1. kapitola, příklad 13)

$E_0 = 938\ MeV$; $l = 4\,m$, $t_i = \{15, 19, 25, 35\}\,ns$

$h = 6{,}626 \cdot 10^{-34}\,J\cdot s = 4{,}136 \cdot 10^{-15}\,eV\cdot s$

$\rightarrow v_i = \frac{l}{t_i} \cdot \frac{c}{c} = \frac{4}{t_i} \cdot \frac{c}{3\cdot 10^8} =$

- $0{,}889c = v_1$
- $0{,}702c = v_2$
- $0{,}533c = v_3$
- $0{,}381c = v_4$

$\rightarrow \gamma_i = \frac{1}{\sqrt{1-\frac{v_i^2}{c^2}}} =$

- $2{,}184 = \gamma_1$
- $1{,}404 = \gamma_2$
- $1{,}182 = \gamma_3$
- $1{,}082 = \gamma_4$

$\rightarrow E = E_0 + E_k$

$\uparrow E_0 = E_0 + E_k \rightarrow E_{ki} = E_0(\gamma_i - 1) =$

E_k

- $1110{,}5\ MeV = E_{k1}$
- $379\ MeV = E_{k2}$
- $170{,}7\ MeV = E_{k3}$
- $76{,}9\ MeV = E_{k4}$

$\rightarrow E_i = E_0 + E_{ki} =$

E

- $2048{,}5\ MeV = E_1$
- $1317\ MeV = E_2$
- $1108{,}7\ MeV = E_3$
- $1014{,}9\ MeV = E_4$

$\rightarrow E^2 = E_0^2 + p^2c^2 \rightarrow (E_k + E_0)^2 = E_0^2 + p^2c^2$

$E_k^2 + 2E_kE_0 = p^2c^2 \rightarrow p = \sqrt{\frac{E_k^2 + 2E_kE_0}{c^2}}$

$p_i = \frac{1}{c}\sqrt{E_k^2 + 2E_kE_0} =$

p

- $1821\ MeV/c = p_1$
- $924\ MeV/c = p_2$
- $591\ MeV/c = p_3$
- $387\ MeV/c = p_4$

$$\lambda_i = \frac{h}{p_i} = \frac{4{,}136 \cdot 10^{-15}\ [\mathrm{eV \cdot s}]}{p_i \left[\frac{\mathrm{MeV}}{c}\right]} = 3 \cdot 10^{8}\ \frac{4{,}136 \cdot 10^{-15}}{p_i}$$

$$= 3 \cdot 10^{8}\ \frac{4{,}136 \cdot 10^{-15}}{1821 \cdot 10^{6}} = 6{,}8 \cdot 10^{-16}\ m = \boxed{0{,}68\ fm = \lambda_1}$$

$$\boxed{\begin{array}{l} 1{,}3\ fm = \lambda_2 \\ 2{,}1\ fm = \lambda_3 \\ 3{,}2\ fm = \lambda_4 \end{array}}$$

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