Семинар №6

Теория относительности

№1.365 (1.398)

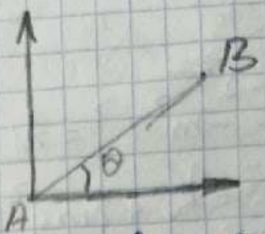
$v = \frac{c}{2}$

$l = 1м$

$\theta = 45^0$

$l_0 - ?$

$A(0, 0; 0)$ $B(l_0 \cos\theta_0; l_0 \sin\theta_0; 0)$



В момент врем t':

$A(vt', 0, 0)$ $B(l_0 \cos\theta_0 \sqrt{1-\beta^2} + vt'; l_0 \sin\theta_0; 0)$

$$\Rightarrow \begin{cases} l\cos\theta_0 = l\cos\theta_0\sqrt{1-\beta^2} \\ l\sin\theta = l_0\sin\theta_0 \end{cases} \Rightarrow$$

$$\Rightarrow l_0^2 = l^2\left(\frac{\cos^2\theta^0 + (1+\beta^2)\sin\theta}{1-\beta^2}\right)$$

$$l_0 = \sqrt{\frac{1-\beta^2\sin\theta}{1-\beta^2}}$$

№1.382 (1.415)

$v_1 = 0{,}5c$

$v_2 = 0{,}75c$

$v - ?$

$v_{2}' - ?$

v сближ: $v = \frac{dx_1}{dt} - \frac{dx_2}{dt} = v_1 - (-v_2) = v_1 + v_2$

Отн скор: $v_{21} = \frac{v_1 + v_2)}{1 - \frac{v_1(-v_2)}{c^2}} = \frac{v_1 + v_2}{1 + \frac{v_1 v_2}{c^2}}$

Отв: $v_1 + v_2$; $\frac{v_1 + v_2}{1 + \frac{v_1 v_2}{c^2}}$

№1.395 (1.428

m_0

$t_1 = 0{,}6c$

$t_2 = 0{,}8c$

$A - ?$

$A = \Delta W_k$

$A = \frac{1}{2} m_0 c^2 (0{,}8^2 - 0{,}6^2) = 0{,}14 m_0 c^2$ - в нерелятив. мех

$A = \frac{m_0 c^2}{\sqrt{1-0{,}8^2}} - \frac{m_0 c^2}{\sqrt{1-0{,}6^2}} = 0{,}42 m_0 c^2$ - в релятив. мех

Отв: 0, ~~42m~~ $0{,}14 m_0 c^2$
мех
$0{,}42 m_0 c^2$

N 1.409 (1.443

m
K

M − ?
ϑ − ?

(m) (m) ⇒ (M)

$$E^2 - m^2c^2 = M^2c^4$$

$$E = K + 2mc^2 = K + 2E_{покоя}$$

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

$$E = K + mc^2$$

$$(K + mc^2)^2 - m^2c^4 = p^2c^2$$

$$p^2c^2 = K(K + 2mc^2)$$

$$(K + 2mc^2)\,2mc^2 = M^2c^4$$

$$M = \frac{\sqrt{2m(K + 2mc^2)}}{c}$$

$$p = \frac{E\vartheta}{c} \Rightarrow \vartheta = \frac{pc^2}{E}$$

$$pc^2 = \sqrt{K(K + 2mc^2)}\,c$$

$$\vartheta = \frac{\sqrt{K(K + 2mc^2)}\,c}{K + 2mc^2} = \sqrt{\frac{K}{K + 2mc^2}}\,c$$