anyBSM - Model: SM (Amplitude: $h - h$)

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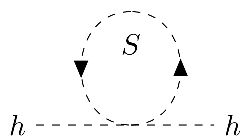
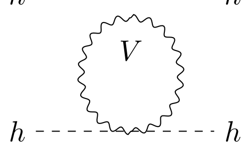
1 Overview

1.1 Topology: TwoPointA

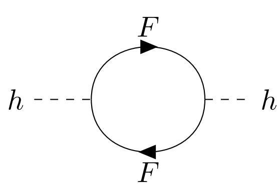


$\{S\} = \quad \{G^+\}, \{G^0\}, \{h\}, \{G^-\}$

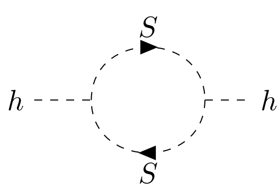


$\{V\} = \quad \{Z\}, \{W^+\}, \{W^-\}$

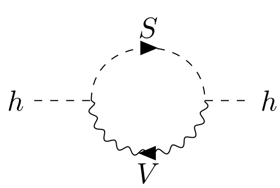
1.2 Topology: TwoPointB



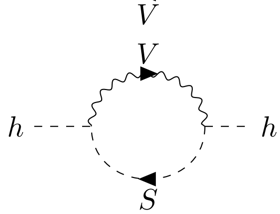
$\{F, F\} = \quad \{d_1, d_1\}, \{d_2, d_2\}, \{d_3, d_3\}, \{u_1, u_1\}, \{u_2, u_2\}, \{u_3, u_3\}, \{e_1, e_1\}, \{e_2, e_2\}, \{e_3, e_3\}, \{\bar{d}_1, \bar{d}_1\}, \{\bar{d}_2, \bar{d}_2\}, \{\bar{d}_3, \bar{d}_3\}, \{\bar{u}_1, \bar{u}_1\}, \{\bar{u}_2, \bar{u}_2\}, \{\bar{u}_3, \bar{u}_3\}, \{\bar{e}_1, \bar{e}_1\}, \{\bar{e}_2, \bar{e}_2\}, \{\bar{e}_3, \bar{e}_3\}$



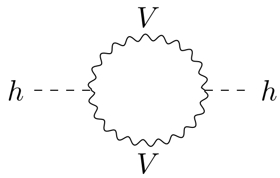
$\{S, S\} = \quad \{G^+, G^+\}, \{G^0, G^0\}, \{h, h\}, \{G^-, G^-\}$



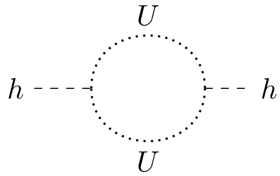
$\{S, V\} = \quad \{G^+, W^+\}, \{G^0, Z\}, \{G^-, W^-\}$



$\{V, S\} = \quad \{W^+, G^+\}, \{Z, G^0\}, \{W^-, G^-\}$

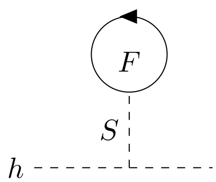


$\{V, V\} = \quad \{Z, Z\}, \{W^+, W^+\}, \{W^-, W^-\}$

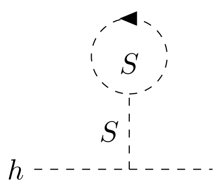


$\{U, U\} = \quad \{\eta^\gamma, \eta^Z\}, \ \{\eta^Z, \eta^Z\}, \ \{\eta^+, \eta^+\}, \ \{\eta^-, \eta^-\}, \ \{\bar{\eta}^Z, \bar{\eta}^\gamma\}, \ \{\bar{\eta}^Z, \bar{\eta}^Z\}, \{\bar{\eta}^+, \bar{\eta}^+\}, \{\bar{\eta}^-, \bar{\eta}^-\}$

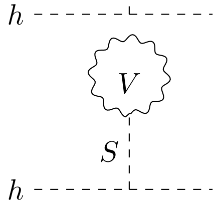
1.3 Topology: TwoPointTA



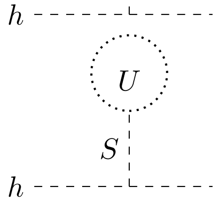
$\{S, F\} = \quad \{h, d_1\}, \{h, d_2\}, \{h, d_3\}, \{h, u_1\}, \{h, u_2\}, \{h, u_3\}, \{h, e_1\}, \{h, e_2\}, \{h, e_3\}, \{h, \bar{d}_1\}, \{h, \bar{d}_2\}, \{h, \bar{d}_3\}, \{h, \bar{u}_1\}, \{h, \bar{u}_2\}, \{h, \bar{u}_3\}, \{h, \bar{e}_1\}, \{h, \bar{e}_2\}, \{h, \bar{e}_3\}$



