$h^0 \to c\bar{c}$ @ full one-loop level in the MSSM with flavour violation

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Outline

- Introduction
- Squark generation mixing in the MSSM
- Theoretical and experimental constraints
- $h^0 \to c\bar{c}$ @ full one-loop level
- Renormalisation
- Numerical results
- An estimate of the errors
- Summary

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- The decays of h^0 are usually assumed to be quark-flavour conserving (QFC)
- Generation mixing in the MSSM squark sector may influence the decay widths of h^0 at 1 loop level
- One can observe then quark flavour violating (QFV) h^0 decays with sizeable rates

Squark generation mixing in the MSSM

- In our study we assume non-minimal flavour violation (NMFV): new sources of QFV appear (not connected to the CKM matrix) that are free parameters in the theory
- The flavour-violating terms are contained in the mass matrices of the squarks at the electroweak scale

$$\mathcal{M}^2_{\tilde{q}} = \begin{pmatrix} \mathcal{M}^2_{\tilde{q}\,LL} & (\mathcal{M}^2_{\tilde{q}\,RL})^\dagger \\ \mathcal{M}^2_{\tilde{q}\,RL} & \mathcal{M}^2_{\tilde{q}\,RR} \end{pmatrix}, \quad q = u, d.$$

- The 3×3 soft-breaking matrices can introduce flavour-violating (off-diagonal) terms, e.g. in the up-squark sector

$$\begin{aligned}
(\mathcal{M}^2_{\tilde{u}\,LL})_{\alpha\beta} &= M^2_{Q_u\alpha\beta} + \left[\left(\frac{1}{2} - \frac{2}{3}\sin^2\theta_W\right)\cos 2\beta\ m_Z^2 + m^2_{u_\alpha}\right]\delta_{\alpha\beta} \\
(\mathcal{M}^2_{\tilde{u}\,RR})_{\alpha\beta} &= M^2_{U\alpha\beta} + \left[\left(\frac{2}{3}\sin^2\theta_W\right)\cos 2\beta\ m_Z^2 + m^2_{u_\alpha}\right]\delta_{\alpha\beta} \\
(\mathcal{M}^2_{\tilde{u}\,RL})_{\alpha\beta} &= (v_2/\sqrt{2})\ T_{U\beta\alpha} - m_{U_\alpha}\mu^*\cot\beta\ \delta_{\alpha\beta}
\end{aligned}$$

- After diagonalization with the rotation matrix $U^{\tilde{u}}_{6\times6}$, the mass eigenstates are obtained $\tilde{u}_i = U^{\tilde{u}}_{i\alpha}\tilde{u}_{0\alpha}$, where $U^{\tilde{u}}\mathcal{M}^2_{\tilde{u}}U^{\tilde{u}\dagger} = \mathrm{diag}(m_{\tilde{u}_1}, ..., m_{\tilde{u}_6})$ and $m_{\tilde{u}_i} < m_{\tilde{u}_j}$ for $i < j$

Squark generation mixing in the MSSM

- In order to estimate the amount of QFV dimensionless parameters are introduced. In the up-type squark sector $(\alpha, \beta = u, c, t, \ \alpha \neq \beta)$

$$\begin{aligned}
\delta^{LL}_{\alpha\beta} &\equiv M^2_{Q\alpha\beta}/\sqrt{M^2_{Q\alpha\alpha}M^2_{Q\beta\beta}}\ {}^{1} \\
\delta^{uRR}_{\alpha\beta} &\equiv M^2_{U\alpha\beta}/\sqrt{M^2_{U\alpha\alpha}M^2_{U\beta\beta}} \\
\delta^{uRL}_{\alpha\beta} &\equiv (v_2/\sqrt{2})T_{U_{\beta\alpha}}/\sqrt{M^2_{U\alpha\alpha}M^2_{Q\beta\beta}}
\end{aligned}$$

- Analogously in the down-type squark sector $(\alpha, \beta = d, s, b, \ \alpha \neq \beta)$

$$\begin{aligned}
\delta^{dRR}_{\alpha\beta} &\equiv M^2_{D\alpha\beta}/\sqrt{M^2_{D\alpha\alpha}M^2_{D\beta\beta}} \\
\delta^{dRL}_{\alpha\beta} &\equiv (v_2/\sqrt{2})T_{D_{\beta\alpha}}/\sqrt{M^2_{D\alpha\alpha}M^2_{Q\beta\beta}}
\end{aligned}$$

