南京邮电大学
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物理实验教学中心

Physics Experiment Center

Michelson Interferometer

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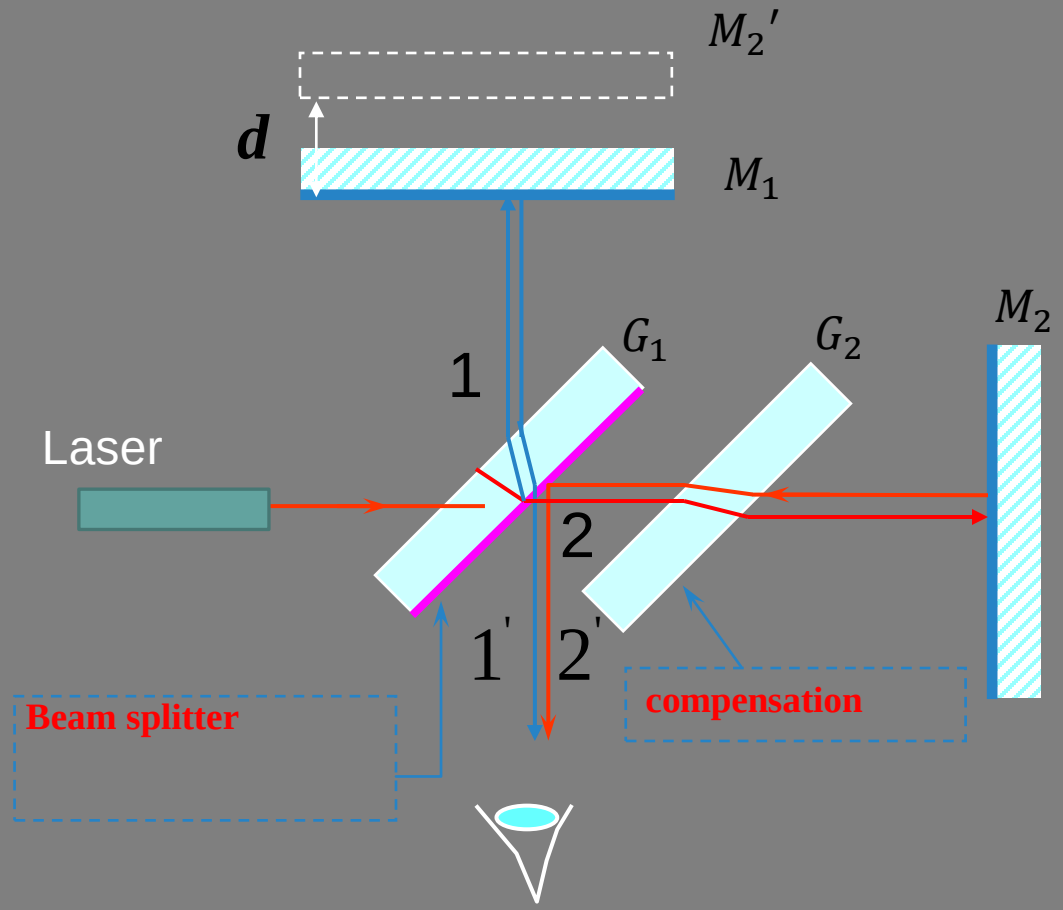
- Experimental Goals
- Experimental Principles
- Contents and Steps
- Data Processing

Experimental Goals

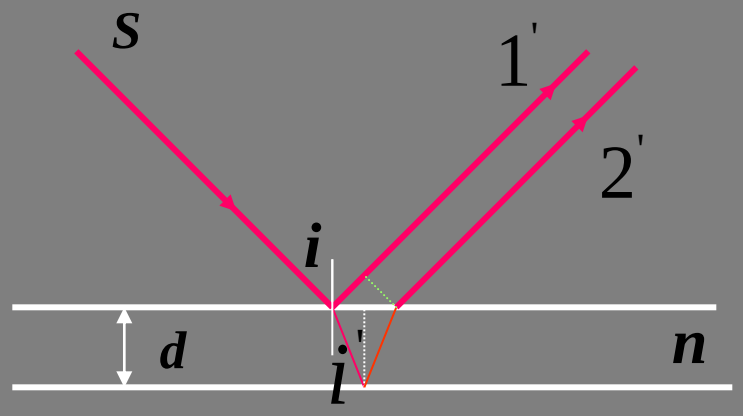
- Adjustment and application methods of the Michelson's Interferometer
- The principles and structure of the Michelson's Interferometer
- Observe the interference of equal inclination
- Measure the wavelength of red light from He-Ne laser

