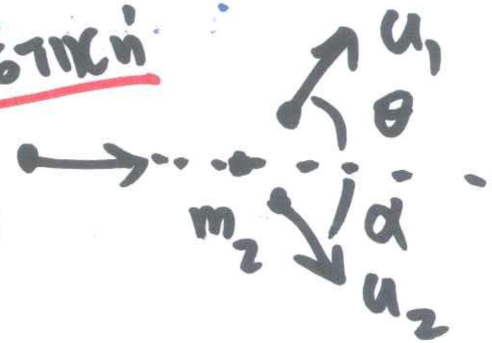
3/12/21

1

ΦΥΣΙΚΗ

πλάγια ελαστική



$$\vec{p}_1 = \vec{p}_1' + \vec{p}_2' \Rightarrow \vec{p}_1'^2 = (\vec{p}_1 - \vec{p}_2')^2$$

$$p_1^2/2m_1 = p_1'^2/2m_1 + p_2'^2/2m_2$$

$$\left.\begin{aligned} p_1'^2 &= \cancel{\vec{p}_1^2} + p_2'^2 - 2\vec{p}_1\cdot\vec{p}_2' \\ p_1'^2 &= \cancel{p_1^2} - p_2'^2\frac{m_1}{m_2} \end{aligned}\right\} \quad p_2'^2\left(1+\frac{m_1}{m_2}\right) = 2\vec{p}_1\cdot\vec{p}_2' = 2p_1p_2'\cos\alpha$$

$$\cancel{m_2^2}\, u_2^{\cancel{2}}\left(\frac{m_1+m_2}{\cancel{m_2}}\right) = 2m_1u_1\cancel{m_2}\cancel{u_2}\cos\alpha$$

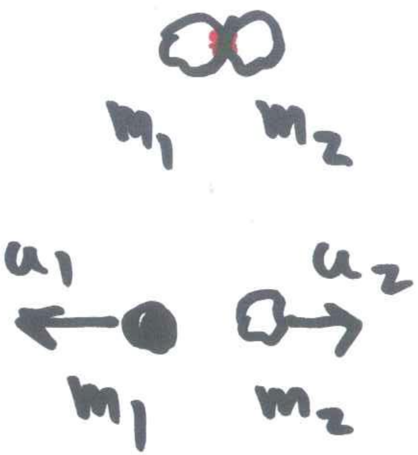
$$\boxed{u_2 = \frac{2m_1}{m_1+m_2}u_1\cdot\cos\alpha}$$

ΕΚΡΗΞΗ ΔΥΟ ΘΡΑΥΣΜΑΤΩΝ 1→2

(2)

ΠΡΙΝ

ΜΕΤΑ



$$\left.\begin{aligned} Q &= \tfrac{1}{2}m_1u_1^2 + \tfrac{1}{2}m_2u_2^2 \\ &= \tfrac{1}{2}\mu u^2 \\ m_1u_1 + m_2u_2 &= 0 \end{aligned}\right\} 2\times 2$$

$$u_2 = -u_1\frac{m_1}{m_2}$$

$$\left(Q = \frac{1}{2}m_1u_1^2 + \frac{1}{2}\cancel{m_2}\cdot u_1^2\frac{m_1^2}{\cancel{m_2^2}}\right) \quad u = \sqrt{\frac{2Q}{\mu}}$$

$$u_1 - u_2 = \sqrt{\frac{2Q}{\mu}}$$

$$u_1\left(1+\frac{m_1}{m_2}\right) = \sqrt{2Q/\mu}$$

1→2

$$\boxed{u_1 = \frac{\sqrt{2Q/\mu}}{1+m_1/m_2} \qquad u_2 = -\frac{\sqrt{2Q\mu}}{1+m_2/m_1}}$$

