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PHZ4390
Nov. 13, 2013

Homework 10
Due Monday, Nov. 18

1. The CKM matrix member $|V_{ud}|$ is determined very accurately from studies of "superallowed" nuclear beta decays $0^+ \rightarrow 0^+$ (spin 0, positive parity). According to the PDG article on the CKM matrix (http://pdg.lbl.gov/2012/reviews/rpp2012-rev-ckm-matrix.pdf) the average of the twenty most precise measurements yields $|V_{ud}| = 0.97425 \pm 0.00022$. To an extremely good approximation $V_{ud} = \cos\theta_C$ and $V_{us} = \sin\theta_C$, where θ_C is the Cabibbo angle.

   a. (7 pts) Using the value shown for $|V_{ud}|$, what is the value and error of V_{us}?

   b. (3 pts) How does this value and error compare with other V_{us} measurements mentioned in the article?

2. (10 pts) What physics processes are used to measure V_{cs} and V_{cb}?

3. (5 pts) The lifetime of the b quark (measured in decays of B mesons and baryons) is similar to that of the charm quark (measured in decays of charm mesons and baryons) in spite of being three times more massive. However, weak decay rates increase approximately as the fifth power of mass. Why are the lifetimes similar? (Hint: Look at the information in the review article above).