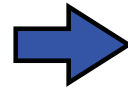# Single-Sector SUSY Breaking from a Warped Dimension

Tony Gherghetta
University of Minnesota
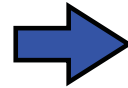
with Maxime Gabella, Joel Giedt, to appear

Warped Extra Dimension ➡ Explain hierarchies

5D metric ➡ IR = UV $e^{-\pi k R}$

- Gauge hierarchy problem: Higgs mass [Randall, Sundrum 99]

X SM on IR brane
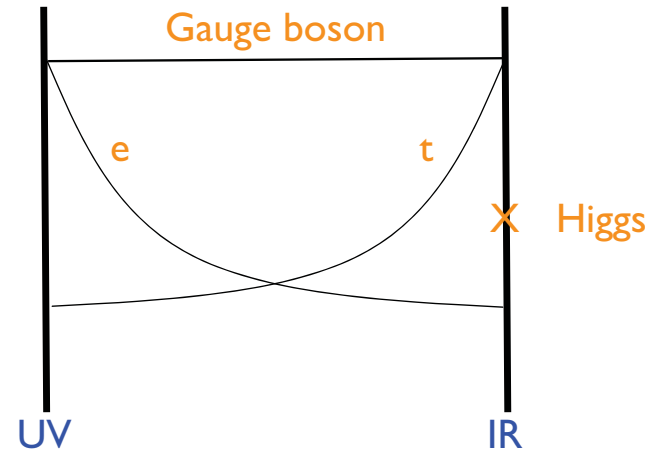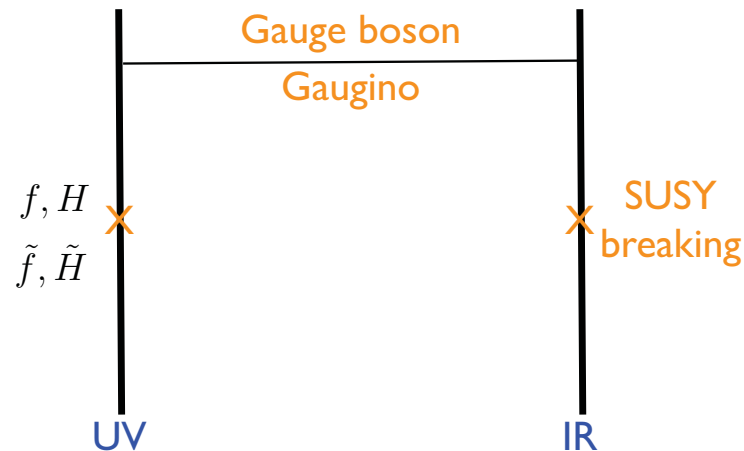
UV   IR

- **Fermion masses:**
  e.g. electron, top
  [TG, Pomarol 00]

Gauge boson

e   t

X Higgs

UV   IR

- **SUSY-breaking scale**
  e.g. Warped MSSM
  [TG, Pomarol 00]

Gauge boson
Gaugino

f, H X
$\tilde{f}, \tilde{H}$ X SUSY
                      breaking

UV   IR

Can we explain fermion mass hierarchies
AND low SUSY-breaking scale? Yes!

Reality Check: AdS/CFT correspondence

[Maldacena, 97]

