```
C_{HW} \rightarrow \frac{1}{16\,\pi^2}\,\left(-\,\frac{1}{16}\,\,g_2^2\,\left(2\,\,c_\gamma^{\,2}\,\overline{y_e}^{pr}\,\,y_e^{\,pr}\,\,+\,\sum_{p}\,c_{2\,\gamma}\,g_1^{\,2}\right)\,\,LF_{3\,,0}\left[\,m_{\tilde{l}}^{\,\,p}\,\right]\,\,+\,\frac{1}{16}\,\,g_2^{\,2}\,\left(2\,\,c_\gamma^{\,2}\,\,\overline{y_e}^{pr}\,\,y_e^{\,pr}\,\,+\,\sum_{p}\,c_{2\,\gamma}\,g_1^{\,2}\right)\,\,.
                                                                           LF_{4,-1}[m_1^{p}] + \frac{1}{16}g_2^2(-6c_y^2\overline{y_d}^{pr}y_d^{pr} - 6s_y^2\overline{y_u}^{pr}y_u^{pr} + \sum_n c_{2y}g_1^2)LF_{3,0}[m_{\tilde{a}}^{p}] +
                                                               \frac{1}{16} g_2^2 \left( 6 c_{\gamma}^2 \overline{y_d}^{pr} y_d^{pr} + 6 s_{\gamma}^2 \overline{y_u}^{pr} y_u^{pr} - \sum_{p} c_{2\gamma} g_1^2 \right) LF_{4,-1} \left[ m_{\tilde{a}}^{p} \right] +
                                                               \frac{1}{64} \left( g_1^2 g_2^2 (1 + 3 c_{4 \gamma}) + 3 g_2^4 (-1 + c_{4 \gamma}) \right) LF_{3,0} [m_{\oplus}] -
                                                             \frac{1}{64} g_2^2 \left( g_1^2 (1 + 3 c_{4\gamma}) + 3 g_2^2 (-1 + c_{4\gamma}) \right) LF_{4,-1}[m_{\Phi}] + \frac{5}{4} g_2^4 LF_{2,2,-1}[m_2, \tilde{\mu}] +
                                                           m_2 s_{\gamma} \tilde{\mu} c_{\gamma} g_2^4 LF_{2,2,0}[m_2, \tilde{\mu}] + g_2^4 LF_{3,1,-1}[m_2, \tilde{\mu}] - g_2^4 LF_{3,2,-2}[m_2, \tilde{\mu}] -
                                                           2\ \mathsf{m_2}\ \mathsf{s_{\gamma}}\ \tilde{\mu}\ \mathsf{c_{\gamma}}\ \mathsf{g_2}^4\ \mathsf{LF_{3,2,-1}}\ [\mathsf{m_2}\ ,\ \tilde{\mu}\ ]\ -\ \mathsf{g_2}^4\ \mathsf{LF_{4,1,-2}}\ [\mathsf{m_2}\ ,\ \tilde{\mu}\ ]\ -\ 2\ \mathsf{m_2}\ \mathsf{s_{\gamma}}\ \tilde{\mu}\ \mathsf{c_{\gamma}}\ \mathsf{g_2}^4\ \mathsf{LF_{4,1,-1}}\ [\mathsf{m_2}\ ,\ \tilde{\mu}\ ]\ -\ \mathsf{g_2}^4\ \mathsf{LF_{4,1,-2}}\ [\mathsf{m_2}\ ,\ \tilde{\mu}\ ]\ -\ \mathsf{g_2}^4\ \mathsf{g_2}^4\ \mathsf{g_2}^4\ \mathsf{g_2}^4\ \mathsf{g_2}^4\ \mathsf{g_2}^6\ 
                                                               \frac{1}{4} g_2^2 \left( c_{\gamma} \overline{a_e}^{pr} - s_{\gamma} \widetilde{\mu} \overline{y_e}^{pr} \right) \left( c_{\gamma} a_e^{pr} - s_{\gamma} \widetilde{\mu} y_e^{pr} \right) LF_{4,1,-1} \left[ m_{\tilde{l}}^{p}, m_{\tilde{e}}^{r} \right] +
                                                                                    g_2^2 \left( c_{\gamma} \overline{a_e}^{pr} - s_{\gamma} \widetilde{\mu} \overline{y_e}^{pr} \right) \left( c_{\gamma} a_e^{pr} - s_{\gamma} \widetilde{\mu} y_e^{pr} \right) LF_{5,1,-2} \left[ m_{\tilde{l}}^{p}, m_{\tilde{e}}^{r} \right] - c_{\gamma}^2 \left[ m_{\tilde{l}}^{p}, m_{\tilde{e}}^{p} \right] 
