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An on-shell perspective on neutrino oscillations and non-standard interactions

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We apply on-shell amplitude techniques to the study of neutrino oscillations in vacuum, focussing on processes involving W bosons. We start by determining the 3-point amplitude involving one neutrino, one charged lepton and one W boson, highlighting all the allowed kinematic structures. The result we obtain contains terms generated at all orders in an expansion in the cutoff scale of the theory, and we explicitly determine the lower dimensional operators behind the generation of the different structures. We then use this amplitude to construct the 4-point amplitude in which neutrinos are exchanged in the s -channel, giving rise to oscillations. We also study in detail how flavor enters in the amplitudes, and how the PMNS matrix emerges from the on-shell perspective.

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