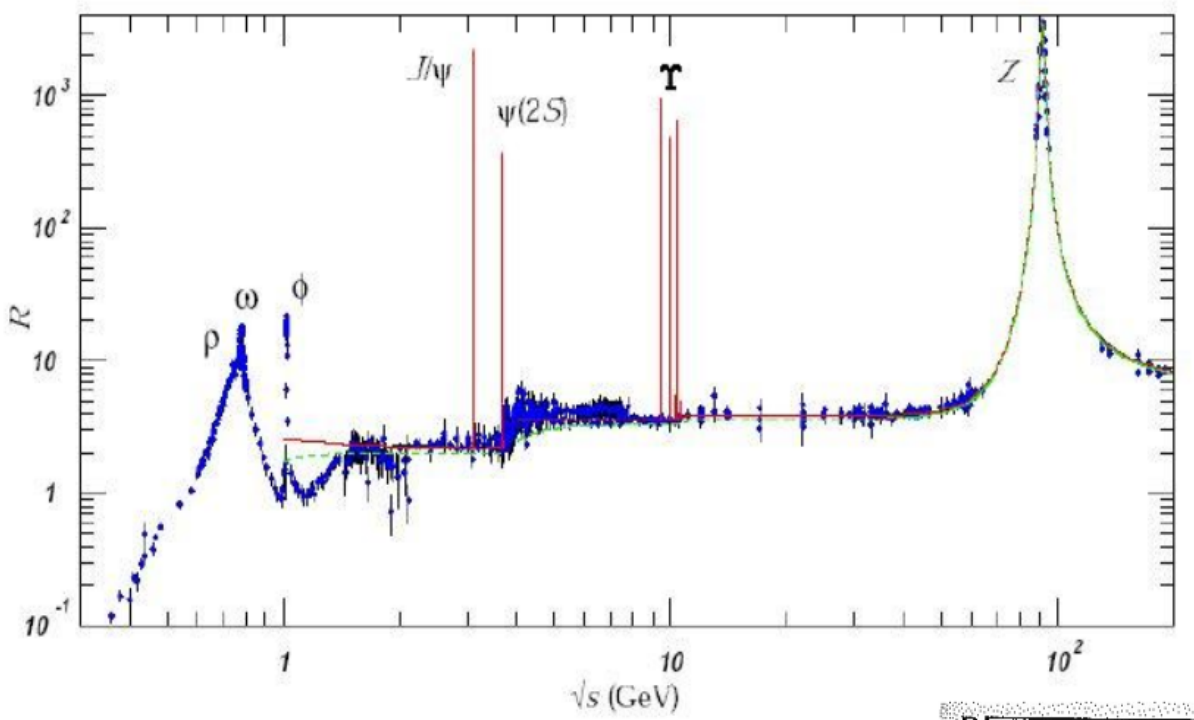
Evidence for 3 colors

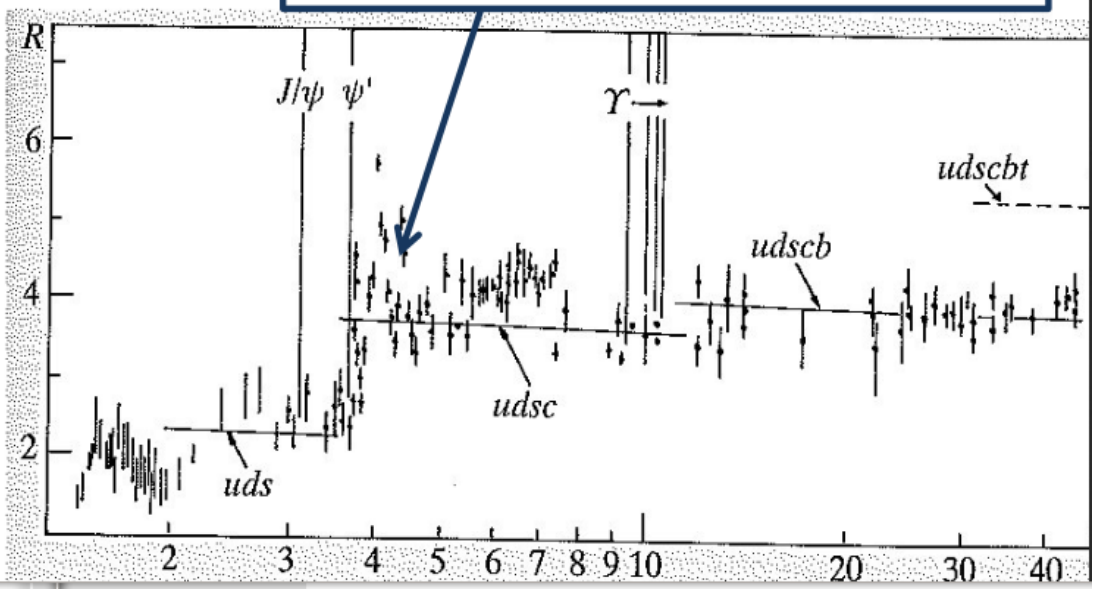


$$R = \frac{\sigma(e^+e^- \rightarrow hadrons)}{\sigma(e^+e^- \rightarrow \mu^+\mu^-)}$$

$$= N_c \sum_i Z_i^2$$

q	Z_i^2	$R[\sqrt{s} \leq 2m(q)]$
u	4/9	4/3
d	1/9	5/3
s	1/9	2
c	4/9	10/3
b	1/9	11/3
t	4/9	5