$\{S, S\} = \quad \{h, G^+\}, \{h, G^0\}, \{h, h\}, \{h, G^-\}$



$\{S, V\} = \quad \{h, Z\}, \{h, W^+\}, \{h, W^-\}$

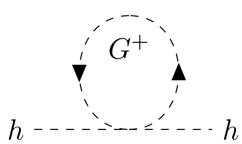


$\{S, U\} = \quad \{h, \eta^Z\}, \{h, \eta^+\}, \{h, \eta^-\}, \{h, \bar{\eta}^Z\}, \{h, \bar{\eta}^+\}, \{h, \bar{\eta}^-\}$

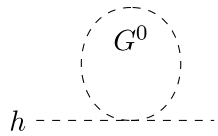
2 Individual results

2.1 Topology: TwoPointA

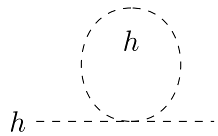
2.1.1 S

$64\pi^2 \times$ 

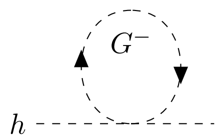
$= \quad -2\lambda A_0((M_{G^+})^2)$

$64\pi^2\times$ 

$= \quad -2\lambda A_0((M_{G^0})^2)$

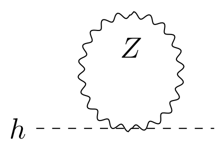
$64\pi^2\times$ 

$= \quad -6\lambda A_0(M_h^2)$

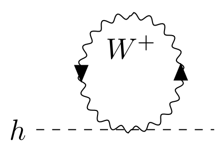
$64\pi^2\times$ 

$= \quad -2\lambda A_0((M_{G^+})^2)$

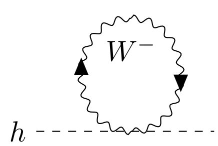
2.1.2 V

$64\pi^2\times$ 

$$= \quad -4\left(-\frac{M_Z^2}{2}+A_0(M_Z^2)\right)(g_1\sin(\theta_w)+g_2\cos(\theta_w))^2$$

$64\pi^2\times$ 

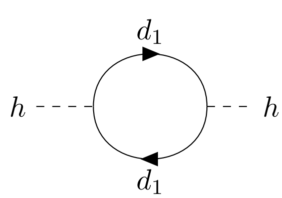
$$= \quad -4g_2^2\left(-\frac{(M_{W^+})^2}{2}+A_0((M_{W^+})^2)\right)$$

$64\pi^2\times$ 

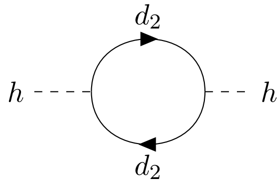
$$= \quad -4g_2^2\left(-\frac{(M_{W^+})^2}{2}+A_0((M_{W^+})^2)\right)$$

2.2 Topology: TwoPointB

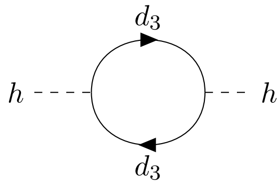
2.2.1 FF

$64\pi^2\times$ 

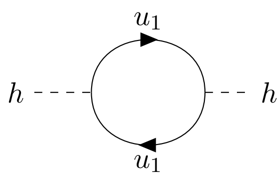
$$= \quad 12M_{d_1}^2\left(Y_{11}^d\right)^2B_0(p_1^2,M_{d_1}^2,M_{d_1}^2)-6\left(Y_{11}^d\right)^2\left(\left(-2M_{d_1}^2+p_1^2\right)B_0(p_1^2,M_{d_1}^2,M_{d_1}^2)-\right.$$

$64\pi^2\times$ 

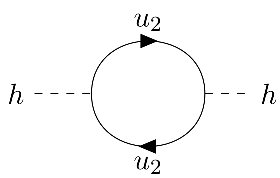
$$= \quad 12M_{d_2}^2\left(Y_{22}^d\right)^2B_0(p_1^2,M_{d_2}^2,M_{d_2}^2)-6\left(Y_{22}^d\right)^2\left(\left(-2M_{d_2}^2+p_1^2\right)B_0(p_1^2,M_{d_2}^2,M_{d_2}^2)-\right.$$

$64\pi^2\times$ 

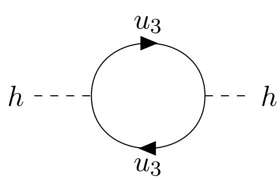
$$= \quad 12M_{d_3}^2\left(Y_{33}^d\right)^2B_0(p_1^2,M_{d_3}^2,M_{d_3}^2)-6\left(Y_{33}^d\right)^2\left(\left(-2M_{d_3}^2+p_1^2\right)B_0(p_1^2,M_{d_3}^2,M_{d_3}^2)-\right.$$

