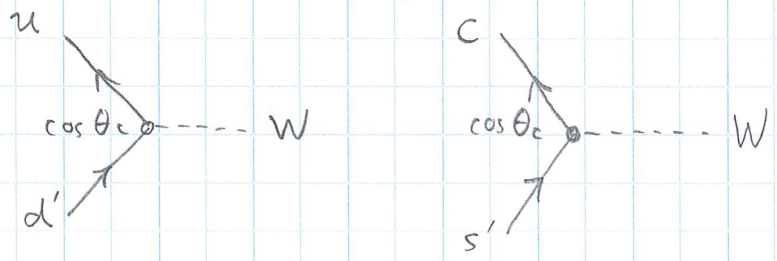
Two families of quarks & leptons

$$\begin{pmatrix} \nu_e \\ e^- \end{pmatrix} \quad \begin{pmatrix} \nu_\mu \\ \mu \end{pmatrix}$$

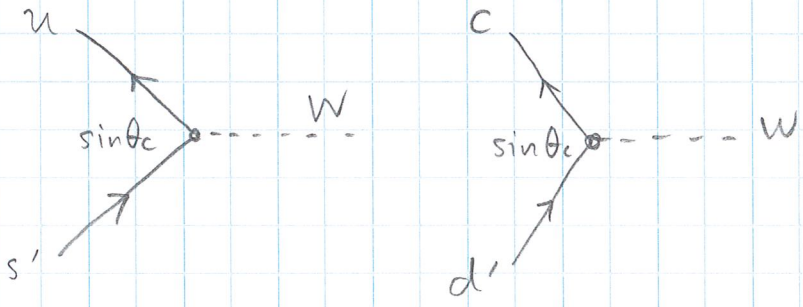
$$\begin{pmatrix} u \\ d \end{pmatrix} \quad \begin{pmatrix} c \\ s \end{pmatrix}$$

Weak eigenstates:

$$d' = d\cos\theta_c + s\sin\theta_c$$
$$s' = -d\sin\theta_c + s\cos\theta_c$$



Cabibbo favored transitions



Cabibbo suppressed decays.

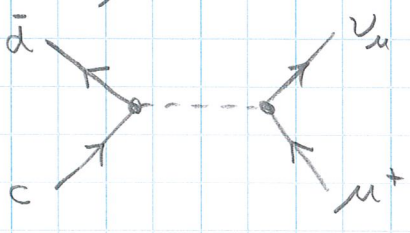
The D mesons

$D^+ = (c\bar{d})$ $\quad D^- = (\bar{c}d)$

$D^0 = (c\bar{u})$ $\quad \bar{D}^0 = (\bar{c}u)$

Leptonic decays

$D^+ \to \mu^+ \nu_\mu$ $\quad Br = 3.7 \times 10^{-4}$



$D^0 \to \mu^+\mu^-$ $\quad < 6 \times 10^{-9}$

Semileptonic decays

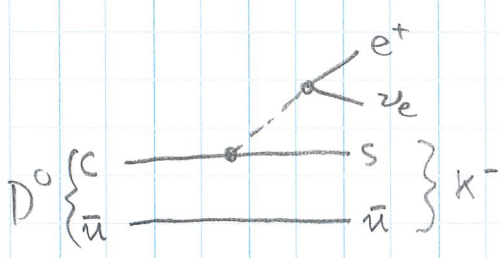
$D^+ \to \bar{K}^0 e^+ \nu_e$, $\bar{K}^0 \mu^+ \nu_\mu$ $\quad$ 9% each

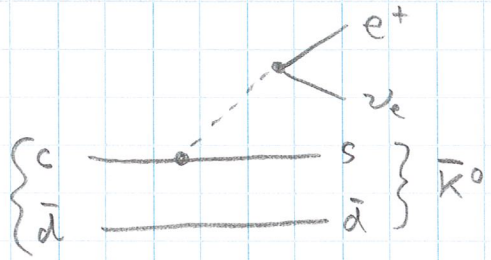
$\bar{K}^{*0} e^+ \nu_e$ $\quad \bar{K}^{*0} \mu^+ \nu_\mu$ $\quad$ 5% each

(lepton universality)

