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Pinning Down Two Right-Handed Neutrinos with Neutrinoless Double Beta Decay

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The addition of two gauge singlet right-handed neutrinos to the Standard Model conveniently explains neutrino oscillations, while also potentially explaining the matter-antimatter asymmetry. The possible Majorana nature of neutrinos resulting from this modification can lead to observable signals in the form of neutrinoless double beta decay. Recent calculations show that the neutrinoless double beta decay rates may be underestimated in the standard parametrisation, calling for a better computation from an EFT perspective. The computations reveal significant differences in the amplitude, especially for light neutrinos where the ultra-soft mode becomes relevant. We show that, in the inverted mass ordering of neutrinos, with future limits on neutrinoless double beta decay, it is possible to precisely pin down the regions in the mass-coupling parameter space where a model with two right-handed neutrinos could exist, and that these regions are subject to cosmological constraints while also being a target for future collider and beam dump searches.

Primary author: PLAKKOT, Vaisakh (University of Amsterdam & Nikhef)**Presenter:** PLAKKOT, Vaisakh (University of Amsterdam & Nikhef)**Session Classification:** Theory**Track Classification:** Theory