Nonleptonic Weak Decays of Bottom Mesons with Soft-Pion Emission.

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Summary. — Inclusive soft-meson theorems are derived for the nonleptonic decay of the bottom meson within the framework of the Kobayashi-Maskawa six-quark model.

The discovery of the narrow upsilon states \( \Upsilon, \Upsilon' \) and \( \Upsilon'' \) (\(^{1}\)) and its confirmation in \( e^+e^- \) annihilation at the DORIS (\(^{2}\)) storage ring at DESY strongly suggest that a new quark called bottom, \( b \), with charge \( Q = -\frac{2}{3} \) exists. A fourth broad upsilon state \( \Upsilon'' \) has been discovered at the Cornell Electron Storage Ring and the broad width of this new resonance suggests that it decays strongly into mesons containing a \( b \)-quark which subsequently undergoes weak decay. The measurement of the charged multiplicity on and off the \( \Upsilon'' \)-resonance and charged and neutral kaon content of \( \Upsilon'' \) decays give further information on the properties of \( B \)-mesons (\(^{3}\)).

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The favoured model of weak interaction for the b-quark is the Kobayashi-Maskawa six-quark model\(^{(4)}\). This is a natural extension of the earlier four-quark model of Glashow, Iliopolous and Maiani\(^{(5)}\) which came to prominence with the discovery of the charmed hadrons. The general properties of bottom particles have been analysed by Ellis et al.\(^{(6)}\). With the help of the quark-parton model, the two-body decays of bottom mesons have been studied by Ali et al.\(^{(7)}\). Instead of using the dynamical model approach, one of us (WL) has discussed the two-body decays of bottom mesons from a pure symmetric consideration\(^{(8)}\) based on the Kobayashi-Maskawa model. However, it may be very difficult to observe these two-body decay experimentally due to their small branching ratios. This is because of the fact that the masses of the bottom mesons are heavy and hence multiparticle decays are dominant. Therefore, it may be more practical to study the soft-pion theorem

In this note we discuss the application of the soft-pion idea to the weak nonleptonic decay of bottom mesons. The application of the soft-pion idea to the weak nonleptonic decay of charmed hadrons has been discussed by Kingsley et al.\(^{(9)}\) who based themselves on the four-quark model. In this work we discuss the soft-pion emission in the bottom meson inclusive decays within the framework of the Kobayashi-Maskawa six-quark model. Consider the 24-component quark field

\[
q(x) = \begin{pmatrix}
u(x) \\
\bar{d}(x) \\
\bar{s}(x) \\
\bar{c}(x) \\
\bar{b}(x) \\
\bar{t}(x)
\end{pmatrix}
\]

(1)

\(q\) transforms according to the fundamental representation of SU\(_{6}\) and the component fields \(u, d,\) etc. are quantized according to the conventional canonical anticommutation

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\(\text{References:}\)