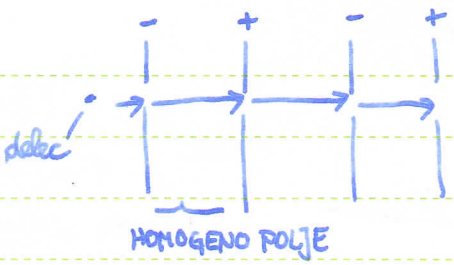
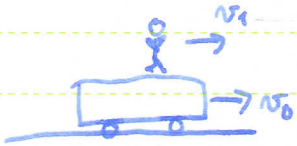
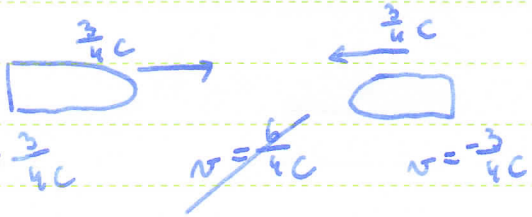
delovanje pospeševalnika:



delca na koncu ni bilo, zato klasična enačba $W_k = \frac{1}{2}mv^2$ ne velja



$v' = v_0 + v_1$



$u' = \frac{\frac{6}{4}c}{1+\frac{9}{16}} = \frac{\frac{3}{2}c}{\frac{25}{16}} = \frac{48}{50}c$

$\pi^0 \rightarrow \gamma + \gamma$

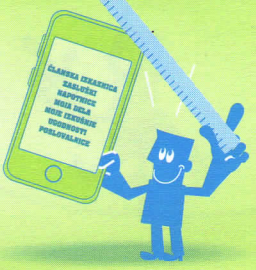
NEVTRALNI PIONI

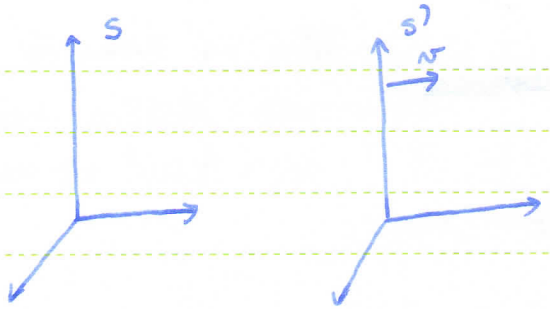
$W_k = 6\ GeV \Rightarrow v = 0{,}9999\,c$

$\pi^0 \xrightarrow{v}$ → hitrost naj bi bila $1{,}9999\,c$; je pa kar c

POSEBNA TEORIJA RELATIVNOSTI

1) Vsi fizikalni zakoni imajo vedno isto obliko.
2) Hitrost svetlobe je vedno c.

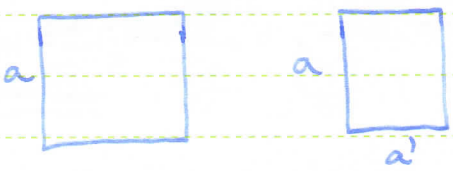


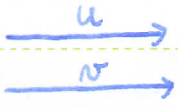


$$t' = \gamma\left(t - \frac{vx}{c^2}\right)$$
$$x' = \gamma(x - vt)$$
$$\boxed{\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}}$$
$$y' = y \qquad z' = z$$

$\Delta t' = \gamma \Delta t$ → čas se podaljša za faktor $\gamma > 1$

ko miniemo





$$u' = \frac{u - v}{1 - \frac{uv}{c^2}}$$

$E = mc^2$ m - masa, ko telo miruje

$\vec{p} = m\gamma\vec{v}$ gib. količina

$E^2 = c^2p^2 + m^2c^4$

$$\boxed{W_k = m(\gamma - 1)c^2} \text{ graf!!} = mc^2\left(\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} - 1\right) = mc^2\left(1 + \frac{1}{2}\frac{v^2}{c^2} + \frac{3}{8}\frac{v^4}{c^4} \ldots - 1\right) =$$

razvijemo v Taylorjevo vrsto

$$= \frac{1}{2}mv^2 + \frac{3}{8}\frac{v^4}{c^2} + \ldots$$

zanemarimo pri nizkih hitrostih

elektronski antinevtrino

μ^- - mioni $\longrightarrow e^- + \bar{\nu}_e + \nu_\mu$

mionski nevtrino

$\frac{dc}{dt} = -kc$ $\quad \frac{dN}{dt} = -kN$ $\quad k = \frac{1}{\tau}$ - tau (karakteristični čas)