Experimental Principles

1. The light path



The Michelson Interferometer light route



Interference of equal thick thin-film

2. The interference of equal inclination

The light path difference:

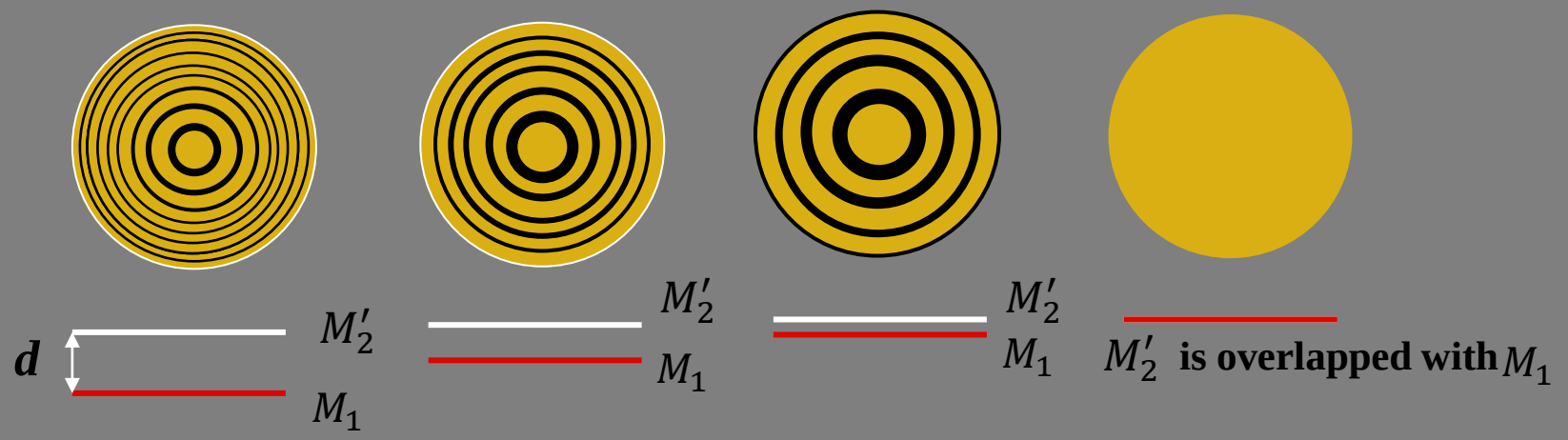
$$\delta = 2d\cos i' = \begin{cases} K\lambda \\ (2K+1)\dfrac{\lambda}{2} \end{cases}$$

(K=0,1,2…) **Bright stripes**

(K=0,1,2…) **Dark stripes**

(a) A greater thickness leads to denser stripes.

(b) When d increases, the stripes pop up; when d reduces, the stripes shrink in.



