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Asymptotic grand unification in SO(10)

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Asymptotic unification, distinct from the conventional concept of unification, suggests that couplings unify at a non-trivial ultraviolet (UV) fixed point. Theory with an interacting UV fixed point is normally referred to as asymptotic safety to address the famous UV Landau pole problem. Alternative to a usual grand unified theory (GUT), an asymptotic GUT gradually unifies gauge couplings in the deep UV limit. Using an economical and realistic particle content setup, we demonstrate that asymptotic grand unification can be achieved in SO(10) with one extra dimension. One intermediate scale, the Pati-Salam symmetry breaking scale, is included below the compactification scale. The top, bottom and tau masses are split, and the smallness of the neutrino mass is explained via inverse seesaw. Due to the absence of large-dimensional Higgs representations, gauge couplings exhibit asymptotic safety and are thus asymptotically unified, regardless of their initial values. In contrast, Yukawa couplings can achieve asymptotic freedom if the negative gauge contributions dominate over the positive Yukawa terms.

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