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Upper bound on the smuon mass from vacuum stability in the light of muon g−2 anomaly

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We derive an upper bound on the smuon mass assuming that the muon $g-2$ anomaly is explained by the supersymmetric (SUSY) contribution. In the minimal SUSY standard model, the SUSY contribution to the muon $g-2$ is enhanced when the Higgsino mass parameter is large. Then, the smuon-smuon-Higgs trilinear coupling is enhanced, which may destabilize the electroweak vacuum. We calculate precisely the decay rate of the electroweak vacuum in such a case. We include one-loop effects which are crucial to determine the overall normalization of the decay rate. Requiring that the theoretical prediction of the muon anomalous magnetic moment is consistent with the observed value at the 1 and 2σ levels (equal to the central value of the observed value), we found that the lightest smuon mass should be smaller than 1.38 and 1.68 TeV (1.20 TeV) for $\tan\beta = 10$ (with $\tan\beta$ being the ratio of the vacuum expectation values of the two Higgs bosons), respectively, and the bound is insensitive to the value of $\tan\beta$.

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