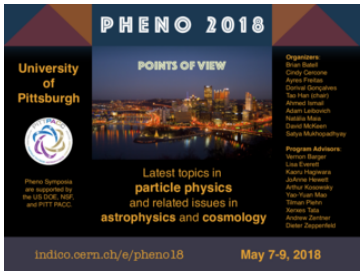

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Symmetric Two Higgs Doublet Model

Tuesday 8 May 2018 16:45 (15 minutes)

We present a simple twist in the well studied two Higgs doublet model in the form of an extra interchange symmetry between the two Higgs doublets ($\Phi_1 \leftrightarrow \Phi_2$). There is a residual Z_2 symmetry that remains unbroken after the original symmetry $\Phi_1 \leftrightarrow \Phi_2$ is spontaneously broken. This unbroken Z_2 symmetry makes the charged scalars $H^{\pm}$, the neutral scalar H and the pseudoscalar A to have Z_2 negative charges and all the other fields remain Z_2 positive. This, in turn, makes the lightest Z_2 negative particle, the neutral scalar H to be the candidate for Dark Matter. This neutral scalar H can be much lighter in mass in comparison to the Standard Model-(SM) like neutral scalar h having mass $m_h \simeq 125$ GeV as seen by the LHC. Interestingly this lighter neutral scalar H, as well as the charged scalars $H^{\pm}$ and the pseudoscalar A, do not couple to fermions. The lighter neutral scalars also don't have the usual three-point couplings with the Gauge bosons($W^{\pm}$ and Z) present in the Standard Model, but only have four-point couplings with $W^{\pm}$ and Z. As the neutral scalars h and H have interactions among them, the only way to produce the lightest Z_2 negative DM candidate H will be through the decays of the SM-like neutral scalar h where this SM-like neutral scalar h will have an extra invisible decay channel through $h \to HH$. Taking the Invisible decay branching ratio of the 125 GeV SM-like Higgs can be as large as $Br_{inv_h} < 25\%$, we have studied the parameter space of the effective coupling λ^* between the neutral scalars (hHH) and the mass of the DM candidate lighter neutral scalar m_H. We also comment on the other possible phenomenology for the charged scalars $H^{\pm}$ and pseudoscalar A.

Summary

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