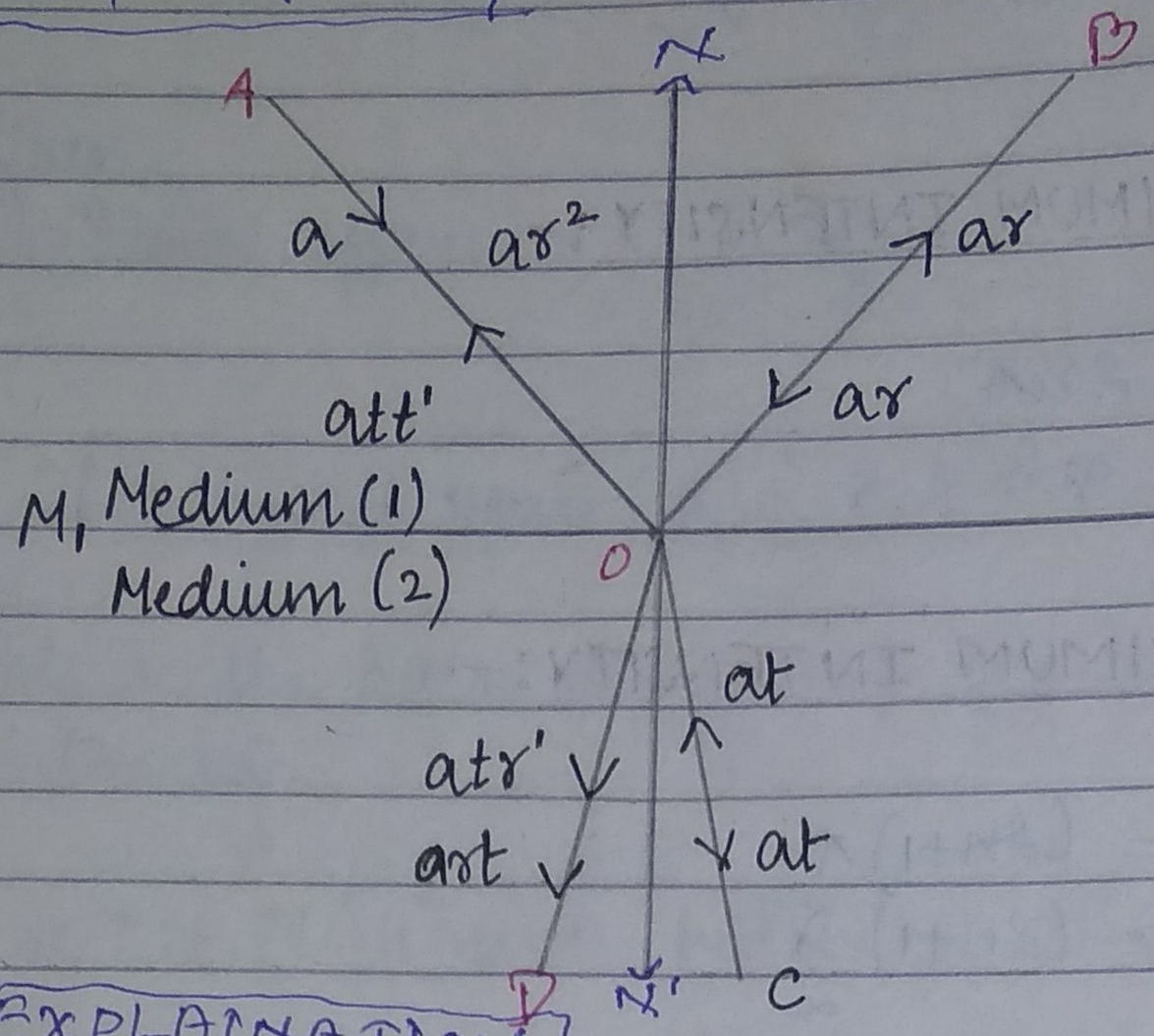
- Change of Phase on reflection :- [Stoke's treatment]

(A) [RAY DIAGRAM]



Figure

(B) [EXPLAINATION].

Let M_1 and M_2 be a boundary seperating the medium (1) and medium (2). Let r and t be the reflection coefficient and transmission coefficient [fraction of amplitude] in the first and second medium. Similarly r' and t' be the reflection and transmision coefficient of the second and first medium.

Let AO be the incident ray of amplitude 'a' in the first medium. Let OB be the reflected light of amplitude ar and OC be the transmitted ray of amplitude 'at'

Now,

The transmitted ray 'OC' is ~~reflected~~ reversed of amplitude 'at' which gives OD as the reflected light of amplitude atr' and OA is the transmitted ray of amplitude att'

According to Energy conservation law:-

$$\boxed{r^2+t^2=1} \quad -(1)$$

According to the "principle of reversibility"

$$ar^2+att'=a$$
$$r^2+tt'=1$$
$$\text{or, } r^2+tt'=r^2+t^2$$
$$\therefore tt'=t^2$$
$$\therefore \boxed{t'=t} \quad -(2)$$

This result indicates that in case of transmission there is no difference between transmission from medium one to two or from two to one

In other words we can say that for the transmitted ray there is no phase difference or path difference between them.

Also, from the diagram

$$atr'+art=0$$
$$\text{or, } atr'=-art$$
$$\boxed{r=-r'} \quad -(3)$$

This result indicates that in case of reflection when the light is coming from rarer to the denser medium then their amplitudes are in opposite side.

It means that in case of reflected side there is a phase difference of 'π' and path difference '$\frac{\lambda}{2}$' on reflection known as "Phase reversibility".