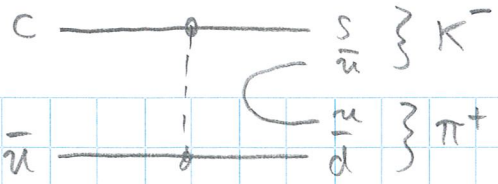
$D^0 \to K^- e^+ \nu_e$ $\quad K^- \mu^+ \nu_\mu$ $\quad$ 3.5 , 3.3%

$K^{*-} e^+ \nu_e$ $\quad K^{*-} \mu^+ \nu_\mu$ $\quad$ 2.2 , 1.9%

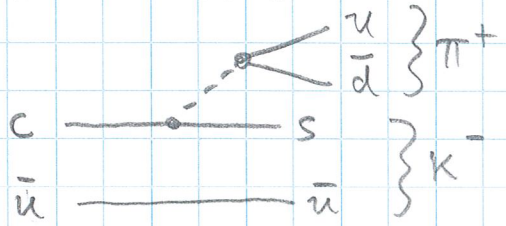




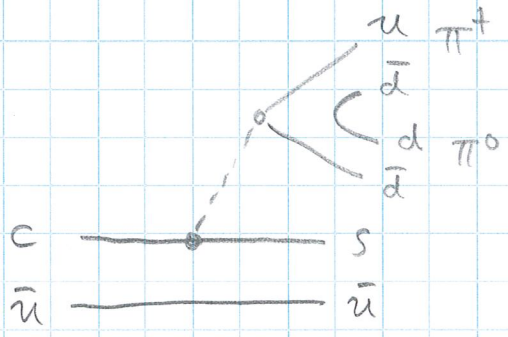
Hadronic decays



$D^0 \to K^- \pi^+$

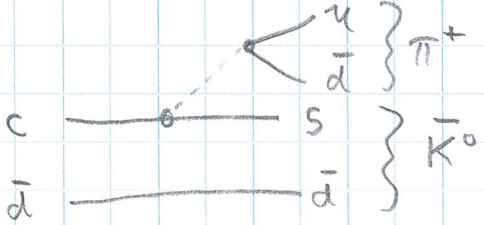


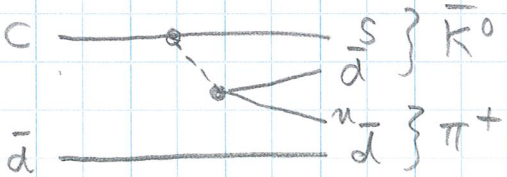
Br = 4%



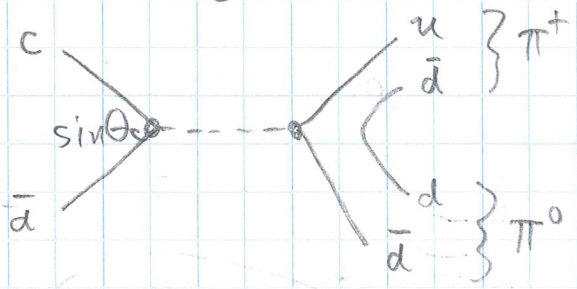
Br = 14%

$D^+ \to K^0 \pi^+$





$\sim \cos\theta_c$



Cabibbo suppressed

$\tau(D^+) = 1.04 \times 10^{-12}$ s
$m(D^+) = 1870$ MeV

$\tau(D^0) = 0.41 \times 10^{-12}$ s
$m(D^0) = 1865$ MeV

Excited D mesons

Ground state D mesons have spin 0.

$D^+ = (c\uparrow \bar{d}\downarrow)$ $\quad$ $D^0 = (c\uparrow \bar{u}\downarrow)$

The spin-1 D-mesons have spins aligned

$D^{*+} = (c\uparrow \bar{d}\uparrow)$ $\quad$ $D^{*0} = (c\uparrow \bar{u}\uparrow)$

$m(D^{*+}) = 2010$ MeV

$D^{*+} \to D^0\pi^+$ 68% } Isospin
$D^+\pi^0$ 30% }
$D^+\gamma$ 2% electromagnetic decay

$D^{*0} \to D^0\pi^0$ 65%
$D^0\gamma$ 35%

Mass splitting suppressed by $\frac{1}{m_1 m_2}$ so the mass difference is much smaller than in K^*/K situation.