ID de Contribution: **35** Type: **Contributed talk**

Next-to-minimal dark matter at the LHC

mardi 26 juin 2018 16:50 (20 minutes)

We examine the collider signatures of a WIMP dark matter scenario comprising a singlet fermion and an SU(2) n-plet fermion, with a focus on n=3 and n=5. The singlet and n-plet masses are of the order of the electroweak scale. The n-plet contains new charged particles which will be copiously pair-produced at the LHC. Small mixing angles and near-degenerate masses, both of which feature naturally in these models, give rise to long-lived particles and their characteristic collider signatures. In particular, the n=5 model can be constrained by displaced lepton searches independently of the mixing angle, generically ruling out 5-plet masses below about 280 GeV. For small mixing angles, we show that there is a parameter range for which the model reproduces the observed thermal relic density but is severely constrained by disappearing track searches in both the n=3 and the n=5 cases. The n=3 model is further constrained by soft di-lepton searches irrespectively of whether any new particles are long-lived.

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Classification de Session: Parallel I

Classification de thématique: Dark matter at colliders