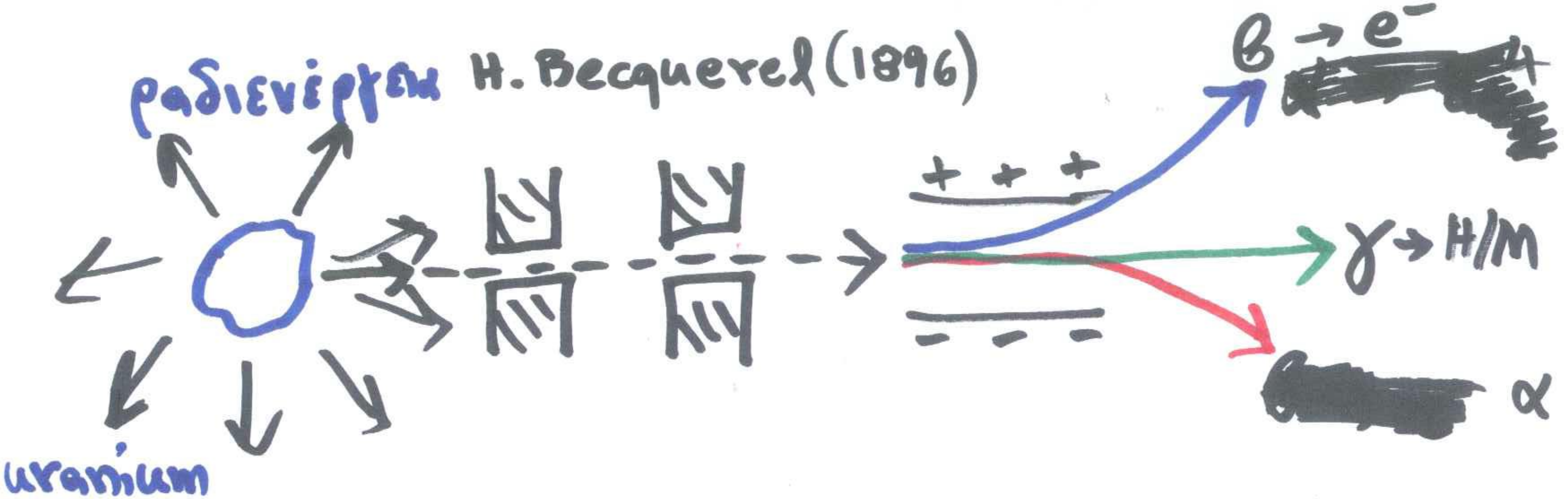
συγκεκριμένες ταχύτητες

$$p_1' = m_1u_1 = \mu\sqrt{2Q/\mu} = \sqrt{2Q\mu}$$

$$p_2' = \ldots = \sqrt{2Q\mu}$$

③

ραδιενέργεια H. Becquerel (1896)

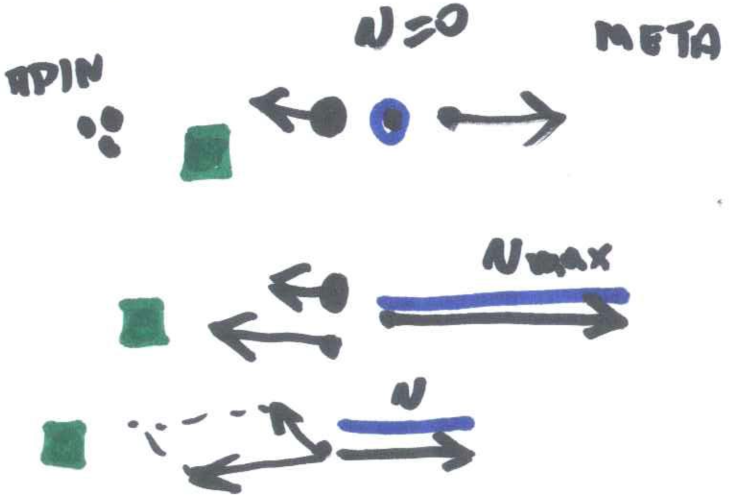


1→2 α-διάσπαση $M_Z^A \to \Theta_{Z-2}^{A-4} + He_2^4$

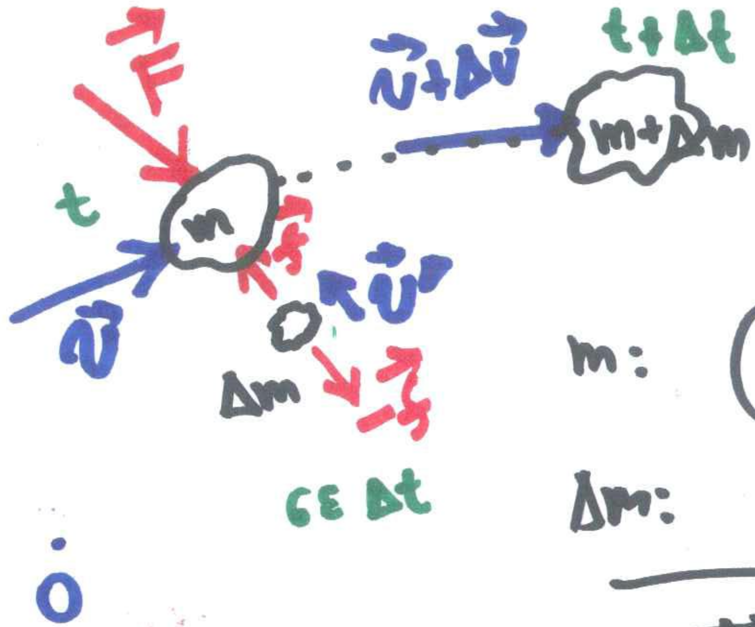
~~1→2~~ 1→3 β-διάσπαση $M_Z^A \to \Theta_{Z+1}^{A} + e^- + \bar{\nu}_e$ ✓ W. Pauli (1930) 1→3

