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GUT-inspired SUSY and the muon $g-2$ anomaly: prospects for LHC 14 TeV

Content :

We consider the possibility that the muon $g-2$ anomaly, $\delta(g-2)_\mu$, finds its origins in low energy supersymmetry (SUSY). In the general MSSM the parameter space consistent with $\delta(g-2)_\mu$ and correct dark matter relic density of the lightest neutralino easily evades the present direct LHC limits on sparticle masses and also lies to a large extent beyond future LHC sensitivity. The situation is quite different in GUT-defined scenarios where input SUSY parameters are no longer independent. We analyze to what extent the LHC can probe a broad class of GUT-inspired SUSY models with gaugino non-universality that are currently in agreement with the bounds from $\delta(g-2)_\mu$, as well as with the relic density and the Higgs mass measurement. To this end we perform a detailed numerical simulation of several searches for electroweakino and slepton production at the LHC and derive projections for the LHC 14 TeV run. We show that, within GUT-scale SUSY there is still plenty of room for the explanation of the muon anomaly, although the current LHC data already imply strong limits on the parameter space consistent with $\delta(g-2)_\mu$. On the other hand, we demonstrate that the parameter space will be basically fully explored within the sensitivity of the 14 TeV run with 300 inverse fb. This opens up the interesting possibility that, if the $(g-2)_\mu$ anomaly is real then some positive signals must be detected at the LHC, or else these models will be essentially ruled out. Finally, we identify the few surviving spectra that will provide a challenge for detection at the LHC 14 TeV run and we characterize their properties.

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