

First Order EWPT & Limited LHC Sensitivity

$$V = V_{\text{SM}} + C_6|H|^6 + C_8|H|^8.$$

BM EFT-C6 $C_6 = \frac{m_h^2}{v^4} = 4.27 \times 10^{-6}, \quad C_8 = 0. \quad \lambda_3 = 3\lambda_3^{\text{SM}}$

Generates a strong first-order EWPT. hh production cross section is suppressed.

BM EFT-C8 $C_6 = -1.2\frac{m_h^2}{v^4} = -6.83 \times 10^{-6}, \quad C_8 = 1.08 \times 10^{-4}\frac{m_h^2}{v^6} = 7.70 \times 10^{-15} \quad \lambda_3 = 4.58\lambda_3^{\text{SM}}$

Generates a strong first-order EWPT. hh production cross section is enhanced, but the LHC sensitivity is limited.

BM singlet $V(\phi_h, \phi_s, T) = \frac{m_0^2 + a_0 T^2}{2} \phi_h^2 + \frac{\lambda_h}{4} \phi_h^4 + a_{hs} \phi_s \phi_h^2 + \frac{\lambda_{hs}}{2} \phi_s^2 \phi_h^2 + t_s \phi_s + \frac{m_s^2}{2} \phi_s^2 + \frac{a_s}{3} \phi_s^3 + \frac{\lambda_s}{4} \phi_s^4$

m_{singlet} (GeV)	$\sin^2 \theta$	v_s (GeV)	λ_h	λ_{hs}
1000	0.23	-1159	2	1

$$\lambda_3 = 2.24\lambda_3^{\text{SM}}$$

Generates a strong first-order EWPT. hh production cross section is suppressed.

Deficits in cross section at the LHC can be hints for new physics. Future lepton (and hadron collider) will be sensitive. New search strategies for large trilinear coupling