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## **Optimized Observables in non-leptonic decays**

Friday 21 June 2024 10:00 (20 minutes)

We study the penguin-mediated  $\bar{B}_{d(s)} \to K^{(*)0}\bar{K}^{(*)0}$  and  $\bar{B}_{d(s)} \to \bar{K}^{*0}(K^{*0})\phi$  transitions. We propose optimised observables  $L_{K(*)\bar{K}(*)}$ ,  $L_{K^*\phi}$  from the ratio of longitudinal branching ratios of these decays, with limited hadronic uncertainties and enhanced sensitivity to New Physics.  $L_{K(*)\bar{K}(*)}$  deviates at the 2.4 $\sigma$  $(2.6\sigma)$  level while  $L_{K^*\phi}$  exhibits a deviation at the 1.48  $\sigma$  level between its experimental value and its SM determination within QCD factorisation. These results can be accommodated together, if New Physics is assumed to affect either the QCD penguin operator  $Q_4$  or the chromomagnetic dipole operator  $Q_{8g}$  for both  $b \to d$  and  $b \to s$  transitions. The allowed range for the Wilson coefficients  $C_{4s,8gs}$  is narrower compared to  $C_{4d,8gd}$  since the  $b \to s$  transition  $\bar{B}_d \to \bar{K}^{*0}\phi$  is in better agreement with the SM. If we add the measured branching ratio for the  $\bar{B}_d \to \bar{K}^0\phi$  to our analysis, the simultaneous explanation of all the experimental data for the  $K^{(*)}\bar{K}^{(*)}$  and the  $K^*(\bar{K}^{(*)})\phi$  channels in terms of New Physics in  $C_{4d,s}$  or  $C_{8gd,s}$  operators only becomes very constrained. This set of observables can be explained more easily if we assume New Physics either in  $(C_{4f}, C_{6f})$  or  $(C_{6f}, C_{8gf})$  in both f = d, s. This should provide a strong incentive for the LHCb experiment to perform a measurement of the branching ratios of  $\bar{B}_d \to \bar{K}^{(*)0}\phi$  and an improved measurement for the branching ratio of  $\bar{B}_s \to K^{*0}\phi$ 

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