$64\pi^2\times$ 

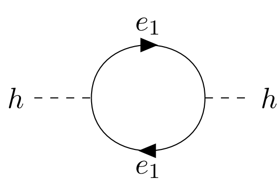
$$= \quad 12M_{u_1}^2\left(Y_{11}^u\right)^2B_0(p_1^2,M_{u_1}^2,M_{u_1}^2)-6\left(Y_{11}^u\right)^2\left(\left(-2M_{u_1}^2+p_1^2\right)B_0(p_1^2,M_{u_1}^2,M_{u_1}^2)-\right.$$

$64\pi^2\times$ 

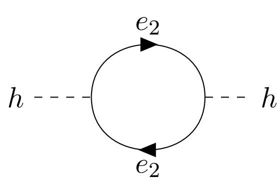
$$= \quad 12M_{u_2}^2\left(Y_{22}^u\right)^2B_0(p_1^2,M_{u_2}^2,M_{u_2}^2)-6\left(Y_{22}^u\right)^2\left(\left(-2M_{u_2}^2+p_1^2\right)B_0(p_1^2,M_{u_2}^2,M_{u_2}^2)-\right.$$

$64\pi^2\times$ 

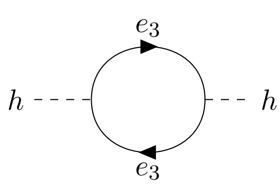
$$= \quad 12M_{u_3}^2\left(Y_{33}^u\right)^2B_0(p_1^2,M_{u_3}^2,M_{u_3}^2)-6\left(Y_{33}^u\right)^2\left(\left(-2M_{u_3}^2+p_1^2\right)B_0(p_1^2,M_{u_3}^2,M_{u_3}^2)-\right.$$

$64\pi^2\times$ 

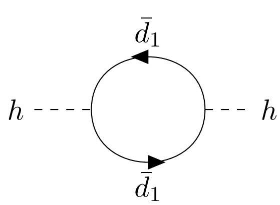
$$= \quad 4M_{e_1}^2\left(Y_{11}^e\right)^2B_0(p_1^2,M_{e_1}^2,M_{e_1}^2)-2\left(Y_{11}^e\right)^2\left(\left(-2M_{e_1}^2+p_1^2\right)B_0(p_1^2,M_{e_1}^2,M_{e_1}^2)-2\right.$$

$64\pi^2\times$ 

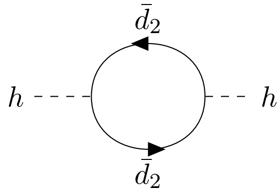
$$= \quad 4M_{e_2}^2\left(Y_{22}^e\right)^2B_0(p_1^2,M_{e_2}^2,M_{e_2}^2)-2\left(Y_{22}^e\right)^2\left(\left(-2M_{e_2}^2+p_1^2\right)B_0(p_1^2,M_{e_2}^2,M_{e_2}^2)-2\right.$$

$64\pi^2\times$ 

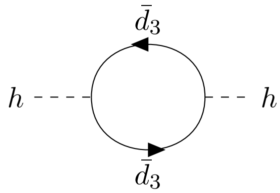
$$= \quad 4M_{e_3}^2\left(Y_{33}^e\right)^2B_0(p_1^2,M_{e_3}^2,M_{e_3}^2)-2\left(Y_{33}^e\right)^2\left(\left(-2M_{e_3}^2+p_1^2\right)B_0(p_1^2,M_{e_3}^2,M_{e_3}^2)-2\right.$$

$64\pi^2\times$ 

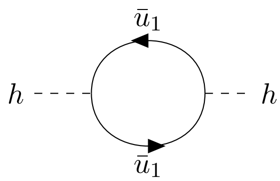
$$= \quad 12M_{d_1}^2\left(Y_{11}^d\right)^2B_0(p_1^2,M_{d_1}^2,M_{d_1}^2)-6\left(Y_{11}^d\right)^2\left(\left(-2M_{d_1}^2+p_1^2\right)B_0(p_1^2,M_{d_1}^2,M_{d_1}^2)-\right.$$

$64\pi^2\times$ 

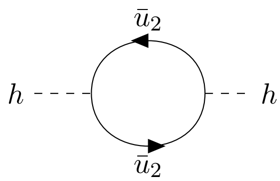
$= \quad 12M_{d_2}^2\left(Y_{22}^d\right)^2 B_0(p_1^2, M_{d_2}^2, M_{d_2}^2) - 6\left(Y_{22}^d\right)^2\left(\left(-2M_{d_2}^2 + p_1^2\right)B_0(p_1^2, M_{d_2}^2, M_{d_2}^2) -\right.$

