

Supersymmetry, naturalness and the landscape

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While the ATLAS/CMS experiments discovered a Standard Model-like Higgs boson at LHC, no compelling new physics signal has been seen yet. Lack of experimental evidence of *sparticles* has pushed the lower limit on their masses in the multi-TeV regime. LHC searches for Weak scale supersymmetry (SUSY) show that gluinos should lie beyond 2.2 TeV and top squarks should lie beyond 1.1 TeV. Such high mass limits are well beyond early upper limits from naturalness and gives rise to the question whether SUSY is now unnatural. We critique the older notions of naturalness and suggest an update based on the more conservative electroweak naturalness measure. In that case, SUSY with light higgsinos and highly mixed TeV-scale top squarks is still quite natural. The emergence of the string landscape within the setting of eternal inflation adds substance to the naturalness debate. In this case, a statistical pull to large soft terms must be balanced by the requirement that the derived weak scale lie within the narrow ABDS anthropic window. Then the landscape predicts $m_h \sim 125$ GeV with *sparticles*, except light higgsinos, generally beyond LHC reach. We outline consequences of this “stringy naturalness” for future collider and dark matter searches.

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