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Linking the Supersymmetric Standard Model to the Cosmological Constant

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String theory has no parameter except the string scale M_S, so the Planck scale $M_{\rm Pl}$, the supersymmetry-breaking scale $m_{\rm susy}$, the electroweak scale $m_{\rm EW}$ as well as the vacuum energy density (cosmological constant) Λ are to be determined dynamically at any local minimum solution in the string theory landscape. Here we consider a model that links the supersymmetric electroweak phenomenology (bottom up) to the string theory motivated flux compactification approach (top down). In this model, supersymmetry is broken by a combination of the racetrack K\"ahler uplift mechanism, which naturally allows an exponentially small positive Λ in a local minimum, and the anti-D3-brane in the KKLT scenario. In the absence of the Higgs doublets from the supersymmetric standard model, one has either a small Λ or a big enough $m_{\rm susy}$, but not both. The introduction of the Higgs fields (with their soft terms) allows a small Λ and a big enough $m_{\rm susy}$ simultaneously. Since an exponentially small Λ is statistically preferred (as the properly normalized probability distribution $P(\Lambda)$ diverges at $\Lambda = 0^+$), identifying the observed $\Lambda_{\rm obs}$ to the median value $\Lambda_{50\%}$ yields $m_{\rm EW} \sim 100$ GeV. We also find that the warped anti-D3-brane tension has a SUSY-breaking scale $M_{\rm susy} \sim 100\, m_{\rm EW}$ while the SUSY-breaking scale that directly correlates with the Higgs fields in the visible sector is $m_{\rm susy} \simeq m_{\rm EW}$.

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