SEM-II
Hons (C IV: WAVES AND OPTICS)
L-3

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Resolving power of grating.

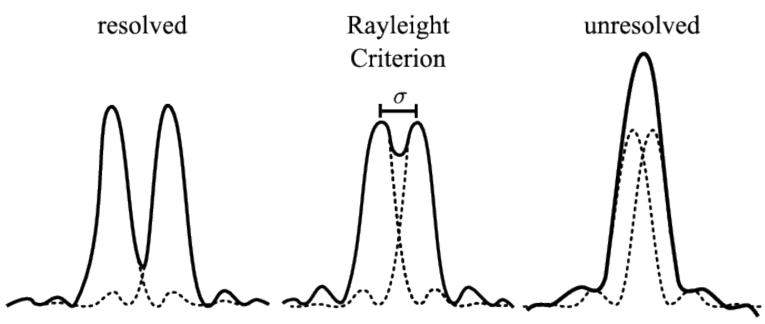
Resolving Power: The process of separation of two very close objects by an optical instrument is known as resolution and the ability of an optical instrument to resolve the images of two nearby objects is termed as resolving power.

Raleigh's criterion: Lord Rayleigh studied the intensity of the diffraction patterns of two closely situated point objects in details and arrived at the following results:

- The two objects are said to be resolved, if the separation between the central maximum and the first minimum of any one of the two objects .If it is not happened i.e. the separation between the central maximum and the first minimum of any two objects is larger than the separetion between central maximum of two objects, the object are said to be unresolved .

- The two objects are said to be well resolved if the distance between the central maximum and the first minimum of any of the two objects is smaller than the separation between central maximum of the two objects.

So, when the central maximum of one source coincide with the first minimum of the other the two diffraction pattern with equal intensities of two nearby source will be just resolved . This is called Raleigh's criterion.



Resolving power of grating: The resolving power of grating is its ability to just distinguish two nearby spectral lines with two close wavelengths. If the wavelength of two nearby spectral lines be λ and $\lambda + d\lambda$, the resolving power of grating is defined mathematically as $R.P. = \frac{\lambda}{d\lambda}$. So smaller value of $d\lambda$, we get the larger value of resolving power.

According to Rayleigh's criterion the two spectral lines of wavelength λ and $\lambda + d\lambda$, are said to be just resolved when the central maximum of one pattern falls with the first minimum of the other.

According to the theory of grating , the condition of nth principal maximum of wavelength $\lambda \pm d\lambda$ can be written as,

$$dSin\theta = n(\lambda \pm d\lambda) \tag{0.0.1}$$

The first minimum on either side of the nthprincipal maximum of wavelength λ is given by

$$dSin\theta = n\lambda \pm \frac{\lambda}{N} \tag{0.0.2}$$

So it can be said that two spectral lines of wavelengths λ and $\lambda + d\lambda$,will be just resolved for a common diffraction angle θ, When above two equation are simultaneously satisfied

$$n(\lambda \pm d\lambda) = n\lambda \pm \frac{\lambda}{N} \tag{0.0.3}$$

or

$$\frac{\lambda}{d\lambda} = nN \tag{0.0.4}$$

This equation gives the expression of resolving power of grating. Hence resolving power of grating is proportional to the order number n of the spectrum and the total number of lines$N$in the grating.