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Heavy Neutrino Searches at Future Colliders

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We discuss the future prospects of heavy neutrino searches at future lepton colliders. In particular, we focus on the planned electron-positron colliders, operating in two different beam modes, namely, e^+e^- and e^-e^- . In the e^+e^- beam mode, we consider various production and decay modes of the heavy neutrino (N), and find that the final state with $e + 2j + \cancel{E}$, arising from the $e^+e^- \rightarrow N\nu$ production mode, is the most promising channel. However, since this mode is insensitive to the Majorana nature of the heavy neutrinos, we also study a new production channel $e^+e^- \rightarrow Ne^\pm W^\mp$, which leads to a same-sign dilepton plus four jet final state, thus directly probing the lepton number violation in e^+e^- colliders. In the e^-e^- beam mode, we study the prospects of the lepton number violating process of $e^-e^- \rightarrow W^-W^-$, mediated by a heavy Majorana neutrino. We use both cut-based and multivariate analysis techniques to make a realistic calculation of the relevant signal and background events, including detector effects.

Author: DEV, Bhupal (University of Manchester)

Presenter: DEV, Bhupal (University of Manchester)

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