[1] $\delta^{uLL}_{\alpha\beta} \equiv \delta^{dLL}_{\alpha\beta} \equiv \delta^{LL}_{\alpha\beta}$

Constraints on the MSSM parameters
Theoretical constraints

- The vacuum stability conditions are placing constraints on the trilinear coupling matrices

$$
\begin{aligned}
|T_{U\alpha\alpha}|^2 &< 3\,Y_{U\alpha}^2\,(M_{Q\alpha\alpha}^2 + M_{U\alpha\alpha}^2 + m_2^2)\ ,\\
|T_{D\alpha\alpha}|^2 &< 3\,Y_{D\alpha}^2\,(M_{Q\alpha\alpha}^2 + M_{D\alpha\alpha}^2 + m_1^2)\ ,\\
|T_{U\alpha\beta}|^2 &< Y_{U\gamma}^2\,(M_{Q\alpha\alpha}^2 + M_{U\beta\beta}^2 + m_2^2)\ ,\\
|T_{D\alpha\beta}|^2 &< Y_{D\gamma}^2\,(M_{Q\alpha\alpha}^2 + M_{D\beta\beta}^2 + m_1^2)\ ,
\end{aligned}
$$

where $\alpha, \beta = 1, 2, 3,\ \alpha \neq \beta;\ \gamma = \mathrm{Max}(\alpha, \beta)$ and

$$
m_1^2 = (m_{H^+}^2 + m_Z^2 \sin^2\theta_W)\sin^2\beta - \frac{1}{2}m_Z^2,
$$
$$
m_2^2 = (m_{H^+}^2 + m_Z^2 \sin^2\theta_W)\cos^2\beta - \frac{1}{2}m_Z^2.
$$

$Y_{U\alpha}$ and $Y_{D\alpha}$ are the Yukawa couplings of the up-type and down-type quarks.

- Strong constraints on mixing involving the first generation squarks from precision measurements of K and B meson decays
- $\Rightarrow$ only mixing between second and third generation squarks is considered. Appreciable mixing is still possible despite the B physics constraints
- SUSY mass limits and Higgs mass limits from direct collider searches
- Electroweak precision and low-energy measurements

$$\mathrm{B}(b \to s\gamma) = (3.37 \pm 0.23) \times 10^{-4}$$

$$\Delta M_{B_s} = (17.725 \pm 0.049)\ \mathrm{ps}^{-1}$$

$$\Delta\rho\ (\mathrm{SUSY}) < 0.0012$$

$$\mathrm{B}(b \to s\ \mu^+\mu^-) = (1.60 \pm 0.50) \times 10^{-6}$$

$$\mathrm{B}(B_s \to \mu^+\mu^-) < 4.2 \times 10^{-9}$$

$h^0 \to c\bar{c}$ @ full one-loop level

- We study the decay of the lightest neutral Higgs boson, $h^0 \to c\bar{c}$, at full one-loop level in the MSSM with non-minimal flavour violation
- The partial decay width, including one-loop contributions can be written as

$$\Gamma(h^0 \to c\bar{c}) = \Gamma^{\text{tree}}(h^0 \to c\bar{c}) + \Delta\Gamma^{\text{1loop}}(h^0 \to c\bar{c})\,,$$

where the tree-level decay width is

$$\Gamma^{\text{tree}}(h^0 \to c\bar{c}) = \frac{\mathrm{N_C}}{8\pi} m_{h^0} (s_1^c)^2 \left(1 - \frac{4m_c^2}{m_{h^0}^2}\right)^{3/2}, \quad \text{with } \mathrm{N_C} = 3\,,$$

