Two-real-scalar Produktion

Vergleich von Wirkungsquerschnittgrenzen
der Higgspaarproduktion im $b\bar{b}WW^*$- Zerfallskanal mit Vorhersagen der
Two-real-scalar-singlet Erweiterung des SM

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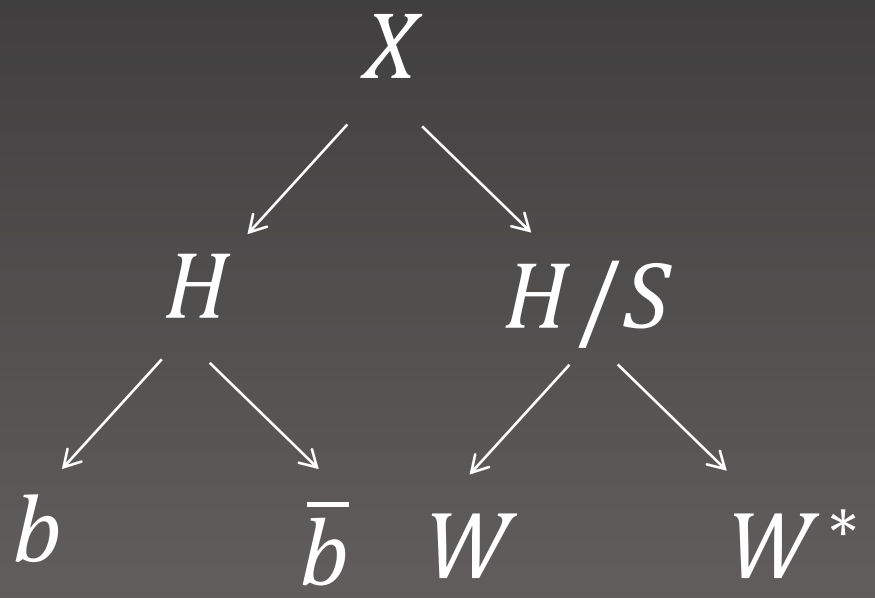
TRSM im $b\bar{b}WW^*$- Kanal

- Suche nach Physik über SM hinaus
- Two-real-scalar Singlet Erweiterung des SM
- Singlet Felder X und S
- $m_x > m_S > m_H$
- W nicht mehr virtuell



Freie Parameter

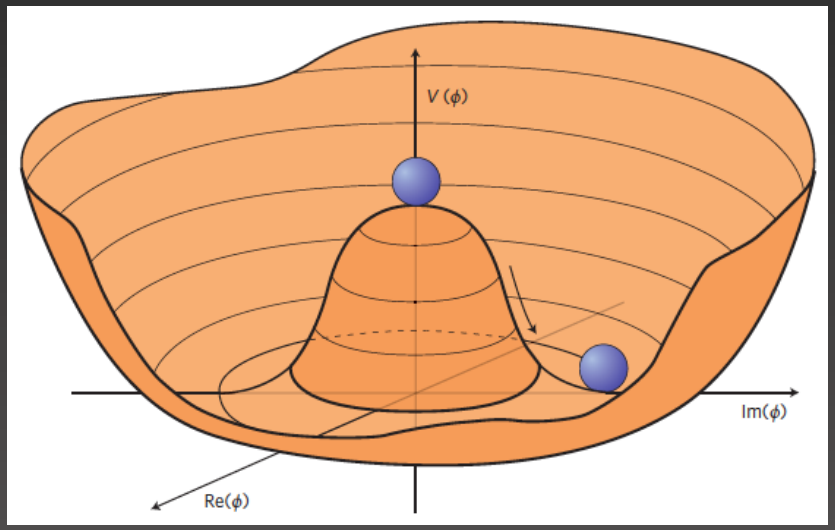
$$V(\Phi) = \mu_\Phi^2 \Phi\Phi^\dagger + \lambda_\Phi (\Phi\Phi^\dagger)^2$$

$$\partial_\phi V(\Phi) = 0 \rightarrow \frac{-\mu_\Phi^2}{2\lambda_\Phi} = v^2$$

