

RELATIVISTIC CORRECTIONS TO THE HARMONIC-OSCILLATOR  
QUARK MODEL IN WEAK NONLEPTONIC MESON DECAYS

P. Colić and J. Trampetić

Rudjer Bošković Institute, Zagreb

D. Tadić

Zavod za teorijsku fiziku, Prirodoslovno-matematički  
fakultet, University of Zagreb, Zagreb

Current algebra is the only way by which quark models can be introduced into the calculation of weak meson decay amplitudes. The nonrelativistic harmonic-oscillator quark model was used to explain  $K \rightarrow \pi\pi$  weak decays<sup>1)</sup>. In Ref. 2) a relativistic modification was introduced because of the well-known fact that quark momenta in hadrons are not negligible. This means that small components ought to be taken into account even when using the HO model. The estimate can be made by replacing quark Pauli spinors by Dirac spinors.

Because of the complexity of a full relativistic treatment of a two-body potential problem, we shall content ourselves with relativistic corrections to the nonrelativistic two-body HO model. The corrections turn out to be very large, so that one should not refer to corrections, but to a reformulated approach.

Using the formalism of Refs.<sup>1,2)</sup> to calculate the decay amplitudes and employing the relativized HO quark model to estimate the matrix elements  $\langle \pi | H_W^{\text{eff}} | K \rangle$ , we find

$$\begin{aligned} 10^8 A(K^+ \rightarrow \pi^+ \pi^0) &= 9.85x, \\ 10^8 A(K^0 \rightarrow \pi^+ \pi^-) &= 16.163 + 4.64x + 4.66P, \\ 10^8 A(K^0 \rightarrow \pi^0 \pi^0) &= 16.163 - 9.28x + 4.66P. \end{aligned}$$

Here  $x$  indicates the quenching of the  $\Delta I = 3/2$  operator, while  $P$  measures the increase in strength of the well-known<sup>3)</sup> penguin terms. The values  $x = 1$ ,  $P = 1$  correspond to the standard QCD enhanced weak Hamiltonian, while  $x = 0.19$ ,  $P = 2.34$  fit the experimental data<sup>4)</sup> practically ideally.

References:

- 1) M. Milošević, D. Tadić and J. Trampetić, Nucl. Phys. B187 (1981) 514;
- 2) P. Colić, J. Trampetić and D. Tadić, Relativized harmonic-oscillator quark model and  $K \rightarrow \pi\pi$  decays, to be published in Phys. Rev. D;
- 3) M.A. Shifman, A.I. Vainshtein and V.I. Zakharov, Nucl. Phys. B120 (1977) 316;
- 4) Particle Data Group, Rev. Mod. Phys. 52, no 2 (1980).