

High Intensity Physics and CP Violation at Belle II

The Belle II experiment at SuperKEKB explores the high-intensity frontier of particle physics, providing a powerful environment for precision tests of the Standard Model (SM) and the search for phenomena beyond it. Through detailed studies of flavour physics, Belle II investigates the structure of the Cabibbo–Kobayashi–Maskawa (CKM) matrix, CP violation, and potential sources of New Physics manifested in rare or forbidden processes. The detector’s exceptional performance enables sensitive measurements in key areas such as lepton flavour violation, lepton flavour universality, electroweak “penguin” decays, and dark sector searches. In particular, Time-dependent CP violation analyses in B meson decays allow to put stringent constraints on the Unitarity Triangle, offering insights into possible inconsistencies with SM predictions. This presentation outlines the Belle II physics programme, detector capabilities, some analyses highlights, with an insight into the specific time dependent CP violation analysis in the decay $B \rightarrow \eta' K_L$.