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Comparison of flavour codes

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Codes, Overview

3 public codes flavour codes

- `SuperIso` v2.7
  BR($b \to s\gamma$), isospin assymmetry in $B \to K^*\gamma$, BR($B_u^+ \to \tau^+\nu$),
  BR($B_u^+ \to \tau^+\nu$)/BR($B_u^+ \to \tau^+\nu)_{SM}$, BR($B_s \to \mu^+\mu^-$), BR($B \to D\tau\nu$)
  BR($B \to D\tau\nu$)/BR($B \to De\nu$), BR($D_s \to \tau\nu$, BR($D_s \to \mu\nu$,
  BR($K \to \mu\nu$)/BR($\pi \to \mu\nu$)
- `SUSY_FLAVOUR` v1
  BR($b \to s\gamma$), BR($b \to s\mu^+\mu^-$), BR($B_s \to \mu^+\mu^-$), BR($B_d \to \mu^+\mu^-$), ΔM_{B_s}, ΔM_{B_d},
  ΔM_D, ϵ_K, Δm_K, BR($K_L^0 \to \pi^0\nu\nu$), BR($K^+ \to \pi^+\nu\nu$)
- `SusyBSG` 1.3.1
  BR($b \to s\gamma$)

1 hidden flavour code

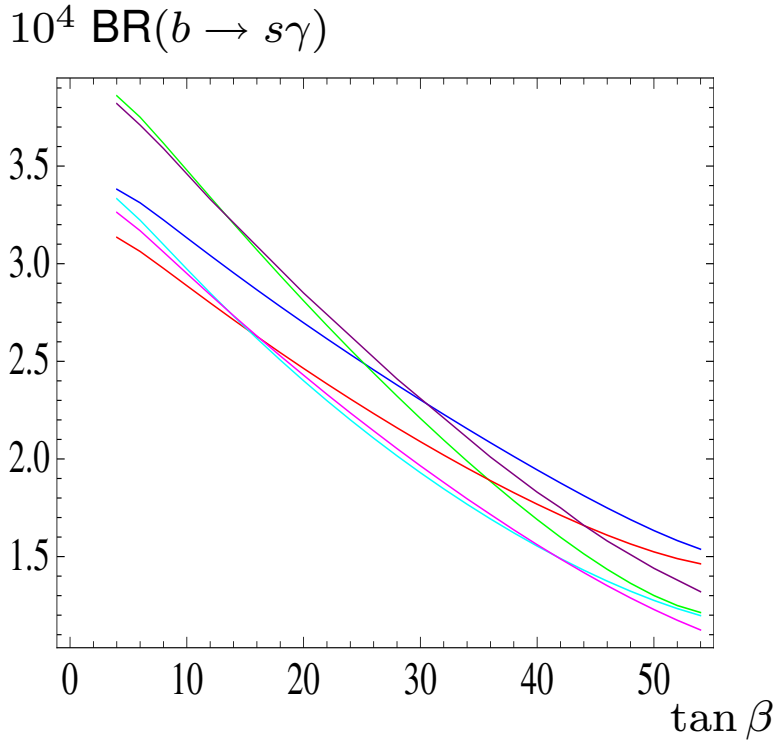
- `MasterCode`
  BR($b \to s\gamma$), BR($B_s \to \mu^+\mu^-$), BR($B_d \to \mu^+\mu^-$), BR($b \to s\mu^+\mu^-$),
  BR($B_u^+ \to \tau^+\nu$), ΔM_{B_s}, ΔM_{B_d}, Δm_K, BR($K_L^0 \to \pi^0\nu\nu$) (?), BR($K \to \mu\nu$)
  except for BR($B_s \to \mu^+\mu^-$) and BR($B_d \to \mu^+\mu^-$) normalized to SM values

