



Identifiant de la contribution : 31

Type : non spécifié

The Dark Side of Naturalness Beyond the MSSM

vendredi 16 janvier 2015 12:12 (14)

Direct searches of neutralino dark matter in underground scattering experiments constitute a significant pressure on weak scale naturalness in the MSSM. The resulting neutralino fine-tuning is almost as severe as that arising from the heavy stops required by a 125 GeV Higgs boson. We analyse in an effective field theory framework the implication for neutralino fine-tuning of MSSM extensions which solve the little hierarchy problem of the Higgs mass through the introduction of a heavy, non-decoupled supersymmetric sector. We argue that in these models the neutralino fine-tuning is parametrically worse than in the MSSM for gaugino dark matter. Thermally produced Higgsino dark matter typically displays a comparable level of fine-tuning with the noteworthy exception of dark matter below the WW annihilation threshold. This light Higgsino scenario is only mildly fine-tuned and, in contrast with the MSSM, it does not conflict with the LEP bound on chargino. Any improvement on either charged higgsino searches or direct dark matter detection would test this scenario.

Summary

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Classification par session : Dark Matter - Astroparticles