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Revisiting Bino-slepton Coannihilation Dark Matter in Light of Recent Experimental Results

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Despite being a simple and well-motivated thermal relic scenario, coannihilation dark matter (DM) has remained largely unexplored experimentally due to the difficulty of probing its nearly degenerate mass spectrum. Recent LHC searches, however, have improved sensitivity, enabling broader explorations of the parameter space. We revisit the Bino-slepton coannihilation scenario in Supersymmetric
(SUSY) models, incorporating the latest experimental results. We first focus on the minimal scenario, in which only the Bino-like neutralino and left- or right-handed sleptons are light (O(100) GeV), with all other SUSY particles decoupled. We find that the dark matter mass is constrained to be in the range of about 210–350 GeV (150–425 GeV) for left-handed (right-handed) slepton coannihilation, with lower bounds set by recent LHC searches. We then investigate scenarios with light Higgsino, where direct detection experiments impose strong constraints on the Higgsino mass. Finally, we discuss the implications of these constraints for the muon g − 2 in the BHR, BHL, and BLR scenarios, and find that the combined LHC and LZ limits constrain the SUSY contribution to $|\Delta a_\mu| \boxtimes 1.2 \times 10{-}9$

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