

W Boson Mass and Grand Unification (30' talk + 15' discussion)

Thursday 20 April 2023 14:45 (45 minutes)

It is known that the recently reported shift of the W boson mass can be easily explained by an $SU(2)_L$ triplet Higgs boson with zero hypercharge if it obtains a vacuum expectation value of $O(1)$ GeV.

Surprisingly, the addition of a TeV scale complex triplet Higgs boson to the standard model leads to a precise unification of the gauge couplings at around 10^{14} GeV.

Although it seems the proton decay constraints would doom such a low unification scale, I will show that the constraints can be avoided by introducing vector-like fermions which mix with the SM fermions through mass terms involving the GUT breaking Higgs field.

As I will discuss, this will lead to a scenario which is not ruled out but could be tested in near future proton decay experiments. Importantly, the simplest viable model only requires the addition of one pair of vector-like fermions transforming 10 and $\bar{10}$.

I will also discuss a minor tweak to this model which will allow us to identify the other triplet as dark matter. Lastly, I will discuss the more general ramifications of the W boson mass for grand unification.

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