Elektroschwache Symmetriebrechung

$$V(\phi_i, \Phi) = V_{Singlets}(\phi_i, \Phi) + V_{SM}(\Phi)$$

$$\Phi = \begin{pmatrix} 0 \\ \frac{\phi_h + v_h}{\sqrt{2}} \end{pmatrix}, \qquad S = \frac{\phi_S + v_S}{\sqrt{2}}, \qquad X = \frac{\phi_X + v_X}{\sqrt{2}}$$



$\mu_\Phi^2 < 0$

Freie Parameter

Higgs: $v_h = 246\ GeV,\ m_h = 125.09\ GeV$

- Mixing Matrix R durch $\theta_{hS}, \theta_{hX}, \theta_{SX}$ parametrisiert

$$\begin{pmatrix} h_1 \\ h_2 \\ h_3 \end{pmatrix} = R \begin{pmatrix} \phi_h \\ \phi_S \\ \phi_X \end{pmatrix}$$

→ Freie Input Parameter: $M_S, M_X, \theta_{hS}, \theta_{hX}, \theta_{SX}, v_S, v_X$

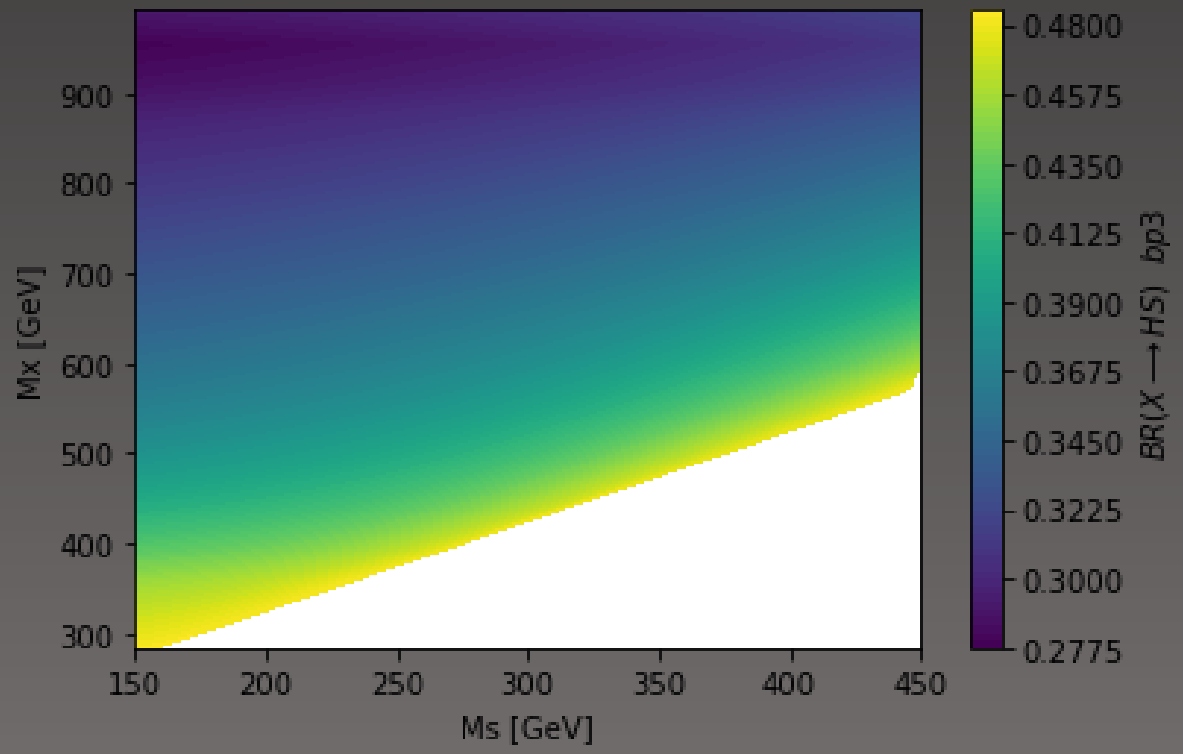
Benchmark Szenarios

- Benchmark 3 und 6: $m_x > m_S > m_H$
- BP3: $X \rightarrow HS$
- BP6: $X \rightarrow HH$

