(ii) The source is stationary and the observer is moving towards the source with a velocity v., $\nu' = \nu + \frac{v}{\lambda}$

$$\nu' = \nu\left[1 + \frac{v}{c}\right] \quad \text{———— (ii)}$$

Therefore eqn (i) and (ii) are similar.

(iii) When the source moves away from the stationary observer or the observer moves away from the stationary source with a velocity v

$$\nu' = \nu - \frac{v}{\lambda}$$

$$\nu' = \nu - \frac{\nu v}{c} \; ; \; \nu' = \nu\left[1 - \frac{v}{c}\right] \quad \text{———— (iii)}$$

(iv) When the source and the observer move towards each other and each is moving with a velocity v.

$$\nu' = \nu\left[1 + \frac{v}{c}\right]^2 \quad \text{———— (iv)}$$

(v) When the source and the observer move away from each other and each is moving with a velocity v.

$$\nu' = \nu\left[1 - \frac{v}{c}\right]^2 \quad \text{———— (v)}$$

The phenomenon of Doppler effect is of great importance is light. It shows that there is a shift in the frequency when the source of light moves with a velocity comparable to the velocity of light. In the field of astronomy, Doppler effect has been found to be most useful - (i) velocity and Rotation of the sun

(ii) Discovery of double stars.

(iii) Red shift.

(iv) Saturn's rings.

B.Sc. Sem-II Physics (MJC)

Dopplor effect in light waves moves with velocity

There is a change in the frequency of light radiation when the source or the observer moves with respect to one another. This phenomenon is known as Doppler effect. It is similar to the apparent change in the pitch of sound when either the source or the observer is in motion with respect to one another.

According to the theory of relativity a material medium is not necessary for the propagation of light waves whereas for sound waves, material medium is a necessity. In sound the Doppler effect is asymmetric, the apparent frequencies are different when the source is moving towards a stationary observer and when the observer is moving towards a stationary source.

In the first case $\nu' = \nu\left(\frac{c}{c-v}\right)$

and second case $\nu' = \nu\left(\frac{c+v}{c}\right)$

But it is not so in the case of light. In light the Doppler effect is symmetric.

① Suppose the observer is stationary and the source is moving towards the observer with a velocity v. Let the velocity of light be c, $c = \nu\lambda$

As there is no medium the observer will receive more waves due to the motion of the source. The wave length is no changed

The apparent frequency $\nu' = \nu + \frac{v}{\lambda}$

$$\nu' = \nu + \frac{v\nu}{c}$$

$$\nu' = \nu\left[1 + \frac{v}{c}\right] \quad \text{--- ①}$$