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Neutrino masses from SUSY breaking in radiative seesaw models

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requirecancel

def
SUSYSUSY

def
nSUSYcancelSUSY

def
Msoftm_{soft}

def
nSUSYEWSBnSUSYEWSB

def
nSUSYEWSnSUSYEWS

Radiatively generated neutrino masses (m_ν) are proportional to supersymmetry (SUSY) breaking, as a result of the SUSY non-renormalisation theorem. In this work, we investigate the space of SUSY radiative seesaw models with regard to their dependence on SUSY breaking (

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cancelSUSY). In addition to contributions from sources of *nSUSY* that are involved in electroweak symmetry breaking (*nSUSYEWSB* contributions), and which are manifest from $\langle F_H^\dagger \rangle = \mu \langle \bar{H} \rangle \neq 0$ and $\langle D \rangle = g \sum_H \langle H^\dagger \otimes H \rangle \neq 0$, radiatively generated m_ν can also receive contributions from *nSUSY* sources that are unrelated to EWSB (*nSUSYEWS* contributions). We point out that recent literature overlooks pure-

nSUSYEWSB contributions ($\propto \mu/M$) that can arise at the same order of perturbation theory as the leading order contribution from *nSUSYEWS*.

We show that there exist realistic radiative seesaw models in which the leading order contribution to m_ν is proportional to

nSUSYEWS. To our knowledge no model with such a feature exists in the literature. We give a complete description of the simplest model-topologies and their leading dependence on

nSUSY. We show that in one-loop realisations *LLHH* operators are suppressed by at least μ

Msoft/M³ or

Msoft²/M³. We construct a model example based on a one-loop type-II seesaw. An interesting aspect of these models lies in the fact that the scale of soft-

nSUSY effects generating the leading order m_ν can be quite small without conflicting with lower limits on the mass of new particles.

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