Parameter	Benchmark scenario					
	BP1	**BP2**	**BP3**	**BP4**	**BP5**	**BP6**
M_1 [GeV]	$[1, 62]$	$[1, 124]$	125.09	$[1, 62]$	$[1, 124]$	125.09
M_2 [GeV]	$[1, 124]$	125.09	$[126, 500]$	$[1, 124]$	125.09	$[126, 500]$
M_3 [GeV]	125.09	$[126, 500]$	$[255, 650]$	125.09	$[126, 500]$	$[255, 1000]$
θ_{hs}	1.435	1.352	-0.129	-1.284	-1.498	0.207
θ_{hx}	-0.908	1.175	0.226	1.309	0.251	0.146
θ_{sx}	-1.456	-0.407	-0.899	-1.519	0.271	0.782
v_s [GeV]	630	120	140	990	50	220
v_x [GeV]	700	890	100	310	720	150
κ_1	0.083	0.084	0.966	0.073	0.070	0.968
κ_2	0.007	0.976	0.094	0.223	-0.966	0.045
κ_3	-0.997	-0.203	0.239	0.972	-0.250	0.246

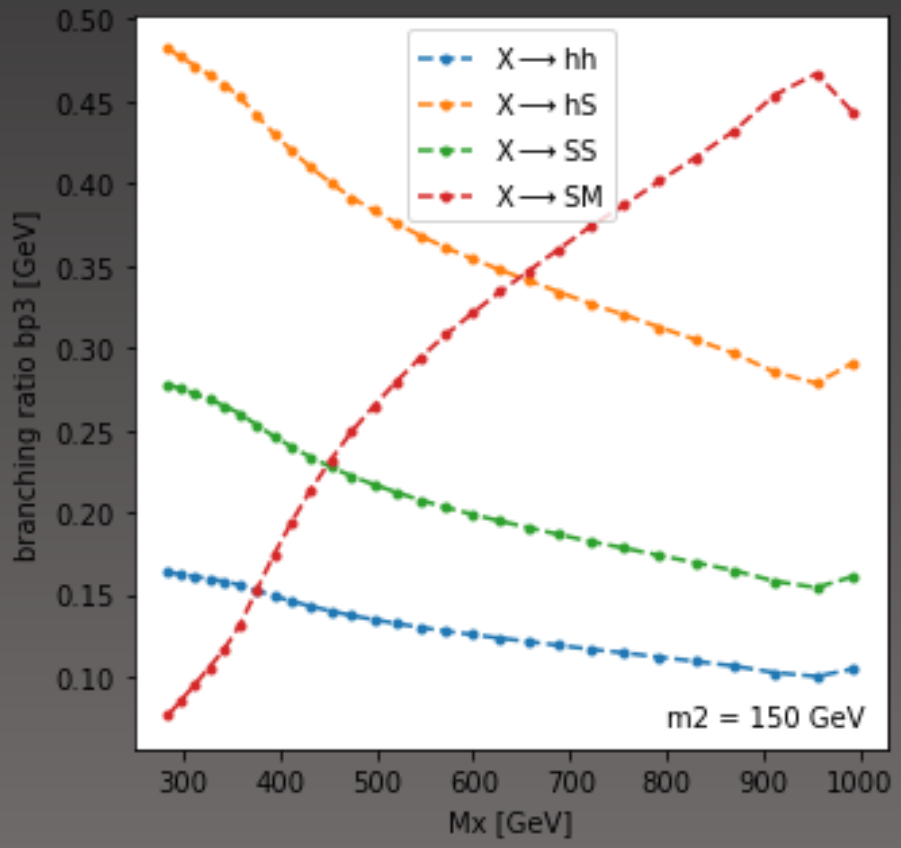
Branching Ratio

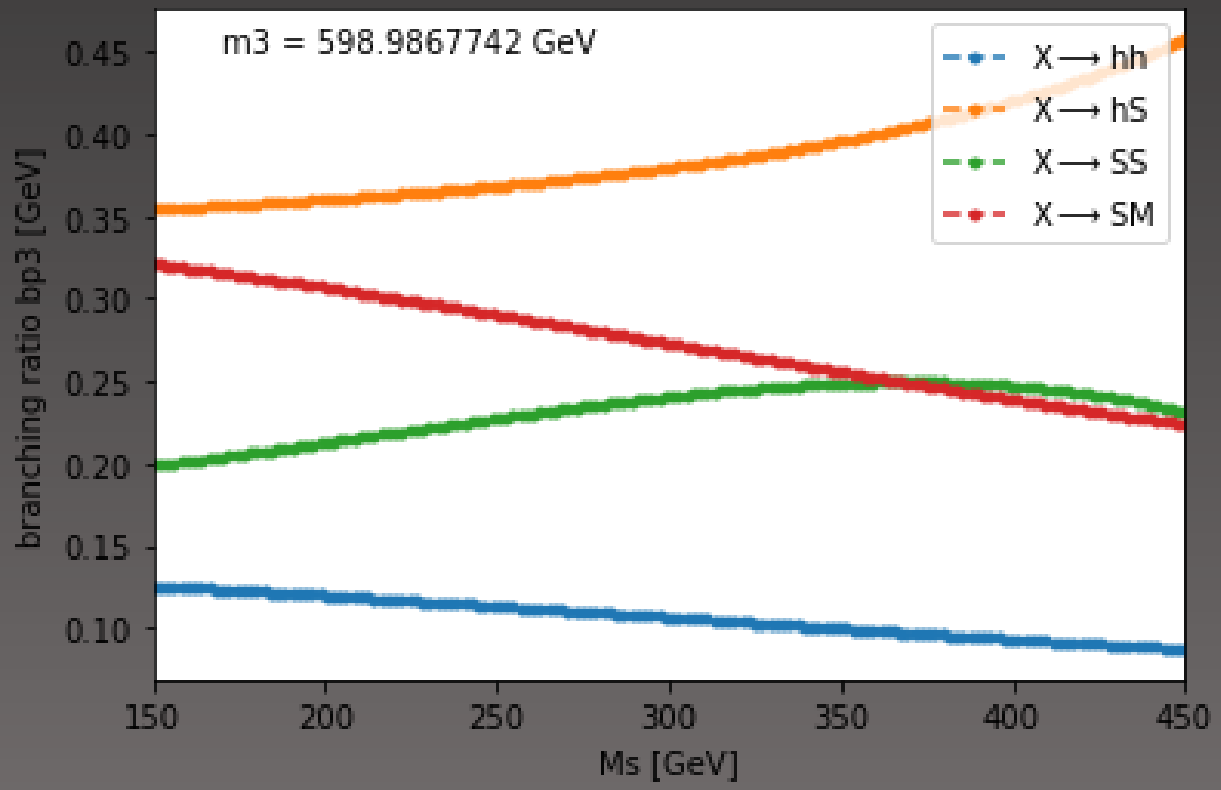
$$BR(h_a \to h_b h_c) = \frac{\Gamma_{a\to bc}}{\kappa_a^2 \ \Gamma_{tot}(h_{SM}; M_a) + \sum_{xy} \Gamma_{a\to xy}}$$



$$\kappa_a = R_{a1}$$

Branching Ratio





Wirkungsquerschnittsgrenzen

$$\sigma(pp \to h_a \to h_b h_c) = \kappa_a^2 \, \sigma(gg \to h_{SM})|_{M_a} BR(h_a \to h_b h_c)$$