and the tree-level coupling s_1^c reads

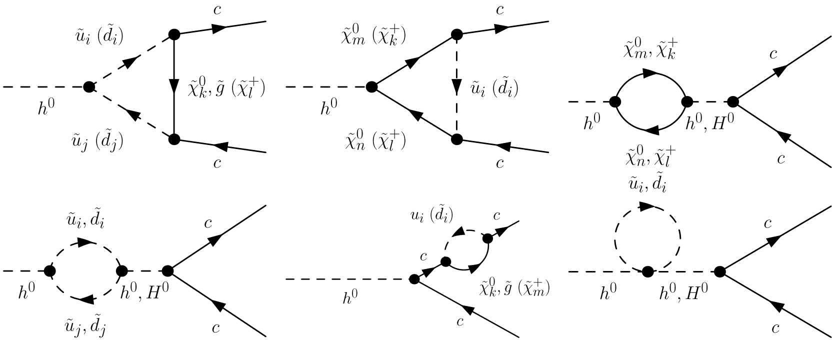
$$s_1^c = -g\frac{m_c}{2m_W}\frac{\cos\alpha}{\sin\beta} = -\frac{h_c}{\sqrt{2}}\cos\alpha\,.$$

Here α is the mixing angle of h^0 and H^0.

$h^0 \to c\bar{c}$ @ full one-loop level

Contributions

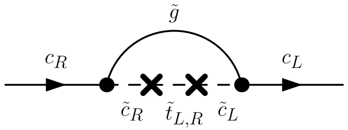
- All 1-loop contributions to $\Delta\Gamma^{1\text{loop}}(h^0 \to c\bar{c})$ include: SM contributions, Higgs contributions, SUSY contributions
- The flavour mixing is induced by 1-loop diagrams with SUSY particles

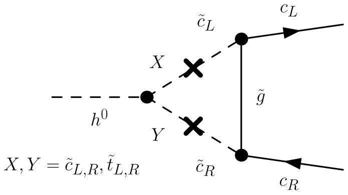


$h^0 \to c\bar{c}$ @ full one-loop level

Flavour violation

- Flavour violation enters through mixing of the squarks, example: schematically in the up-type squarks -gluino contribution ($\tilde{u}_{1,2} = \tilde{c}_{R,L} - \tilde{t}_{R,L}$ mixture)





- In the super-CKM basis, the Lagrangian including the coupling of up-type squarks to h^0 contains the trilinear couplings $(T_U)_{ij}$ which are explicitly flavour-breaking terms that couple left-handed to right-handed squarks

$$\mathcal{L} \ni -\frac{g_2}{2m_W} h^0 \Big[\tilde{u}^*_{iR}\tilde{u}_{jL} \Big(\mu^* \frac{\sin\alpha}{\sin\beta} m_{u,i}\delta_{ij} + \frac{\cos\alpha}{\sin\beta}\frac{v_2}{\sqrt{2}}(T_U)_{ji} \Big) + \text{h.c.} \Big]$$

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Renormalisation

- Calculating higher order corrections requires renormalisation due to UV and IR divergences
- For the UV divergences we employ the $\overline{\mathrm{DR}}$ renormalisation scheme at one-loop level: all tree-level input parameters (masses, fields and parameters in the couplings) of the Lagrangian are UV finite (everywhere $\Delta = 0$) and defined at a fixed scale $Q = m_{h^0} = 125.5$ GeV
- The renormalised finite one-loop amplitude is given by

$$\mathcal{M}^{1loop} = \mathcal{M}^{vertex} \left(+\mathcal{M}^{CT}\right) + \mathcal{M}^{WFR}$$

- The Higgs wave-function renormalisation constants read

$$\delta Z_{h^0 h^0} = -\mathrm{Re}\ \dot{\Pi}^H_{h^0 h^0}(m^2_{h^0})$$

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$$\delta Z_{h^0 H^0} = \frac{2}{m^2_{h^0} - m^2_{H^0}} \left(\mathrm{Re}\ \Pi^H_{h^0 H^0}(m^2_{h^0}) - \delta t_{h^0 H^0}\right)$$

where $\delta t_{h^0 H^0}$ are the tadpole contributions

$$\delta t_{h^0 H^0} = -\frac{1}{v}\left[\tau_{h^0}\left(\frac{s_\alpha^2 c_\alpha}{c_\beta} + \frac{c_\alpha^2 s_\alpha}{s_\beta}\right) + \tau_{H^0}\left(-\frac{c_\alpha^2 s_\alpha}{c_\beta} + \frac{s_\alpha^2 c_\alpha}{s_\beta}\right)\right]$$

with τ_{h^0} and τ_{H^0} are the loop corrections from the tadpole diagrams with h^0 and H^0 respectively