5D warped dimension ⟷ strongly coupled 4D theory

Bottom line: Extra dimensions need not be real

⟹ mathematical tool

Witten 81: Dynamical SUSY breaking $\quad M_{SUSY} = e^{-\frac{8\pi}{g^2}} M_p$

AdS/CFT: $\quad e^{-\frac{8\pi}{g^2}} \longleftrightarrow e^{-\pi k R}$

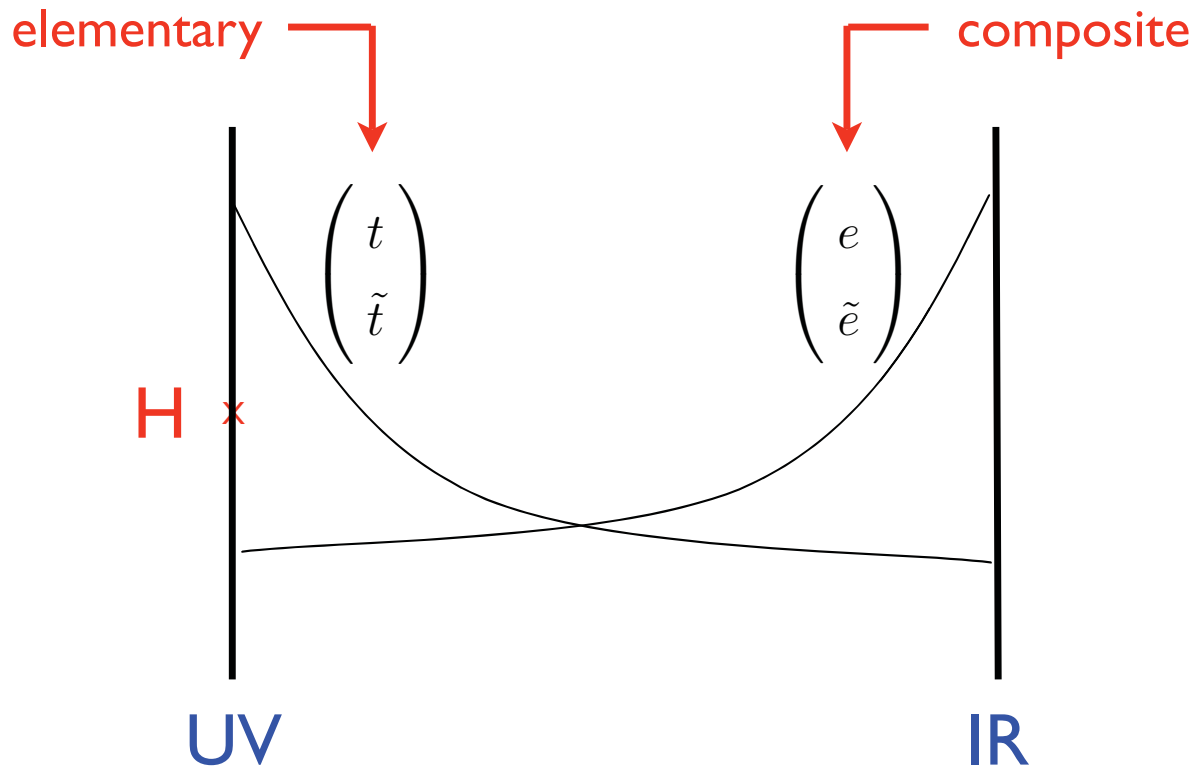Build strongly coupled 4D model using 5D warped dimension

⟶ new tool

5D model: Motivated from SUSY breaking in string theory

- 5D metric deviates in IR

$$ds_5^2 = A^2(z) \left(dx^2 + dz^2 \right) \qquad A^2(z) = \frac{1}{(kz)^2} \left[1 - \epsilon \left(\frac{z}{z_{\text{IR}}} \right)^4 \right]$$
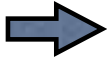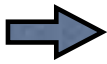
- Flux compactification $\Rightarrow$ gaugino masses

