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Mirror asymmetric dark matter and its direct detection

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Summary

The most popular class of candidates for dark matter are the stable weakly interacting massive particles (WIMPs), which arise in many well-motivated TeV scale extensions of the standard model. Their stability is guaranteed by some symmetries. However in most models, the energy densities of normal matter and dark matter are unrelated. In this talk, I review a model of asymmetric dark matter we proposed recently, in which the dark sector is an identical copy of both forces and matter of the standard model (SM) as in the mirror universe models discussed in literature. In addition to being connected by gravity, the SM and DM sectors are also connected at high temperature by a common set of heavy right-handed Majorana neutrinos via their Yukawa couplings to leptons and Higgs bosons. The lightest nucleon in the dark (mirror) sector is a candidate for dark matter. The out of equilibrium decay of right-handed neutrino produces equal lepton asymmetry in both sectors via resonant leptogenesis which then get converted to baryonic and dark baryonic matter. A kinetic mixing between the $U(1)$ gauge fields of the two sectors is introduced to guarantee the success of Big-Bang Nucleosynthesis and make the direct detection of the mirror dark matter possible. We explore how this model can be tested in direct search experiments. In particular, we point out that if the dark matter happens to be the mirror neutron, the direct detection cross section has the unique feature that it increases at low recoil energy unlike the case of conventional WIMPs. It is also interesting to note that the

predicted spin-dependent scattering could make
significant
contribution to the total direct detection rate, especially
for
light nucleus. With this scenario, one could explain
recent DAMA and CoGeNT results.

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