- The charm quarks wave-function renormalisation constants are

$$\begin{aligned}\delta Z_{cc}^{L/R} \quad = \quad & -\mathrm{Re}\ \Pi_{cc}^{L/R}(m_c) + \frac{1}{2m_c}\mathrm{Re}\left(\Pi_{cc}^{S,\ L/R}(m_c) - \Pi_{ii}^{S,\ R/L}(m_c)\right) \\ & -m_c\mathrm{Re}\Big[m_c\left(\dot{\Pi}_{cc}^{L/R}(m_c) + \dot{\Pi}_{cc}^{R/L}(m_c)\right) \\ & +\dot{\Pi}_{cc}^{S,\ L/R}(m_c) + \dot{\Pi}_{cc}^{S,\ R/L}(m_c)\Big]\end{aligned}$$

- In order to get rid of the IR divergences one must include the contribution of the real soft/hard gluon and photon radiation from the final charm quarks
- The convergent decay width $\Gamma^{corr}(h^0 \to c\bar{c})$ in the limit of vanishing gluon/photon mass, $\lambda = 0$, is given by

$$\Gamma^{corr}(h^0 \to c\bar{c}) = \Gamma(h^0 \to c\bar{c}) + \Gamma^{hard}(h^0 \to c\bar{c}g/\gamma)$$

where e.g. the hard gluon radiation width is given by

$$\Gamma^{hard}(h^0 \to c\bar{c}g) = \frac{2\alpha_s |s_1^c|^2}{\pi^2 m_{h^0}} \left[J_1 - (m_{h^0}^2 - 4m_c^2)(J_2 - (m_{h^0}^2 - 2m_c^2)J_3) \right]$$

with $J_1, J_2, J_3, = J_1, J_2, J_3(m_c, m_{h^0}, \lambda)$ [Denner, '93]

- The gluino 1-loop contribution, renormalised in the $\overline{\mathrm{DR}}$ scheme reads

$$\Delta\Gamma^{\tilde{g}}_{h^0} = \frac{\mathrm{N_C}}{4\pi} m_{h^0}\ s^c_1\ \mathrm{Re}(\Delta S^{c,\tilde{g}}_1)\left(1 - \frac{4m_c^2}{m_{h^0}^2}\right)^{3/2}$$

- $\Delta S^{c,\tilde{g}}_1$ acquires contributions from the vertex correction and the wave-function correction due to gluino interaction

$$\Delta S^{c,\tilde{g}}_1 = \delta S^{c(\tilde{q},v)}_1 + \delta S^{c(\tilde{q},\omega)}_1 \left(+\delta S^{c(\tilde{q},0)}_1\right)$$

where the individual contributions are given by

$$\begin{aligned}\delta S^{c(\tilde{g},v)}_1 \quad &= \quad \frac{\alpha_s}{4\pi}\mathrm{C_F}\sum_{i,j=1}^{6} G^{\tilde{u}}_{ij1}\Big[m_{\tilde{g}}(U^{\tilde{u}*}_{i2}U^{\tilde{u}}_{j5} + U^{\tilde{u}*}_{i5}U^{\tilde{u}}_{j2})C^{ij}_0 \\ &\qquad + m_c(U^{\tilde{u}*}_{i2}U^{\tilde{u}}_{j2} + U^{\tilde{u}*}_{i5}U^{\tilde{u}}_{j5})(C^{ij}_1 + C^{ij}_2)\Big]\end{aligned}$$

$$\delta S_1^{c(\tilde{g},\omega)} = -\frac{\alpha_s}{4\pi} \mathrm{C_F} s_1^c \sum_{i=1}^{6} \Big\{ (|U_{i2}^{\tilde{u}}|^2 + |U_{i5}^{\tilde{u}}|^2)(B_0^i + B_1^i)$$
$$+2m_c \Big[(|U_{i2}^{\tilde{u}}|^2 + |U_{i5}^{\tilde{u}}|^2)(\dot{B}_0^i + \dot{B}_1^i) - \frac{2m_{\tilde{g}}}{m_c}(U_{i2}^{\tilde{u}*}U_{i5}^{\tilde{u}} + U_{i5}^{\tilde{u}*}U_{i2}^{\tilde{u}})\dot{B}_0^i \Big] \Big\}$$

