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Imprint of SUSY in radiative B-meson decays

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We study the supersymmetric (SUSY) effects on $C_7(\mu_b)$ and $C_7'(\mu_b)$ which are the Wilson coefficients (WC) for $b \rightarrow s\gamma$ at b quark mass scale μ_b and are closely related to radiative B meson decays. The SUSY-loop contributions to $C_7(\mu_b)$ and $C_7'(\mu_b)$ are calculated at leading order (LO) in the Minimal Supersymmetric Standard Model (MSSM) with general quark flavor violation (QFV). For the first time we perform a systematic MSSM parameter scan for the WCs $C_7(\mu_b)$ and $C_7'(\mu_b)$ respecting all the relevant constraints, i.e. the theoretical constraints from vacuum stability conditions and the experimental constraints, such as those from K - and B -meson data and electroweak precision data, as well as recent limits on SUSY particle masses and the 125 GeV Higgs boson data from LHC experiments.

From the parameter scan, we find the following:

- (1) The MSSM contribution to $\text{Re}(C_7(\mu_b))$ can be as large as $\sim \pm 0.05$ which could correspond to about 3σ significance of New Physics (NP) signal in the future LHCb-Upgrade and Belle II experiments.
- (2) The MSSM contribution to $\text{Re}(C_7'(\mu_b))$ can be as large as ~ -0.08 which could correspond to about 4σ significance of NP signal in the future LHCb-Upgrade and Belle II experiments.
- (3) These large MSSM contributions to the WCs are mainly due to (i) large scharm-stop mixing and large scharm/stop involved trilinear couplings T_{U23} , T_{U32} and T_{U33} , (ii) large sstrange-sbottom mixing and large sstrange-sbottom involved trilinear couplings T_{D23} , T_{D32} and T_{D33} and (iii) large bottom Yukawa coupling Y_b for large $\tan \beta$ and large top Yukawa coupling Y_t .

In case such large NP contributions to the WCs are really observed in the future experiments at Belle II and LHCb-Upgrade, this could be the imprint of QFV SUSY (the MSSM with general QFV) and would encourage to perform further studies of the WCs $C_7(\mu_b)$ and $C_7^{MSSM}(\mu_b)$ at higher order (NLO/NNLO) level in this model.

Note: This work is based on collaboration with Helmut Eberl, Elena Ginina (HEPHY, Vienna) and Akimasa Ishikawa (Belle II, KEK).

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Primary authors: Dr EBERL, Helmut (HEPHY, Vienna); Prof. HIDAKA, Keisho (Tokyo Gakugei University); Dr GININA, Elena (HEPHY, Vienna); Prof. ISHIKAWA, Akimasa (IPNS, KEK)

Presenter: Prof. HIDAKA, Keisho (Tokyo Gakugei University)

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