                                                                                    g_2^2 \left( c_{\gamma} \, \overline{a_d}^{\text{pr}} - s_{\gamma} \, \widetilde{\mu} \, \overline{y_d}^{\text{pr}} \right) \, \left( c_{\gamma} \, a_d^{\text{pr}} - s_{\gamma} \, \widetilde{\mu} \, y_d^{\text{pr}} \right) \, LF_{4,1,-1} \big[ \, m_{\tilde{q}}^{\text{p}} \, , \, m_{\tilde{d}}^{\text{r}} \, \big] \, + \, c_{\tilde{q}}^{\text{pr}} \, + \, c_{\tilde{q}}^{\text{
                                                                                    g_2^2 \left( c_{\gamma} \overline{a_d}^{pr} - s_{\gamma} \widetilde{\mu} \overline{y_d}^{pr} \right) \left( c_{\gamma} a_d^{pr} - s_{\gamma} \widetilde{\mu} y_d^{pr} \right) LF_{5,1,-2} \left[ m_{\tilde{q}}^{p}, m_{\tilde{d}}^{r} \right] - c_{\gamma}^2 \left[ m_{\tilde{q}}^{p}, m_{\tilde{q}}^{pr} \right] 
                                                                                      g_2^2 \left( s_{\gamma} \overline{a_u}^{pr} - \tilde{\mu} c_{\gamma} \overline{y_u}^{pr} \right) \left( s_{\gamma} a_u^{pr} - \tilde{\mu} c_{\gamma} y_u^{pr} \right) LF_{2,2,0} \left[ m_{\tilde{u}}^{p}, m_{\tilde{u}}^{r} \right] - \tilde{\mu} c_{\gamma} y_u^{pr} 
                                                                                      g_2^2 \left( s_{\gamma} \overline{a_u}^{pr} - \widetilde{\mu} c_{\gamma} \overline{y_u}^{pr} \right) \left( s_{\gamma} a_u^{pr} - \widetilde{\mu} c_{\gamma} y_u^{pr} \right) LF_{3,1,0} \left[ m_{\tilde{q}}^p, m_{\tilde{u}}^r \right] +
                                                                                      g_2^2 \left( s_\gamma \, \overline{a_u}^{\text{pr}} - \widetilde{\mu} \, c_\gamma \, \overline{y_u}^{\text{pr}} \right) \, \left( s_\gamma \, a_u^{\text{pr}} - \widetilde{\mu} \, c_\gamma \, y_u^{\text{pr}} \right) \, \text{LF}_{3,2,-1} \left[ \, m_{\tilde{q}}^{\text{p}} \, , \, m_{\tilde{u}}^{\text{r}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{u}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{q}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{q}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{q}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde{q}}^{\text{pr}} \, , \, m_{\tilde{q}}^{\text{pr}} \, \right] \, + \, \left[ \, m_{\tilde
                                                                                      g_2^2 \left( s_{\gamma} \overline{a_u}^{pr} - \widetilde{\mu} c_{\gamma} \overline{y_u}^{pr} \right) \left( s_{\gamma} a_u^{pr} - \widetilde{\mu} c_{\gamma} y_u^{pr} \right) LF_{4,1,-1} \left[ m_{\tilde{u}}^{p}, m_{\tilde{u}}^{r} \right] +