Codes, Overview

2 codes which also calculate flavour observables

- `SPheno` v3.0
  BR($b \to s\gamma$), BR($B_s \to \mu^+\mu^-$), BR($b \to s\mu^+\mu^-$), BR($b \to s\nu\nu$), BR($B_d \to \mu^+\mu^-$), BR($B_u^+ \to \tau^+\nu$), ΔM_{B_s}, ΔM_{B_d}, ϵ_K, BR($K_L^0 \to \pi^0\nu\nu$), BR($K^+ \to \pi^+\nu\nu$)
- `Micromegas` 2.4.Q
  BR($b \to s\gamma$), BR($B_s \to \mu^+\mu^-$)

$b \to s\gamma$, $b \to s l^+ l^-$

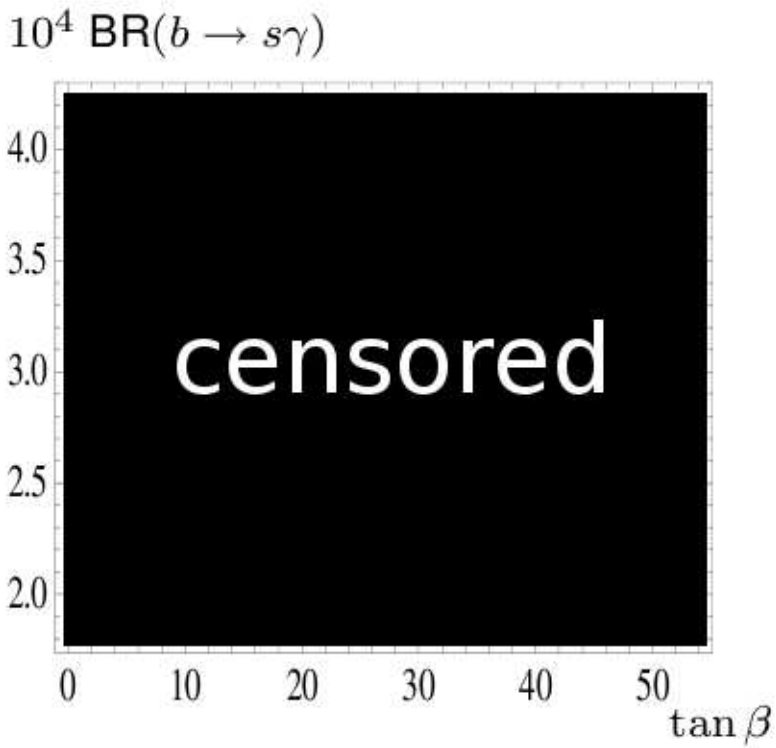


$m_b(m_b) = 4.2$ GeV, $m_t = 172.9$ GeV, $m_0 = 400$ GeV, $M_{1/2} = 300$ GeV, $A_0 = 0$, $\mu > 0$

MasterCode , SUSY_FLAVOUR , SPheno , SusyBSG , SuperIso , Micromegas

BR$(b \to s l^+ l^-)$: agreement between SUSY_FLAVOUR and SPheno within 5-6%

$b \to s\gamma$ II



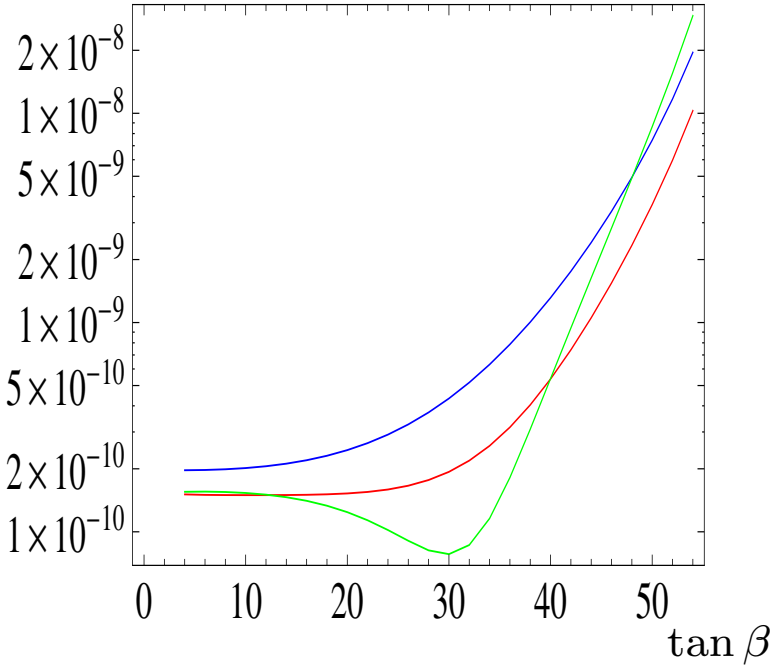
$m_b(m_b) = 4.2$ GeV, $m_t = 172.9$ GeV, $m_0 = 1$ TeV, $M_{1/2} = 300$ GeV, $A_0 = -100$ GeV, $\mu > 0$

