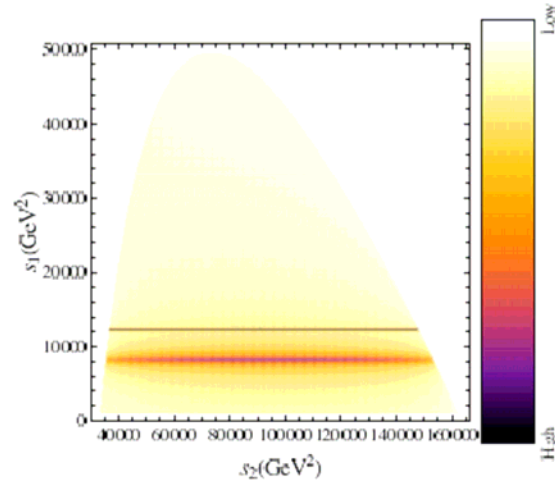
Electroweak scalars

nd Dirac

Lepton flavor violation in chargino decays

Wojciech Kotlarski, magistrant IFTUW

(a) SPS1a

(b) SPS1a'

$$\chi_2^+ \rightarrow \chi_1^+ \tau^+ \mu^-$$

	SPS1a'	SPS1a
Γ_e	23.6505 MeV	21.9227 MeV
Γ_μ	23.8401 MeV	22.0708 MeV
Γ_τ	77.5871 MeV	62.3345 MeV
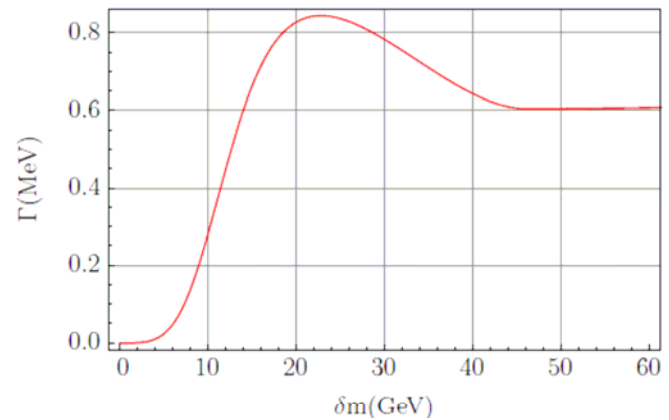
Total decay width 2.33 GeV

J. Kalinowski

FACULTY OF PHYSICS
WARSAW UNIVERSITY