$$\left(\delta S_1^{c(\tilde{g},0)} \quad = \quad \frac{\alpha_s}{4\pi} \mathrm{C_F} s_1^c \Big\{ (|U_{i2}^{\tilde{u}}|^2 + |U_{i5}^{\tilde{u}}|^2)\frac{\Delta}{2} - \frac{m_{\tilde{g}}}{m_c}(U_{i2}^{\tilde{u}*}U_{i5}^{\tilde{u}} + U_{i5}^{\tilde{u}*}U_{i2}^{\tilde{u}})\Delta \Big\} \right)$$

with $\mathrm{C_F} = 4/3$. Here Δ is the UV divergence factor and B_k^i and C_k^i are the two- and three-point functions

$$B_k^i = B_k(m_c^2, m_{\tilde{u}_i}^2, m_{\tilde{g}}^2), \quad k = 0, 1.$$

$$\dot{B}_k^i = \frac{\partial B_k(p^2, m_{\tilde{u}_i}^2, m_{\tilde{g}}^2)}{\partial p^2}\bigg|_{p^2 = m_c^2}, \quad k = 0, 1.$$

$$C_k^{ij} = C_k(m_c^2, m_{h^0}^2, m_c^2, m_{\tilde{g}}^2, m_{\tilde{u}_i}^2, m_{\tilde{u}_j}^2), \quad k = 0, 1, 2.$$

- The numerical calculations are performed with our own developed code with the help of FeynArts and FormCalc. We have also used SPheno v3.3.0 and SSP
- The corresponding theoretical and experimental constraints are taken into account
- Mixing between the second and the third generation up-type squarks ($\tilde{c} - \tilde{t}$ mixing) is considered
- M_3 is chosen so that the guino is within the reach of the LHC
- The gaugino masses M_1, M_2 and M_3 are satisfying GUT relations $M_1 \approx 0.5\ M_2$, $M_3/M_2 = g_3^2/g_2^2$, where g_2 and g_3 are the SU(2) and SU(3) gauge coupling constants, respectively
- The lightest Higgs mass is within the range of the Higgs signal at the LHC, $h^0 \approx 126$ GeV [2]

[2] At our reference scenario

$h^0 \to c\bar{c}$ @ full one-loop level

Reference scenario

- MSSM input parameters at $Q = m_{h^0} = 125.5$ GeV for our reference scenario. $T_{U\alpha\alpha} = T_{D\alpha\alpha} = 0$, except for $T_{U33} = -2050$ GeV ($\delta^{uRL}_{33} = -0.34$)

M_1	M_2	M_3
170 GeV	350 GeV	1000 GeV

μ	$\tan\beta$	m_{A^0}
2000 GeV	20	1500 GeV

	$\alpha = 1$	$\alpha = 2$	$\alpha = 3$
$M^2_{Q\alpha\alpha}$	$(2400)^2$ GeV^2	$(2360)^2$ GeV^2	$(1850)^2$ GeV^2
$M^2_{U\alpha\alpha}$	$(2380)^2$ GeV^2	$(836)^2$ GeV^2	$(804)^2$ GeV^2
$M^2_{D\alpha\alpha}$	$(2380)^2$ GeV^2	$(2340)^2$ GeV^2	$(2300)^2$ GeV^2

δ^{LL}_{23}	δ^{uRR}_{23}	δ^{uRL}_{23}	δ^{uLR}_{23}
0.05	0.2	-0.05	0.06

$h^0 \to c\bar{c}$ @ full one-loop level
Numerical results

- Physical masses in GeV of the particles in our reference scenario

$m_{\tilde{\chi}_1^0}$	$m_{\tilde{\chi}_2^0}$	$m_{\tilde{\chi}_3^0}$	$m_{\tilde{\chi}_4^0}$	$m_{\tilde{\chi}_1^+}$	$m_{\tilde{\chi}_2^+}$
175	373	2020	2021	373	2022

m_{h^0}	m_{H^0}	m_{A^0}	m_{H^+}
125.95	1498	1500	1504

$m_{\tilde{g}}$	$m_{\tilde{u}_1}$	$m_{\tilde{u}_2}$	$m_{\tilde{u}_3}$	$m_{\tilde{u}_4}$	$m_{\tilde{u}_5}$	$m_{\tilde{u}_6}$
1058s	663	920	1859	2351	2352	2386

