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

Scalars≈$M_{3/2}$ ≳ 30 TeV; gluinos ≳ TeV; LSP(wino-like)≳200 GeV

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

→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; ≳ 1 events pass 35pb^{-1} ATLAS, CMS cuts]

- could describe world: 4D; TeV scale emerges; deS; CC~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 μ problem, predicts $\gtrsim_{SI}$ $10^{-45}cm^2$**
  - ***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 ~ M3/2 → *moduli and gravitino masses related!***

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

- Cosmology (BBN, or energy density) → moduli masses ⪆ 30 TeV →M3/2 ⪆ 30 TeV
- Then supergravity implies scalars (squarks etc) and trilinears ⪆ 30 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 ⪆ 50 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 ~ 30 TeV, like REWSB, 3rd 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 μ, scalars ~ tens of TeV – have found one analytically, several numerically – need to show boundary conditions for those solutions inevitable in underlying theory