

Ratio of the color suppressed decays $\Lambda_b \rightarrow \Lambda J/\psi$ and $B^0 \rightarrow KJ/\psi$

A K GIRI and R MOHANTA

Physics Department, Utkal University, Bhubaneswar 751 004, India
E-mail: nanda@iop.ren.nic.in

MS received 5 April 1997; revised 4 December 1997

Abstract. Based on the factorization approximation, we have estimated the ratio of the branching fractions for the color suppressed nonleptonic decays $\Lambda_b \rightarrow \Lambda J/\psi$ and $B^0 \rightarrow KJ/\psi$. Treating the s -quark as heavy, we have used the HQET to calculate the hadronic matrix elements. The mesonic Isgur–Wise function is calculated in the quark model whereas for the baryonic IW function we have employed the bound state soliton picture. The results obtained agree very well with the recent CDF experimental data.

Keywords. Factorization approximation; heavy quark effective theory; Isgur–Wise function.

PACS Nos 11.30; 13.25; 13.30

1. Introduction

Recently the decay mode $\Lambda_b \rightarrow \Lambda J/\psi$ has been observed at the Femilab [1] and the production cross section times branching fraction for the decay $\Lambda_b \rightarrow \Lambda J/\psi$ relative to that of $B^0 \rightarrow KJ/\psi$ has been measured to be $0.27 \pm 0.12 \pm 0.05$. Based on the factorization approach, we have shown that the CDF data [1] for the ratio $\text{Br}(\Lambda_b \rightarrow \Lambda J/\psi)/\text{Br}(B^0 \rightarrow KJ/\psi)$ can be well accounted for in the framework of heavy quark effective theory (HQET) [2–5]. Much of the success of HQET has been in the treatment of decays from one heavy flavor to another, namely $b \rightarrow c$ transitions. However, one approximation used recently in the literature has been to treat the *strange* quark as heavy, so that the decays we are interested here can be considered as heavy to heavy transitions. In fact the previous challenging studies [6–9] suggest that the heavy quark effective theory is still effective for s -system, if a constituent quark mass is employed for m_s and $1/m_s$ corrections are taken into account properly. Therefore it is interesting to examine the applicability of the heavy flavor symmetry in the s -quark system even if the s quark mass is not large enough compared to the QCD scale Λ_{QCD} . There is a lot of altercation in the literature regarding the fact, ‘whether HQET could be applied to s quark system or not’. In a recent letter Chakraverty *et al* [10] have shown that heavy quark symmetry is not reliable for the s quark system. On the other hand applying HQET to $B \rightarrow K^{(*)}$ transitions, Robert and Ledroit [11] suggested that the heavy s limit may give an acceptable description of unpolarized