

We set in the flavor basis  $X_u, X_d$

$$M = \begin{pmatrix} 2m_u & 0 \\ 0 & 2m_d \end{pmatrix} + \delta \begin{pmatrix} 1 & \mathbf{1} \\ \mathbf{1} & 1 \end{pmatrix}$$

where the mixing matrix has a diagonal structure in the Isospin  $I = 0, 1$  basis, its eigenvectors being

$$\frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ 1 \end{pmatrix} \quad \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$