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The Scale-Invariant NMSSM and the 126 GeV Higgs Boson

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The recent LHC discovery of a Higgs-like resonance at 126 GeV suggests that the minimal supersymmetric standard model must be modified in order to preserve naturalness. A simple extension is to include a singlet superfield and consider the scale-invariant NMSSM, whose renormalizable superpotential contains no dimensionful parameters. This extension not only solves the \mu-problem, but can easily accommodate a 126 GeV Higgs. I will present our recent study of naturalness in the scale-invariant NMSSM taking into account the constraints from LHC searches, flavor physics and electroweak precision tests. We show that TeV-scale stop masses are still allowed in much of the parameter space with 5% tuning for a low messenger scale of 20 TeV, split families (with third-generation sleptons decoupled) and Higgs-singlet coupling \lambda of order one. For larger values of the Higgs-singlet coupling, which can relieve the tuning in the Higgs VEV, an additional tuning in the Higgs mass limits increasing the (lightest) stop mass beyond 1.2 TeV, the gluino mass above 3 TeV, and electroweak charginos and neutralinos beyond 400 GeV for a combined tuning better than 5%. This implies that the natural region of parameter space for the scale-invariant NMSSM will be fully explored at the 14 TeV LHC.

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