Contribution ID: **51** Type: **not specified**

Common origin of baryon asymmetry, dark matter and neutrino mass

Wednesday 25 September 2019 14:35 (15 minutes)

In this work, we explain three beyond standard model (BSM) phenomena, namely neutrino masses, the baryon asymmetry
of the Universe and Dark Matter, within a single model and in each explanation the right handed (RH) neutrinos play the
prime role. Indeed by just introducing two RH neutrinos we can generate the neutrino masses by the Type-I seesaw
mechanism. The baryon asymmetry of the Universe can arise from thermal leptogenesis from the decay of lightest RH
neutrino before the decoupling of the electroweak sphaleron transitions, which redistribute the $B-L$ number into a
baryon number. At the same time, the decay of the RH neutrino can produce the Dark Matter (DM) as an asymmetric Dark Matter component. The source of CP violation in the two sectors is exactly the same, related to the complex couplings of the neutrinos.
By determining the comoving number density for different values of the CP violation in the DM sector, we obtain
a particular value of the DM mass after satisfying the relic density bound. We also give prediction for the DM direct detection (DD) in the near future by different ongoing DD experiments.

Summary

In this work we have tried to solve three major puzzles of cosmology by the presence of two RH neutrinos and a Dark Sector charged under an $SU(2)_D$. The hidden sector of the model is chosen to resemble the SM electroweak sector, but with just two non mixing families, so that the mass of the DM particles could be similar to the SM fermions and the presence of the $SU(2)_D$ interaction is crucial for annihilating away all the symmetric Dark Matter components.

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Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics