APR13-2013-020113

Abstract for an Invited Paper
for the APR13 Meeting of
the American Physical Society

Observation of time-reversal violation in B meson transitions at BABAR

FERNANDO MARTINEZ-VIDAL, IFIC, Universitat de Valencia-CSIC Apdo. 22085 E-46071 Valencia, Spain

In the standard model of elementary particle physics, charge-parity (CP) violation in the quark sector of weak interactions arises from the single physical phase of the three-generation Cabibbo-Kobayashi-Maskawa matrix. This mechanism has been validated by more than a decade of intense experimental work probing CP violation, particularly with the studies with B mesons at B factories, BABAR at SLAC (USA) and Belle at KEK (Japan). The success of the three-generation theory was recognized by the award of a share of the 2008 Nobel Prize in Physics to Kobayashi and Maskawa. Since the standard model is CPT invariant, it predicts a time-reversal (T) symmetry breaking matching the large observed CP asymmetry in B mesons. However, until recently, there has been no direct observation of this expected, large T asymmetry. In this talk we shall discuss how the BABAR experiment at the SLAC National Accelerator Laboratory has conducted a data analysis where the decays of entangled neutral B mesons allow comparisons between the rates of four different transitions between quantum states and their inverse, as a function of the time evolution of the B meson. The results lead to the first direct observation with high significance of time-reversal non-invariance through the exchange of initial and final states in transitions that can only be connected by a time-reversal symmetry transformation.