Non-SUSY BSM Working Group: Opening Remarks

Maxim Perelstein, Cornell [on behalf of the conveners]

Snowmass, August 16, 2005

Practical Information I

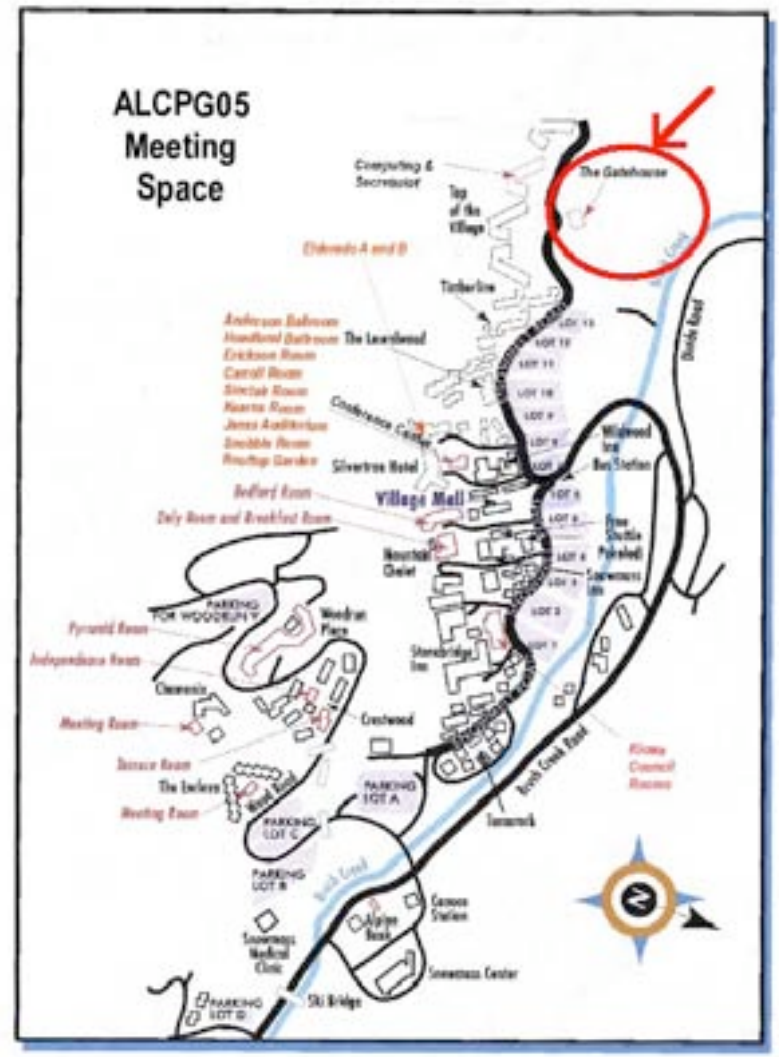
- Web Site:

  www.lns.cornell.edu/~maxim/snowmass

- Conveners: Graham Kribs (IAS/Oregon), Nobuchika Okada (KEK), Maxim Perelstein (Cornell), Sabine Riemann (DESY)
- Participants: ~120 expressed interest at registration
- Information on participants' interests/area of expertise: on the web site, cont. updates (email M.P. to be included!)

Practical Information II

- Philosophy: Less talks, more work (no contributed parallel talks are planned)
- First meeting: Wed Aug 17, 1:30-3:30 pm, Gatehouse - informal discussion of plans for the workshop



Practical Information III

- Monday August 22, afternoon: a session of invited mini-review talks on BSM
- Speakers: Kaustubh Agashe (RS models with matter in the bulk), Greg Landsberg (tba), Tao Han (extra dimensions), Martin Schmaltz (little Higgs models)
- Exact time/location TBA soon!

Motivation

- The mechanism which breaks electroweak symmetry remains a fundamental, unsolved mystery
- Several theoretical ideas for what the EWSB mechanism might be have been proposed (supersymmetry, dynamical symmetry breaking, extra dimensions, little Higgs, ...)
- True model is unknown (only theoretical prejudice to guide us at this point...)
- Need to be prepared for various scenarios!