$64\pi^2\times$ 

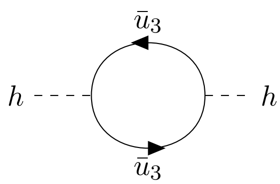
$= \quad 12M_{d_3}^2\left(Y_{33}^d\right)^2 B_0(p_1^2, M_{d_3}^2, M_{d_3}^2) - 6\left(Y_{33}^d\right)^2\left(\left(-2M_{d_3}^2 + p_1^2\right)B_0(p_1^2, M_{d_3}^2, M_{d_3}^2) -\right.$

$64\pi^2\times$ 

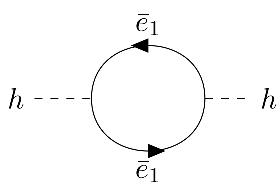
$= \quad 12M_{u_1}^2\left(Y_{11}^u\right)^2 B_0(p_1^2, M_{u_1}^2, M_{u_1}^2) - 6\left(Y_{11}^u\right)^2\left(\left(-2M_{u_1}^2 + p_1^2\right)B_0(p_1^2, M_{u_1}^2, M_{u_1}^2) -\right.$

$64\pi^2\times$ 

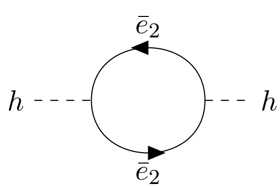
$= \quad 12M_{u_2}^2\left(Y_{22}^u\right)^2 B_0(p_1^2, M_{u_2}^2, M_{u_2}^2) - 6\left(Y_{22}^u\right)^2\left(\left(-2M_{u_2}^2 + p_1^2\right)B_0(p_1^2, M_{u_2}^2, M_{u_2}^2) -\right.$

$64\pi^2\times$ 

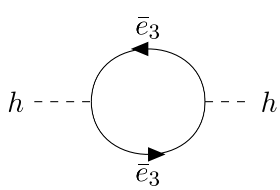
$= \quad 12M_{u_3}^2\left(Y_{33}^u\right)^2 B_0(p_1^2, M_{u_3}^2, M_{u_3}^2) - 6\left(Y_{33}^u\right)^2\left(\left(-2M_{u_3}^2 + p_1^2\right)B_0(p_1^2, M_{u_3}^2, M_{u_3}^2) -\right.$

$64\pi^2\times$ 

$= \quad 4M_{e_1}^2\left(Y_{11}^e\right)^2 B_0(p_1^2, M_{e_1}^2, M_{e_1}^2) - 2\left(Y_{11}^e\right)^2\left(\left(-2M_{e_1}^2 + p_1^2\right)B_0(p_1^2, M_{e_1}^2, M_{e_1}^2) - 2\right.$

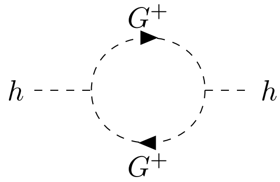
$64\pi^2\times$ 

$= \quad 4M_{e_2}^2\left(Y_{22}^e\right)^2 B_0(p_1^2, M_{e_2}^2, M_{e_2}^2) - 2\left(Y_{22}^e\right)^2\left(\left(-2M_{e_2}^2 + p_1^2\right)B_0(p_1^2, M_{e_2}^2, M_{e_2}^2) - 2\right.$

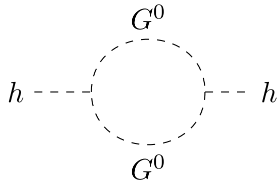
$64\pi^2\times$ 

$= \quad 4M_{e_3}^2\left(Y_{33}^e\right)^2 B_0(p_1^2, M_{e_3}^2, M_{e_3}^2) - 2\left(Y_{33}^e\right)^2\left(\left(-2M_{e_3}^2 + p_1^2\right)B_0(p_1^2, M_{e_3}^2, M_{e_3}^2) - 2\right.$

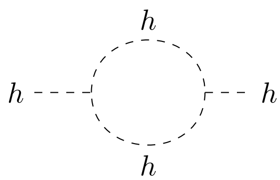
2.2.2 SS

$64\pi^2\times$ 

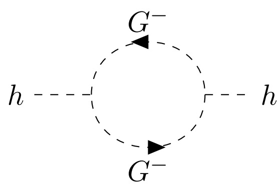
$= -2\lambda^2 v^2 B_0(p_1^2, (M_{G^+})^2\,, (M_{G^+})^2)$

