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Loop-corrected Higgs Masses in the NMSSM with Inverse Seesaw Mechanism

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The Next-to-Minimal Supersymmetric extension of the Standard Model (NMSSM) including additionally six leptonic singlet superfields can explain the small active neutrinos masses via the inverse seesaw mechanism (ISS), while it still allows for large values of the neutrino Yukawa couplings with a mass scale of sterile neutrinos of order TeV. While R-parity is conserved in this model, lepton number is explicitly violated. The extended (s)neutrino sector therefore can affect the Higgs sector and the lepton flavor-violating observables through radiative corrections. We investigated these impacts by computing the complete one-loop corrections with full momentum dependence and consistently combined them with the dominant two-loop corrections at $\mathcal{O}(\alpha_s\alpha_t + \alpha_t^2)$ to the Higgs boson masses and their mixings. We further computed the radiative decays $l_i \to l_j + \gamma$, and the oblique parameters S, T, U at one-loop level. In our numerical study, we showed that these impacts can be significant depending on the parameter space. We take into account the constraints from the Higgs data, the neutrino oscillation data, the lepton flavor-violating decays, and the oblique parameters to have a realizable analysis. Our computations have been implemented in the public Fortran code `NMSSMCALC-nuSS` that computes the Higgs mass spectrum as well as the Higgs boson decay widths including the state-of-the-art higher-order corrections.

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