Goals

- Survey the known signatures of non-SUSY BSM models; understand the requirements they put on the accelerator and detector design; compare with the "standard" (SM + SUSY) benchmarks - any new requirements? [exp]
- Discuss the recent progress in model building; initiate phenomenological studies of promising models
- Make progress towards building robust simulation tools for non-SUSY BSM models

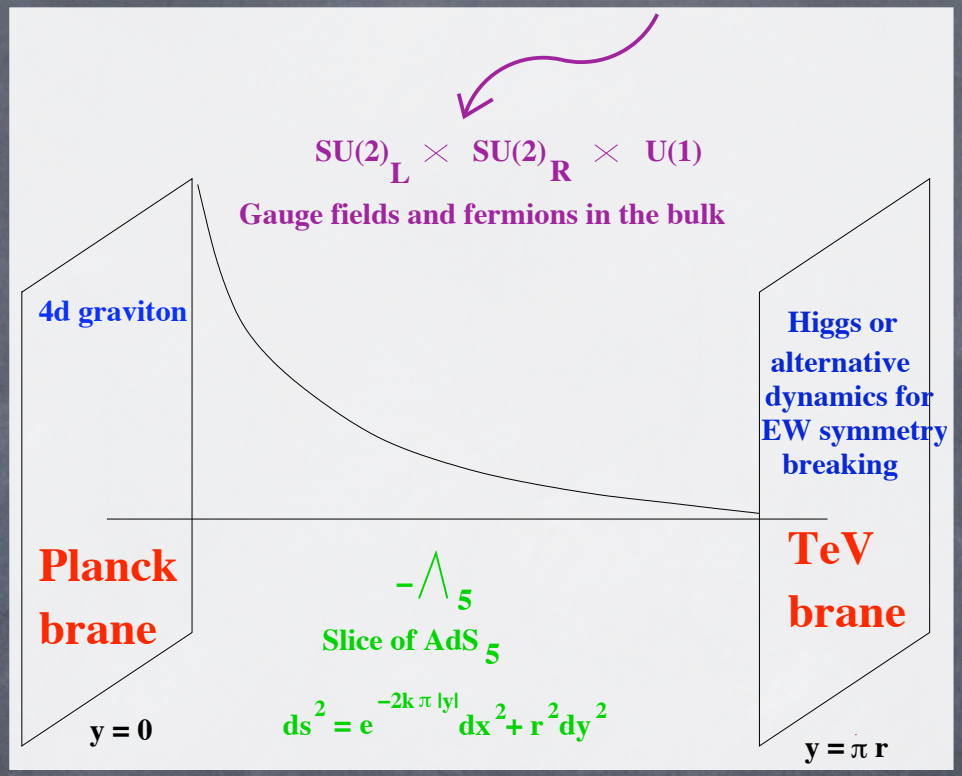
Recent Progress in non-SUSY BSM Model Building: Examples

- Extra-Dim. Models: Randall-Sundrum (type I) with matter in the bulk [see Agashe's talk on 8/22], Higgsless models
- Improved Little Higgs models, in particular models with T parity [Schmaltz's talk]

Particle physics model building in warped space

2005 FAVOURITE SET-UP:

- ✔ hierarchy pb
- ✔ fermion masses
- ✔ High scale unification
- ✔ FRW cosmology



Now embed this into a GUT + solve proton stability

→

- ✔ Dark matter

[see Agashe's talk]

