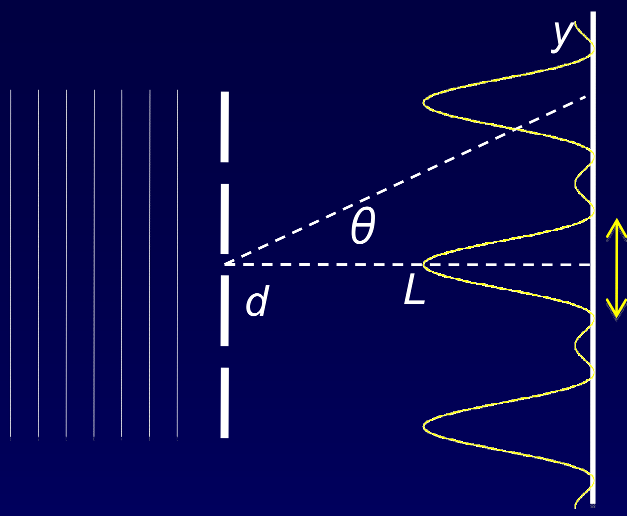
Solution

Three narrow slits with equal spacing d are at a distance L = 1.4 m away from a screen. The slits are illuminated at normal incidence with light of wavelength λ = 570 nm. The first principal maximum on the screen is at y = 2.0 mm.

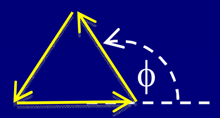


1. What is the slit spacing, d?

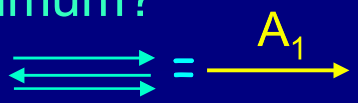
   The first maximum occurs when the path difference between adjacent slits is λ. This happens at $\sin\theta = \lambda/d$. We are told that $\tan\theta = y/L = 1.43\times10^{-3}$, so the small angle approximation is OK. Therefore, $d \approx \lambda/\theta$ = 0.40 mm.

2. If the wavelength, λ, is increased, what happens to the width of the principal maxima?

   The relation between θ and ϕ is $\phi/2\pi = \delta/\lambda = d\sin\theta/\lambda$.
   Therefore, for every feature that is described by ϕ (peaks, minima, *etc.*) $\sin\theta$ is proportional to λ. The width increases.



3. If the intensity of each slit alone is I_1, what is the intensity of the secondary maximum?

   Phasor diagram: 

   Two phasors cancel, leaving only one → I_1