CP Violation in B0d â†’ Ï€0KS. Are there any Hints of New Physics?

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Abstract

The basic goal of my thesis is to search for New Physics studying CP Violation in B0 d â†’ Ï€0KS. We perform a state-of-the-art analysis of the Standard Model picture with predictions, which will be very valuable in particular for the Belle-II experiment at KEK. As we know, there are two manifestations of CP violation in B-meson decays: the mixing-induced and the direct CP asymmetry. A reliable Standard Model prediction of these two observables is essential for the search of signals of New Physics.

The B0d â†’ Ï€0KS decay proceeds through a b â†’ qÂ¯ qs transition. It is dominated by QCD penguins but electroweak penguins have also a signiï¬•cant impact on the decay amplitude. These topologies describe Flavour Changing Neutral Currents (FCNC), which arise at the loop level in the Standard Model. Consequently, we expect this decay to be sensitive to sources of CP violation from beyond the Standard Model as there can be signiï¬•cant additional contributions to the decay amplitudes from FCNC phenomena.

The electroweak penguin eï¬€ects are described by both a parameter q, which provides a measure of the strength of the electroweak penguins with reference to tree-diagram topologies and a CP-violating phase Ï†. In the Standard Model, the phase Ï† vanishes and the q parameter can be determined using the SU(3) ï¬,avour symmetry of strong interactions.

However, beyond the Standard Model, there are cases where electroweak penguins carry a non-vanishing phase Ï†. If this phase is signiï¬•cantly large, there is an impact on CP asymmetries of B0d â†’ Ï€0KS. Our aim is to ï¬•nd an optimal way to determine both the q and the Ï† using the currently available data. Decays such as Bâ†’Ï€K and Bâ†’Ï€Ï€ help us to study the theoretical uncertainties which arise and reveal the dynamics.