Contribution ID: **24** Type: **Oral Contributions**

Radiative Type III Seesaw Model and its collider phenomenology

Tuesday, September 13, 2016 5:10 PM (20 minutes)

We analyze the present bounds of a scotogenic model, the Radiative Type III Seesaw (RSIII), in which an additional scalar doublet and at least two fermion triplets of $SU(2)_L$ are added to the Standard Model (SM). In the RSIII the new physics (NP) sector is odd under an exact global Z_2 symmetry. This symmetry guaranties that the lightest NP neutral particle is stable, providing a natural dark matter (DM) candidate, and leads to naturally suppressed neutrino masses generated by a one-loop realization of an effective Weinberg operator. We focus on the region with the highest sensitivity in present and future LHC searches, with light scalar DM and at least one NP fermion triplet at the sub-TeV scale. This region allows for significant production cross-sections of NP fermion pairs at the LHC. We reinterpret a set of searches for supersymmetric particles at the LHC obtained using the package CheckMATE, to set limits on our model as a function of the masses of the NP particles and their Yukawa interactions. The most sensitive search channel is found to be dileptons plus missing transverse energy. In order to target the case of tau enhanced decays and the case of compressed spectra we reinterpret the recent slepton and chargino search bounds by ATLAS. For a lightest NP fermion triplet with a maximal branching ratio to either electrons or muons we exclude NP fermion masses of up to 650 GeV, while this bound is reduced to approximately 400 GeV in the tau-philic case. Allowing for a general flavor structure we set limits on the Yukawa couplings, which are directly related to the neutrino flavor structure.

Summary

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Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders