04.11.2020

cl.12a – (S8.1-2) Rezolvări de pb. – EC – efectul Compton.
manual (pag. 50)

(3.5/50)

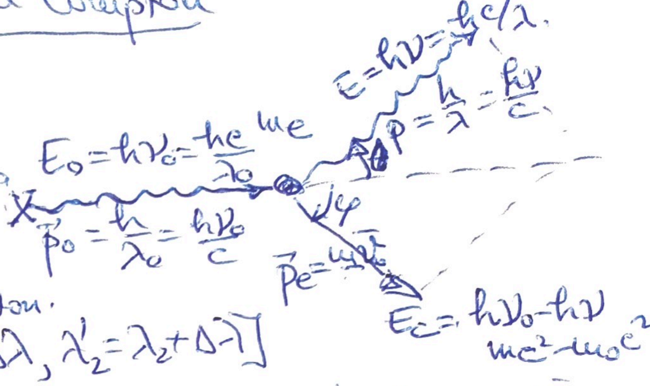
Date:
- rad. X $[\lambda_1, \lambda_2]$
- $\theta = 90^\circ$
- $\lambda_1 = 0{,}63\,\mathring{A}$
- $\lambda_2 = 0{,}75\,\mathring{A}$
- $m_0 = 9{,}1\cdot10^{-31}\,kg$
- $c = 3\cdot10^8\,m/s$
- $h = 6{,}626\cdot10^{-34}\,J\,s$

$[\lambda_1', \lambda_2'] = ?$

$\Delta\lambda = (\lambda - \lambda_0) = \Lambda(1-\cos\theta)$

$\Delta\lambda = 2\Lambda\sin^2(\theta/2)$ – deplasarea Compton

$\Lambda = \left(\frac{h}{m_0 c}\right) = 2{,}426\cdot10^{-12}\,m$ – lung. de undă Compton.



$[\lambda_1, \lambda_2] \longrightarrow [\lambda_1' = \lambda_1 + \Delta\lambda,\ \lambda_2' = \lambda_2 + \Delta\lambda]$

Datorită împrăștierii Compton, lungimile de undă inițiale ale rad. X, $[\lambda_1, \lambda_2]$ cresc la $[\lambda_1', \lambda_2']$

λ_1 – rad. X incidentă $\rightarrow \lambda_1' = (\lambda_1 + \Delta\lambda)$ rad. X. împrăștiată la $\theta = 90^\circ$

λ_2 – rad. $\quad \lambda_2' = (\lambda_2 + \Delta\lambda)$.

$\Delta\lambda = 2\Lambda\sin^2\left(\frac{90^\circ}{2}\right) = 2\Lambda\sin^2 45^\circ = 2\Lambda\left(\frac{\sqrt{2}}{2}\right)^2 = 2\frac{2}{4}\Lambda$

deci $\Delta\lambda = \Lambda$ la $\theta = 90^\circ$

atunci $[\lambda_1, \lambda_2] \rightarrow [\lambda_1 + \Lambda, \lambda_2 + \Lambda]$

$\hookrightarrow [0{,}63\,\mathring{A}; 0{,}75\,\mathring{A}] \rightarrow [0{,}654\,\mathring{A}; 0{,}774\,\mathring{A}]$

(3.6/50)

Date:
- $E_0 = 0{,}4\,MeV$
- $\theta = 90^\circ$
- m, c, h

a) $E = ?$
b) $E_c = ?$

ⓐ $E_0 = E + E_c$

$E_0 = h\nu_0 = \frac{hc}{\lambda_0} \rightarrow \lambda_0 = \frac{hc}{E_0}$

$E = h\nu = hc/\lambda \rightarrow \lambda = \frac{hc}{E}$

$\Delta\lambda = \lambda - \lambda_0 = 2\Lambda\sin^2\frac{\theta}{2} \rightarrow \lambda = \lambda_0 + 2\Lambda\sin^2\frac{\theta}{2}$

$\frac{hc}{E} = \frac{hc}{E_0} + 2\Lambda\sin^2\theta/2$

$hc\cdot E_0 = hc\cdot E + 2E_0E\Lambda\sin^2\frac{\theta}{2}$

$hcE_0 = E(hc + 2E_0\Lambda\sin^2\theta/2) \rightarrow E = \frac{hcE_0}{hc + 2E_0\Lambda\sin^2\theta/2}$

sau $E = E_0\,\frac{1}{1 + 2\left(\frac{E_0}{hc}\right)\Lambda\sin^2\theta/2} = 0{,}176\,MeV$.

ⓑ $E_0 = E + E_c \rightarrow E_c = (E_0 - E) = E_0\left[1 - \frac{1}{1 + \left(\frac{E_0}{hc}\right)\Delta\lambda}\right]$

$E_c = (0{,}400 - 0{,}176) = 0{,}224\,MeV$.