

LHC and dark matter

- What can LHC say about dark matter?
- Direct production of DM probably not visible because it is dark: e.g. $pp \rightarrow XX$ + assorted hadronic debris: usually no trigger
- Dark matter requires new physics
- LHC designed to discover new physics which may be associated with DM

- Examples: SUSY, UED, LHT, etc: large event samples **may** be needed to differentiate
- Suppose it is SUSY: DM=neutralino, axino, gravitino, sneutrino, axion,.... ?
- Battaglia et al. prescribed program (actually begun by Drees et al., PRD63 (2001) 035008 and Nojiri et al., JHEP 0603 (2006) 063):

- Measure as many SUSY particle masses, couplings, BFs etc as possible, to constrain the weak scale MSSM parameter choices
- Calculate thermal neutralino abundance from the measured parameters (with some error), and see if calculated abundance due to collider measurements agrees with astrophysical measurements

- Has given impetus to extracting SUSY parameters from possible LHC new physics data
- Nojiri, Tovey, Polesello; Arnowitt, Dutta, Kamon ...(TAMU); Battaglia et al.; Barr, Lester, White, Webber; Matchev et al.; Paige et al; Gunion et al; Raklev, Kraml, et al.;
- If Ωh^2 matches, then verify thermal WIMP production!

If Ω_{h}^2 too small?

- Scalar-tensor cosmology (Catena et al.)?
- Late decaying scalar field (Moroi, Randall; Gelmini, Gondolo, Soldatenko, Yaguna; Archarya et al.)?
- gravitino decay? (Endo et al.)
- axino decay? (Choi et al.)
- decay to axino but also axion DM?

