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Taming Penguins: towards high precision measurements of ϕ_d and ϕ_s

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Experimentally, the phases ϕ_d and ϕ_s are determined from CP asymmetry measurements in the “golden modes” $B_d^0 \rightarrow J/\psi K^0$ and $B_s^0 \rightarrow J/\psi \phi$. At leading order, the theoretical interpretation of these measurements is straightforward. However, to reach high precision determinations of ϕ_d and ϕ_s , which is desirable in view of the searches for signs of beyond the SM physics, corrections from next-to-leading order effects need to be accounted for. These corrections primarily originate from so-called penguin topologies. Using the SU(3) flavour symmetry, these corrections can be determined using suitably chosen control modes. Recent new CP asymmetry measurement from LHCb on $B \rightarrow DD$ and Belle-II on $B_d^0 \rightarrow J/\psi \pi^0$ decays greatly improve our knowledge on the parameters describing the contribution from penguin topologies. I will show the current constraints on the penguin parameters in $B \rightarrow J/\psi X$ and $B \rightarrow DD$ decays and highlight what we can expect at the end of the HL-LHC and Belle-II programmes.

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