

Apparatus :-

- (i) Diode Laser
- (ii) Plano-convex lens
- (iii) Fabry-Perot Etalon
- (iv) Diffuser screen with scale and needle
- (v) Optical rail
- (vi) Power supply.

SLO :-

To find spacing of the Etalon

Theory :-

Fabry-Perot design contains plane surface that are partially reflecting so that multiple rays of light are responsible for the creation of the observed interference patterns. For high resolution spectroscopy, where a resolution of MHz to GHz is required, a Fabry Perot Interferometer (FP) is used.

The FP consists of 2 plane mirrors mounted accurately parallel to each other, with an optical spacing 'd' between them.

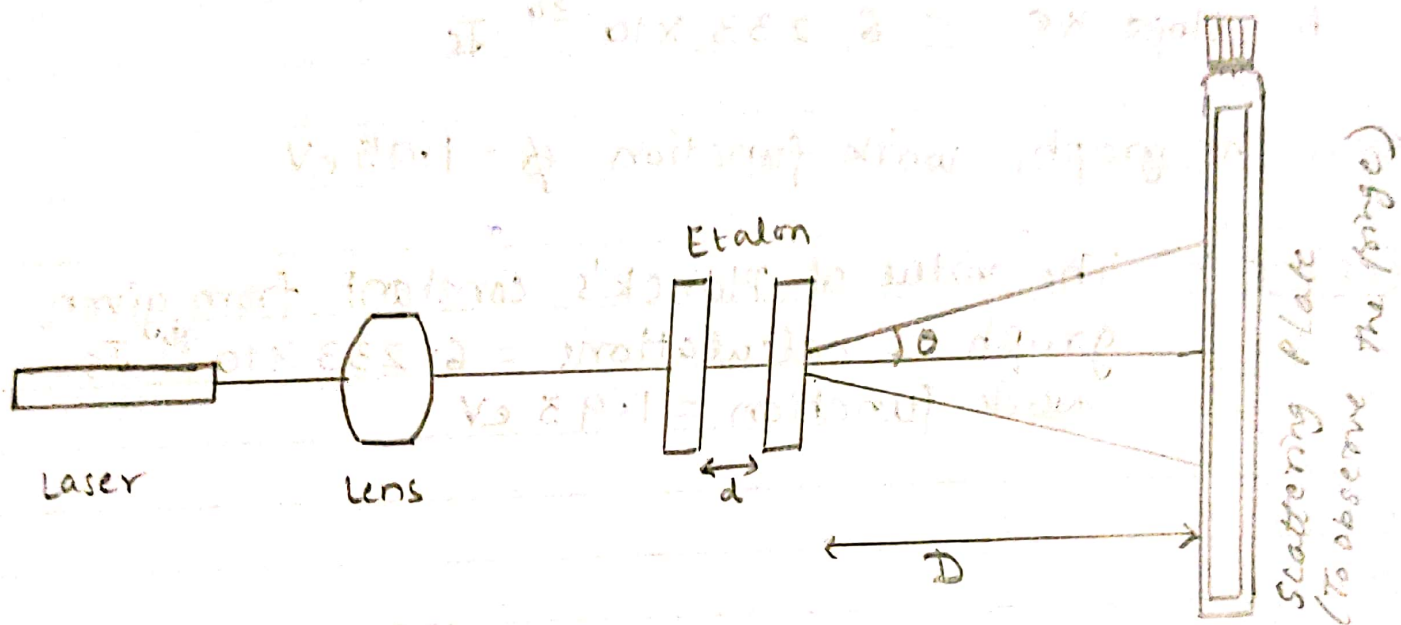
Wavelength of Laser is 532 nm

To find spacing of the Etalon :-

$$t = nD^2\lambda / \lambda_n^2$$

$$\lambda_n^2 = \lambda_{m+n}^2 - \lambda_m^2$$

λ_{m+n}^2 is the square of the radius of $(m+n)^{th}$ ~~side~~ ring &



Observation Table :-

Fringe No.	Radius (cm) Centre Position	X Fringe Position	Radius (cm)	Radius ² X ² (cm)	X _n ² = X _{m+n} ² - X _m ²	$t = \frac{nD^2\lambda}{X_n^2}$
X _m	60.05	53.8	6.25	39.06	205.86	3.178×10^{-3}
X _{m+1}		50.7	9.35	87.43	139.80	3.447×10^{-3}
X _{m+2}		48.9	11.15	124.32	201.48	3.240×10^{-3}
X _{m+3}		47.1	12.95	167.7	246.42	2.66×10^{-3}
X _{m+4}		45	15.05	226.5	204.06	3.207×10^{-3}
X _{m+5}		44.2	15.65	244.92		
X _{m+6}		43.2	16.65	277.22		
X _{m+7}		42	18.05	325.8		
X _{m+8}		39.7	20.35	414.12		
X _{m+9}		39.3	20.75	430.56		

x_m^2 that of m^{th} ring

Distance between the screen and Fabry Perot Etalon $D = 496 \text{ nm}$

$x_m = \text{line of } m^{\text{th}} \text{ fringe} - \text{centre of fringe}$

Scale reading = MSR (cm) + [V.S.D \times 0.01 (cm)]

Calculation:-

$$\frac{N\lambda}{2d} = D$$

$$\begin{aligned} \text{Mean value of } t &= \frac{(3.178 + 3.447 + 3.248 + 2.660 + 3.207)}{5} \times 10^{-3} \\ &= 3.148 \times 10^{-3} \text{ m} \end{aligned}$$

Result:-

The spacing between the etalon lenses are found to be equal to $3.148 \times 10^{-3} \text{ m} = \underline{\underline{3.14 \text{ mm}}}$

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Teacher's Signature : _____