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Resoliving Power

The ability of an optical instrument to produce the seprate images of two objects placed very close to each other is known as resolving power.

Expression:

Let a ligh consisting of two wave lengths λ_1 and λ_2 is incident normally on a grating element $(e+d)$ and the spectral lines corresponding to λ_1 and λ_2 are formed on screen P_1 and P_2

These spectral lines, just resolve if they satisfy the rayleigh's criterion, the direction of n^{th} principal maxima for wave-length (λ_1) is given by

$$(e+d)\sin\theta = n\lambda_1$$

$$N(e+d)\sin\theta = Nn\lambda_1$$

and I^{st} minima in direction $(\theta+d\theta)$ is

$$N(e+d)\sin\theta = Nn\lambda_1 .$$

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except $(m = 0, N, 2N \ldots)$

when $m = (nN + 1)$, eq (4.26.2)) become

$$N(e+d)\sin(\theta + d\theta) = (nN+1)\lambda_1$$

The Principal maxima due to wave-length λ_2 in direction $(\theta + d\theta)$ is

$$(e+d)\sin(\theta + d\theta) = n\lambda_2$$

$$N(e+d)\sin(\theta + d\theta) = Nn\lambda_2$$

Comparing eq we get

$$(nN+1)\lambda_1 = Nn\lambda_2$$

if $\lambda_1 = \lambda$, $\lambda_2 = \lambda + d\lambda$

$d\lambda = \lambda_2 - \lambda_1$ eq become

$$(nN+1)\lambda = Nn(\lambda + d\lambda)$$

or $\lambda = Nn\,d\lambda$ or $\frac{\lambda}{d\lambda} = nN$

But $(e+d)\sin\theta = n\lambda$ or $n = \frac{(e+d)\sin\theta}{\lambda}$

$$\frac{\lambda}{d\lambda} = \frac{N(e+d)\sin\theta}{\lambda}$$