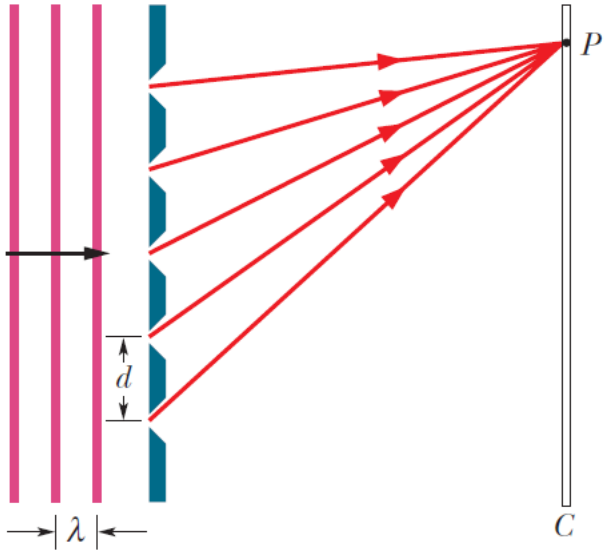
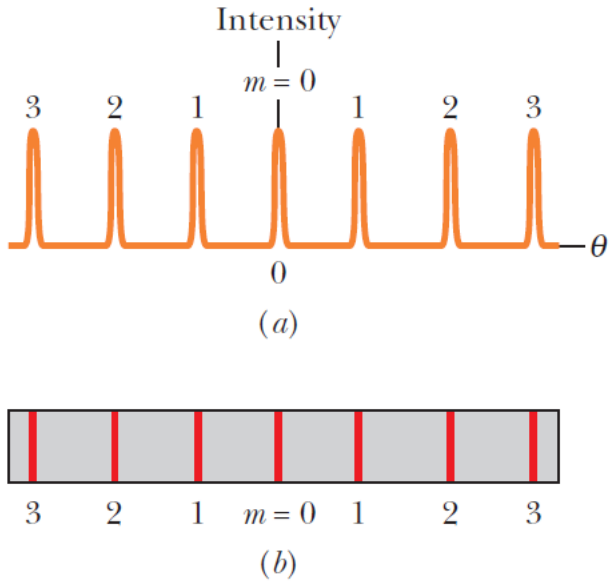
Diffraction Grating:

- A set of many closely spaced slits is called diffraction grating.
- It is useful in spectroscopic analysis of light.
- Diffraction grating disperses white light into its constituent colors.
- It has several thousand slits called lines per cm.

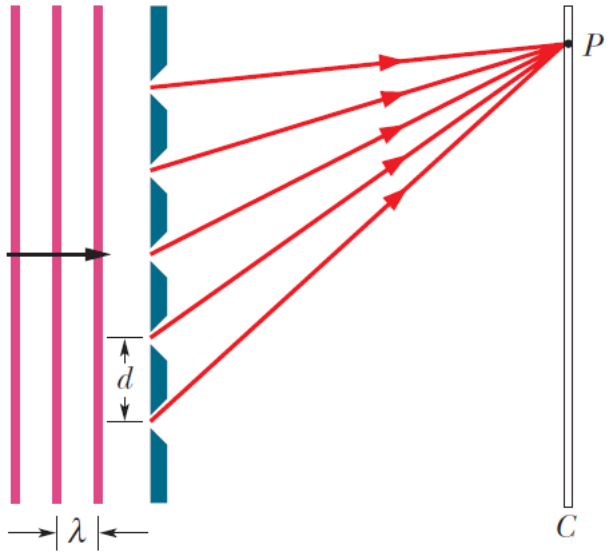


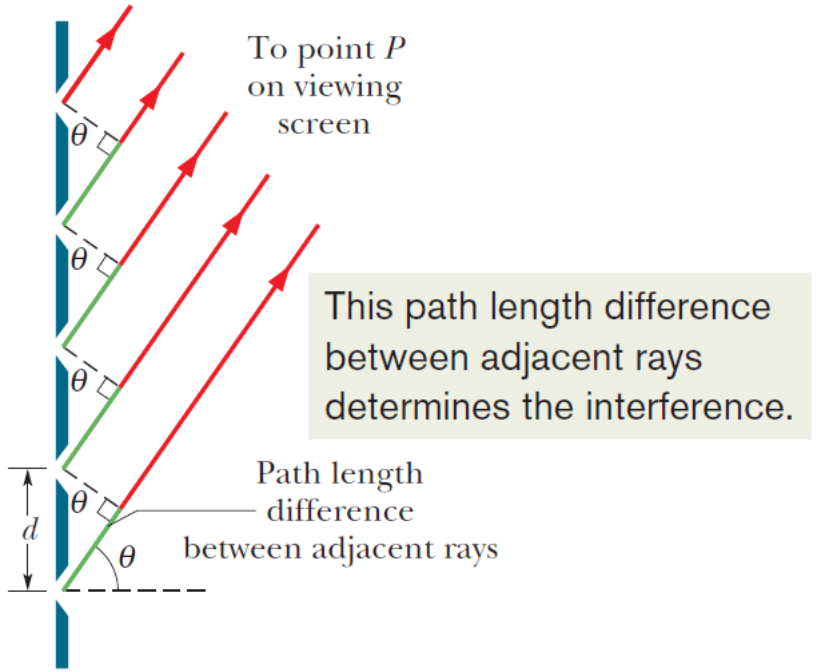


dSinθ =mλ for m = 0 , all wavelengths peak together at the central maximum, but for larger m the angular position of the maximum depends on wavelength.