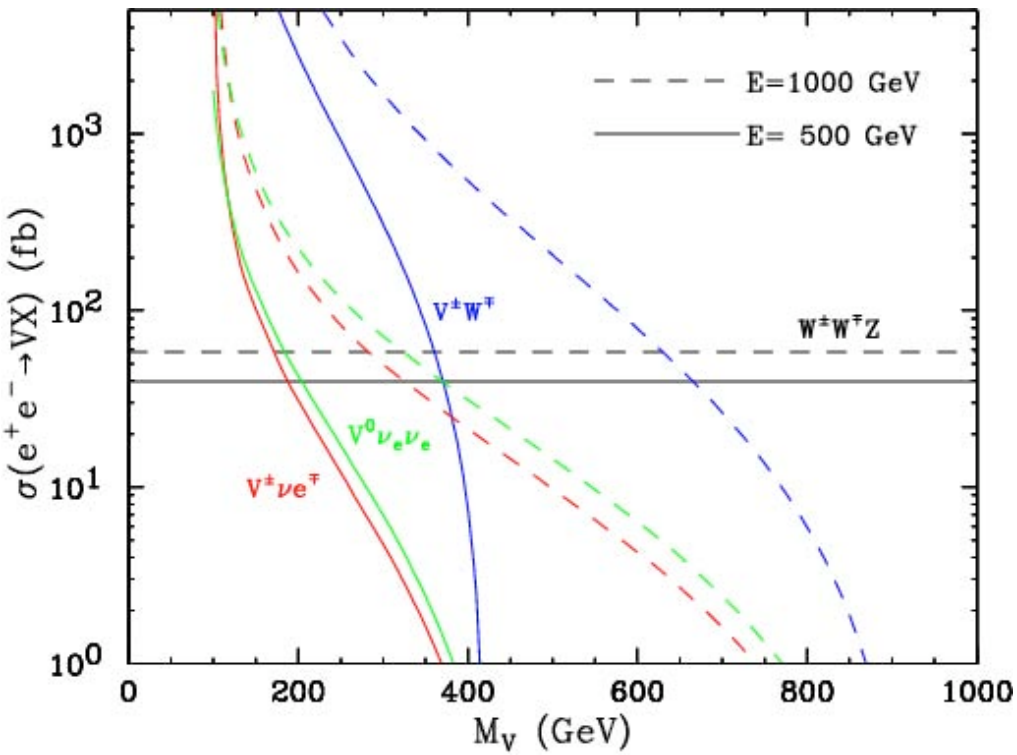
Scorecard for Xtra Dim

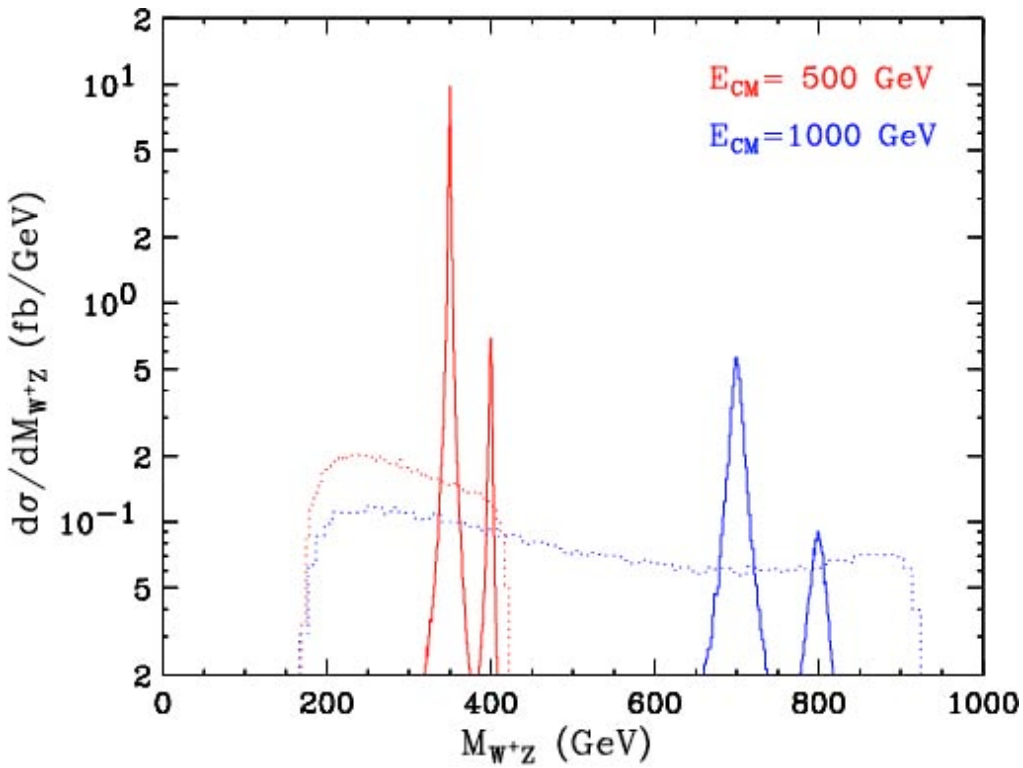
	hierarchy	unification	WIMP
ADD	-	-	-
RS1	+	-	-
UED	+?	-	+
RSMB	+	+	+
HL	+	+?	+?

A Sample Project

- New massive vector bosons (MVBs) below 1 TeV are essential to raise the strong coupling scale in the Higgsless model
- The couplings of MVBs to SM Ws and Zs are constrained by two simple sum rules
- LHC will be able to discover the MVBs, but not test the sum rule [Birkedal, Matchev, MP]
- ILC should be able to test the sum rule ("prove Higgsless") - what measurements are required? what precision can be achieved?

