* Variation of mass with velocity (Conservation of momentum) :-

Using law of conservation of linear momentum together with Lorentz transformation equations, the following expression for the variation in the mass with velocity is obtained,

$$\text{i.e., } m = \frac{m_0}{\sqrt{1 - v^2/c^2}}$$

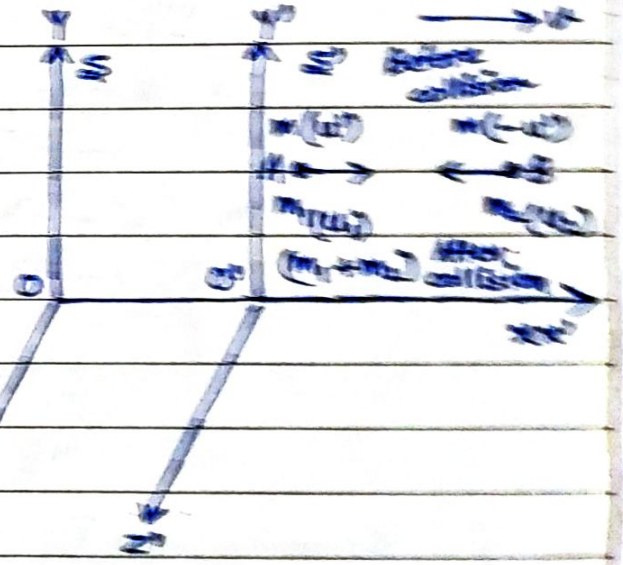
where, m = relativistic mass

m_0 = rest mass

e.g.) synchrocyclotron

Derivation :-

Let us consider two inertial frames S & S' where S' frame is moving with the constant velocity towards +ve x-direction w.r.t. stationary frame S.



Let us consider two identical bodies A and B having masses 'm' are moving towards each other with velocities u' & $-u'$ parallel to x-axis in S' frame as shown in the figure.

Let masses of these bodies in S frame are m_1 and m_2 with their respective velocities u_1 and u_2 along x-axis.

Using Law of addition of velocities,

$$u_1 = \frac{u' + v}{1 + u'v/c^2} \quad \text{---(4)}$$

$$u_2 = \frac{-u' + v}{1 + (u'v/c^2)} = \frac{-u' + v}{1 - u'v/c^2} \quad \text{---(5)}$$