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Improved (g-2)_mu Measurements and Supersymmetry

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The electroweak (EW) sector of the Minimal Supersymmetric Standard Model (MSSM) can account for variety of experimental data. The lighest supersymmetric particle (LSP), which we take as the lightest neutralino, $\tilde{\chi}_1^0$, can account for the observed Dark Matter (DM) content of the universe via coannihilation with the next-to-LSP (NLSP), while being in agreement with negative results from Direct Detection (DD) experiments. Owing to relatively small production cross-sections a comparably light EW sector of the MSSM is also in agreement with the unsuccessful searches at the LHC. Most importantly, the EW sector of the MSSM can account for the persistent $3 - 4\,\sigma$ discrepancy between the experimental result for the anomalous magnetic moment of the muon, $(g-2)_\mu$, and its Standard Model (SM) prediction. Under the assumption that the $\tilde{\chi}_0^1$ provides the full DM relic abundance we first analyze which mass ranges of neutralinos, charginos and scalar leptons are in agreement with all experimental data, including relevant LHC searches.
We find an upper limit of $\sim$ 600~GeV for the LSP and NLSP masses.
In a second step we assume that the new result of the Run~1 of the "MUON G-2" collaboration at Fermilab yields a precision comparable to the existing experimental result with the same central value. We analyze the potential impact of the combination of the Run~1 data with the existing \gmin2\ data on the allowed MSSM parameter space. We find that in this case the upper limits on the LSP and NLSP masses are substantially reduced by roughly 100~GeV. This would yield improved upper limits on these masses of $\sim$ 500~GeV.
In this way, a clear target could be set for future LHC EW searches, as well as for future high-energy e^+e^-~colliders, such as the ILC or CLIC.

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