                                                                                        g_2^2 \left( s_{\gamma} \overline{a_u}^{pr} - \widetilde{\mu} c_{\gamma} \overline{y_u}^{pr} \right) \left( s_{\gamma} a_u^{pr} - \widetilde{\mu} c_{\gamma} y_u^{pr} \right) LF_{3,1,0} \left[ m_{\tilde{u}}^r, m_{\tilde{q}}^p \right] +
                                                                                      g_{2}^{2}\left(s_{\gamma}\,\overline{a_{u}}^{\mathsf{pr}}-\widetilde{\mu}\;c_{\gamma}\,\overline{y_{u}}^{\mathsf{pr}}\right)\;\left(s_{\gamma}\,a_{u}^{\;\mathsf{pr}}-\widetilde{\mu}\;c_{\gamma}\,y_{u}^{\;\mathsf{pr}}\right)\;\mathsf{LF}_{3,2,-1}\big[\mathsf{m}_{\tilde{u}}^{\;\mathsf{r}}\,,\;\mathsf{m}_{\tilde{a}}^{\;\mathsf{p}}\big]\;-
                                                                                      g_2^2 \left( s_{\gamma} \overline{a_u}^{pr} - \widetilde{\mu} c_{\gamma} \overline{y_u}^{pr} \right) \left( s_{\gamma} a_u^{pr} - \widetilde{\mu} c_{\gamma} y_u^{pr} \right) LF_{4,1,-1} \left[ m_{\widetilde{u}}^{r}, m_{\widetilde{q}}^{p} \right] +
                                                                                    g_2^2 \left( s_\gamma \, \overline{a_u}^{\text{pr}} - \widetilde{\mu} \, c_\gamma \, \overline{y_u}^{\text{pr}} \right) \, \left( s_\gamma \, a_u^{\text{pr}} - \widetilde{\mu} \, c_\gamma \, y_u^{\text{pr}} \right) \, \mathsf{LF}_{5,1,-2} \left[ \mathsf{m}_{\tilde{u}}^{\text{r}}, \, \mathsf{m}_{\tilde{q}}^{\text{p}} \right] - \left[ \mathsf{m}_{\tilde{u}}^{\text{pr}}, \, \mathsf{m}_{\tilde{q}}^{\text{pr}} \right] \, + \, \left[ \mathsf{m}_{\tilde{u}}^{\text{pr}}, \, \mathsf{m}_{\tilde{q}}^{\text{pr}} \right
                                                                                    g_1^2 g_2^2 LF_{3,1,-1}[\tilde{\mu}, m_1] - \frac{1}{4} m_1 s_{\gamma} \tilde{\mu} c_{\gamma} g_1^2 g_2^2 LF_{3,1,0}[\tilde{\mu}, m_1] + \frac{3}{8} g_1^2 g_2^2 LF_{4,1,-2}[\tilde{\mu}, m_1] + \frac{3}{8} g_1^2 g_1^2 LF_{4,1,-2}[\tilde{\mu}, m_1] + \frac{3}{8} g_1^2 LF_{4,1,-2}[\tilde{\mu}, m_1] 
                                                               \frac{1}{2} m<sub>1</sub> s<sub>\gamma</sub> 	ilde{\mu} c<sub>\gamma</sub> g<sub>1</sub><sup>2</sup> g<sub>2</sub><sup>2</sup> LF<sub>4,1,-1</sub> [	ilde{\mu}, m<sub>1</sub>] - \frac{1}{4} g<sub>1</sub><sup>2</sup> g<sub>2</sub><sup>2</sup> LF<sub>5,1,-3</sub> [	ilde{\mu}, m<sub>1</sub>] -
