# CERNTH Group Retreat

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hello, I'm Adam Martin

moved here Sept 1 as fellow

#### from Geneva, IL, USA



#### to Geneva, CH



#### glad to be part of CERH PH-TH

#### my research expertise/interests are:

# BSM (+SM) phenomenology collider physics, model building



recently I've thought about:

### modifying Higgs production: using simple SM extensions... or other particles posing as Higgs

• Tevatron anomalies: (in)famous Wjj, more recently A<sup>FB</sup>tt

• jet substructure + BSM: finding boosted Higgses from cascade decays

# supersoft SUSY

usual MSSM: Majorana mass for gauginos

why not Dirac masses instead?

$$\begin{array}{ccc} M_{3} \lambda_{a} \psi_{a} & \swarrow & \underbrace{ & \swarrow' & \swarrow_{a} \Phi_{a} \\ \text{extra adjoint} & & & & \\ \end{array} , \, \psi' = \theta \ \mathsf{D} \end{array} \\ \end{array}$$

give up minimality, but simple change has some remarkable consequences

squark/slepton masses are not sensitive to SUSYbreaking scale  $\Lambda$  [Fox, Nelson, Weiner '02]



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U(1)<sub>R</sub> in SUSY preserved by Dirac mass -> no q̃q, q̃\*q̃\*, just q̃q̃\*



violate R-symmetry

preserve R-symmetry

#### supersoft SUSY production further suppressed

### net result:

[Kribs, AM 1203.4821]

colored superpartner limits significantly relaxed within 'simplified' setup, M<sub>sq</sub> ~ 750 GeV (summer 2012)

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### not done:

if Dirac mass for SU(2), U(1) inos,  $m_{H,tree} = 0$ several directions to go from here

- really heavy stops (> 5 TeV)...
- keep the winos, binos Majorana
- nMSSM-ology
- additional SUSY-breaking

•

add F-term breaking X, soft masses for new adjoints



generate effective quartic, viable  $m_H = no problem$ 

one interesting setup in this category: [Kribs, Poppitz, Weiner '07] MRSSM = R-symmetry extended to whole theory Higgs sector must be extended

# relaxed flavor constraints strong 1st order EW phase transition possible

[Fok, Kribs, AM, Tsai '12]

but thats just one possibility

supersoft/R-symmetric SUSY has lots of nice features. An interesting playground for model-building...

### happy to discuss in detail, or any other idea

# THANK YOU