Lab AA652
Experiment 2
Fabry-Perot Interferometer

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1 Objectives

1.To find the calibration constant of the micrometer on the partially reflecting mirror mount of the Fabry-Perot etalon.
2.Determining the unknown wavelength of laser using the interferometer.

2 Instruments

1.Optical rail.
2.Kinematic laser mount.
3.Convex lens with mounts.
4.Fabry-Perot etalon unit.
5.Screen.
6.Laser.

3 Measurements

3.1 Table for Δ

Least count of micrometer is 0.001 mm. λ=650nm

Table 1: Measurements for Calibration Constant

Serial No.	No. of fringes(N)	Distance or change in position(d)in mm	Δ=Nλ/2d
1	20	0.022	0.2955
2	20	0.027	0.2407
3	20	0.023	0.2826

Average value of the calibration constant $\sim$0.2729

3.2 Measurements for unknown wavelength

The average value of the wavelength is $\sim$566.3nm.

Table 2: Measurements for unknown wavelength

Serial No.	No. of fringes(N)	Distance or change in position(d)in mm	λ(in nm)=2dΔ/N
1	20	0.022	600.4
2	20	0.020	545.8
3	20	0.020	545.8
4	20	0.021	573.1

3.3 Error Analysis

3.3.1 Result and Error on Δ

The average value of calibration constant Δ is (found from Table 1)=0.2729 To find the error,

$$\delta\Delta = \Delta\sqrt{(\frac{\delta\lambda}{\lambda})^2 + (\frac{\delta d}{d})^2} \tag{1}$$

Now assuming $\delta\lambda$=2nm and δd=least count of micrometer = 0.001mm from equation(4) it is obtained $\delta\Delta$=0.0124 So the final result is 0.2729$\pm$0.0124.

3.3.2 Result and Error on wavelength

The average value of wavelength is 566.3nm. To find the error,

$$\delta\lambda = \lambda\sqrt{(\frac{\delta\Delta}{\Delta})^2 + (\frac{\delta d}{d})^2} \tag{2}$$

Now $\delta\Delta$=0.0124 found in the previous section and δd=0.001mm=l.c. of the micrometer the error on wavelength $\delta\lambda\simeq$38.3nm So the final result is 566.3$\pm$38.3nm

4 Conclusions

1.The value of calibration constant should be near the value of unity for an ideal system.For most practical case it deviates from unity and ours is no exception.

2.The error on the wavelength and calibration constant have been found using the wavelength spread (deviation of monochromaticity)of the laser and the least count of the micrometer as the instrumental uncertainty in this experiment.

4.Due to use of laser(with very large coherence length) the separation between the mirrors can be made significantly larger without destroying thr fringe pattern on the screen.

5.A diverging lens in front of the laser is used here to uniformly illuminate the reflection cavity in order to confirm that the collimated cross-section of light is approximately equal to the surface area of the mirrors,otherwise due to small roughness or beveled surface of the mirror the fringes would be deformed.Another lens is used to focus the light on the screen while producing the fringes.