Regarding to central level of stripes (i=0)：

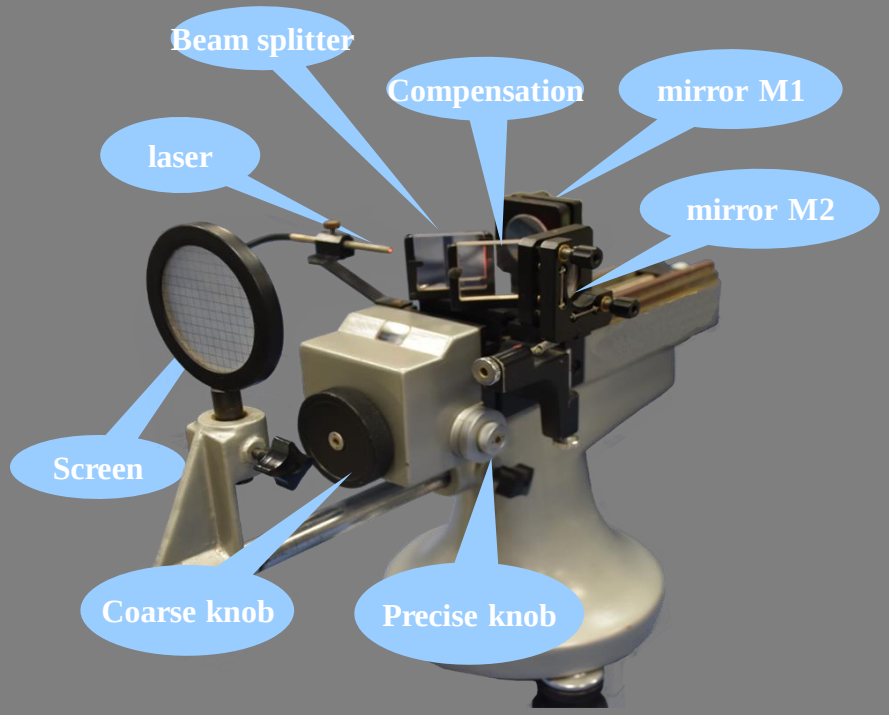
$$\left.\begin{array}{l} 2d = k\lambda \\ d = k\lambda/2 \\ d' = (k+1)\lambda/2 \end{array}\right\} \Longrightarrow \Delta d = \Delta N \frac{\lambda}{2}$$

Wavelength: $\lambda = \frac{2\Delta d}{\Delta N}$

Contents and Steps

1. The condition to obtain the interference of equal inclination:

Two brightest light dots must be overlapped.

