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2025061L

Why is the Higgs so light?

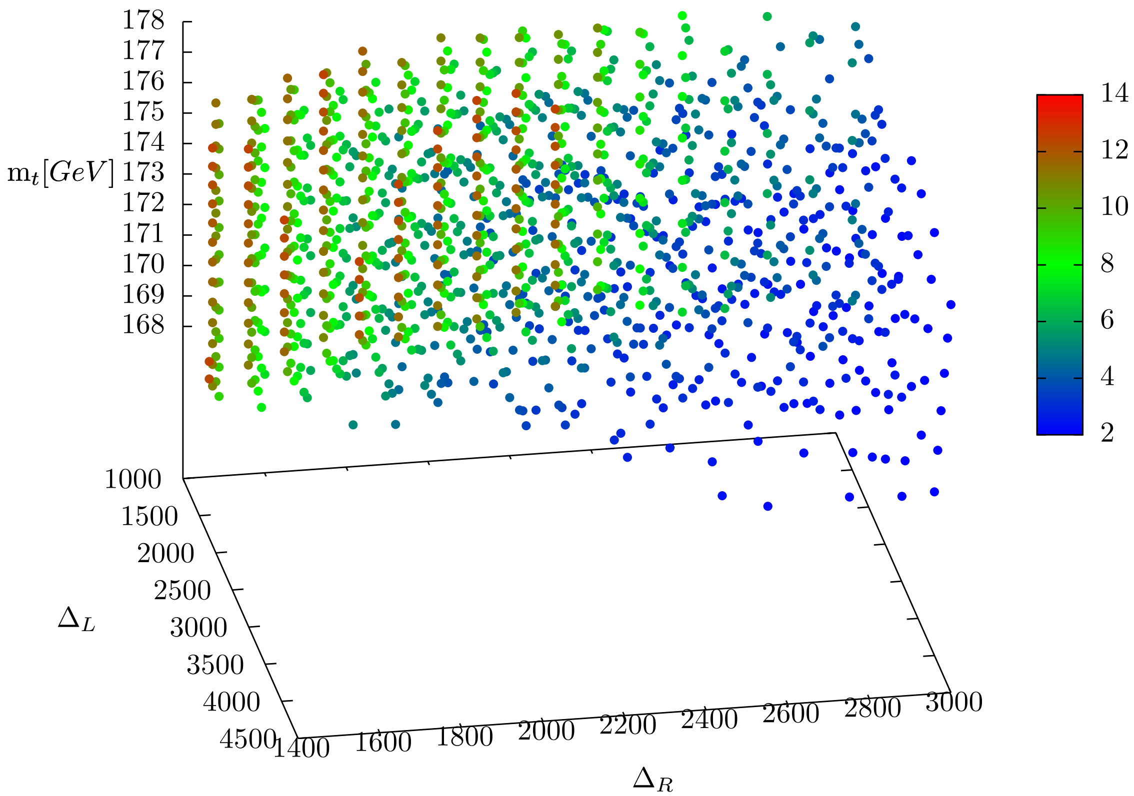
- Quantum corrections are expected to drive the Higgs mass to ~10^{19} GeV (Planck scale)
- Standard Model requires (and we observe) a Higgs mass around 125 GeV
- A large fine-tuning is required to offset this