MasterCode , SUSY_FLAVOUR , SPheno , SusyBSG , SuperIso , Micromegas

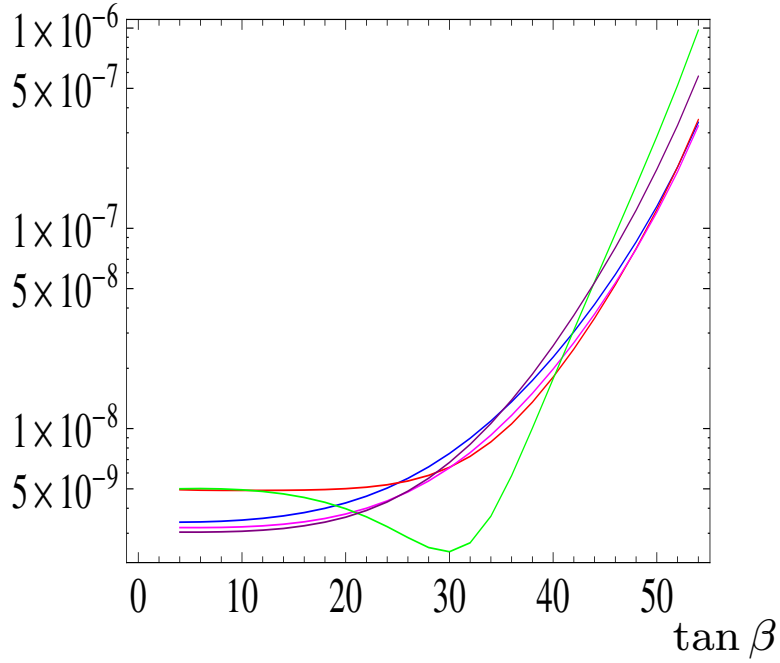
BR$(b \to s l^+ l^-)$: agreement between SUSY_FLAVOUR and SPheno within 5-6%

$B_d \to \mu^+\mu^-$, $B_s \to \mu^+\mu^-$

BR($B_d \to \mu^+\mu^-$)



BR($B_s \to \mu^+\mu^-$)