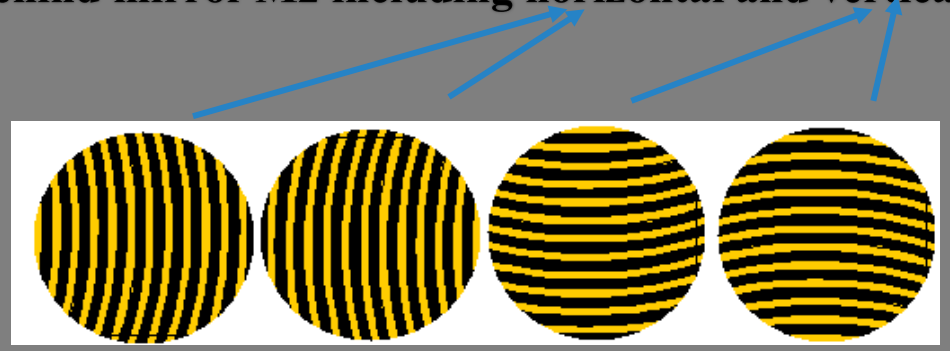


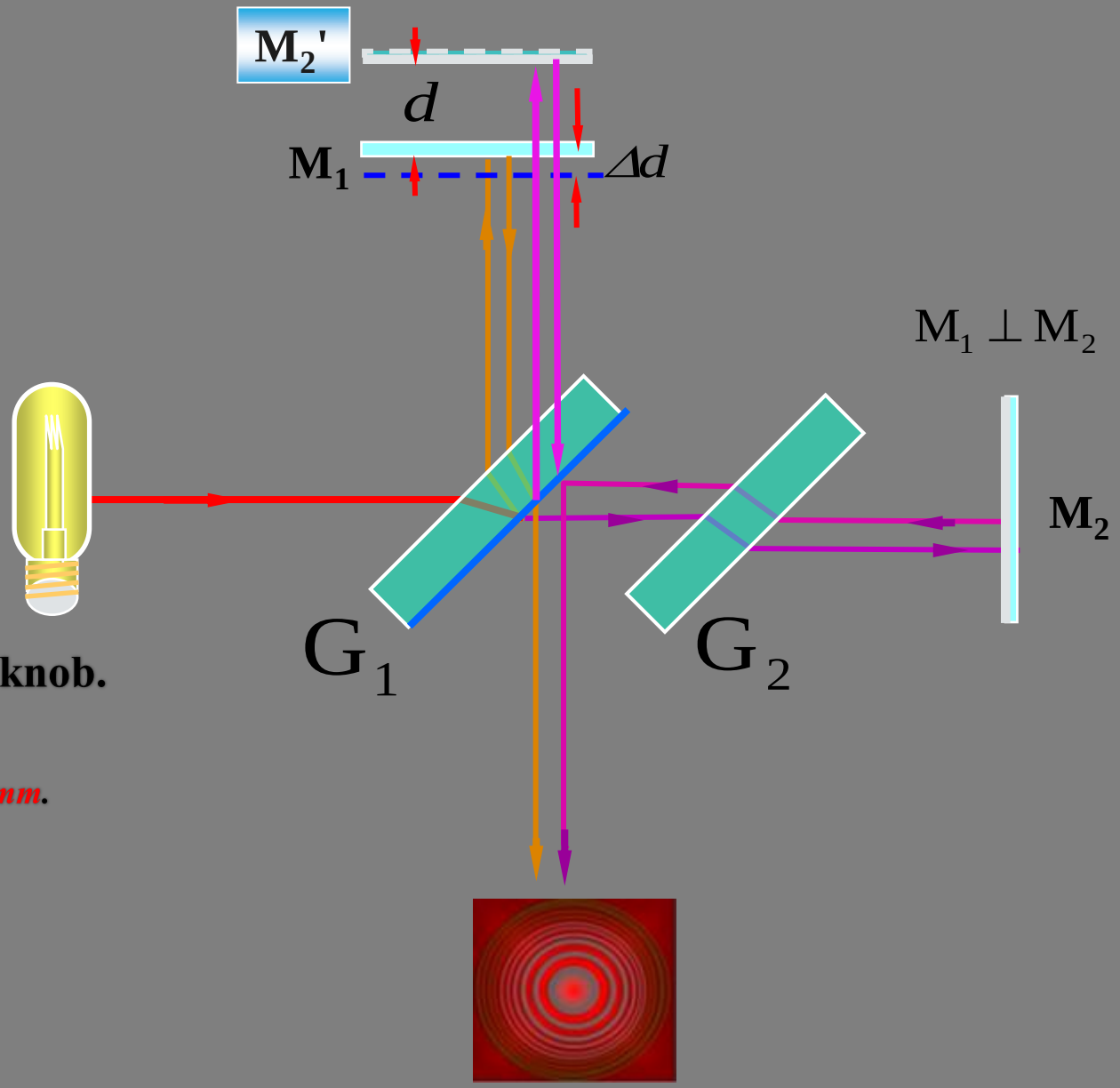
2. We observe the stripe diversification of equal inclination by changing *d*.

(Stripes shrink or expand by rotating the coarse knob and precise knob.)

The M_1 position is adjusted by coarse knob to remove M1 fleetly and precise knob to remove M1 slightly