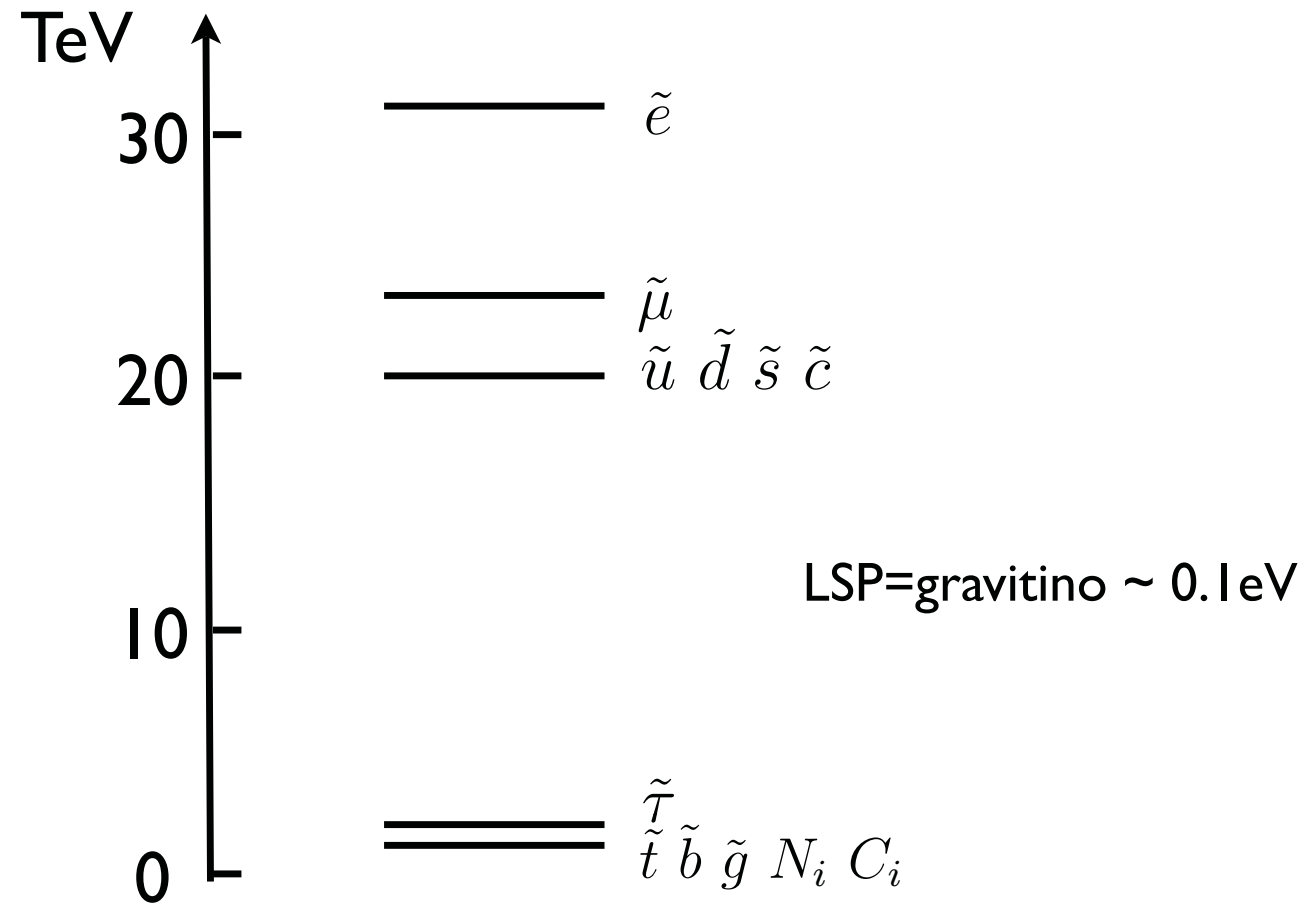$$G_{ijk} \lambda\lambda + \text{h.c.} \qquad \int_{S^3} G_{(3)} \sim z.$$

Sparticle spectrum determined by <u>fermion mass</u> spectrum!

Dual 4D theory mimics Single-Sector Model [Arkani-Hamed, Luty, Terning 97]

- NO messenger sector

- Single sector ➡ Dynamically breaks SUSY

  ➡ Generates composite 1st two generation quarks and leptons

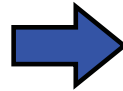- Gauge mediated contributions to gauginos and 3rd generation

Mass Spectrum

Like "more" minimal SSM
[Cohen, Kaplan, Nelson 96]

