Description of `c2HDM.m`

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The file `c2HDM.m` contains computer-readable results for the Two Higgs Doublet Model (2HDM) contributions to the Wilson coefficients C_7 and C_8 that have been calculated in Ref. [1]. Furthermore, the corresponding effective Wilson coefficients are also provided. They are defined through

$$C_i^{\rm eff}(\mu) = \begin{cases} C_i(\mu), & \text{for } i = 1, ..., 6, \\ \frac{4\pi}{\alpha_s} C_7(\mu) + \sum_{j=1}^{6} y_j C_j(\mu), & \text{for } i = 7, \\ \frac{4\pi}{\alpha_s} C_8(\mu) + \sum_{j=1}^{6} z_j C_j(\mu), & \text{for } i = 8, \end{cases}$$

with $\vec{y} = (0, 0, -\frac{1}{3}, -\frac{4}{9}, -\frac{20}{3}, -\frac{80}{9})$ and $\vec{z} = (0, 0, 1, -\frac{1}{6}, 20, -\frac{10}{3})$.

The notation used in the file `c2HDM.m` is described in the tables below, where we use

$$C_i^{\rm eff} = C_i^{\rm SM,eff} + C_i^{\rm 2HDM,eff},$$
$$C_i^{\rm 2HDM,eff} = C_i^{H(0)\rm eff} + \left(\frac{\alpha_s}{4\pi}\right) C_i^{H(1)\rm eff} + \left(\frac{\alpha_s}{4\pi}\right)^2 C_i^{H(2)\rm eff} + \ldots$$

together with the variables

$$r = \frac{m_t^2(\mu_0)}{M_{H^+}^2}, \qquad u = 1 - \frac{1}{r}, \qquad \bar{u} = 1 - r.$$

The quantities `c7t3L2HDM` and `c8t3L2HDM` are defined as piecewise functions according to Eqs. (34) and (35) of Ref. [1].

`MATADMasterIntegralRule` are MATHEMATICA replacement rules for symbols.

The file `c2HDM.m` contains also expansions of the three-loop Wilson coeffficients C_7 and C_8 of the Standard Model (SM) around the point $M_W \approx m_t$. More terms in such expansions have been computed in Ref. [1]. The quantities `c7t3LSM` and `c8t3LSM` are the respective results for $C_7^{t(3)}$ and $C_8^{t(3)}$ as power series in

$$w = 1 - \frac{M_W^2}{m_t^2}.$$

References

[1] T. Hermann, M. Misiak and M. Steinhauser, *$\bar{B} \to X_s\gamma$ in the Two Higgs Doublet Model up to Next-to-Next-to-Leading Order in QCD*, SFB/CPP-12-60, TTP12-29, IFT-5/2012.

`r`	r
`u`	u
`ubar`	$\bar{u}$
`mt`	$m_t(\mu_0)$
`mu`	μ_0

Table 1: Notation for used variables.

c2HDM.m	quantity
`cH[0,i]`	$C_i^{H(0)}$ for $i = 1, \ldots, 6$
`cHeff[0,i]`	$C_i^{H(0)\text{eff}}$ for $i = 7, 8$
`cH[1,i]`	$C_i^{H(1)}$ for $i = 1, \ldots, 6$
`cH[2,7]`	$C_7^{H(2)}$
`cH[2,8]`	$C_8^{H(2)}$
`cHeff[1,i]`	$C_i^{H(1)\text{eff}}$ for $i = 7, 8$

Table 2: LO (top) and NLO (bottom) Wilson coefficients.

c2HDM.m	quantity
`cH3uuL[7]`	Eq. (14) of [1]
`cH3duL[7]`	Eq. (15) of [1]
`cH3uuL[8]`	Eq. (16) of [1]
`cH3duL[8]`	Eq. (17) of [1]
`cH3uur0[7]`	Eq. (18) of [1]
`cH3uur1m[7]`	Eq. (19) of [1]
`cH3uur1p[7]`	Eq. (20) of [1]
`cH3uurinf[7]`	Eq. (21) of [1]
`cH3dur0[7]`	Eq. (22) of [1]
`cH3dur1m[7]`	Eq. (23) of [1]
`cH3dur1p[7]`	Eq. (24) of [1]
`cH3durinf[7]`	Eq. (25) of [1]
`cH3uur0[8]`	Eq. (26) of [1]
`cH3uur1m[8]`	Eq. (27) of [1]
`cH3uur1p[8]`	Eq. (28) of [1]
`cH3uurinf[8]`	Eq. (29) of [1]
`cH3dur0[8]`	Eq. (30) of [1]
`cH3dur1m[8]`	Eq. (31) of [1]
`cH3dur1p[8]`	Eq. (32) of [1]
`cH3durinf[8]`	Eq. (33) of [1]
`cH[2,i]`	$C_i^{H(2)}$ for $i = 1, \ldots, 6$
`cH[3,7]`	$C_7^{H(3)}$
`cH[3,8]`	$C_8^{H(3)}$
`cHeff[2,i]`	$C_i^{H(2)\text{eff}}$ for $i = 7, 8$

Table 3: NNLO Wilson coefficients.