3. To adjust circle center (Adjust screws behind mirror M2 including horizontal and vertical screws)

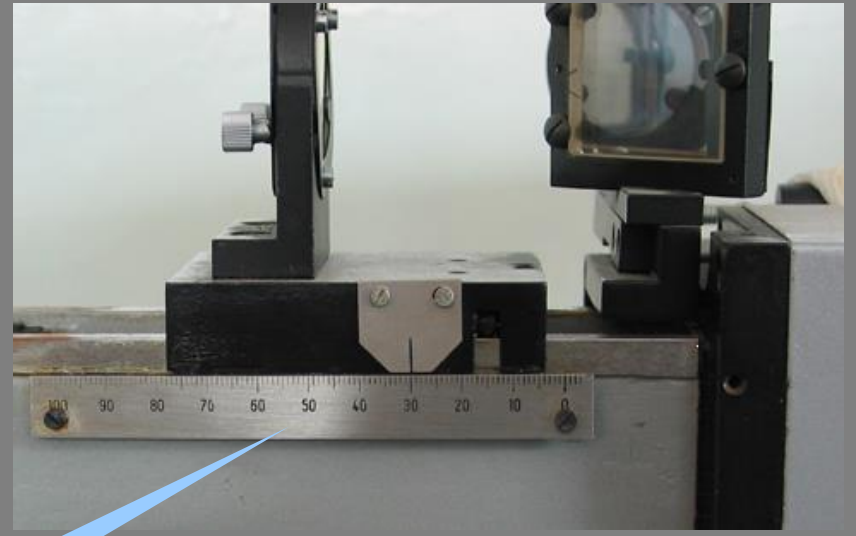




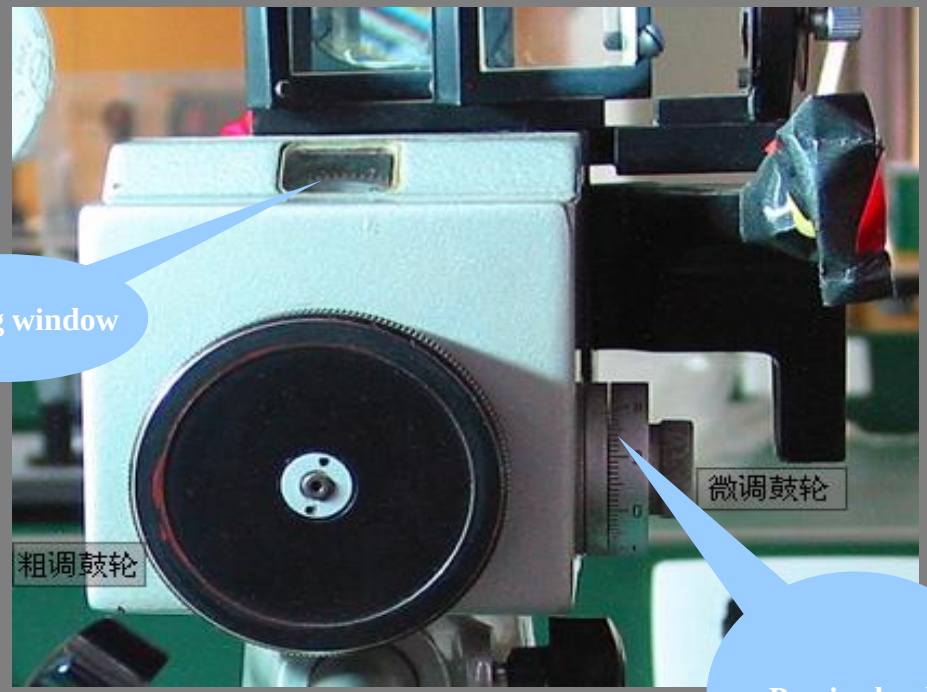
4. Make the stripe clear and stable by adjusting coarse knob.

Note: Before the measurement, M1's position was adjusted to be at about 50 mm.

5. Count the circle number and read the data when the number reaches 50.



Attention: The precise knob has to be rotated toward a fixed direction during measurement.



