

Recent progress on supersymmetric effects in rare K decays

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Supersymmetry offers one of the most attractive extensions of the Standard Model. Intensive searches for supersymmetric partners will soon start at the LHC. In that context, rare K decays will play an essential role, complementary to direct searches at colliders. Indeed, they allow us to study in an exceptionally clean way the flavor breaking structures. In the minimal supersymmetric extension of the SM (MSSM), these are completely arbitrary parameters (the so-called soft-breaking terms), related to the unknown supersymmetry breaking mechanism. Knowing them will therefore give us a glimpse of the physics at a still higher scale. This general statement will be explained and illustrated within recently studied scenarios[1,2]. For instance, in the MSSM at moderate $\tan(\beta)$, both with or without the minimal flavor violation hypothesis, rare K decays (especially $K \rightarrow \pi \nu \bar{\nu}$) are the most sensitive probe of the flavor-breaking in the up squark sector[1]. Also, combined studies of $KL \rightarrow \pi^0 e^+ e^-$ and $KL \rightarrow \pi^0 \mu^+ \mu^-$ could provide clean evidence for the MSSM at large $\tan(\beta)$ [2]. Finally, these two modes also allow for studies of R-parity violating effects[2].

[1] Isidori, Mescia, Paradisi, Smith, Trine, "Exploring the flavour structure of the MSSM with rare K decays", JHEP 0608 (2006) 064 [arXiv:hep-ph/0604074].

[2] Mescia, Smith, Trine, " $KL \rightarrow \pi^0 e^+ e^-$ and $KL \rightarrow \pi^0 \mu^+ \mu^-$: A binary star on the stage of flavor physics", JHEP 0608 (2006) 088 [arXiv:hep-ph/0606081].

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