

The Two Scales of New Physics in Higgs Couplings

[arXiv:2305.19325 [hep-ph]]

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Higgs Hunting 2023

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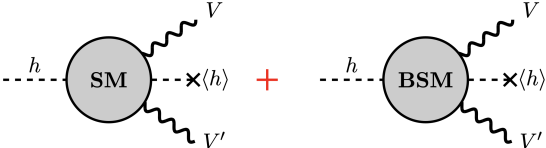


General Idea

Higgs mass:



Production and decay:

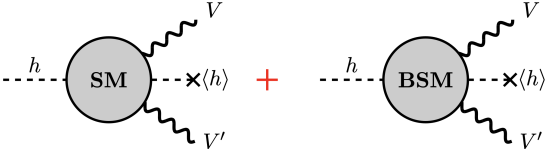


General Idea

Higgs mass:



Production and decay:



MODEL-INDEPENDENT STATEMENT?

Naturalness \longleftrightarrow Higgs couplings

Proof by Contradiction

How to bound new bosons?

- ▶ BSM fermions in generic representation
- ▶ Yukawas $\mathcal{L} \supset -yLHN^c - y^c L^c H^\dagger N$



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 1. **Deviations** in hWW and hZZ
 2. **Instability** in RGEs



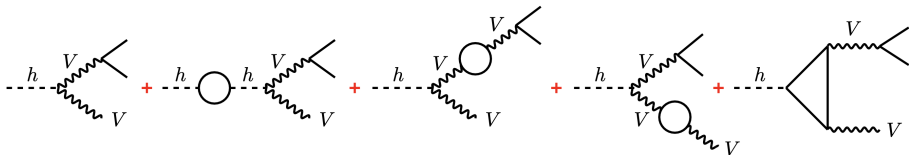
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 1. **Deviations** in hWW and hZZ
 2. **Instability** in RGEs
- ▶ Vary masses and representations
- ▶ **Upper bound** on Λ_B



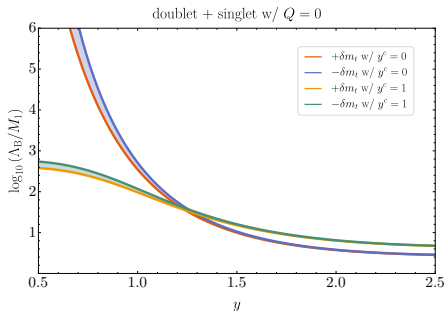
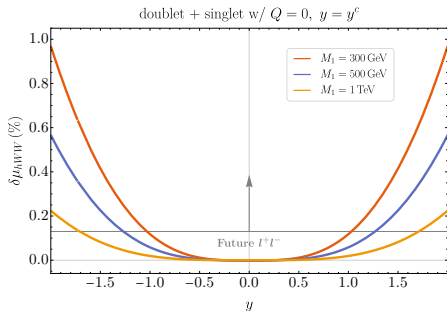
Practical Overview



Three steps:

- ▶ Renormalize SM + VLFs $\rightarrow \delta\mu_{hVV} \sim f(y, M)$

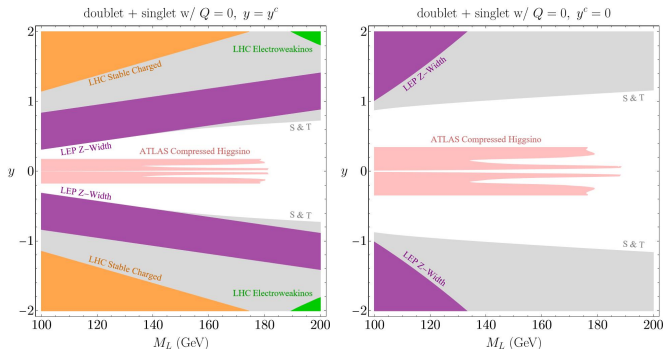
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Practical Overview

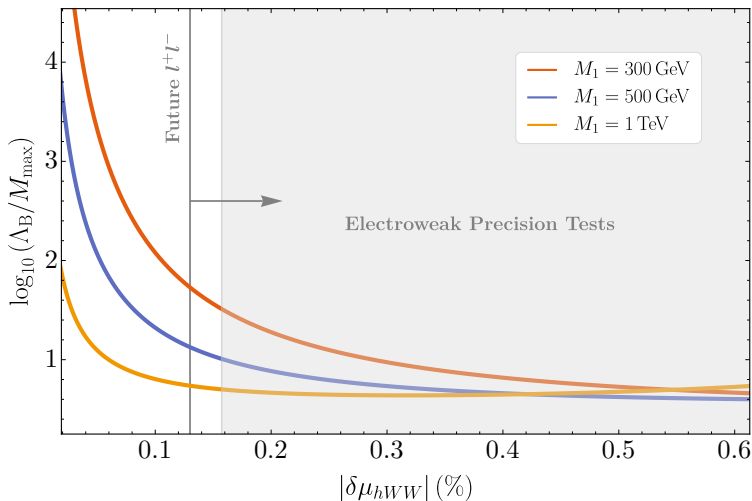


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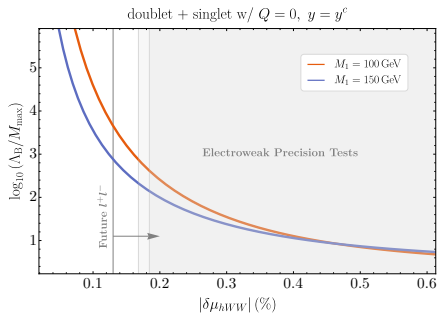
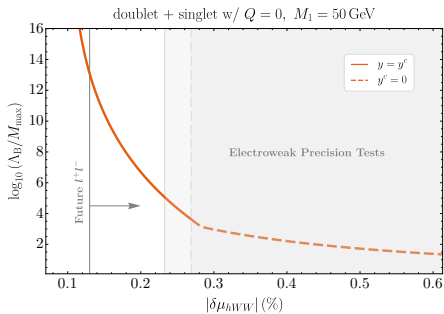
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- ▶ **Experimental** constraints (EWPTs, collider)

Money Plots

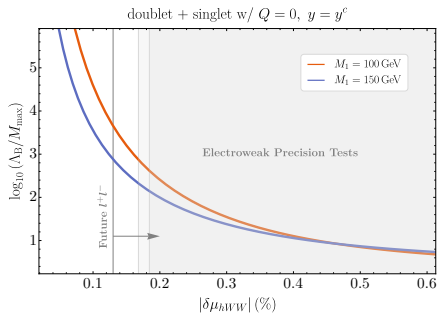
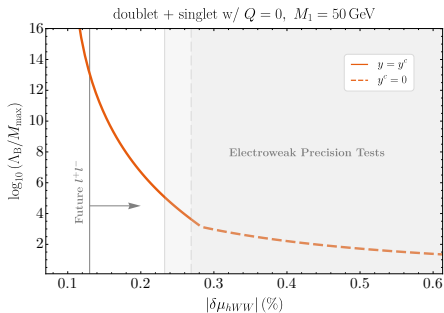
doublet + singlet w/ $Q = 0$, $y = y^c$



Money Plots



Money Plots



Take-home message:

- ▶ Future collider deviation?
- ▶ Either light **new fermions**
- ▶ Or **new bosons** under 100 TeV

Thank you!