Contribution ID: **14** Type: **not specified**

Constraints on Seesaw Models and Signatures at the LHC

Monday 20 July 2015 16:20 (20 minutes)

We consider variants of TeV-scale seesaw models in which two and three additional heavy right-handed neutrinos are added to the standard model to generate the hierarchical and quasidegenerate light neutrinos respectively. These models are theoretically interesting since they can be fully reconstructed from the neutrino oscillation data except for an unknown constant in the Dirac-Yukawa coupling. We study the constraints on this coupling
coming from metastability of the electroweak vacuum. An even stronger bound comes from the lepton flavor violating decays on these models, especially in a heavy neutrino mass scenario which is within the collider's reach. With these constrained parameters, we study the production of heavy neutrinos at the Large Hadron Collider through the dominant
s-channel production mode as well as the vector boson fusion process. The conventional same-sign-dilepton signal at the Large Hadron Collider is highly suppressed in such models. We analyze the collider signatures with the trilepton final state and missing transverse energy as well as vector boson fusion type signals which are characterized by
two additional forward tagged jets. Our investigation reveals that due to stringent constraints on light-heavy mixing coming from lepton flavor violation and metastability bounds, the model can be explored only for a light to moderate mass range of heavy neutrinos.

Summary

Collider signatures at 14 TeV LHC have been performed in the context of realistic seesaw models (i.e. seesaw models those successfully account all the neutrino oscillation data). Effect of CP-violating phases on such signals has been discussed.

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Session Classification: Student talks