ALEX SPORNI - XSPORN01 - 204633

1. $\lambda = 543 \cdot 10^{-9}$, $z = 3m$, $z_1 = 0{,}5 \cdot 10^{-3}$, $P = 1mW = 10^{-3} W$, $z_0 = 1{,}5m$

$$I = \frac{2 \cdot P}{\pi \cdot w^2}$$

$$z_0 = \frac{\pi \cdot w_0^2}{\lambda} \Rightarrow w_0 = \sqrt{\frac{z_0 \cdot \lambda}{\pi}} = \sqrt{\frac{1{,}5 \cdot 543 \cdot 10^{-9}}{\pi}} = \underline{\underline{5{,}0918 \cdot 10^{-4}}}\ m$$

$$w(z) = w_0 \left[1 + \left(\frac{z}{z_0}\right)^2\right]^{\frac{1}{2}}$$

$$w(3) = 5{,}0918 \cdot 10^{-4} \cdot \left[1 + \left(\frac{3}{1{,}5}\right)^2\right]^{\frac{1}{2}} = \underline{\underline{1{,}138 \cdot 10^{-3}}}\ m$$

$$w(0{,}5 \cdot 10^{-3}) = 5{,}0918 \cdot 10^{-4} \cdot \left[1 + \left(\frac{0{,}5 \cdot 10^{-3}}{1{,}5}\right)^2\right]^{\frac{1}{2}} = \underline{\underline{5{,}0918 \cdot 10^{-4}}}\ m$$

$$I(3) = \frac{2 \cdot 10^{-3}}{\pi \cdot 1{,}138 \cdot 10^{-3}} = \underline{\underline{0{,}55941\ W/m^2}}$$

$$I(0{,}5 \cdot 10^{-3}) = \frac{2 \cdot 10^{-3}}{\pi \cdot 5{,}0918 \cdot 10^{-4}} = \underline{\underline{4{,}2502\ W/m^2}}$$

Špičková intenzita laseru pre 3 m je $0{,}55941\ W/m^2$ a pre vzdialenosť $0{,}5$ mm je intenzita $1{,}2502\ W/m^2$

② $m = 2{,}2\ MeV/c^2$

$2{,}2\ MeV/c^2 = 2{,}2 \cdot 10^{-3}\ GeV/c^2$

$2{,}2 \cdot 10^{-3}\ GeV \cdot 1{,}78266192 \cdot 10^{-27} = 3{,}9219 \cdot 10^{-30}\ kg$

převrácená hodnota kg

$E = m \cdot c^2$

$E_q = m_q \cdot c^2$

$E_q = 3{,}9219 \cdot 10^{-30} \cdot (3 \cdot 10^8)^2$

$E_q = 3{,}5297 \cdot 10^{-13}\ J$

$2 \cdot E_f = E_q$

$2 \cdot E_f = 3{,}5297 \cdot 10^{-13}$

$E_f = \frac{3{,}5297 \cdot 10^{-13}}{2}$

$E_f = 1{,}764855 \cdot 10^{-13}\ J$

$E = \frac{h \cdot c}{\lambda} \Rightarrow \lambda = \frac{h \cdot c}{E_f}$

$\lambda = \frac{h \cdot (3 \cdot 10^8)}{1{,}764855 \cdot 10^{-13}}$

$h = 6{,}626 \cdot 10^{-34}$

$\lambda = 1{,}1263 \cdot 10^{-11}\ m$

Vlnová délka fotonu musí být $1{,}1263 \cdot 10^{-11}$

Hmotnost srovnatelná s hmotností kg je $3{,}9219 \cdot 10^{-30}\ kg$