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Quantum Effects on Neutrino Parameters from a Flavored Gauge Boson

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Over the past two to three decades neutrino oscillation experiments have shown that neutrinos are massive and mix significantly. This can be described largely model-independently using the dimension-five Weinberg operator, giving rise to Majorana neutrino masses after electro-weak symmetry breaking. Its renormalization and running effects have also been increasingly considered. It was found that the rank of the mass matrix cannot be increased at the one-loop level, while two-loop running effects can raise the rank via Yukawa interactions. However, effects from flavor-dependent gauge interactions have not been taken into account until now. We show that in such theories, the rank of the mass matrix can be increased already at the one-loop level, generating non-zero neutrino masses via RGE running, presenting the only possibility to do so. We elucidate this mechanism using the example of a U(1){Lmu - Ltau} gauge extension with an anarchical structure of the mass matrix, and a possible ultraviolet completion with right-handed neutrinos in a Type-I Seesaw model.

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