## Phenomenology 2021 Symposium



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## Distribution of supersymmetry mu parameter and Peccei-Quinn scale f\_a from the landscape

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A scan of soft SUSY breaking parameters within the string theory landscape with the MSSM assumed as the low energy effective field theory–using a power-law draw to large soft terms coupled with an anthropic selection of a derived weak scale to be within a factor four of our measured value–predicts a peak probability of  $m_h \simeq 125$  GeV with sparticles masses typically beyond the reach of LHC Run 2. Such multiverse simulations usually assume a fixed value of the SUSY conserving superpotential  $\mu$  parameter to be within the assumed anthropic range,  $\mu <\sim 350$  GeV. However, depending on the assumed solution to the SUSY  $\mu$  problem, the expected  $\mu$  term distribution can actually be derived. We examine two solutions to the SUSY  $\mu$  problem. The first is the gravity-safe Peccei-Quinn (GSPQ) model based on an assumed  $\mathbb{Z}_{24}^R$  discrete R-symmetry which allows a gravity-safe accidental, approximate Peccei-Quinn global symmetry to emerge which also solves the strong CP problem. The second case is the Giudice-Masiero solution wherein the  $\mu$  term effectively acts as a soft term and has a linear draw to large values. For the first case, we also present the expected landscape distribution for the PQ scale  $f_a$ ; in this case, weak scale anthropics limits its range to the cosmological sweet zone of around  $f_a \ 10^{11}$  GeV.

## Summary

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