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Testing tree level TeV scale seesaw scenarios in μTRISTAN

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We investigate TeV scale seesaw scenarios at μ^+e^- and $\mu^+\mu^+$ colliders in the μTRISTAN experiment. In minimal type-I seesaw scenario we consider two generations of Standard Model (SM) singlet heavy Majorana type Right Handed Neutrinos (RHNs) which couples with SM gauge bosons through light-heavy neutrino mixing. \bl{We discuss the prospects of probing heavy neutrinos via the processes such as $\mu^+e^- \to \nu N_i \to e^+jj\nu$ or $\mu^-jj\nu$ for $\sqrt{s} = 346$~GeV and 1 ab^{-1} luminosity. Studying these process, we estimate limits on the light-heavy neutrino mixing angles as a function of heavy neutrino mass, which could be two orders of magnitude stronger than electroweak precision data.} Further, we study the effect of doubly charged scalar boson (H^{++}) from the type-II seesaw scenario in $\mu^+\mu^+$ collision at $\sqrt{s} = 2$ TeV. In this case we consider $\mu^+\mu^+ \to \ell_i^+\ell_j^+$ and $\mu^+\mu^+ \to H^{++}Z/\gamma$ processes followed by the same sign dilepton decay of H^{++}. We find that events involving e^+e^+ among these final states can probe the neutrino mass ordering in μTRISTAN experiment at 5σ significance. In addition to that we study the production of positively charged triplet fermion in μTRISTAN following $\mu^+\mu^+ \to \mu^+\Sigma^+$ process where Σ^+ decays into μ^+jj mode through Z boson exchange. Considering a triplet at 1 TeV and studying SM backgrounds we estimate the discovery potential of $\mu^+\mu^+jj$ signal at μTRISTAN with respect to projected luminosity.

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