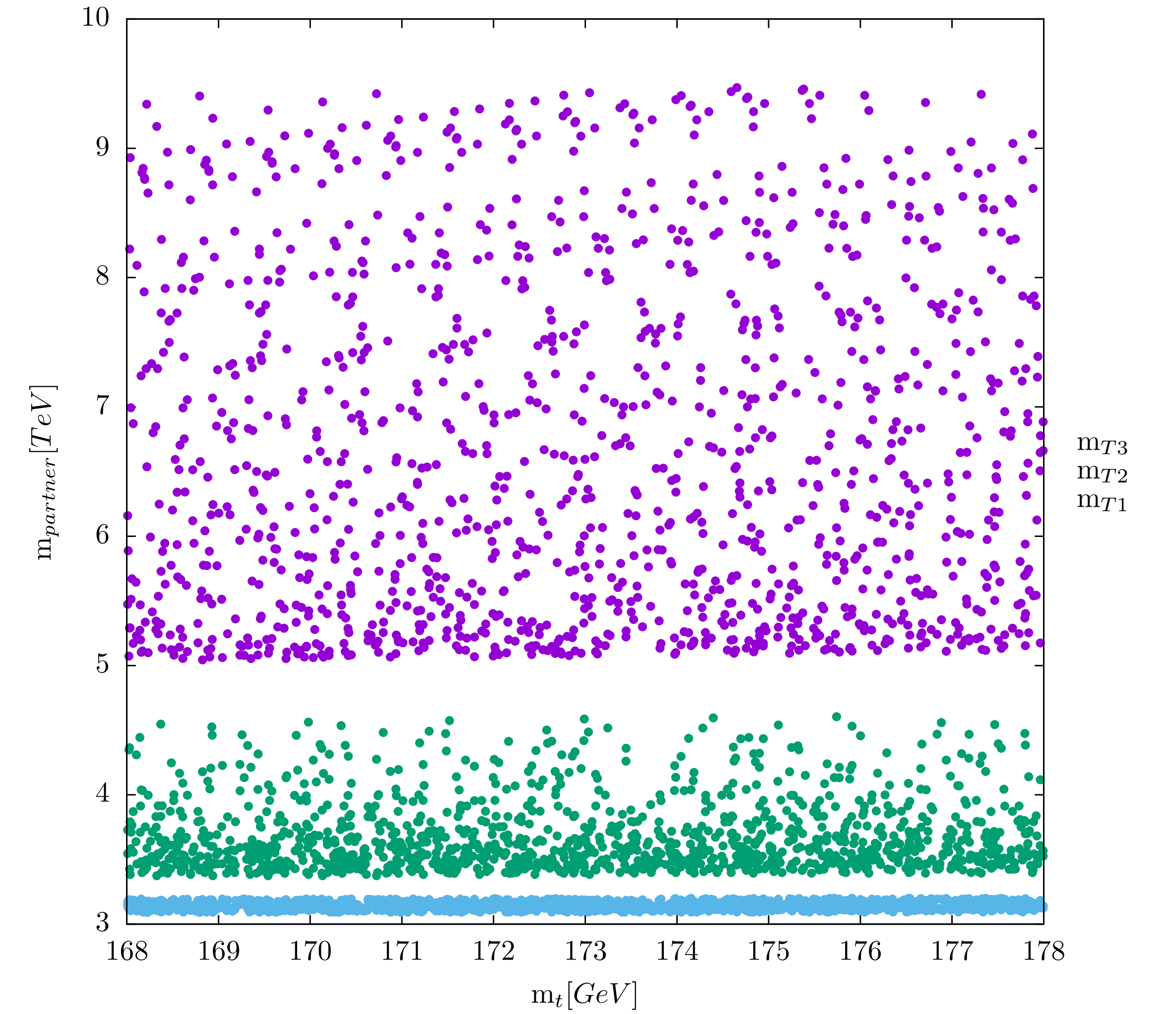
Composite Higgs models offer a more natural solution

