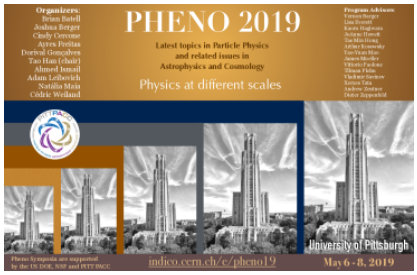

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Inflation, Proton Decay, and Higgs Portal Dark Matter in $SO(10) \times U(1)_\psi$

Monday 6 May 2019 17:30 (15 minutes)

We consider a simple non-supersymmetric $SO(10)$ grand unification in which a successful unification of the gauge couplings is realized with a two-step symmetry breaking (SB), for example, the $SO(10)$ group is broken into an intermediate Pati-Salam group at $M_{\rm GUT} \simeq 10^{16}$ GeV, which is further broken into the Standard Model (SM) group at an intermediate scale $M_I \simeq 10^{11}$ GeV. Both the SBs produce topologically stable monopoles whose abundance is severely constrained. A low scale inflationary scenario can inflate away these monopoles if the Hubble during the inflation (H_{inf}) is smaller than the SB scale which produces them. However, in a simple single field inflation scenario $H_{\rm inf} \gg M_I$, and hence the monopoles produced during the PS SB cannot be sufficiently diluted. To solve this problem, we consider an inflection-point inflation (IPI), a unique low scale single field inflation scenario which guarantees $H_{\rm inf} \ll 10^{11}$ GeV. To implement the IPI in the $SO(10)$ model, we propose a simple extension based on a gauge group $SO(10) \times U(1)_\psi$, where an $SO(10)$ singlet scalar is identified to be the inflaton. The model inclues 3 generations of fermions in **16** $(+1)$, **10** (-2), and **1** $(+4)$ representations, where the **16**-plets are the SM fermions (plus RHNs), and the extra new fermions are necessary to make the model anomaly-free. We consider various phenomenological constraints and theoretical consistencies, such as the successful gauge coupling unification, proton decay constraints, and stability of the SM Higgs potential. We identify a model parameter space which satisfies all these constraints. After the SBs a $\mathbf{Z}_2$ symmetry remains unbroken such that the lightest mass eigenstate of the **10**-plet and the singlet new fermion is a dark matter (DM) candidate. The DM particle communicates with SM particles through SM Higgs portal interactions. We show that the allowed parameter region for the DM scenario will be fully explored by the LUX-ZEPLIN DM experiment in the near future.

Summary

Non-SUSY SO(10) GUT

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