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Long-Lived Superparticles with Hadronic Decays at the LHC

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Supersymmetry searches at the LHC are both highly varied and highly constraining, but the vast majority are focused on cases where the final-stage visible decays are prompt. Scenarios featuring superparticles with detector-scale lifetimes have therefore remained a tantalizing possibility for sub-TeV SUSY, since explicit limits are relatively sparse. Nonetheless, the extremely low backgrounds of the few existing searches for collider-stable and displaced new particles facilitates recastings into powerful long-lived superparticle searches, even for models for which those searches are highly non-optimized. In this paper, we assess the status of such models in the context of baryonic R-parity violation, gauge mediation, and mini-split SUSY. We explore a number of common simplified spectra where hadronic decays can be important, employing recasts of LHC searches that utilize different detector systems and final state objects. The LSP/NLSP possibilities considered here include generic colored superparticles such as the gluino and light-flavor squarks, as well as the lighter stop and the quasi-degenerate Higgsino multiplet motivated by naturalness. We find that complementary coverage over large swaths of mass and lifetime is achievable by superimposing limits, particularly from CMS's tracker-based displaced dijet search and heavy stable charged particle searches. Adding in prompt searches, we find many cases where a range of sparticle masses is now excluded from zero lifetime to infinite lifetime with no gaps. In other cases, the displaced searches furnish the only extant limits at any lifetime.

Oral or Poster Presentation

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