τ$\bar{\tau}$ treshold, however not all τ decay into hadronic jets



Relation of Gell-Mann matrices with quarks

Color SU(3): Quark states

$$R=\begin{pmatrix}1\\0\\0\end{pmatrix},\quad G=\begin{pmatrix}0\\1\\0\end{pmatrix},\quad B=\begin{pmatrix}0\\0\\1\end{pmatrix}$$

$R \leftrightarrow G \quad \lambda_1=\begin{pmatrix}0&1&0\\1&0&0\\0&0&0\end{pmatrix} \quad \lambda_2=\begin{pmatrix}0&-i&0\\i&0&0\\0&0&0\end{pmatrix} \quad \lambda_3=\begin{pmatrix}1&0&0\\0&-1&0\\0&0&0\end{pmatrix}$

$T_\pm = 1/2(\lambda_1 \pm i\lambda_2)$ $\quad r\bar{g},\quad g\bar{r}$

$\frac{1}{\sqrt{2}}(r\bar{r}-g\bar{g})$

$R \leftrightarrow B \quad \lambda_4=\begin{pmatrix}0&0&1\\0&0&0\\1&0&0\end{pmatrix} \quad \lambda_5=\begin{pmatrix}0&0&-i\\0&0&0\\i&0&0\end{pmatrix}$

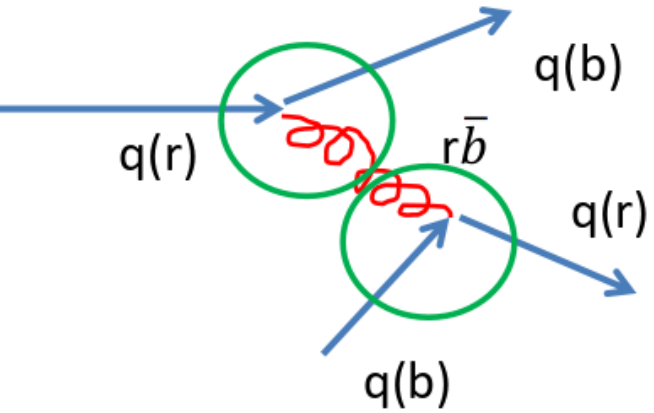
$V_\pm = 1/2(\lambda_4 \pm i\lambda_5)$ $\quad r\bar{b},\ b\bar{r}$

$B \leftrightarrow G \quad \lambda_6=\begin{pmatrix}0&0&0\\0&0&1\\0&1&0\end{pmatrix} \quad \lambda_7=\begin{pmatrix}0&0&0\\0&0&-i\\0&i&0\end{pmatrix}$

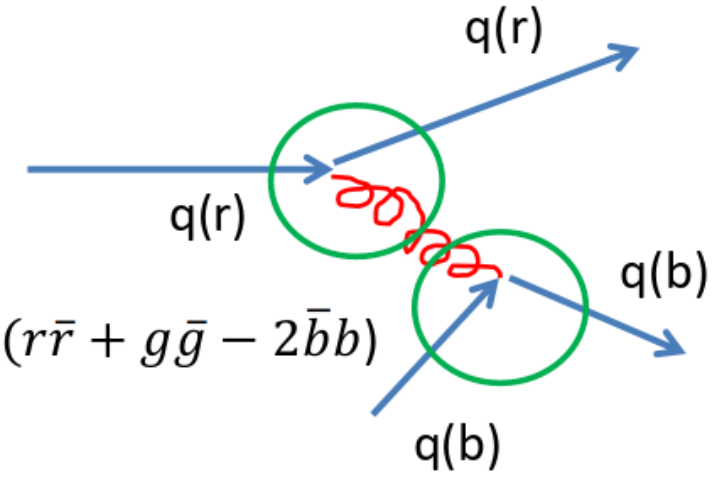
$U_\pm = 1/2(\lambda_6 \pm i\lambda_7)$ $\quad b\bar{g},\ \bar{b}g$

$\lambda_8=\begin{pmatrix}1&0&0\\0&1&0\\0&0&-2\end{pmatrix}$

$\frac{1}{\sqrt{6}}(r\bar{r}+g\bar{g}-2\bar{b}b)$



conservation of color at each vertex



$\frac{1}{\sqrt{6}}(r\bar{r}+g\bar{g}-2\bar{b}b)$