chapter 4 (lecture 5)

9) From the time dependent CP asymmetry in the decay $B^0 \to J/\psi K_S^0$ we can measure the CKM angle β. We now consider the decay $B^0 \to \pi^+\pi^-$.

   (a) Draw the decay diagram for $B^0 \to \pi^+\pi^-$.

   (b) Show that $|\pi^+\pi^-\rangle$ is a CP eigenstate.

   (c) What is the CP-eigenvalue of $|\pi^+\pi^-\rangle$?

   (d) The decay $B^0 \to \pi^+\pi^-$is the result of interference between a direct decay amplitude and mixing-plus-decay amplitude. Draw the diagrams for both amplitudes.

   (e) What are the weak phases of each amplitude?

   (f) What is the weak phase difference between the amplitudes?

   (g) Show that you effectively measure the CKM angle α with this decay.