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Origin of Neutrino Masses on the Convex Cone of Positivity Bounds

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We exhibit the geometric structure of the convex cone in the linear space of the Wilson coefficients for the dimension-8 operators involving the left-handed lepton doublet L and the Higgs doublet H in the Standard Model effective field theory (SMEFT). The boundary of the convex cone gives rise to the positivity bounds on the Wilson coefficients, while the extremal ray corresponds to the unique particle state in the theory of ultra-violet completion. Among three types of canonical seesaw models for neutrino masses, we discover that only right-handed neutrinos in the type-I seesaw model show up as one of extremal rays, whereas the heavy particles in the type-II and type-III seesaw models live inside the cone. The experimental determination of the relevant Wilson coefficients close to the extremal ray of type-I seesaw model will unambiguously pin down or rule out the latter as the origin of neutrino masses. This discovery offers a novel way to distinguish the most popular seesaw model from others, and also strengthens the SMEFT as an especially powerful tool to probe new physics beyond the Standard Model.

In-person participation

No

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