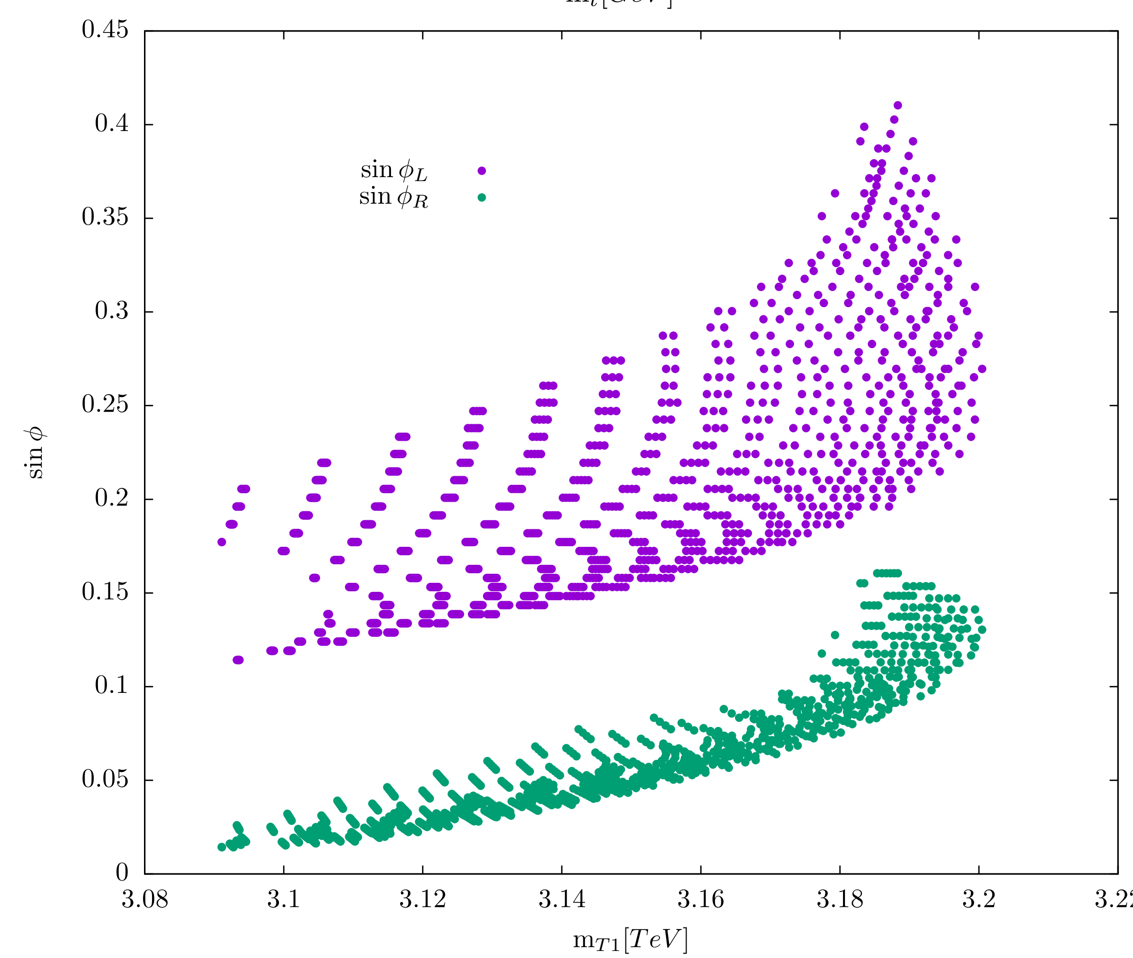
- Consider the Higgs as a strongly interacting bound state (analogous to the pion)
- Fermionic resonances are described using partial compositeness [arXiv:1206.7120v2]

$$-\mathcal{L}_m = \overline{\begin{pmatrix} t_L \\ T_L \\ X_L^{2/3} \\ \tilde{T}_L \end{pmatrix}} \underbrace{\begin{pmatrix} 0 & \Delta_L & 0 & 0 \\ 0 & M_0 + \frac{fys^2}{2} & \frac{yfs^2}{2} & \frac{yfsc}{\sqrt{2}} \\ 0 & \frac{yfs^2}{2} & M_0 + \frac{fys^2}{2} & \frac{yfsc}{\sqrt{2}} \\ \Delta_R & \frac{yfsc}{\sqrt{2}} & \frac{fysc}{\sqrt{2}} & M_0 + yfc^2 \end{pmatrix}}_{M^t} \begin{pmatrix} t_R \\ T_R \\ X_R^{2/3} \\ \tilde{T}_R \end{pmatrix} + h.c.$$

Solutions are found at energy scales currently probed at LHC







$$M_0 = 3000\ GeV$$

$$0.5 \leq \frac{\Delta_L}{\Delta_R} \leq 1.5$$

Current experimental bounds set $m_T \gtrsim 855$ GeV [arXiv:1505.04306v3] where theoretical bounds are lacking

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