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# Bayesian Analysis and Naturalness in (Next-to-)Minimal SUSY Models

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One of the key motivations for supersymmetric (SUSY) models is their ability to naturally stabilize the electroweak scale and so address the hierarchy problem. However, in the Minimal Supersymmetric Standard Model (MSSM) accommodating a 125 GeV Higgs boson appears to once again require a degree of fine-tuning. This has fueled interest in non-minimal SUSY models, such as the Next-to-MSSM (NMSSM), that raise the Higgs mass at tree-level, and so are claimed to be more natural. Such a comparison, when made on the basis of traditional fine-tuning measures, is somewhat futile, since the result heavily depends on the chosen definition of fine-tuning. We instead advocate for an approach in which the plausibility that a given model reproduces the electroweak scale is quantified using Bayesian statistics. We contrast popular fine-tuning measures with naturalness priors, which automatically arise in this approach, in the constrained MSSM and a semi-constrained NMSSM. We find that results obtained using naturalness priors agree qualitatively with traditional measures, while having a well-defined probabilistic interpretation. Our comparison shows that naturalness can be rigorously grounded in Bayesian statistics, and that naturalness priors provide valuable insight into the hierarchy problem.

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