$64\pi^2\times$ 

$= -2\lambda^2 v^2 B_0(p_1^2, (M_{G^0})^2\,, (M_{G^0})^2)$

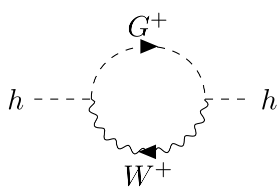
$64\pi^2\times$ 

$= -18\lambda^2 v^2 B_0(p_1^2, M_h^2, M_h^2)$

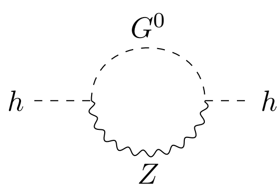
$64\pi^2\times$ 

$= -2\lambda^2 v^2 B_0(p_1^2, (M_{G^+})^2\,, (M_{G^+})^2)$

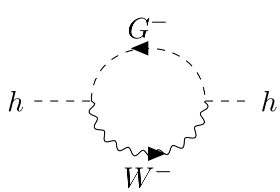
2.2.3 SV

$64\pi^2\times$ 

$$= -g_2^2 \left(-\left(2\,(M_{G^+})^2 - (M_{W^+})^2 + 2p_1^2\right) B_0(p_1^2, (M_{G^+})^2\,, (M_{W^+})^2) + A_0((M_{G^+})^2) - 2A_0((M_{W^+})^2)\right)$$

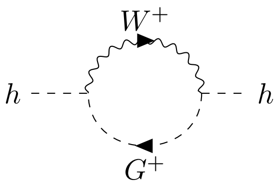
$64\pi^2\times$ 

$$= -4\left(\frac{g_1\sin(\theta_w)}{2} + \frac{g_2\cos(\theta_w)}{2}\right)^2 \left(-\left(2\,(M_{G^0})^2 - M_Z^2 + 2p_1^2\right) B_0(p_1^2, (M_{G^0}) + A_0((M_{G^0})^2) - 2A_0(M_Z^2)\right)$$

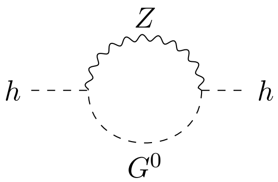
$64\pi^2\times$ 

$$= -g_2^2 \left(-\left(2\,(M_{G^+})^2 - (M_{W^+})^2 + 2p_1^2\right) B_0(p_1^2, (M_{G^+})^2\,, (M_{W^+})^2) + A_0((M_{G^+})^2) - 2A_0((M_{W^+})^2)\right)$$

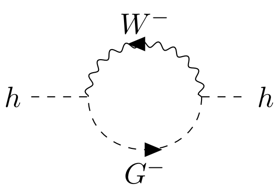
2.2.4 VS

$64\pi^2\times$ 

$$= 0$$

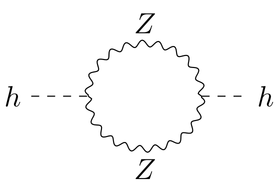
$64\pi^2\times$ 

$$= 0$$

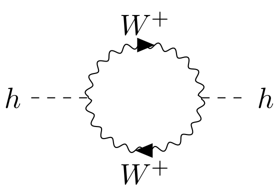
$64\pi^2\times$ 

$$= 0$$

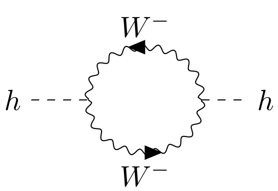
2.2.5 VV

$64\pi^2\times$ 

$$= -2v^2\left(g_1\sin\left(\theta_w\right)+g_2\cos\left(\theta_w\right)\right)^4\left(B_0(p_1^2,M_Z^2,M_Z^2)-\frac{1}{2}\right)$$

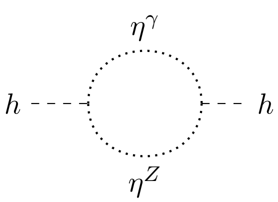
$64\pi^2\times$ 

$$= -2g_2^4v^2\left(B_0(p_1^2,\left(M_{W^+}\right)^2,\left(M_{W^+}\right)^2)-\frac{1}{2}\right)$$

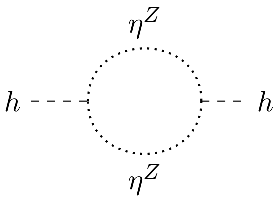
$64\pi^2\times$ 

$$= -2g_2^4v^2\left(B_0(p_1^2,\left(M_{W^+}\right)^2,\left(M_{W^+}\right)^2)-\frac{1}{2}\right)$$

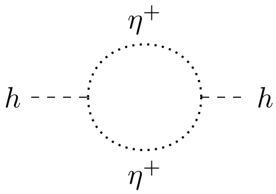
2.2.6 UU

$64\pi^2\times$ 

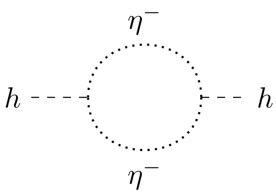
$$= \frac{\xi_Z^2v^2\left(2g_1g_2\cos\left(2\theta_w\right)+\left(g_1^2-g_2^2\right)\sin\left(2\theta_w\right)\right)^2B_0(p_1^2,0^2,\left(M_{\eta^Z}\right)^2)}{32}$$