νετρίνο (1956)

1→3 όχι συγκεκριμένες ταχύτητες $n \to p^+ + e^- + \bar{\nu}_e$



Η απαίτηση της ύπαρξης του νετρίνου και η μετέπειτα ανακάλυψή του αποκατέστησε τη διατήρηση της ορμής και της ενέργειας στη β-διάσπαση



Αρχη της Ορμης

$$\Delta\vec{p} = \vec{F}\Delta t$$

$$m: \quad \left(m[redacted](\vec{v}+\Delta\vec{v}) - m\cancel{\vec{v}}\right) = \vec{F}\Delta t + \cancel{\vec{f}}\Delta t$$

$$\Delta m: \quad \Delta m(\vec{v}+\Delta\vec{v}) - \Delta m\vec{v}' = -\cancel{\vec{f}}\Delta t$$

$$\cancel{m\Delta\vec{v} + \Delta m\vec{v} + \Delta m\Delta\vec{v}}$$

$$\cancel{\Delta m}$$

$$m\Delta\vec{v} + \Delta m\vec{v} + \Delta m\Delta\vec{v} - \Delta m\vec{v}' = \vec{F}\Delta t$$

$$\lim_{\Delta t\to 0} \quad m\frac{\Delta\vec{v}}{\Delta t} + \frac{\Delta m}{\Delta t}(\vec{v}-\vec{v}') + \cancel{\frac{\Delta m\,\Delta\vec{v}}{\Delta t}}^{\to 0} = \vec{F}$$

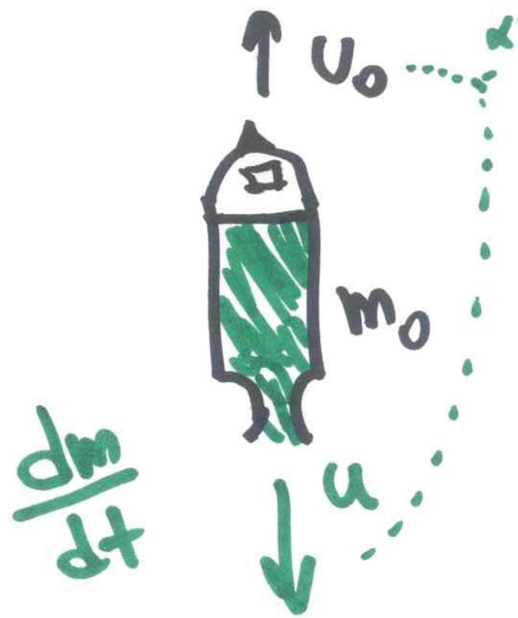
$$\boxed{m\frac{d\vec{v}}{dt} = \vec{F} + \frac{dm}{dt}(\vec{v}'-\vec{v})}$$

$$\boxed{m\frac{d\vec{v}}{dt} = \vec{F} + \frac{dm}{dt}\vec{u}}$$

(5)

πρόωση ή ωστική δύναμη (thrust) $\vec{F}_T = \vec{u}\frac{dm}{dt}$

ΠΥΡΑΥΛΟΣ = (ΕΞΟΠΛΙΣΜΟΣ + ΠΡΟΣΩΠΙΚΟ + ΩΦΕΛ. ΦΟΡΤΙΟ) στα? + (ΚΑΥΣΙΜΑ) μεταβλ.



αντίθετα

$$m\frac{dv}{\cancel{dt}} = -\frac{dm}{\cancel{dt}}u \qquad u = 4{,}5 \text{ km/s}$$

$$\int_{v_0}^{v}\frac{dv}{u} = -\int_{m_0}^{m}\frac{dm}{m} \Rightarrow \frac{\overbrace{v-v_0}^{\Delta v}}{u} = -\ln\left(\frac{m}{m_0}\right)$$

$$e^{-\Delta v/u} = \frac{m}{m_0}$$

$$\boxed{v = v_0 + u\ln\left(\frac{m_0}{m}\right)} \qquad \boxed{m = m_0 e^{-\Delta v/u}}$$