- Relativistically explain how a massless particle can carry energy.

OR

A energy & momentum carrying particle may be massless :- justify relativistically.

Ans:- According to classical mechanics, a particle must have some rest mass to carry energy and momentum, But in relativistic mechanics this requirement does not hold.

We have the total relativistic energy is

$$E = mc^2 = \frac{m_0 c^2}{\sqrt{1 - v^2/c}} \rightarrow (1)$$

& the relativistic momentum is

$$p = mv = \frac{m_0 v}{\sqrt{1 - v^2/c^2}} \rightarrow (2)$$

where $m_0 \rightarrow$ the mass of the relativistic particle

For photon $m_0 = 0$ & $v = c$

In that case $E = \frac{0}{0}$ & $p = \frac{0}{0}$ $\rightarrow (3)$

Equation (3) shows that E and p are indeterminate. E and p can have any values. ∴ A massless particle can carry energy and momentum.