Neutral Weak Interaction

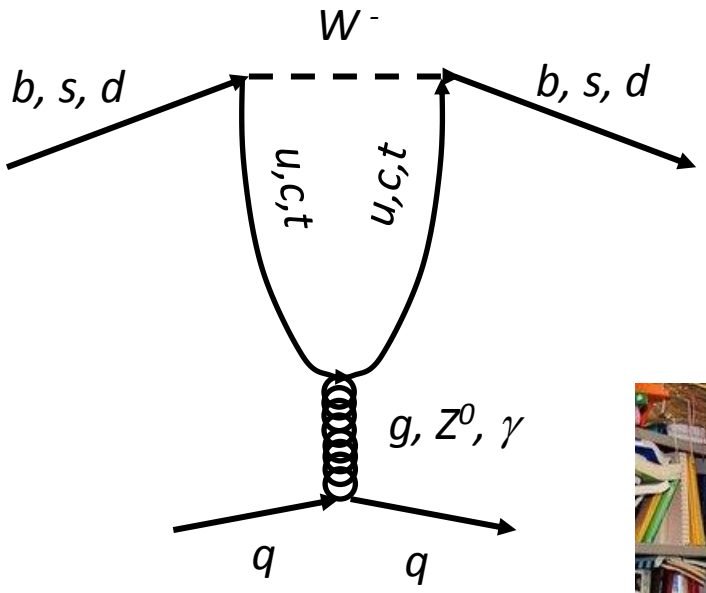
$$\left[\bar{d}',\bar{s}',\bar{b}'\right]\begin{bmatrix} d' \\ s' \\ b' \end{bmatrix} = \left[\bar{d},\bar{s},\bar{b}\right] V_{CKM}^{+} V_{CKM} \begin{bmatrix} d \\ s \\ b \end{bmatrix}$$

$$V_{CKM}^{+} V_{CKM} = \begin{bmatrix} V_{ud}^{*} & V_{cd}^{*} & V_{td}^{*} \\ V_{us}^{*} & V_{cs}^{*} & V_{ts}^{*} \\ V_{ub}^{*} & V_{cb}^{*} & V_{tb}^{*} \end{bmatrix} \begin{bmatrix} V_{ud} & V_{us} & V_{ub} \\ V_{cd} & V_{cs} & V_{cb} \\ V_{td} & V_{ts} & V_{tb} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\left[\bar{d}',\bar{s}',\bar{b}'\right]\begin{bmatrix} d' \\ s' \\ b' \end{bmatrix} = \left[\bar{d},\bar{s},\bar{b}\right]\begin{bmatrix} d \\ s \\ b \end{bmatrix} = \bar{d}d + \bar{s}s + \bar{b}b$$

absence of Flavour Changing
Neutral Current:
Glashow-Iliopoulos-Maiani
mechanism

FCNC appear only as higer order processes:



„Penguin“ diagram

(origin:
loosing a bet in a pub upon a darts game, John Ellis had to use the word penguin in his next paper)

(why higher order?
this process is of the order of
$|\mathfrak{M}|^2 \propto \alpha_{weak}^2 \, \alpha_{strong}^2$)