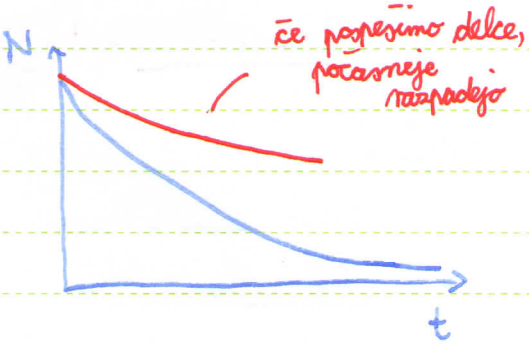
$\int_{N_0}^{N} \frac{dN}{N} = \int_0^t -k\,dt$ $\quad N = N_0 e^{-\frac{t}{\tau}}$

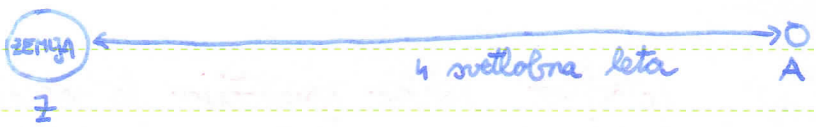
dlje časa čakamo, manj dolgo razpade

$\ln N\Big|_{N_0}^{N} = -kt\Big|_0^t$

$\frac{N}{N_0} = e^{-kt}$

$\boxed{N = N_0 e^{-kt}}$

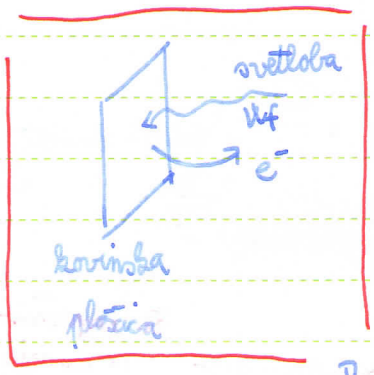




Z → A $\quad$ 5 let do zvezde + 5 let nazaj = 10 let

$\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{1}{\sqrt{1-\frac{16}{25}}} = \frac{5}{3} \Rightarrow$ $\quad$ Z → A $\quad$ 3 leta + 3 leta = 6 let

FOTOEFEKT



ploščico osvetlimo s svetlobo, izhajajo e^-;
odvisna je, kakšna je valovna dolžina

A_i - izstopno delo

Po Einsteinu je svetloba curek delcev - fotoni

$W_{foton} = h\nu$

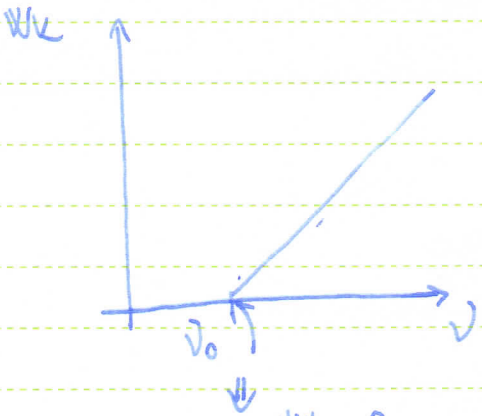
(v okviru eksp. napake) $\Rightarrow$ nimajo mase, saj se gibljejo s hitrostjo c

$$W_f = A_i + W_k$$

$$W_k = h\nu - A_i$$

h - Planckova konstanta

$$h = 6{,}62 \cdot 10^{-34}\ Js$$



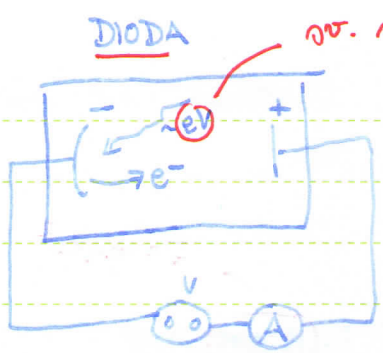
fotoefekt lahko povzročijo le delci, ki imajo določeno frekvenco (nad ν_0)

