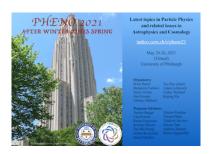
Phenomenology 2021 Symposium



Contribution ID: 1306 Type: Axions & ALPs

$SU(5) \times U(1)_X$ Axion Model with Observable Proton Decay

Monday, 24 May 2021 15:00 (15 minutes)

We propose a $SU(5)\times U(1)_X\times U(1)_{PQ}$ model, where $U(1)_X$ is the generalization of the B-L (baryon minus lepton number) gauge symmetry and $U(1)_{PQ}$ is the global Peccei-Quinn (PQ) symmetry. There are four fermions families in $\overline{\bf 5}+{\bf 10}$ representations of SU(5), a mirror family in ${\bf 5}+\overline{\bf 10}$ representations, and three SU(5) singlet Majorana fermions. The $U(1)_X$ related anomalies all cancel in the presence of the Majorana neutrinos. The SU(5) symmetry is broken at $M_{GUT}\simeq (4-7)\times 10^{15}$ GeV and the proton lifetime τ_p is estimated to be well within the expected sensitivity of the future Hyper-Kamiokande experiment, τ_p lesssim1.3 \times 10³⁵ years. The SU(5) breaking also triggers the breaking of the PQ symmetry, resulting in axion dark matter (DM), with the axion decay constant f_a of order M_{GUT} or somewhat larger. The CASPEr experiment can search for such axion DM candidates. With the identification of the $U(1)_X$ breaking Higgs field with the inflaton field, we implement low scale inflection-point inflation with $H_{inf}<10^9$ GeV which successfully resolve the cosmologically fatal axion domain wall, axion DM isocurvature and SU(5) monopole problems. The vectorlike fermions in the model are essential for achieving a successful unification of the SM gauge couplings as well as the phenomenological viability of both axion DM and inflation scenario.

Summary

Primary authors: RAUT, Digesh (University of Delaware); Prof. SHAFI, Qaisar (University of Delaware); OKADA, Nobuchika (University of Alabama)

Presenter: RAUT, Digesh (University of Delaware)

Session Classification: Axions & ALPs I