

916.

Problem 56.22 (RHK)

We have to analyze the following decays or reactions in terms of the quark contents of the particles:

(a) $\Sigma^- \rightarrow n + \pi^-$; (b) $K^0 \rightarrow \pi^+ + \pi^-$; (c) $\pi^+ + p \rightarrow \Sigma^+ + K^+$; (d) $\gamma + n \rightarrow \pi^- + p$.

Solution:

We write the quark contents of the particles involved in the decays and reactions that we are analyzing.

$p = uud$ $n = udd$ $\Sigma^+ = uus$ $\Sigma^- = dds$
 $\pi^+ = u\bar{d}$ $\pi^- = d\bar{u}$ $K^+ = u\bar{s}$ $K^0 = d\bar{s}$

(a)

We write the quark contents of the particles in the decay

$\Sigma^- \rightarrow n + \pi^-$. We get

$dds \rightarrow udd + d\bar{u}$.

Cancelling the two dd from the left and the right sides of the decay relation, we get

$s \rightarrow d + u + \bar{u}$.

That is in the weak interaction process an s quark is transformed into a d quark and a $u\bar{u}$ pair is created from the decay energy.

(b)

We write the quark contents of the decay process

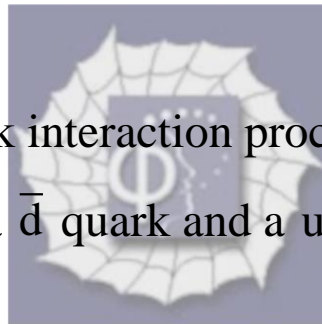
$K^0 \rightarrow \pi^+ + \pi^-$. We get

$d\bar{s} \rightarrow u\bar{d} + d\bar{u}$.

Cancelling d from the left and the right sides of the decay process relation, we get

$\bar{s} \rightarrow \bar{d} + u + \bar{u}$.

That is in the weak interaction process an \bar{s} quark is transformed into a \bar{d} quark and a $u\bar{u}$ pair is created from the decay energy.



(c)

We write the quark contents of the particles in the

reaction $\pi^+ + p \rightarrow \Sigma^+ + K^+$. We get

$u\bar{d} + uud \rightarrow uus + u\bar{s}$.

By cancelling out uuu from the left and the right hand sides of the reaction, we note that $d\bar{d}$ pair goes into $s\bar{s}$ pair. The reaction process takes place due to strong force.

(d)

We write the quark contents of the particles in the

reaction $\gamma + n \rightarrow \pi^- + p$. We get

$udd \rightarrow d\bar{u} + uud$.

In this reaction process which is due to force of electromagnetic interaction udd goes into udd plus $u\bar{u}$ pair.

