Contribution ID: **88** Type: **not specified**

Neutrinos from the LHC: Neutral Current Measurements and Electromagnetic Properties at the FPF

Monday 9 May 2022 17:15 (15 minutes)

The significant neutrino flux at high rapidity (far forward direction) at the LHC has so far gone unstudied and wasted. The proposed Forward Physics Facility (FPF) aims to redress this by having dedicated detectors to study neutrinos at TeV energies. In this talk I will present some phenomenological studies in this direction. i) Charged current neutrino interactions have been extensively studied in the context of various experiments. The presence of a charged lepton in the final state allows for easy identification of candidate signal events and incoming beam energy reconstruction. Neutral current neutrino interactions on the other hand have a neutrino in the final state making signal vs background differentiation, and energy reconstruction much more difficult. We present a technique using machine learning tools to overcome these difficulties and constrain NC cross-section in 100 GeV - a few TeV range. We can convert this sensitivity to limits on neutrino NSI. ii) The electromagnetic properties of neutrinos (magnetic moments, milli-charge, charge radius) have attracted significant interest recently. We make use of the enhanced neutrino flux expected in the HL-LHC era along with the sophisticated detectors at the FPF to constrain these properties. If a new sterile state exists that couple to SM neutrino via the photon through a dipole portal, then it will also leave a signature in these detectors via up-scattering. This allows us to constrain the magnetic dipole moment interaction between SM neutrinos and this new sterile state.

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Session Classification: Neutrinos I