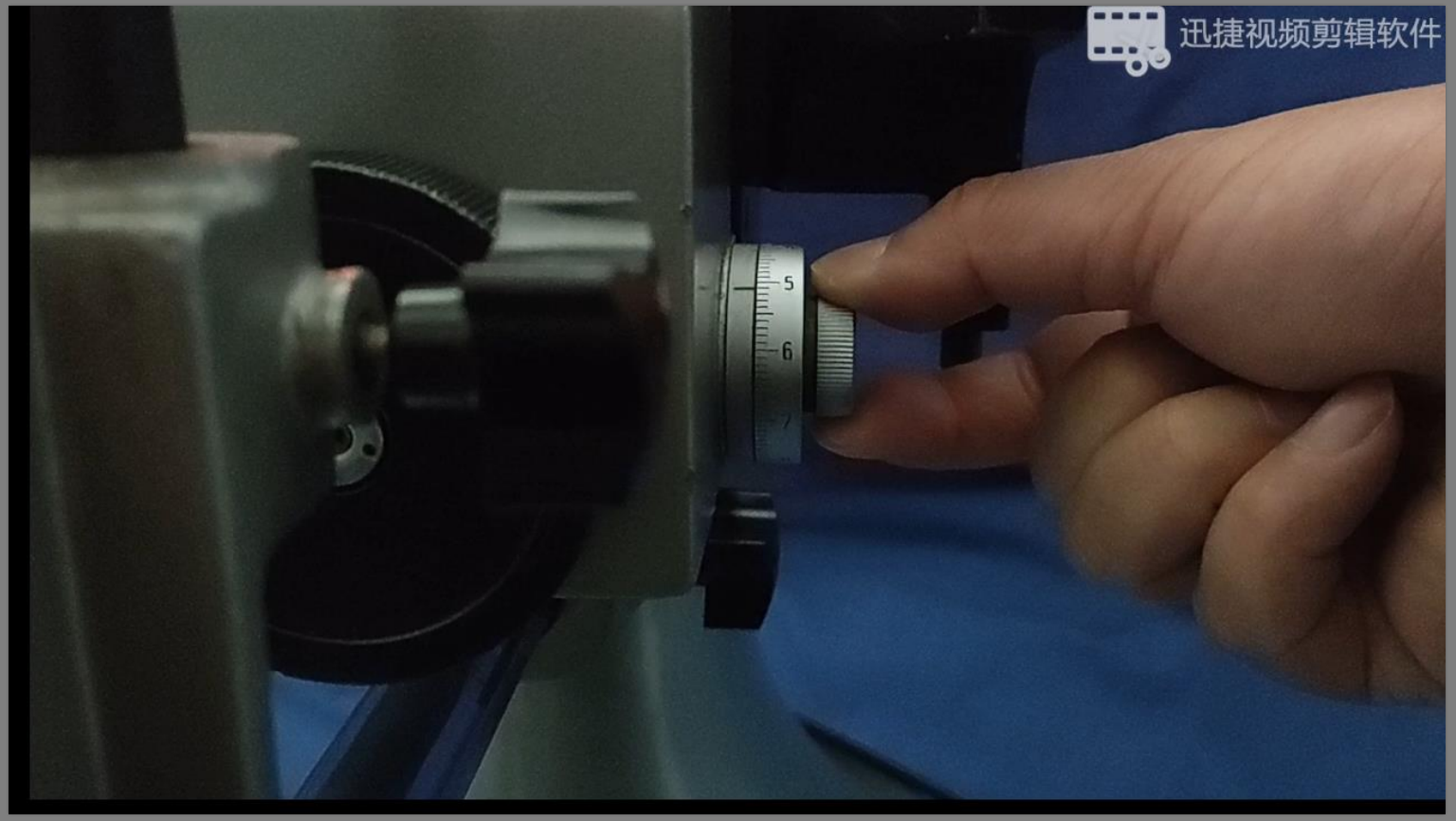
Record: There are five significant digits after the decimal point

Such as: 31.45 67 8mm

Main ruler | Big knob | Small knob | Estimate

Operation video 1

Operation video 2



Data Processing

TABLE I

i	0	1	2	3	4	5
N	0	50	100	150	200	250
d_i (mm)	50.07068	50.08669	50.10280	50.11896	50.13513	50.15144
Δd (mm)	$\Delta d_1=d_3-d_0=$		$\Delta d_2=d_4-d_1=$		$\Delta d_3=d_5-d_2=$	
Average Δd (mm)	$\Delta d=(\Delta d_1+\Delta d_2+\Delta d_3)/3=$					
$\lambda=2\Delta d/\Delta N$ ($\Delta N=150$)						

Noted: wavelength(λ) of He-Ne laser is 632.8nm

END