$64\pi^2\times$ 

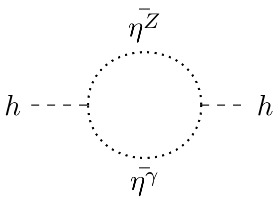
$$= \frac{\xi_Z^2 v^2 \left(g_1 \sin\left(\theta_w\right) + g_2 \cos\left(\theta_w\right)\right)^4 B_0(p_1^2, \left(M_{\eta^Z}\right)^2, \left(M_{\eta^Z}\right)^2)}{8}$$

$64\pi^2\times$ 

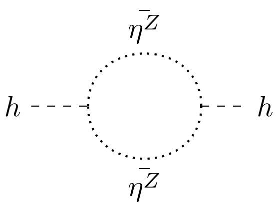
$$= \frac{\left(\xi_{W^+}\right)^2 g_2^4 v^2 B_0(p_1^2, \left(M_{\eta^+}\right)^2, \left(M_{\eta^+}\right)^2)}{8}$$

$64\pi^2\times$ 

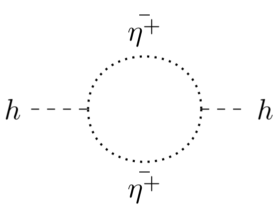
$$= \frac{\left(\xi_{W^+}\right)^2 g_2^4 v^2 B_0(p_1^2, \left(M_{\eta^-}\right)^2, \left(M_{\eta^-}\right)^2)}{8}$$

$64\pi^2\times$ 

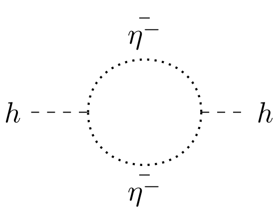
$$= \frac{\xi_Z^2 v^2 \left(2 g_1 g_2 \cos\left(2\theta_w\right) + \left(g_1^2 - g_2^2\right) \sin\left(2\theta_w\right)\right)^2 B_0(p_1^2, \left(M_{\eta^Z}\right)^2, 0^2)}{32}$$

$64\pi^2\times$ 

$$= \frac{\xi_Z^2 v^2 \left(g_1 \sin\left(\theta_w\right) + g_2 \cos\left(\theta_w\right)\right)^4 B_0(p_1^2, \left(M_{\eta^Z}\right)^2, \left(M_{\eta^Z}\right)^2)}{8}$$

$64\pi^2\times$ 

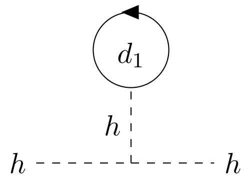
$$= \frac{\left(\xi_{W^+}\right)^2 g_2^4 v^2 B_0(p_1^2, \left(M_{\eta^+}\right)^2, \left(M_{\eta^+}\right)^2)}{8}$$

$64\pi^2\times$ 

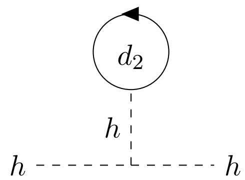
$$= \frac{\left(\xi_{W^+}\right)^2 g_2^4 v^2 B_0(p_1^2, \left(M_{\eta^-}\right)^2, \left(M_{\eta^-}\right)^2)}{8}$$

2.3 Topology: TwoPointTA

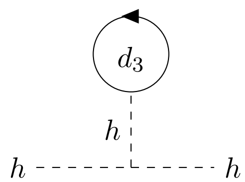
2.3.1 SF

$64\pi^2\times$ 

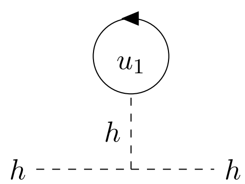
$= -\frac{36\sqrt{2}\lambda M_{d_1} Y^{d}_{11} v A_0(M^2_{d_1})}{M^2_h}$

$64\pi^2\times$ 

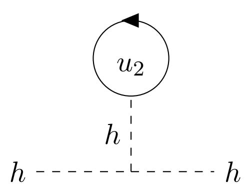
$= -\frac{36\sqrt{2}\lambda M_{d_2} Y^{d}_{22} v A_0(M^2_{d_2})}{M^2_h}$

$64\pi^2\times$ 

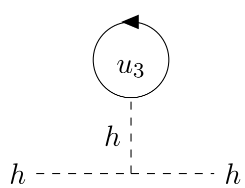
$= -\frac{36\sqrt{2}\lambda M_{d_3} Y^{d}_{33} v A_0(M^2_{d_3})}{M^2_h}$