- Flavour decomposition of $\tilde{u}_1$ and $\tilde{u}_2$ in our reference scenario (shown are the squared coefficients)

	$\tilde{u}_L$	$\tilde{c}_L$	$\tilde{t}_L$	$\tilde{u}_R$	$\tilde{c}_R$	$\tilde{t}_R$
$\tilde{u}_1$	0	0.0001	0.0024	0	0.694	0.303
$\tilde{u}_2$	0	0.0004	0.0184	0	0.304	0.677

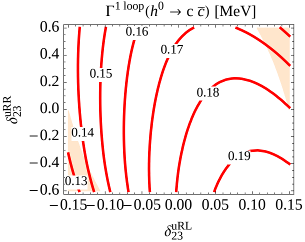
- We consider $\tilde{c} - \tilde{t}$ mixing $\Rightarrow$ the relevant QFV parameters are

$$\delta_{23}^{LL} (\approx M_{Q23}^2) \equiv \ \tilde{c}_L - \tilde{t}_L \text{ mixing parameter}$$
$$\delta_{23}^{uRR} (\approx M_{U23}^2) \equiv \ \tilde{c}_R - \tilde{t}_R \text{ mixing parameter}$$
$$\delta_{23}^{uLR} (\approx T_{U23}) \equiv \ \tilde{c}_L - \tilde{t}_R \text{ mixing parameter}$$
$$\delta_{23}^{uRL} (\approx T_{U32}) \equiv \ \tilde{c}_R - \tilde{t}_L \text{ mixing parameter}$$

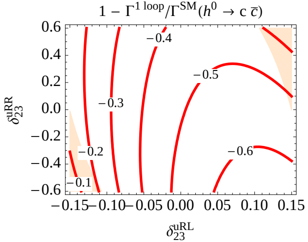
- Plus an important QFC parameter

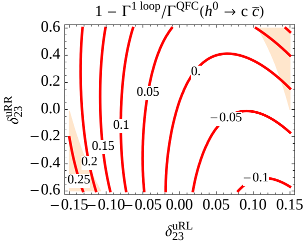
$$\delta_{33}^{uRL} (\approx T_{U33}) \equiv \ \tilde{t}_L - \tilde{t}_R \text{ mixing parameter}$$

- Dependence of the decay width $\Gamma^{1\text{loop}}(h^0 \to c\bar{c})$ on the $\tilde{c}_R - \tilde{t}_L$ and the $\tilde{c}_R - \tilde{t}_R$ mixing parameters (δ_{23}^{uRL} and δ_{33}^{uRL})



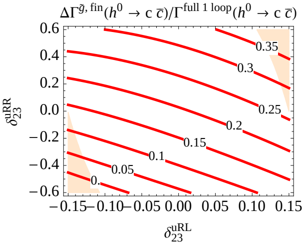
- Relative dependences of $\Gamma^{1\text{loop}}(h^0 \to c\bar{c})$ to $\Gamma^{\text{SM}} = 0.118437$ MeV and $\Gamma^{\text{QFC}} = 0.175951$ MeV as functions to the QFV parameters δ_{23}^{uRL} and δ_{33}^{uRL}



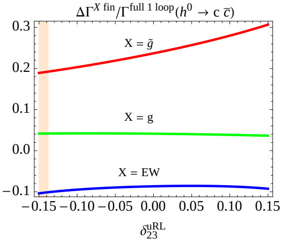


$h^0 \to c\bar{c}$ @ full one-loop level
Numerical results

- The finite part of the gluino contribution to $\Gamma^{1\text{loop}}(h^0 \to c\bar{c})$ relative to $\Gamma^{SM}(h^0 \to c\bar{c})$ as a function of the QFV parameters δ_{23}^{uRL} and δ_{33}^{uRL}



- The finite contributions of gluon, gluino and EW diagrams to $\Gamma^{1\text{loop}}(h^0 \to c\bar{c})$ relative to $\Gamma^{1\text{loop}}(h^0 \to c\bar{c})$ as functions of the QFV parameters δ_{23}^{uRL} and δ_{33}^{uRL}



