

12) Částice Ξ^0 (hmotnost 1314,8 MeV) se rozpadá na hyperon Λ ($m = 1115,7$ MeV) a π^0 mezon (hmotnost 135,0 MeV). Určete kinetickou energii a hybnost hyperonu a mezonu po rozpadu. [$Q = 64,1$ MeV, $E_K(\text{hyperon}) = 8,1$ MeV, $E_K(\text{mezon}) = 56,0$ MeV, $p = 135,0$ MeV/c]



$$E_{\Xi^0} = 1314,8 \text{ MeV}$$

$$E_{\Lambda} = 1115,7 \text{ MeV}$$

$$E_{\pi^0} = 135,0 \text{ MeV}$$

ZZE:

$$Q = E_{\Xi^0} - E_{\Lambda} - E_{\pi^0} = 1314,8 - 1115,7 - 135,0 = \underline{64,1 \text{ MeV}}$$

$$Q = E_{K\Lambda} + E_{K\pi} \rightarrow E_{K\Lambda} = Q - E_{K\pi}$$

ZZH

$$E = E_0 + E_K = \sqrt{E_0^2 + p^2 c^2} \rightarrow p^2 c^2 = (E_0 + E_K)^2 - E_0^2$$

$$p_{\Lambda} = p_{\pi}$$

$$p_{\Lambda}^2 c^2 = p_{\pi}^2 c^2$$

$$(E_{\Lambda} + E_{K\Lambda})^2 - E_{\Lambda}^2 = (E_{\pi^0} + E_{K\pi})^2 - E_{\pi^0}^2$$

$$\cancel{E_{\Lambda}^2} + 2E_{\Lambda} \cdot E_{K\Lambda} + \cancel{E_{K\Lambda}^2} - \cancel{E_{\Lambda}^2} = 2 \cdot E_{\pi^0} \cdot E_{K\pi} + \cancel{E_{K\pi}^2} \quad E_{K\Lambda} = Q - E_{K\pi}$$

$$2E_{\Lambda} Q - 2E_{\Lambda} E_{K\pi} + Q^2 - 2Q \cdot E_{K\pi} + \cancel{E_{K\pi}^2} = 2E_{\pi^0} E_{K\pi} + \cancel{E_{K\pi}^2}$$

$$\underline{E_{K\pi}} = \frac{Q^2 + 2E_{\Lambda} Q}{2(E_{\Lambda} + E_{\pi^0} + Q)} = \frac{64,1^2 + 2 \cdot 1115,7 \cdot 64,1}{2 \cdot (1115,7 + 135,0 + 64,1)} = \underline{55,96 \text{ MeV}}$$

$$Q = E_{K\pi} + E_{K\Lambda}$$

$$\underline{E_{K\Lambda}} = \underline{8,14 \text{ MeV}}$$

$$\underline{p} = \sqrt{(E_0 + E_K)^2 - E_0^2} = \sqrt{(135 + 55,96)^2 - 135^2} = \underline{135,06 \text{ MeV}/c}$$