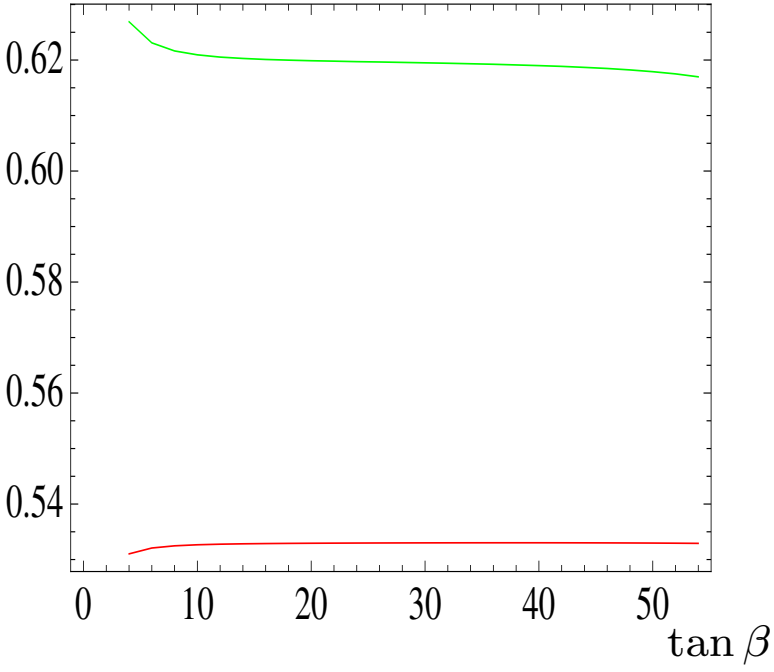


$m_b(m_b) = 4.2$ GeV, $m_t = 172.9$ GeV, $m_0 = 400$ GeV, $M_{1/2} = 300$ GeV, $A_0 = 0$, $\mu > 0$

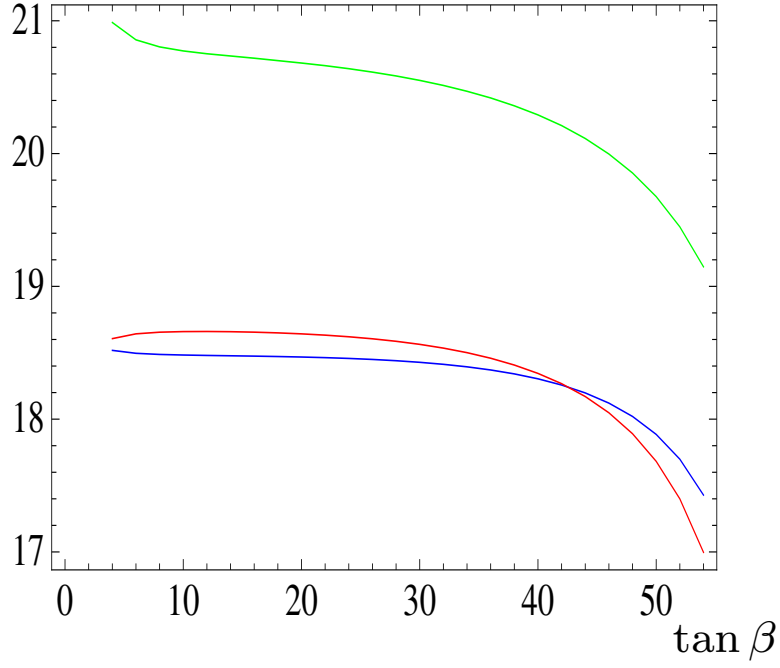
MasterCode , SUSY_FLAVOUR , SPheno , SuperIso , Micromegas

$\Delta M_{B_d}, \Delta M_{B_s}$

BR(ΔM_{B_d})



BR(ΔM_{B_s})



$m_b(m_b) = 4.2$ GeV, $m_t = 172.9$ GeV, $m_0 = 400$ GeV, $M_{1/2} = 300$ GeV, $A_0 = 0$, $\mu > 0$

MasterCode , SUSY_FLAVOUR , SPheno

Conclusions/Outlook

- BR($b \to s\gamma$): reasonable agreement, main differences due to
  - SM NNLO value
  - full versus approximate flavour structure

  however: cases where `MasterCode` behaves differently
- BR($b \to s l^+ l^-$): excellent agreement
- BR($B_d \to \mu^+\mu^-$), BR($B_d \to \mu^+\mu^-$)
  - largest differences at $\tan\beta = 30$, up to factor 6
  - for larger $\tan\beta$, up to factor 2.5
- ΔM_{B_d}, ΔM_{B_s}: except for small details good agreement
- BR($B_u^+ \to \tau^+\nu$): comparision still needs to be done
  tendency in all codes the same
- K-physics: comparision still needs to be done