Answer on Question #39437, Physics, Optics

Why light turns 2θ when mirror turns θ in measuring speed of light by Foucault method?

Answer:

The Foucault apparatus involves light reflecting off a rotating mirror, toward a stationary mirror some 20 miles (35 kilometers) away. As the rotating mirror will have moved slightly in the time it takes for the light to bounce off the stationary mirror (and return to the rotating mirror), it will thus be deflected away from the original source, by a small angle.

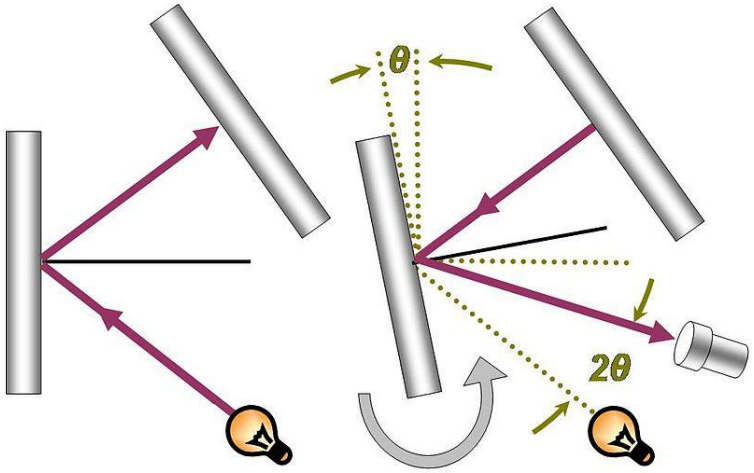
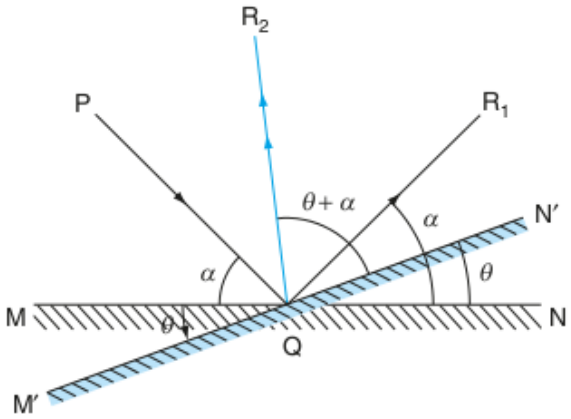


Figure 1: Schematic of the Foucault apparatus.

Consider the figure 2 below...



On the figure 2 the path of ray reflected from the mirror MN is PQR_1, the path of ray reflected from the mirror M'N' is PQR_2.

The angle turned by the reflected ray when mirror rotates through an angle θ would be,

$r = R_2QR_1$.

so, $r = R_2QN - R_1QN = (2\theta+\alpha) - \alpha$

thus, $r = 2\theta$

When a mirror rotates through an angle θ a beam of light reflected from it will rotate through an angle of 2θ.