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Signals for heavy singlet neutrinos in natural warped seesaw and beyond

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Recently, it was shown that a canonical implementation of the type I seesaw mechanism in a warped extra dimensional framework is in reality a natural realization of “inverse” seesaw, i.e., the SM neutrino mass is dominantly generated by exchange of pseudo-Dirac weak-scale SM singlet neutrinos. We study signals from production of these heavy singlet neutrinos at the LHC, using the elementary-composite site parametrization of this model.

The composite gauge symmetry is assumed to be $SU(2)_L \times SU(2)_R \times U(1)_X$, with singlet neutrino being part of a doublet of $SU(2)_R$, thus charged under W_R and produced in its decays (similarly to 4D left-right (LR) symmetric models).

Naively, the direct coupling of light quarks to W_R is negligible, because former is elementary, while latter is composite. However, due to almost degeneracy of mass of composite W_L and W_R , we could obtain maximal mixing between these two after electro-weak symmetry breaking (EWSB), and thus on-shell production of W_R at hadron colliders becomes feasible. Also, because of compositeness of the relevant particles, the dominant decay channel for W_R involves the singlet neutrino and its $SU(2)_R$ doublet partner, i.e., a composite electron (instead of SM electron in 4D LR models). In turn, singlet neutrino can decay (as usual) into SM electron and W , while

the composite electron gives SM Higgs/ Z and SM electron.

We show that a signal of large enough significance is possible at the 14 TeV LHC with 300 fb^{-1} in the final states $l^\pm l^\mp jjH$ and $l^\pm l^\mp l^\pm H + \text{MET}$.

Furthermore, the singlet neutrino can also be pair produced via Z' (the gauge boson of composite $U(1)$ which is orthogonal to composite $U(1)_Y$), following a similar mixing with composite Z from EWSB. Besides, it is possible that singlet neutrinos can come from decays of composite partners of $SU(2)_L$ doublet leptons, which are absent in the 4D LR case. These possibilities might become relevant for the even higher luminosity run of the LHC.

Summary

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