                                                               \frac{1}{2} \, \, \mathsf{m_1} \, \, \mathsf{s_{\gamma}} \, \, \widetilde{\mu} \, \, \mathsf{c_{\gamma}} \, \, \mathsf{g_1}^2 \, \, \mathsf{g_2}^2 \, \, \mathsf{LF_{5,1,-2}} \, [\, \widetilde{\mu} \,, \, \, \mathsf{m_1} \,] \, \, - \, \frac{3}{8} \, \, \mathsf{g_2}^4 \, \, \mathsf{LF_{3,1,-1}} \, [\, \widetilde{\mu} \,, \, \, \mathsf{m_2} \,] \, \, - \, \frac{3}{4} \, \, \mathsf{m_2} \, \, \mathsf{s_{\gamma}} \, \, \widetilde{\mu} \, \, \mathsf{c_{\gamma}} \, \, \mathsf{g_2}^4 \, \, \mathsf{LF_{3,1,0}} \, [\, \widetilde{\mu} \,, \, \, \mathsf{m_2} \,] \, \, - \, \frac{3}{4} \, \, \mathsf{m_2} \, \, \mathsf{s_{\gamma}} \, \, \widetilde{\mu} \, \, \, \mathsf{c_{\gamma}} \, \, \mathsf{g_2}^4 \, \, \mathsf{LF_{3,1,0}} \, [\, \widetilde{\mu} \,, \, \, \mathsf{m_2} \,] \, \, - \, \frac{3}{4} \, \, \mathsf{m_2} \, \, \mathsf{s_{\gamma}} \, \, \widetilde{\mu} \, \, \, \mathsf{c_{\gamma}} \, \, \mathsf{g_2}^4 \, \, \mathsf{LF_{3,1,0}} \, [\, \widetilde{\mu} \,, \, \, \mathsf{m_2} \,] \, \, - \, \frac{3}{4} \, \, \mathsf{m_2} \, \, \mathsf{s_{\gamma}} \, \, \widetilde{\mu} \, \, \, \mathsf{c_{\gamma}} \, \, \mathsf{g_2}^4 \, \, \mathsf{LF_{3,1,0}} \, [\, \widetilde{\mu} \,, \, \, \mathsf{m_2} \,] \, \, - \, \frac{3}{8} \, \, \mathsf{g_2}^4 \, \, \mathsf{LF_{3,1,0}} \, [\, \widetilde{\mu} \,, \, \, \mathsf{m_2} \,] \, - \, \frac{3}{4} \, \, \mathsf{m_2} \, \, \mathsf{s_{\gamma}} \, \, \widetilde{\mu} \, \, \mathsf{c_{\gamma}} \, \, \mathsf{g_2}^4 \, \, \mathsf{LF_{3,1,0}} \, [\, \widetilde{\mu} \,, \, \, \mathsf{m_2} \,] \, \, - \, \frac{3}{8} \, \, \mathsf{g_2}^4 \, \, \mathsf{LF_{3,1,0}} \, [\, \widetilde{\mu} \,, \, \, \mathsf{m_2} \,] \, - \, \frac{3}{4} \, \, \mathsf{m_2} \, \, \mathsf{s_{\gamma}} \, \, \widetilde{\mu} \, \, \mathsf{s_{\gamma}} \, \, \widetilde{\mu} \, \mathsf{s_{\gamma}} \, \, \mathsf{s_{\gamma}} \, \, \mathsf{s_{\gamma}} \, \mathsf{s_
                                                           g_2^4 LF_{3,2,-2}[\tilde{\mu}, m_2] - 2 m_2 s_{\gamma} \tilde{\mu} c_{\gamma} g_2^4 LF_{3,2,-1}[\tilde{\mu}, m_2] + \frac{9}{8} g_2^4 LF_{4,1,-2}[\tilde{\mu}, m_2] +
                                                               \frac{3}{2} \, \mathsf{m}_2 \, \mathsf{s}_{\mathrm{Y}} \, \widetilde{\mu} \, \mathsf{c}_{\mathrm{Y}} \, \mathsf{g_2}^4 \, \mathsf{LF}_{4,1,-1} [\widetilde{\mu},\, \mathsf{m}_2] \, - \, \frac{3}{4} \, \mathsf{g_2}^4 \, \mathsf{LF}_{5,1,-3} [\widetilde{\mu},\, \mathsf{m}_2] \, - \, \frac{3}{2} \, \mathsf{m}_2 \, \mathsf{s}_{\mathrm{Y}} \, \widetilde{\mu} \, \mathsf{c}_{\mathrm{Y}} \, \mathsf{g_2}^4 \, \mathsf{LF}_{5,1,-2} [\widetilde{\mu},\, \mathsf{m}_2] \, \right)
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