Stop-Higgsino Associated Production at a 100 TeV Collider

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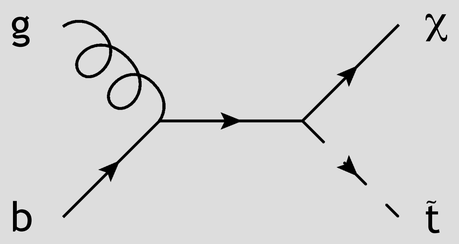
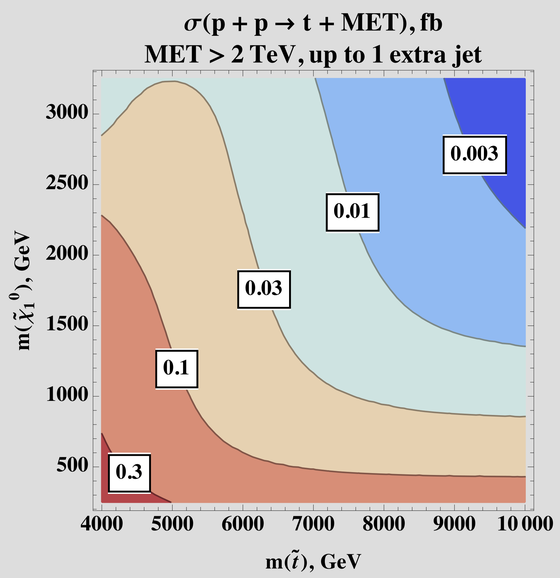
Introduction

- Natural supersymmetry motivates light stops and Higgsinos
- Usually, search through stop pair production, with decay to top + invisible Higgsino
- When stop is parametrically heavier than Higgsino, stop-Higgsino associated production can compete



Search Strategy

- Large top Yukawa compensates for electroweak cross section



- Suggests final state involving boosted top + missing energy

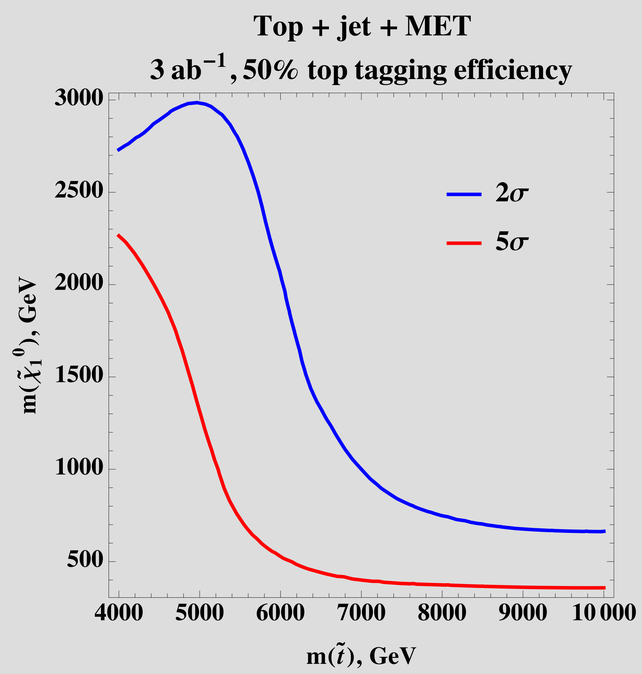
Analysis

- Signal is top + jet + Higgsinos; extra jet from initial state gluon splitting to bottom pair
- Irreducible background from top + jet + invisible Z
- Initially select events with two jets and MET > 2 TeV
- Apply boosted decision tree using kinematics of first two jets and missing energy as inputs, where hardest jet is generally from top
- MadGraph + Pythia simulation with flat top tagging efficiency applied
- Reducible background from light flavor jets faking tops not included, but potentially subdominant with improved detector performance (see poster by Nhan Tran)

Results

- Events with high jet p_T and MET usually offer most discrimination between signal and background
- Can probe stops up to several TeV with 3 ab^{-1} of integrated luminosity
- Significance improves markedly at lower Higgsino mass

Results (cont.)



- Also have bound on Higgsino *independent* of stop mass
- Results from tW production with the off-shell W going to Higgsinos
- Exclusion could eventually reach Higgsino thermal dark matter mass of 1 TeV with increased luminosity

Conclusions

- Associated stop-Higgsino production offers a novel way to test natural supersymmetry at 100 TeV
- Required top tagging rate and integrated luminosity set goals for future collider and detector development