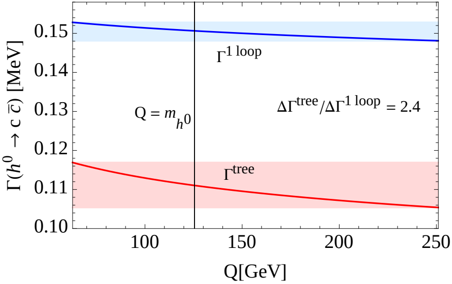
- $\Gamma^{SM}(h^0 \to c\bar{c}) = 0.118437$ MeV (see PDG and Higgs WG report, arXiv:1310.8361), SM prediction uncertainty $\Delta\Gamma^{SM}(h^0 \to c\bar{c}) \sim 11\%$, from which $\sim 7\%$ are due to the error of $\alpha_s(m_Z)$
- $\Delta\Gamma^{MSSM}(h^0 \to c\bar{c}) \sim \sqrt{4^2 + 7?^2 + 2^2} \approx 8.3\%?$

* error in the charm quark mass $m_c(m_c)$ ($\sim$ error in the charm Yukawa coupling $Y_c(m_c)$) $\sim 2\%$
* uncertainties due to the error in the strong coupling constant $\alpha_s(Q) \ \sim \ 7?\%$
  (Note: QCD/ SUSY QCD 1-loop corrections are proportional to $\alpha_s(Q)$!)
  (Note: The error in $\alpha_s(Q)$ induces additionally uncertainties in the scale evolution $m_c(m_c) \longrightarrow m_c(Q = m_{h^0})$!)
* uncertainties due to the renormalisation scale dependences of the width $\sim 2\%$

$h^0 \to c\bar{c}$ @ full one-loop level

Error estimation: theoretical errors

- Dependence of $\Gamma(h^0 \to c\bar{c})$ on the renormalisation scale Q in the range $m_{h^0}/2 < Q < 2m_{h^0}$



- The renormalisation scale Q dependence of the MSSM width is rather small => it results in $\sim 2\%$ theoretical uncertainties

$h^0 \to c\bar{c}$ @ full one-loop level
Error estimation: experimental errors

- Measurement at the LHC: looks bad
- However it is possible to be performed at the ILC
- Higgs coupling uncertainty in % from ILC at its various stages, ArXiv:1312.4974

	250	500	500up	1000	1000up
$c\bar{c}$	6.4	2.6	1.2	0.98	0.72

- $\Delta\Gamma^{\mathrm{DATA}}(h^0 \to c\bar{c}) \sim 1.2\%$ (at ILC(500 GeV and LumiUP))
- We find that the difference between MSSM and SM predictions for the width can be large compared to the expected experimental errors at the ILC, even if we take into account the theoretical uncertainties of the predictions

$h^0 \to c\bar{c}$ @ full one-loop level
Summary

- We have studied the decay of the lightest neutral Higgs boson, $h^0 \to c\bar{c}$, at full one-loop level in the MSSM with non-minimal flavour violation
- We have renormalised the process in the $\overline{\mathrm{DR}}$ renormalisation scheme
- In the numerical analysis we consider mixing between the second and the third squark generations and the relevant constraints from B meson data are taken into account
- We have found that the full one-loop-corrected decay width $\Gamma(h^0 \to c\bar{c})$ can differ up to $\sim 60\%$ from its SM value, due to large $\tilde{c} - \tilde{t}$ mixing and large QFV/QFC trilinear couplings. The leading contributions are those with gluino
- After summarising the theoretical and experimental errors we conclude that an observation of these SUSY QFV effects is possible with a good chance at the ILC.

- The $\tilde{\chi}_i^{\pm}/\tilde{\chi}_k^0/\tilde{g}$ masses of our scenario are relatively low with respect to the recent LHC experiments mass limits: shifting M_1, M_2 and M_3 to larger values and/or giving up the GUT relation does not influence the main results of our study
- In the latest SPheno version - v3.3.2, the constraint coming from $\mathrm{B}(B_s \to \mu^+\mu^-)$ forbids somewhat large region of the flavour violating parameter space. Then again this does not affect the regions with our largest effect

Thank you for your attention!!! :)