PROBING THE STANDARD MODEL IN RARE $b \to s\ell^+\ell^-$ DECAYS

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We study long-distance (LD) effects in rare $FCNC$ transitions $b \to s\ell^+\ell^-$ and their interference with short-distance (SD) effects both in inclusive and exclusive decay modes. The main novel features of our analysis are [1]:

- we take into account the constraints imposed by gauge invariance on the possible form of the long-range $c\bar{c}$ penguin contribution to the SD Wilson coefficient C_{9V}, ruling out in particular the presence of a pole at $q^2 = 0$;
- we consider the effects of nonfactorizable soft gluon exchanges on the Wilson coefficient $C_{7\gamma}$. Measurements of the ψ polarization in $b \to s\psi$ transitions combined with QCD sum rule calculations of nonfactorizable effects in $B \to K^*\gamma$ allow a realistic estimate of the nonfactorizable contributions in the whole kinematically accessible q^2-region in $b \to s\ell^+\ell^-$ decays.

Based on our analysis of the LD effects, we re-examine the interference between the LD and SD contributions to inclusive $B \to X_s\ell^+\ell^-$ decays and find that there is a broad range of values of q^2 where such an interference is negligible.
A similar analysis is performed also for the exclusive modes, where another type of LD effects, connected with the presence of the light meson in the final state and encoded in the meson transition form factors, comes into the game. We find that present-day theoretical uncertainties in the transition form factors strongly influence the dilepton distributions, which cannot therefore be predicted with sufficient accuracy [2]. At the same time, however, the forward-backward asymmetry A_{FB} and the longitudinal lepton polarization asymmetry P_L remain largely unaffected by the uncertainties in the LD effects arising from the $c\bar{c}$ penguins and the meson transition form factors, and exhibit a remarkable sensitivity to the SD Wilson coefficients.
Thus, the determination of the observables A_{FB} and P_L both in inclusive and exclusive rare decays as well as that of the dilepton distribution in inclusive rare decays could allow to *measure* the SD Wilson coefficients, providing in this way a stringent test of the Standard Model.

[1] D. Melikhov, N. Nikitin and S. Simula: preprint INFN-ISS 98/3 (e-print archive hep-ph/9803343).

[2] D. Melikhov, N. Nikitin and S. Simula: Phys. Lett. **B410** (1997) 290; preprint INFN-ISS 97/15 (e-print archive hep-ph/9711362) to appear in Phys. Rev. **D57** (1998).