Contribution ID: **2** Type: **Talk**

Coannihilation and scotogenic fermionic dark matter

Tuesday 19 December 2023 14:30 (20 minutes)

Though the Standard Model assumes the neutrinos to be massless, the phenomenon of neutrino oscillation shows that they have tiny but non-zero masses. Scotogenic models, in which neutrino masses are generated at one-loop level and remain tiny due to loop suppression, are very interesting in this regard. In these models, since the beyond Standard Model (BSM) particles entering inside the neutrino-mass-loop are assumed to be odd under Z_2 symmetry, they can be considered as dark matter depending on their mass hierarchy. We have examined the phenomenology of fermionic dark matter in the singlet-triplet scotogenic model, especially in light of fermion-fermion and fermion-scalar coannihilation. In our analysis, we have considered constraints arising stability and perturbativity, electroweak precision observables, collider searches, charged lepton flavour violation (cLFV), relic density and direct detection experiments of dark matter. We find that bounds from collider and/or cLFV disfavour light fermionic dark matter of mass below 60 GeV. We also notice that fermion-scalar coannihilation is necessary to obtain viable fermionic dark matter within the mass range of 60 GeV to 100 GeV, and beyond 100 GeV fermion-scalar and fermion-fermion coannihilation play complementary roles in different regions of parameter space.

Designation

Postdoc

Reference publication/preprint

2308.09135

Institution

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Session Classification: Parallel: DM + neutrino