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Heavy neutrino signals in models with extended lepton sector

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Although the Standard Model (SM) has become the main theory that describes modern Particle Physics, it fails to answer a number of questions. The most famous of «problems beyond the SM» is the origin of neutrino mass, while SM considers only left massless neutrinos.
To explain «problems beyond the SM», it is necessary to introduce new particles and interactions, which haven't yet been detected, possibly because these particles have large mass or they interact weakly. Although the see-saw mechanism describes the scale of neutrino masses well, the masses of heavy neutral leptons (HNL) have a huge range and it's difficult to narrow the search interval. Detection methods may differ for masses of various orders of magnitude.
A relevant challenge for the planned experiments (e.g., SHiP at CERN) is to find the mass scale of HNL. Creating models using the LanHEP software package tools and testing them by means of CompHEP system will allow us not only to understand how well the obtained data coincide with experiments, but also to predict possible parameters to search for new particles on detectors. We can also study in CompHEP rare decays and production of HNL or other processes with them.
We consider several extensions of the SM lepton sector that take into account both Dirac and Majorana neutrinos. The model using only the Dirac mass type, as expected, differs from the experimental data. Two models were studied for Majorana neutrinos: a simplified model with one light and heavy neutrino, and a complete model with three generations.
The results for cross sections and exclusion contours in the model parameter space are presented for the process $e^+e^- \to \nu_e e^- u\bar{d}$ at complete tree-level set of diagrams. A comparison was made with the contours obtained in the L3 and DELPHI experiments in the simplified model.
For a model with three generations, contours were calculated for a specific case of parameterization of the Dirac mass matrix. The mixing structure is non-trivial, since the widths of all three HNL are considered. The exclusions for this model have taken into account cosmological observations.

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