LHC signal : $pp \rightarrow 2\gamma + \not{E}_T$

Since $\tilde{m}_{1,2}$ very heavy diphoton rates reduced
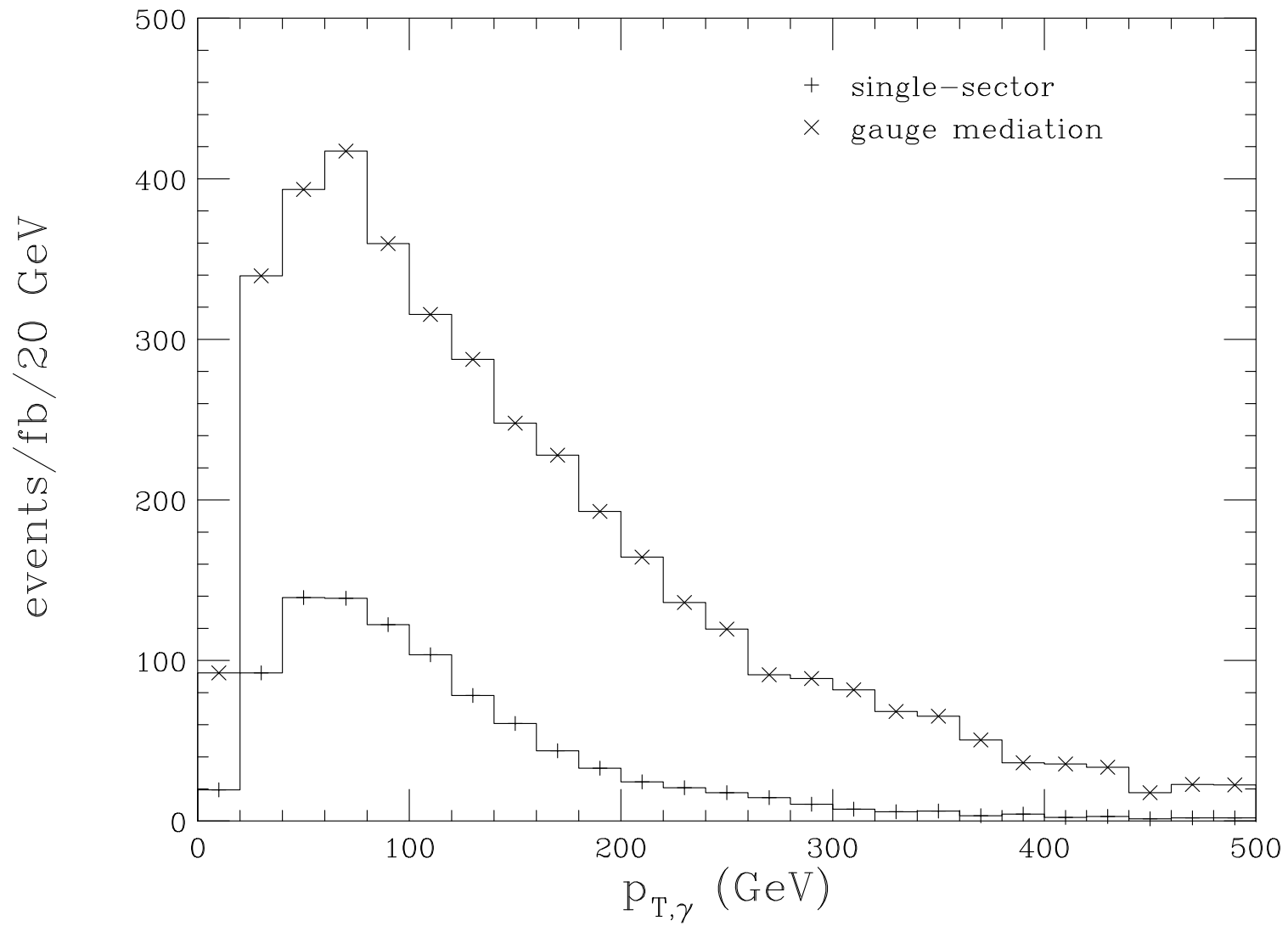
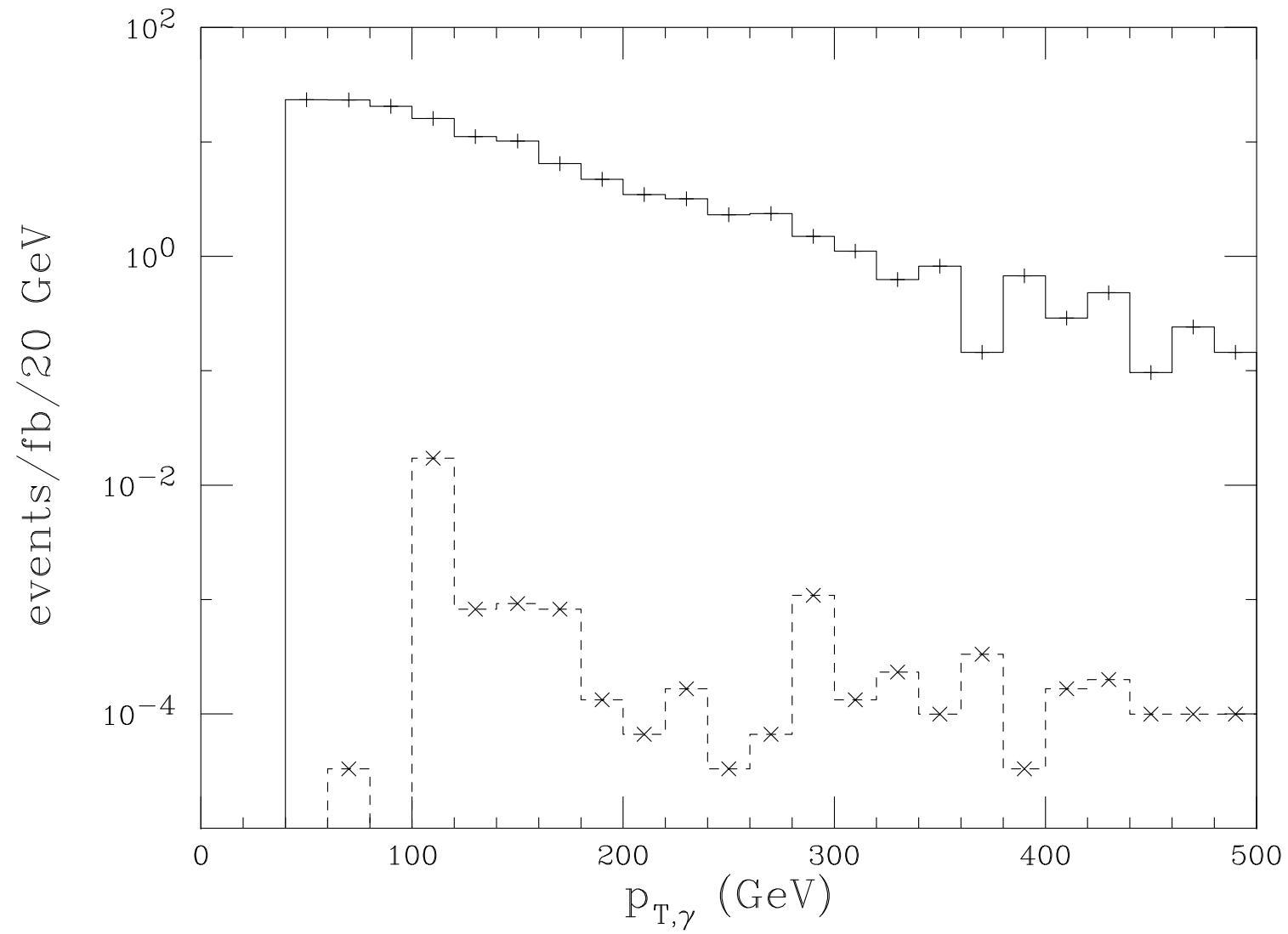At least 10 times more data than conventional gauge mediation needed

Impose cuts to reduce background:

$$p_{T,\gamma} \geq 40 \text{ GeV}, \quad \not{E}_T \geq 60 \text{ GeV}$$

Gabella, TG, Giedt, to appear

Gabella, TG, Giedt, to appear

Conclusion

- Warped dimension provides new tool to study single-sector SUSY breaking models

- Sparticle mass spectrum related to fermion mass spectrum

- Can be eventually seen at LHC