

Abstract

The $B_d^0 \rightarrow \pi^- \pi^+$, $B_s^0 \rightarrow K^- K^+$ system allows the extraction of the angle γ of the unitarity triangle and the B_s^0 - \bar{B}_s^0 mixing phase ϕ_s . The LHCb collaboration presented first results with a precision of $\mathcal{O}(7^\circ)$. Unless there is theoretical progress, it is challenging to reduce this uncertainty below $\mathcal{O}(5^\circ)$ due to U -spin breaking corrections. A new strategy for the optimal determination of ϕ_s is proposed. New elements are the semileptonic decays $B_d^0 \rightarrow \pi^- \ell^+ \nu_\ell$ and $B_s^0 \rightarrow K^- \ell^+ \nu_\ell$. Moreover, the U -spin symmetry is only applied to theoretically favourable quantities. Corrections from U -spin breaking are determined, including a detailed discussion of the exchange and penguin annihilation topologies. All sources of uncertainty included, a determination of ϕ_s with a precision of 1° is possible in the era of Belle II and the LHCb upgrade. As $B_s^0 \rightarrow K^- K^+$ is dominated by penguin topologies, comparison with the SM expectation and alternative determinations such as from $B_s^0 \rightarrow J/\psi \phi$ may reveal new sources of CP violation.