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Naturalizing Supersymmetry with a Two-Field Relaxion Mechanism

We present a supersymmetric version of a two- eld relaxion model that naturalizes tuned versions of supersymmetry. This arises from a relaxion mechanism that does not depend on QCD dynamics and where the relaxion potential barrier height is controlled by a second axion-like eld. During the cosmological evolution, the relaxion rolls with a nonzero value that breaks supersymmetry and scans the soft supersymmetric mass terms. Electroweak symmetry is broken after the soft masses become of order the supersymmetric Higgs mass term and causes the relaxion to stop rolling for superpartner masses up to 10ˆ9 GeV. This can explain the tuning in supersymmetric models, including split-SUSY models, while preserving the QCD axion solution to the strong CP problem. Besides predicting two very weakly-coupled axion-like particles, the supersymmetric spectrum may contain an extra Goldstino, which could be a viable dark matter candidate.

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