EXPEPERIMENT

Resolving power of telescope

Object - To determine the resolving power of telescope.

Apparatus used - Telescope with a rectangular adjustable slit, cardboard with narrow strips on it and metre scale.

Formula -

The theoretical resolving power $= \frac{a}{\lambda}$

and Practical resolving power $= \frac{D}{d}$

Where

λ = mean wavelength of light employed,

a = Width of the rectangular slit for just resolution of two objects,

d = Sepration between two objects,

D = distance of the objects from the objective of the telescope.

Hence $$\frac{\lambda}{a} = \frac{d}{D}$$

Theory - Rayleigh's criterion of resolution: According to Rayleigh's two equally bright sources can be just resolved by any optical system when their distance apart is such that in the diffraction pattern, the maxima due to one falls on the minima due to the other.
Resolving power of Telescope - The resolving power of a telescope may be defined as the inverse of the

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least angle subtended at the objective by two distant point objects which can be just distinguished as separate in their focal plane.

$$\theta = \frac{d}{D} = \frac{\lambda}{a}$$

<u>Observation</u> :- (i) Mean value of $\lambda = 5000 \times 10^{-8}$ cm

(ii) Table for width (a) of slit when micrometer arrangement is attached.

Least count of screw micrometer $= \frac{1}{50}$ mm
$= 0.02$ mm
$= 0.002$ cm

S.	Distance	Slit reading						Width of the slit	$\frac{a}{\lambda}$
		Slit when images cease			When slit is closed				
No.	D	MS	VS	Total X cm	MS	VS	Total Y	a	$\times 10^3$
1	200	3	22×0.002 =.044	.344	2	21×0.002 =.042	.242	0.102	2.04
2	205	3	24×0.002 =.048	.348	2	22×0.002 =.044	.244	0.104	2.08
3	210	3	26×0.002 .052	.352	2	23×0.002 =.046	.246	0.106	2.12

The distance between the two objects (d) =

Theoretical and practical Resolution power:

Distance	Theoretical (a/λ)	Practical D/d
200	2.04×10^3	2.0×10^3
205	2.08×10^3	2.05×10^3
210	2.12×10^3	2.1×10^3

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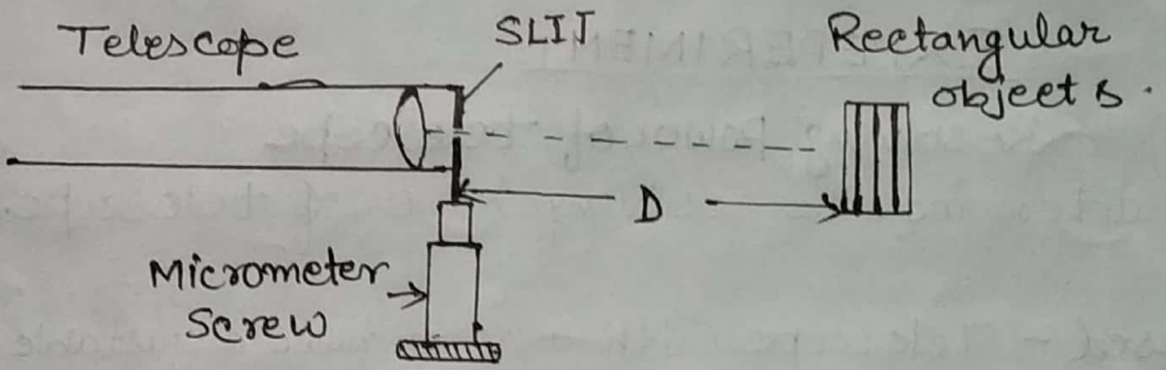

Calculations: Wavelength value(λ) = 5000×10^{-8} cm

Theoretical resolving power. $\frac{a}{\lambda}$

i) For = a = 0.102 $= \frac{0.102}{5000\times10^{-8}} = 2.04\times10^{3}$ rad^{-1}

ii) For a = 0.104 $= \frac{0.104}{5000\times10^{-8}} = 2.08\times10^{3}$ rad^{-1}

iii) For a = 0.106 $= \frac{0.106}{5000\times10^{-8}} = 2.12\times10$ rad^{-1}

Practical resolving power $\frac{D}{d}$

i) For D = 200 cm $= \frac{200}{0.1} = 2.0\times10^{3}$

ii) For D = 205 cm $= \frac{205}{0.1} = 2.05\times10^{3}$

iii) For D = 210 cm $= \frac{210}{0.1} = 2.10\times10^{3}$

Result – A comparison of theoretical and practical resolving power of the telescope in shown above.

Precautions and Sources of error –

i) The axis of telescope should be horizontal
ii) The rectangular object drawn on the card-board should be vertical
iii) Backlash error in the micrometer screw should be avoided.
iv) The plane of the slit should be parallel to the objects.
v) The distance D should be measured from the slit of the telescope to the card-board.