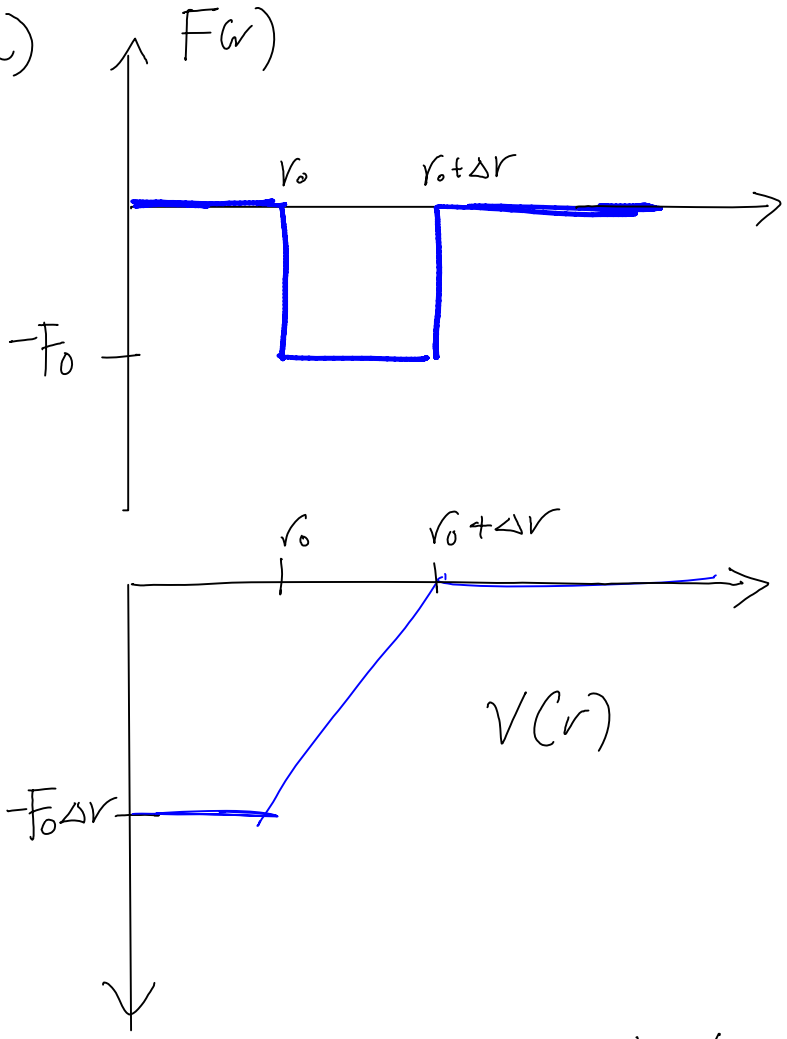
Nelson 8.1

Sunday, June 01, 2008
4:17 PM

a)



b) $\mu v r_1 = \hbar \qquad v = \hbar/\mu r_1$

$$F_0 = \frac{\mu v^2}{r_1} = \frac{\mu \hbar^2}{\mu^2 r_1^3} = \frac{\hbar^2}{\mu r_1^3}$$

c) $r_1 = 1\ \text{fm}$

$\mu = \frac{1}{2} m_p$

$T = \frac{\hbar^2 c^2}{} = (197\ \text{MeV-fm})^2$

$$F_0 = \frac{}{\mu c^2 r_1^3} = \frac{}{470\,\text{MeV}\cdot 1\,\text{fm}^3}$$

$$= 82.6\ \text{MeV/fm}.$$

d) $$V = \frac{\hbar c}{\mu c^2 r_1}(c) \rightarrow \beta = \frac{V}{c} = \frac{197}{470} = 0.42$$

e) $$\frac{1}{2}\mu v^2 + V(r) < 0$$

$$\frac{1}{2}\mu v^2 < -V(r) = +F_0 \Delta r$$

$$\frac{1}{2}\mu \frac{\hbar^2}{\mu^2 r_1^2} < \frac{\hbar^2}{\mu r_1^3}\Delta r$$

$$\Delta r > \frac{1}{2} r_1 \qquad \Delta r \geq \frac{1}{2}\,\text{fm}$$

f) $$V(r \approx 0) = -F_0 \Delta r$$

$$= -F_0 \frac{1}{2} r_1 = 41.6\ \text{MeV}$$

Nelson 8.2

Sunday, June 01, 2008
4:35 PM

$$E_{100} - E_1 = -13.6\,eV\left(\frac{1}{100^2} - 1\right)$$

$$= 13.5986\,eV$$

$$\lambda = \frac{hc}{13.5986\,eV} = \frac{197\,MeV\cdot fm}{13.5986\,eV}\cdot 2\pi$$

$$= 91.106\,nm.$$

$$\frac{\lambda}{r_0} = \frac{91.106\,nm}{0.05\,nm} = 1822$$

Anderson 2.13

Monday, June 02, 2008
9:47 AM

$U_{retard} = 5\ V \rightarrow T = 5\ eV$

$h\nu = W + T = \frac{ch}{\lambda}$

$\lambda = \frac{ch}{W+T} = \frac{3\times10^{8}\ cm/s \cdot 4.1\times10^{-15}\ eV \cdot s}{6.8\ eV}$

