§. Collision of Cosmon with Electron
head on collision

$$\cancel{m_u v_0 = m_u v +}$$

$$m_u u_0 = m_u u + m v$$

$$\frac{m_u c^2}{\sqrt{1-\frac{u_0^2}{c^2}}} = \frac{m_u c^2}{\sqrt{1-\frac{u^2}{c^2}}} + \frac{m c^2}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$W_0 = W + E.$$

$$1 - \frac{u_0^2}{c^2} = \frac{m_u c^2}{W_0}$$

$$\frac{u_0^2}{c^2} = 1 - \frac{m_u c^2}{W_0}$$

$$m_u c \sqrt{1 - \frac{m_u c^2}{W_0}} =$$

$$\frac{1}{c^2}\left(\frac{mv - m_u u_0}{m_u}\right)^2 = 1 - \frac{m_u c^2}{W} = 1 - \frac{m_u c^2}{W_0 - E}.$$

$$\frac{m_u u_0}{\sqrt{1-\frac{u_0^2}{c^2}}} = -\frac{m_u u}{\sqrt{1-\frac{u^2}{c^2}}} + \frac{m v}{\sqrt{1-\frac{v^2}{c^2}}}.$$

$$\left(\frac{mv}{\sqrt{1-\frac{v^2}{c^2}}} - \frac{m_u u_0}{\sqrt{1-\frac{u_0^2}{c^2}}}\right)^2 = \frac{m_u^2 u^2}{1-\frac{u^2}{c^2}}$$

$$\left(\frac{m_u c^2}{\sqrt{1-\frac{u_0^2}{c^2}}} - \frac{m_0 c^2}{\sqrt{1-\frac{v^2}{c^2}}}\right)^2 = \frac{m_u^2 c^2}{1-\frac{u^2}{c^2}}$$

$$(\quad)^2 - (\quad)^2 = m_u^2 c^2$$

$$m_u^2 c^2$$
$$\|$$

$$\left(\frac{m_u^2 c^2}{1-\frac{u_0^2}{c^2}} - \frac{m_u^2 u_0^2}{1-\frac{u_0^2}{c^2}}\right) + \left(\frac{m^2 c^2}{1-\frac{v^2}{c^2}} - \frac{m^2 v^2}{1-\frac{v^2}{c^2}}\right)$$

$$- \frac{2 m_u m (c^2 - u_0 v)}{\sqrt{1-\frac{u_0^2}{c^2}}\sqrt{1-\frac{v^2}{c^2}}} = \cancel{m_u^2 c^2}.$$

$$m \cancel{c^2} = \frac{2 m_u \left(1 - \frac{u_0 v}{c^2}\right)}{\sqrt{1-\frac{u_0^2}{c^2}}\sqrt{1-\frac{v^2}{c^2}}}.$$

$$\boxed{\frac{m}{2m_u} = \frac{1-\frac{u_0 v}{c^2}}{\sqrt{1-\frac{u_0^2}{c^2}}\sqrt{1-\frac{v^2}{c^2}}}}$$

$$1-\left(\frac{u_0}{c}\right)^2 = \left(\frac{2m_u k}{m}\right)^2$$

$$\frac{m}{2m_u}\sqrt{1-\frac{u_0^2}{c^2}} = k \qquad = \frac{mc^2}{2W_0} \ll 1.$$

$$k^2\left(1-\frac{v^2}{c^2}\right) = 1 - \frac{2u_0 v}{c^2} + \frac{u_0^2 v^2}{c^4}.$$

$$\left(\frac{u_0^2}{c^4} + \frac{k^2}{c^2}\right)v^2 - \frac{2u_0 v}{c^2} + (1-k^2) = 0.$$

$$\cancel{v = \frac{\frac{u_0}{c^2} \pm \sqrt{\frac{u_0^2}{c^4} - (1-k^2)\left(\frac{u_0^2}{c^4}+\frac{k^2}{c^2}\right)}}{\frac{u_0^2}{c^4}+\frac{k^2}{c^2}}}$$

$$v \doteqdot \frac{\frac{u_0}{c^2} \pm \sqrt{k^2\left(\frac{u_0^2}{c^4} - \frac{1}{c^2}\right) + \frac{k^4}{c^2}}}{}$$

$$\left(\left(\frac{u_0}{c}\right)^2 + k^2\right)\left(\frac{v}{c}\right)^2 - \frac{2u_0}{c}\cdot\frac{v}{c} + (1-k^2) = 0$$

$$\frac{v}{c} = \frac{\frac{u_0}{c} \pm \sqrt{\left(\frac{u_0}{c}\right)^2 - \left(\left(\frac{u_0}{c}\right)^2 + k^2\right)(1-k^2)}}{\left(\frac{u_0}{c}\right)^2 + k^2} = \frac{\frac{u_0}{c} \pm k\sqrt{\left(\frac{u_0}{c}\right)^2 - 1 + k^2}}{\left(\frac{u_0}{c}\right)^2 + k^2}$$

§ Shower Production by Cosmon

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