$W_k = 0$

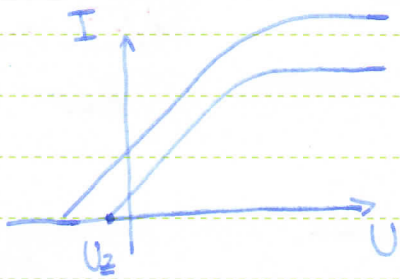
$$A_i - h\nu_0 = 0$$

$$\nu_0 = \frac{A_i}{h}$$

DIODA



sv. reda eV



sv. z večjo jakostjo

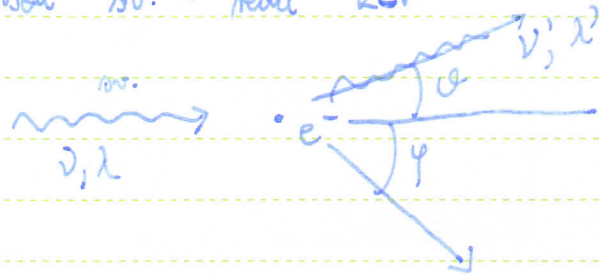
U_z - zaporna napetost

$W_k = W_f - A_i = eU_z$

koliko e^- pride do | je odvisno od jakosti svetlobe

COMPTONOVO SIPANJE

rentgenska sv. = reda keV



1) ENERGIJA SE OHRANJA

$W_f = W_f' + W_k$

začetek konec

2) GIB. KOLIČINA SE OHRANJA

$\vec{p}_f = \vec{p}_f' + \vec{p}_e$

$\vec{p}_f = \begin{bmatrix} p_f \\ 0 \end{bmatrix} \quad \vec{p}_e = \begin{bmatrix} p_e \cos\varphi \\ -p_e \sin\varphi \end{bmatrix}$

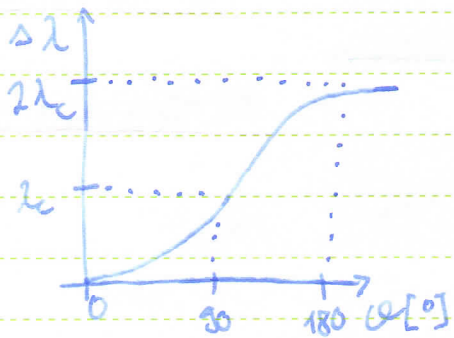
$\vec{p}_f' = \begin{bmatrix} p_f' \cos\theta \\ p_f' \sin\theta \end{bmatrix}$

x: $p_f = p_f' \cos\theta + p_e \cos\varphi$

y: $0 = p_f' \sin\theta - p_e \sin\varphi$

$\Delta\lambda = \lambda' - \lambda = \frac{h}{m_e c}(1 - \cos\vartheta)$ $\quad \lambda_c = \frac{h}{m_e c}$ Comptonova val. dolžina

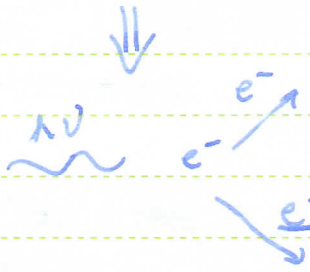
$\lambda_c = 2{,}43 \cdot 10^{-12}\ m$



$E = m_e c^2$

$h\nu < 2 \cdot 0{,}511\ MeV$

$h\nu > 1{,}022\ MeV$



pri višjih: μ^- ↗ μ^+ - μ^+ - antimion

- dsevanje tkiv
- astrofizika
- določanje hitrosti v atomih

} uporaba Comptonovega sipanja