$= 181\ nm = 1810\ \text{Å}$

Anderson 2.15

Monday, June 02, 2008
10:02 AM

a) $T = h\nu - W$

$= \frac{hc}{\lambda}$

$= \frac{2\pi \hbar c}{\lambda} - W$

$= \frac{2\pi \; 197 \text{ MeV} \cdot \text{fm}}{4000 \times 10^{-10} \text{ m}} - 2.13 \text{ eV}$

$= 0.96 \text{ eV}$

b) $T = (\gamma - 1)mc^2 = 2.2\, mc^2$

$\frac{hc}{\lambda} = W + T$

$\lambda_{max} = \frac{2\pi \hbar c}{W + T_{min}}$

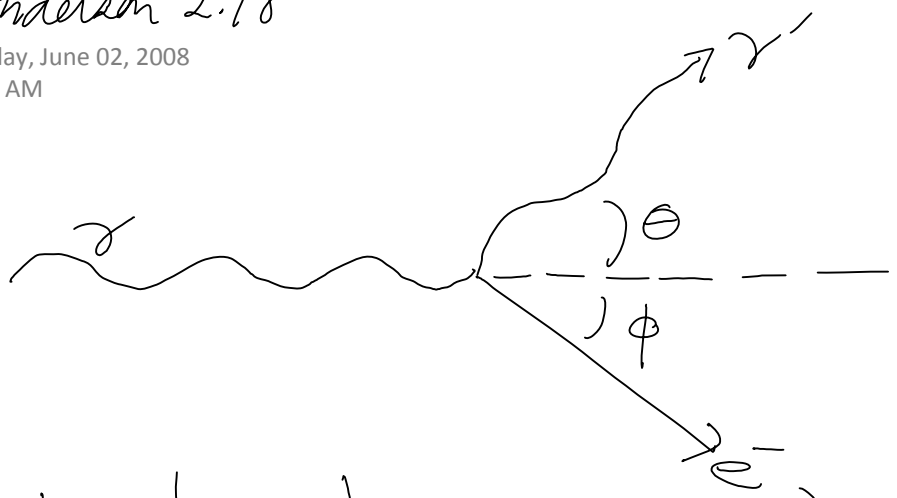
$= \frac{(2\pi)\; 197 \text{ MeV} \cdot \text{fm}}{2.13 \text{eV} + 2.2 \text{ MeV}}$

$= 1125 \text{ fm}$

$= 0.011 \text{ Å}$

Anderson 2.18

Monday, June 02, 2008
10:45 AM



$$\frac{1}{E} - \frac{1}{E'} = \frac{1}{m_0 c^2}\left(1 - \cos(90^\circ)\right)$$

$$\cos(90^\circ) = 0$$

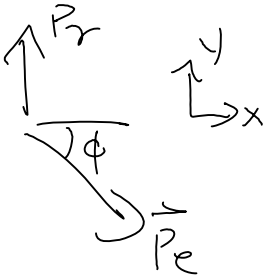
$$E' = \frac{E\, mc^2}{E + mc^2}$$

$$E - E' = E\left(1 - \frac{mc^2}{E + mc^2}\right)$$

$$= 1\,\text{Mev}\left(1 - \frac{0.511}{1.511}\right)$$

$$\boxed{= 0.662\ \text{Mev}}$$

Before $\vec{P}_{tot}$ $\longrightarrow$ After $\vec{P}_{tot}$



$$c\vec{P}_\gamma = (E - E')\,\hat{y}$$

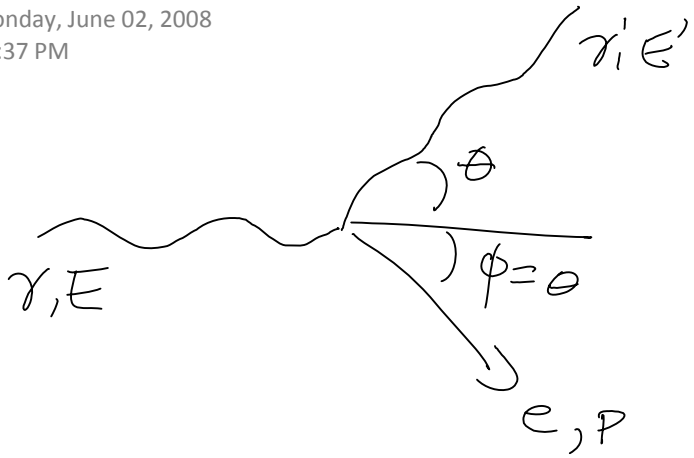
$$c\vec{P}_e = E\hat{x} - (E - E')\,\hat{y}$$

$$\phi = \tan^{-1}\left(\frac{E - E'}{E}\right) = \tan^{-1}\left(\frac{0.338}{1}\right)$$

$= 18.7^{\circ}$

Anderson 2.21

Monday, June 02, 2008
12:37 PM



$$E = E'\cos\theta + p\cos\phi$$

$$0 = E'\sin\theta + p\sin\phi \rightarrow E' = p$$

$$E = 2E'\cos\theta$$

$$\frac{1}{E'} - \frac{1}{E} = \frac{}{mc^2}(1-\cos\theta)$$

$$(2\cos\theta - 1) = \frac{}{mc^2}(1-\cos\theta)E$$

$$2\cos\theta + \frac{E}{mc^2}\cos\theta = 1 + \frac{E}{mc^2}$$

$$\cos\theta = \frac{1 + E/mc^2}{2 + E/mc^2}$$

$$\theta = 41.4^\circ$$

$$E' = \frac{E}{2\cos\theta} = 0.681\ \text{MeV}$$