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Rates and CP asymmetries of Charmless Two-body Baryonic $B_{u,d,s}$ Decays

With the experimental evidences of $\overline{B}^0 \to p\overline{p}$ and $B^- \to \Lambda\overline{p}$ decays, it is now possible to extract both tree and penguin amplitudes of the charmless two-body baryonic B decays for the first time. The extracted penguin-tree ratio agrees with the expectation. Using the topological amplitude approach with the experimental results on $\overline{B}^0 \to p\overline{p}$ and $B^- \to \Lambda\overline{p}$ decay rates as input, predictions on all other $\overline{B}_q \to calB\overline{calB}$, $calB\overline{calD}$, $calD\overline{calB}$ and $calD\overline{calD}$ decay rates, where $\mathcal{B}$ and $calD$ are the low lying octet and decuplet baryons, respectively, are given. It is non-trivial that the results do not violate any existing experimental upper limit. From the analysis it is understandable that why $\overline{B}^0 \to p\overline{p}$ and $B^- \to \Lambda\overline{p}$ modes are the first two modes with experimental evidences. Relations on rates are verified using the numerical results. We note that the predicted $B^- \to p\overline{\Delta^{++}}$ rate is close to the experimental bound, which has not been updated in the last ten years. Direct CP asymmetries of all $\overline{B}_q \to calB\overline{calB}$, $calB\overline{calD}$, $calD\overline{calB}$ and $calD\overline{calD}$ modes are explored. Relations on CP asymmetries are examined using the numerical results. The direct CP asymmetry of $\overline{B}^0 \to p\overline{p}$ decay can be as large as $\pm 50\%$. The CP asymmetries of $\Delta S = -1$ pure penguin modes are constrained to be of few $\%$. These modes are expected to be sensitive to New Physics contributions and are good candidates to be added to the list of the tests of the Standard Model.

Experimental Collaboration

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