Phase Change on Reflection

(Stokes' Principle Of Reversibility)

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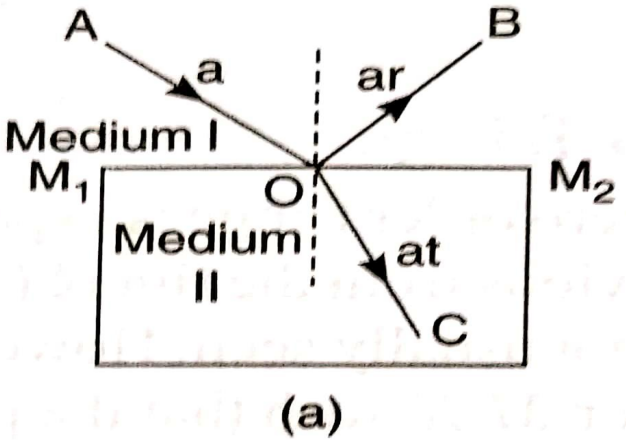
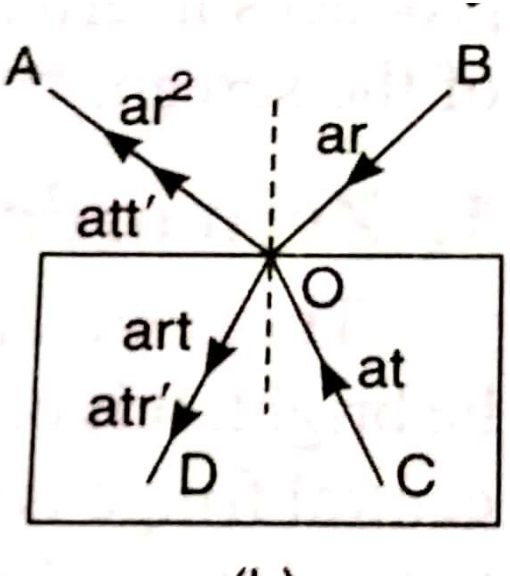
- According to Stokes' when a light wave is reflected at the surface of optically denser medium, it suffers a phase change of π or path difference of $\lambda/2$.
- Consider a light wave AO of amplitude 'a' incident on the boundary MN of two medium I & II .
- Medium II is optically denser than Medium I . The wave OA is partly reflected along OB and partly Transmitted along OC.
- Then the amplitude of the reflected wave = ar and transmitted wave = at where r & t are reflection and transmission coefficients.



(a)

- Now suppose that the directions of reflected and transmitted waves are reversed as shown in figure .
- Now the wave BO undergoes reflection along OA with amplitude (ar)r = ar^2 and refraction along OD with amplitude (ar) t = art .
- The wave OC retraces it's path, then it undergoes reflection along OD with amplitude Atr' and undergoes refraction OA with amplitude att' where r' & t' are reflection and transmission coefficients when the ray is travelling from denser to rarer medium.



- As there is no wave along OD. The amplitude OD should be zero.

i.e., $art + atr' = 0$

$r = - r'$ ---------- (1)

along OA

$ar^2 + att' = a$

$tt' = 1- r^2$ ---------- (2)

- The negative sign in equation (1) indicates that a phase change of π occurs on reflection from a surface backed by a denser medium
- This is known as stokes' principle of reversibility