Higgsless MVBs at the ILC





[Birkedal, Matchev, MP, to appear]

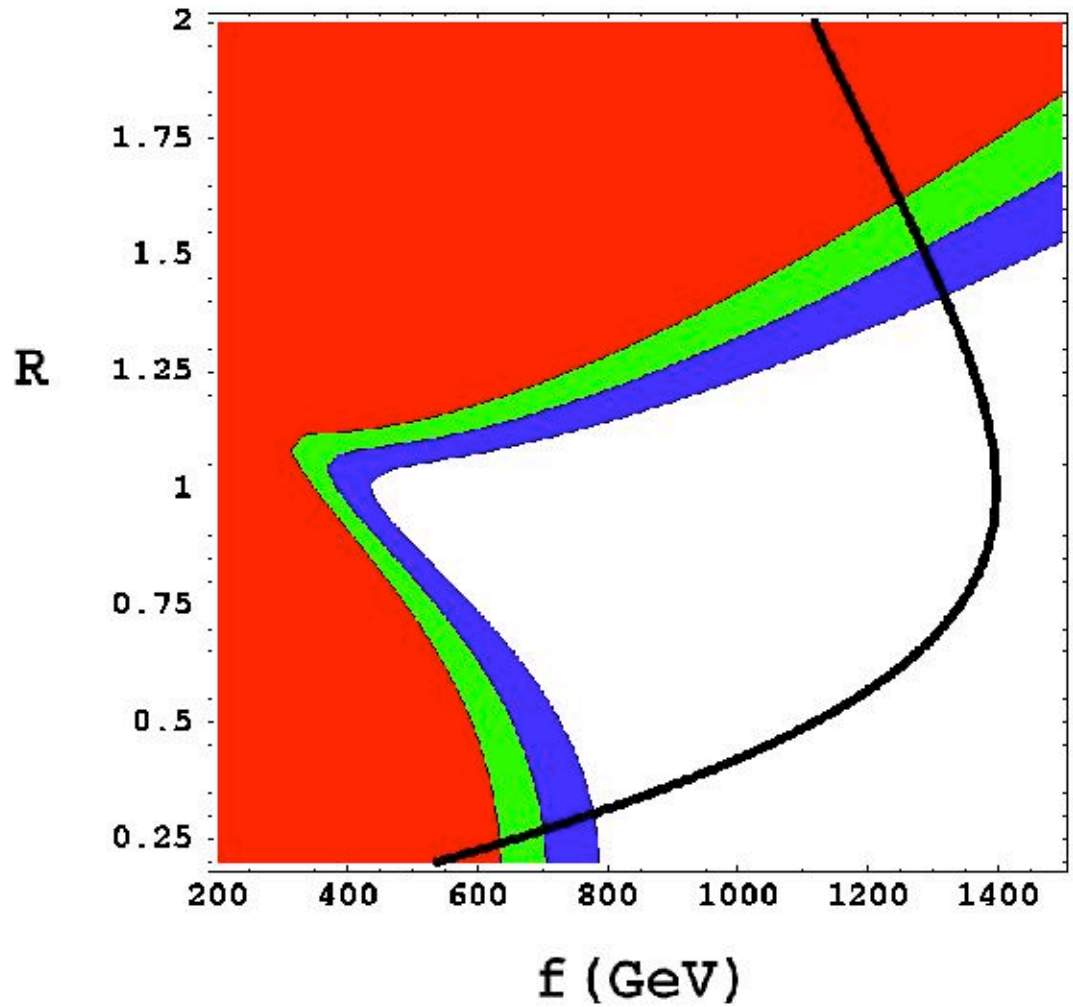
Little Higgs Models

- LH models incorporate light higgs as a pseudo-Goldstone boson associated with global symmetry breaking
- "Collective" symmetry breaking pattern ensures calculable EWSB (by top loops)
- One-loop divergences in Higgs mass are canceled by particles of same spin as their SM partners (W', Z', T)
- Original models had problems with PEW constraints: tree-level corrections

Little Higgs with T Parity

- Cheng and Low suggested introducing an extra discrete symmetry, T parity, a la R parity of SUSY
- All the SM states are T-even, heavy partners are T-odd ⇨ no tree-level corrections to PEW observables!
- Bounds on the partner masses in the few hundred GeV region - interesting ILC phenomenology!

LH with T Parity - PEW Constraints



[Hubisz,Meade, Noble, MP, hep-ph/0506042]

Connections to Other Physics Working Groups

- Cosmological Connections: WIMP Dark Matter candidates exist in many BSM models (e.g. LH with T parity)
- Lack of direct signatures (esp. at the 500 GeV ILC) in many scenarios ⇨ precision measurements of SM/top/Higgs properties required to discern indirect signals
- Obvious LHC/ILC interplay issues

Summary

- Plenty of exciting non-SUSY alternatives for physics at the terascale proposed by theorists
- Experiments at the LHC and the ILC need to be prepared for these scenarios
- Much work remains to be done - let's get started!