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Gluino-SUGRA Type Scenarios In Light of FNAL Muon $g-2$ Anomaly

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Gluino-SUGRA (\tilde{g} SUGRA), which is an economical extension of mSUGRA, adopts much heavier gluino mass parameter than other gauginos mass parameters and universal scalar mass parameter at the unification scale. It can elegantly reconcile the experimental results on the Higgs boson mass, the muon $g-2$, the null results in search for supersymmetry at the LHC and the results from B-physics.

In this work, we propose several new ways to generate large gaugino hierarchy (i.e. $M_3 \gg M_1, M_2$) for \tilde{g} SUGRA model building and then discuss in detail the implications of the new muon $g-2$ results with the updated LHC constraints on such \tilde{g} SUGRA scenarios. We obtain the following observations: (i) For the most interesting $M_1 = M_2$ case at the GUT scale with a viable bino-like dark matter, the \tilde{g} SUGRA can explain the muon $g-2$ anomaly at 1σ level and be consistent with the updated LHC constraints for $6 \geq M_3/M_1 \geq 9$ at the GUT scale; (ii) For $M_1 : M_2 = 5 : 1$ at the GUT scale with wino-like dark matter, the \tilde{g} SUGRA model can explain the muon $g-2$ anomaly at 2σ level and be consistent with the updated LHC constraints for $3 \geq M_3/M_1 \geq 4$ at the GUT scale; (iii) For $M_1 : M_2 = 3 : 2$ at the GUT scale with mixed bino-wino dark matter, the \tilde{g} SUGRA model can explain the muon $g-2$ anomaly at 2σ level and be consistent with the updated LHC constraints for $6.7 \geq M_3/M_1 \geq 7.8$ at the GUT scale.

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