$64\pi^2\times$ 

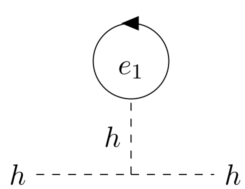
$= -\frac{36\sqrt{2}\lambda M_{u_1} Y^{u}_{11} v A_0(M^2_{u_1})}{M^2_h}$

$64\pi^2\times$ 

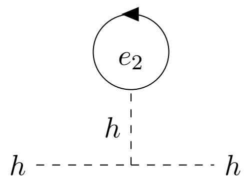
$= -\frac{36\sqrt{2}\lambda M_{u_2} Y^{u}_{22} v A_0(M^2_{u_2})}{M^2_h}$

$64\pi^2\times$ 

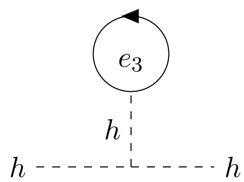
$= -\frac{36\sqrt{2}\lambda M_{u_3} Y^{u}_{33} v A_0(M^2_{u_3})}{M^2_h}$

$64\pi^2\times$ 

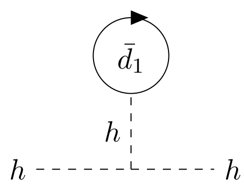
$= -\frac{12\sqrt{2}\lambda M_{e_1} Y^{e}_{11} v A_0(M^2_{e_1})}{M^2_h}$

$64\pi^2\times$


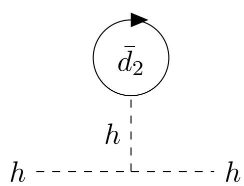
$$= -\frac{12\sqrt{2}\lambda M_{e_2} Y^e_{22} v A_0(M^2_{e_2})}{M_h^2}$$

$64\pi^2\times$


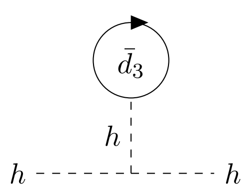
$$= -\frac{12\sqrt{2}\lambda M_{e_3} Y^e_{33} v A_0(M^2_{e_3})}{M_h^2}$$

$64\pi^2\times$


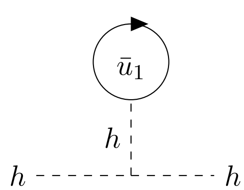
$$= -\frac{36\sqrt{2}\lambda M_{d_1} Y^d_{11} v A_0(M^2_{d_1})}{M_h^2}$$

$64\pi^2\times$


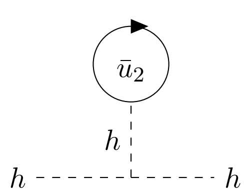
$$= -\frac{36\sqrt{2}\lambda M_{d_2} Y^d_{22} v A_0(M^2_{d_2})}{M_h^2}$$

$64\pi^2\times$


$$= -\frac{36\sqrt{2}\lambda M_{d_3} Y^d_{33} v A_0(M^2_{d_3})}{M_h^2}$$

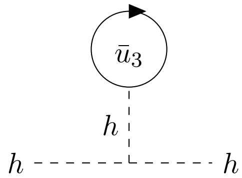
$64\pi^2\times$


$$= -\frac{36\sqrt{2}\lambda M_{u_1} Y^u_{11} v A_0(M^2_{u_1})}{M_h^2}$$

$64\pi^2\times$


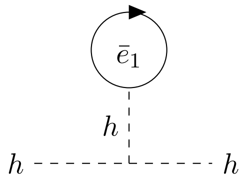
$$= -\frac{36\sqrt{2}\lambda M_{u_2} Y^u_{22} v A_0(M^2_{u_2})}{M_h^2}$$

$64\pi^2\times$



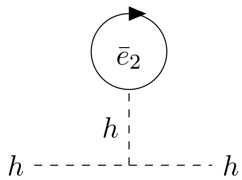
$$= -\frac{36\sqrt{2}\lambda M_{u_3} Y^u_{33} v A_0(M^2_{u_3})}{M_h^2}$$

$64\pi^2\times$



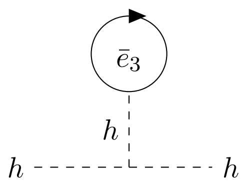
$$= -\frac{12\sqrt{2}\lambda M_{e_1} Y^e_{11} v A_0(M^2_{e_1})}{M_h^2}$$

