

Exercise III

1. $\Sigma^+ \rightarrow \Lambda \mu^+ \mu^-$

Forbidden due to energy conservation

$m(\Sigma^+) \approx 1197 \text{ MeV}$ (& small width γ)

$m(\Lambda) \approx 1116 \text{ MeV}$

$m(\mu) \approx 105 \text{ MeV}$

2. $D^+ \rightarrow p \tau^- \nu_\tau$

Forbidden for several reasons

(a) Energy conservation

$m(D^+) \approx 1870 \text{ MeV} < m(p) + m(\tau^-) \approx 938 + 1777 \text{ MeV}$

(b) Baryon number

$B_i = 0 \neq B_f = 1$

(c) L_τ conservation

$L_{\tau,i} = 0 \neq L_{\tau,f} = +2$

(d) Electric charge: $Q_i = +1 \neq Q_f = 0$

3. $e^- p \rightarrow e^- n \pi^+$

$Q_i = Q_f = 0$

$B_i = B_f = 1$

$L_{e,i} = L_{e,f} = 1$

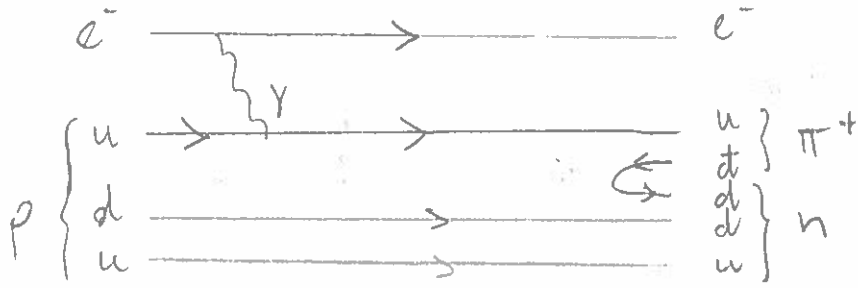
Other charges do not intervene.

\Rightarrow Allowed.

Flavors conserved (also in term of u, d quarks)

Interaction with e^- (impossible by SI) \Rightarrow EM

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4.

$$B^0 \rightarrow \tau^+ \tau^-$$

$$m_i \approx 5 \text{ GeV}$$

$$m_f \approx 3,6 \text{ GeV}$$

$$m_i > m_f$$

$$Q_i = Q_f = 0$$

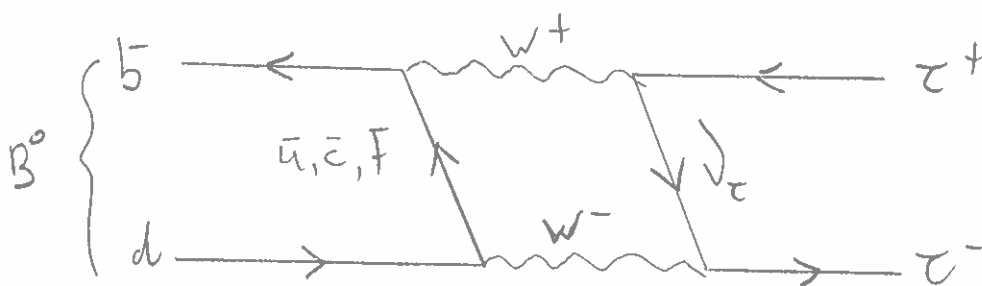
$$L_{\tau,i} = L_{\tau,f} = 0$$

$$B_i = 1 \Rightarrow B_f = 0$$

Other charges do not intervene

E, Q, \mathcal{B}, L_f conserved \Rightarrow Allowed

B violated \Rightarrow wI



5. $e^+ e^- \rightarrow \gamma \gamma$

$$Q_i = Q_f = 0$$

$$L_{e,i} = L_{e,f} = 0$$

Other charges do not intervene

Q, B, L_e conserved \Rightarrow Allowed

presence of leptons and γ , no flavor violation

\Rightarrow EM.

