CLAIM: compactified string theories with stabilized moduli that could describe our world generically have spectrum:

Scalars $\approx M^{3/2}_{3/2}$ 30 TeV; gluinos $\approx$ TeV; LSP (wino-like) $\approx$ 200 GeV

$\rightarrow$ At LHC can only see gluinos, N1, N2, C1, h (h is SM-like)

$\rightarrow$ Gluinos decay dominantly to 3rd family so gluino pair decays mainly to bbbb, bbtt, tbtb, tttt (plus two of N1, N2, C1)

[studied backgrounds, easy to find signals; $\approx$ 1 events pass $35pb^{-1}$ ATLAS, CMS cuts]

- could describe world: 4D; TeV scale emerges; deS; CC $\sim$ 0; BBN; N=1 susy; susy breaking; supergravity framework, etc – expect many solutions that can describe our world, and many that cannot – don’t care about latter

  - First derived in series of papers for M-theory compactified on G2 manifold [Acharya, Kane, Bobkov, Kumar, Shao, Kuflik, Lu, Watson, Feldman, Wang, Nelson, Suruliz Kadota, Velasco]

  - Also showed for M-theory model that TeV scale emerges; potential in metastable deS minimum; universe has non-thermal cosmological history, non-thermal wimp miracle; soft-breaking terms real; all CPV from phases of Yukawas; EDMs ok and predicted; strong CPV explained; no flavor problems; wino-like LSP good DM candidate; first string-based solution of $\mu$ problem, predicts $\approx_{SI} \approx 10^{-45}cm^2$

  - Then realized that some results, including spectrum and signatures, seems valid for any compactified string theory

  - Note – some guessed scalars decoupled – here masses derived, not decoupled
Key point – study full moduli-like mass matrix – assume (at least one) moduli stabilized by susy-breaking interaction – then showed that smallest moduli mass \( \sim M^{3/2} \) → moduli and gravitino masses related!

(NEW, Acharya, GK, Kuflik, arXiv:1006.3272)

- Cosmology (BBN, or energy density) → moduli masses \( \gtrsim 30 \text{ TeV} \) → \( M^{3/2} \) \( \gtrsim 30 \text{ TeV} \)
- Then supergravity implies scalars (squarks etc) and trilinears \( \gtrsim 30 \text{ TeV} \)
- Gauginos too? No in M theory, probably no generically
- Known that if only usual moduli in the theory get AdS minima, not deS
- Generically also have chiral matter at conical singularities on G2, CY manifolds, submanifolds – cannot neglect – condense to mesons, meson F terms positive, raise potential so metastable deS minimum, so these F terms are main contribution to susy-breaking
- Mesons not in gauge kinetic function so do not contribute to leading term for gaugino masses → gaugino masses suppressed \( \gtrsim 50 \text{ in M-theory} \) (at low scale)
- True in M-theory/G2 – some such additional susy-breaking contribution must occur in any string theory to have deS minimum → gaugino mass suppression may be generic in string theories

- Run down from \( \sim 30 \text{ TeV} \), like REWSB, 3\(^{rd}\) family runs fastest, stops and sbottoms lighter, dominate gluino decay, get mainly bbbb, ttbb, tttt each plus N1N1 or N2N2 or C1N1 or C1C1 etc for gluino pairs
- EWSB?? Large little hierarchy?? – Fine Tuning an effective theory concept – there are solutions with EWSB, small \( \mu \), scalars \( \sim \text{tens of TeV} \) – have found one analytically, several numerically – need to show boundary conditions for those solutions inevitable in underlying theory