$64\pi^2\times$



$$= -\frac{12\sqrt{2}\lambda M_{e_2} Y^e_{22} v A_0(M^2_{e_2})}{M_h^2}$$

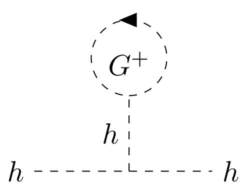
$64\pi^2\times$



$$= -\frac{12\sqrt{2}\lambda M_{e_3} Y^e_{33} v A_0(M^2_{e_3})}{M_h^2}$$

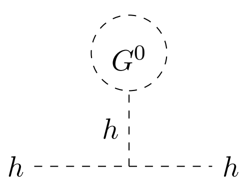
2.3.2 SS

$64\pi^2\times$



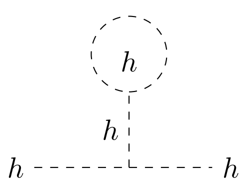
$$= \frac{6\lambda^2 v^2 A_0((M_{G^+})^2)}{M_h^2}$$

$64\pi^2\times$



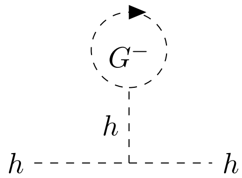
$$= \frac{6\lambda^2 v^2 A_0((M_{G^0})^2)}{M_h^2}$$

$64\pi^2\times$



$$= \frac{18\lambda^2 v^2 A_0(M_h^2)}{M_h^2}$$

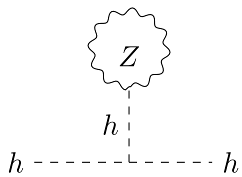
$64\pi^2\times$



$$= \frac{6\lambda^2 v^2 A_0((M_{G^+})^2)}{M_h^2}$$

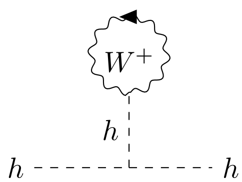
2.3.3 SV

$64\pi^2\times$



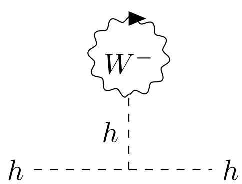
$$= -\frac{6\lambda v^2 \left(M_Z^2 - 2A_0(M_Z^2)\right)\left(g_1 \sin(\theta_w) + g_2 \cos(\theta_w)\right)^2}{M_h^2}$$

$64\pi^2\times$



$$= -\frac{6\lambda g_2^2 v^2 \left((M_{W^+})^2 - 2A_0((M_{W^+})^2)\right)}{M_h^2}$$

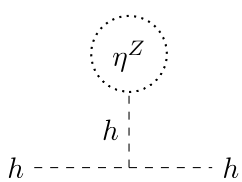
$64\pi^2\times$



$$= -\frac{6\lambda g_2^2 v^2 \left((M_{W^+})^2 - 2A_0((M_{W^+})^2)\right)}{M_h^2}$$

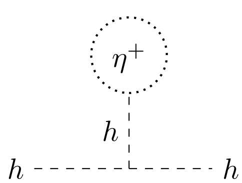
2.3.4 SU

$64\pi^2\times$

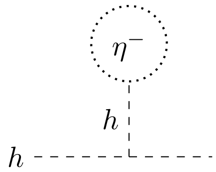


$$= -\frac{3\lambda \xi_Z v^2 \left(g_1 \sin(\theta_w) + g_2 \cos(\theta_w)\right)^2 A_0(\left(M_{\eta^Z}\right)^2)}{2M_h^2}$$

$64\pi^2\times$

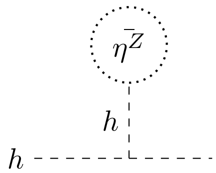


$$= -\frac{3\lambda \xi_{W^+} g_2^2 v^2 A_0(\left(M_{\eta^+}\right)^2)}{2M_h^2}$$

$64\pi^2\times$ 

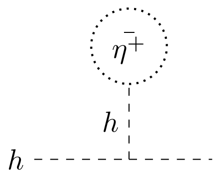
$=$

$$-\frac{3\lambda\xi_{W^+}g_2^2v^2A_0(\left(M_{\eta^-}\right)^2)}{2M_h^2}$$

$64\pi^2\times$ 

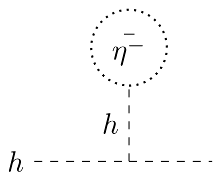
$=$

$$-\frac{3\lambda\xi_Z v^2\left(g_1\sin\left(\theta_w\right)+g_2\cos\left(\theta_w\right)\right)^2A_0(\left(M_{\eta^Z}\right)^2)}{2M_h^2}$$

$64\pi^2\times$ 

$=$

$$-\frac{3\lambda\xi_{W^+}g_2^2v^2A_0(\left(M_{\eta^+}\right)^2)}{2M_h^2}$$

$64\pi^2\times$ 

$=$

$$-\frac{3\lambda\xi_{W^+}g_2^2v^2A_0(\left(M_{\eta^-}\right)^2)}{2M_h^2}$$

This document was compiled with the help of TikZ-Feynman