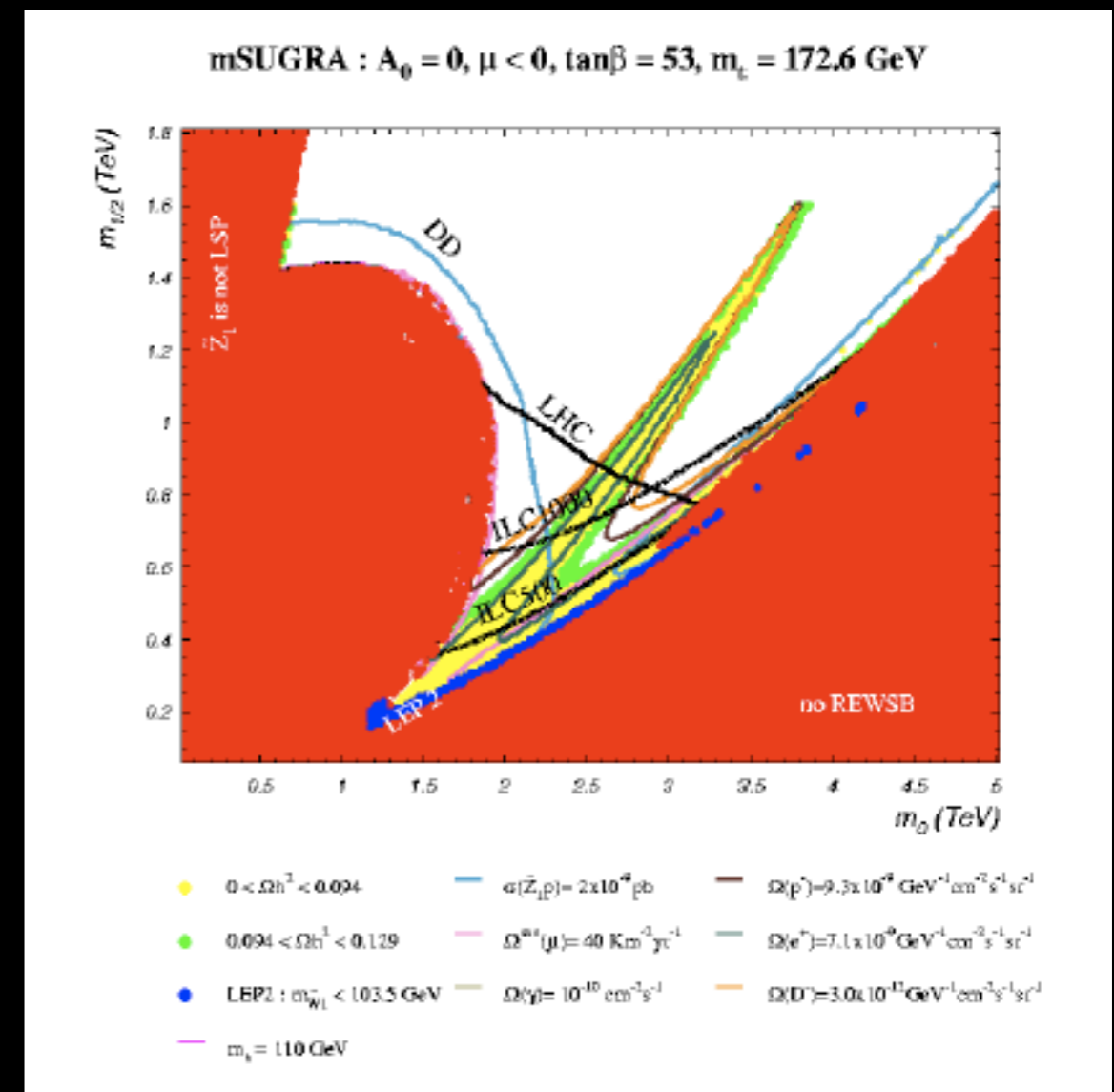
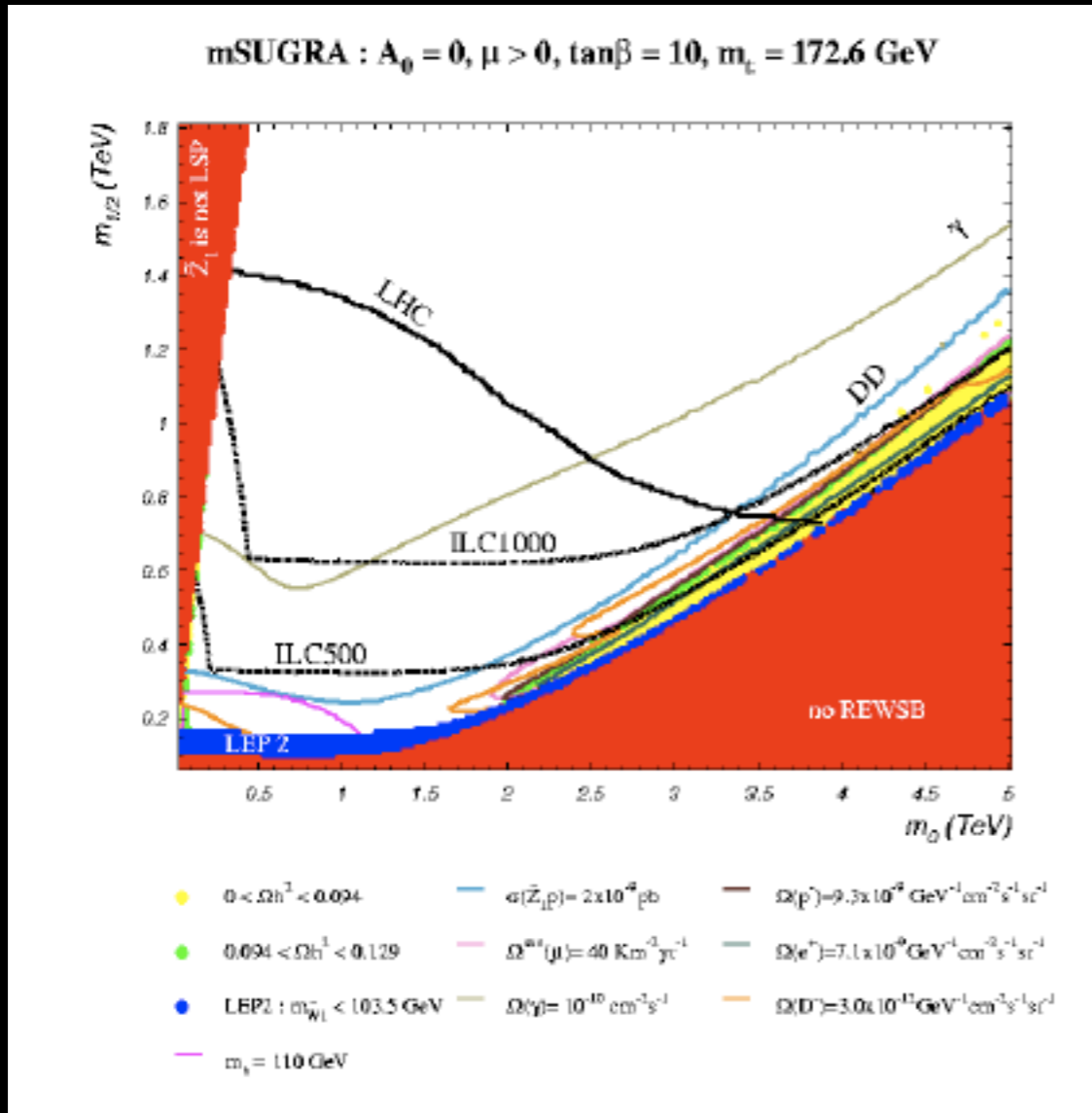
If Ωh^2 too big?

- Scalar-tensor cosmology?
- Scalar field decay to matter (extra entropy injection dilutes abundance)?
- Decay to gravitino or axino? (Covi et al.)
- R-violation? (Buchmuller et al.)

Check LHC data against DM direct/ indirect detection

- Direct or indirect WIMP signals?
- Axion signal?
- Quasi-stable particles at LHC?

Collider, direct, indirect detection of DM in mSUGRA



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