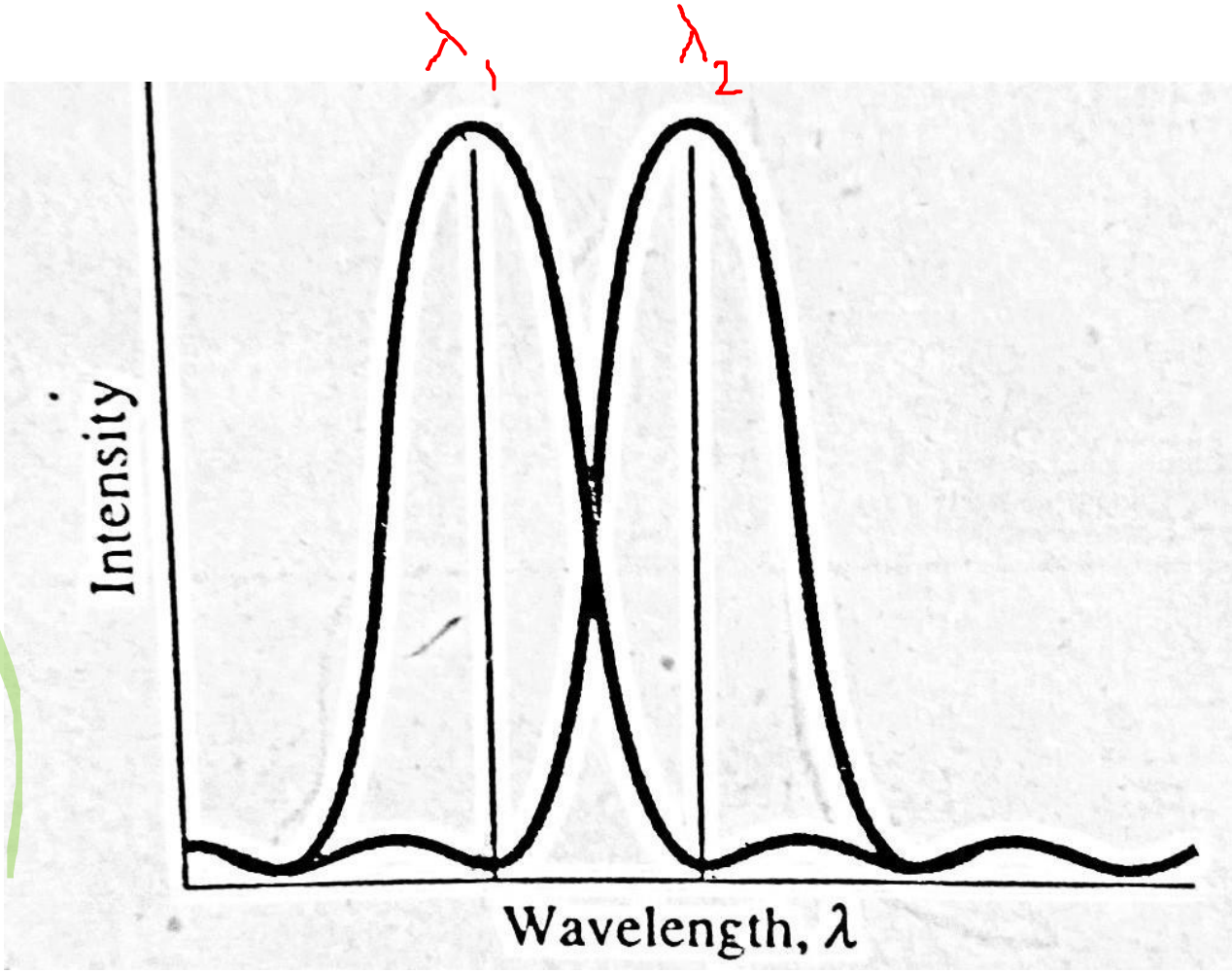
Diffraction grating can be used in place of prism to disperse light into its component wavelength.

m is the order of the dispersion.





Resolving Power:
A measure of ability to distinguish closely spaced wavelength.



- **RESOLVING POWER:**
- A measure of ability to distinguish closely spaced wavelength.
- Two wavelengths λ and λ' passing through grating, one can distinguish two spectral lines if the peak of one line is corresponding to the first minimum of the other.
- Let λ has its m-th order max. at θ. The criterion for this max is
- $dSin\theta_{max} = m\lambda$, equally write this as $dSin\theta_{max} = \frac{mN\lambda}{N}$, where N is no. of slits.
- For minimum $dSin\theta_{max} = \frac{(mN+1)\lambda}{N}$,

Two wavelengths λ and λ' be just distinguishable when maximum of λ' fall at the location of this minimum for λ .

But maximum for λ' satisfies $dsin\theta_{max} = \frac{mN\lambda'}{N}$,

(m N +1)λ = m N λ', solving this equation mNλ +λ= m N λ'

λ= m N λ' -m Nλ = m N(λ' -λ)

$\frac{\lambda}{\lambda'-\lambda}$ =m N

$$\Delta\lambda = \lambda' - \lambda$$

$\frac{\lambda}{\Delta\lambda}$ = m N =R =resolving power

- $\frac{\lambda}{\Delta\lambda} = mN = R$
- Quantity $\frac{\lambda}{\Delta\lambda}$ is resolving power of the grating.
- Equation shows that resolving power increases with the no. of the slits, N, on the grating and also with order, m, of the spectrum.
- Higher the resolving power, smaller the wavelength difference that can be distinguished in the spectrum .

Maximilien Luce, *The Seine at Herblay*, 1890. Musée d'Orsay, Paris, France. Photo by Erich Lessing/Art Resource