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Low scale type II seesaw: Present constraints and prospects for displaced vertex searches

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The type II seesaw mechanism is an attractive way to generate the observed light neutrino masses. It postulates a $SU(2)_L$-triplet scalar field, which develops an induced vacuum expectation value after electroweak symmetry breaking, giving masses to the neutrinos via its couplings to the lepton $SU(2)_L$-doublets. When the components of the triplet field have masses around the electroweak scale, the model features a rich phenomenology. We discuss the current allowed parameter space of the minimal low scale type II seesaw model, taking into account all relevant constraints, including charged lepton flavour violation as well as collider searches.
We point out that the symmetry protected low scale type II seesaw scenario, where an approximate "lepton number"-like symmetry suppresses the Yukawa couplings of the triplet to the lepton doublets, is still largely untested by the current LHC results.
In part of this parameter space the triplet components can be long-lived, potentially leading to a characteristic displaced vertex signature where the doubly-charged component decays into same-sign charged leptons. By performing a detailed analysis at the reconstructed level we find that already at the current run of the LHC a discovery would be possible for the considered parameter point,
via dedicated searches for displaced vertex signatures.
The discovery prospects are further improved at the HL-LHC and the FCC-hh/SppC.

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