Experiment 9 Newton's Rings 牛頓環實驗

Translation: J D White (Bench 8)

Part A: Grating Spectrometer

1. 原理 Theory (See Online Links)

1.1 See Online

1.2 Key equation

The radius of curvature (R) can be calculated using the formula:

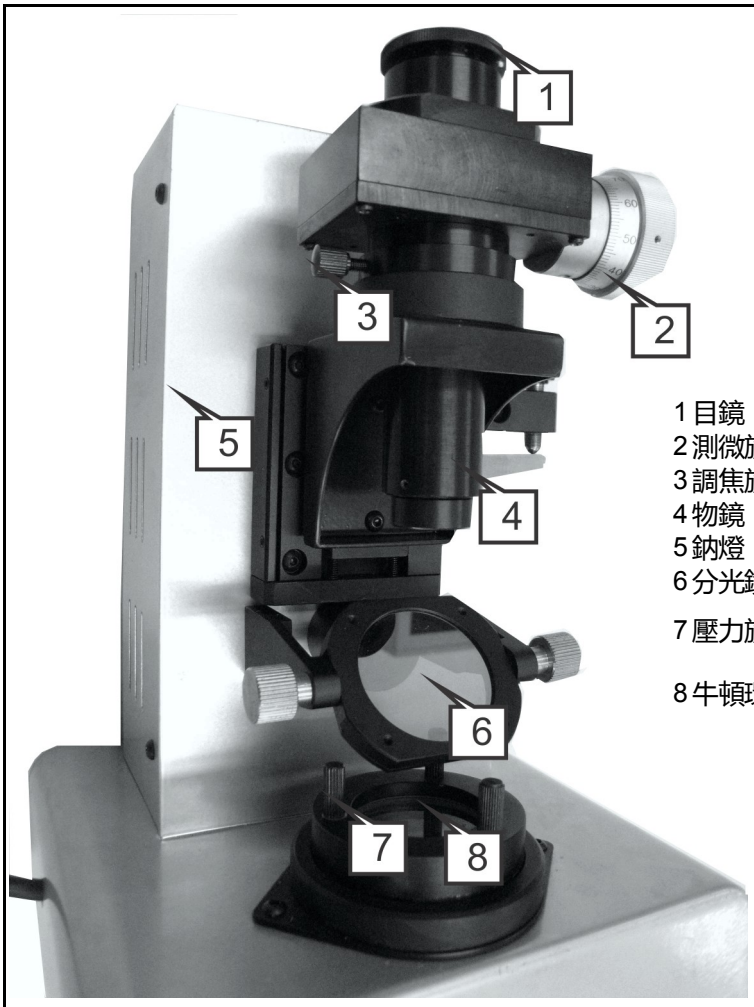
$$R=\frac{r_m^2-r_n^2}{(m-n)\lambda} \quad (5)$$

where r is the distance to the dark fringe, m is the index of the fringe and lambda is the wavelength of light.

2. 實驗目的 (Purpose)

1. To learn how to use a microscope and to observe Newton's Rings
2. Use interferometric techniques to obtain the radius of curvature of a plano-convex lens
3. To learn how to process experimental data.

3. 實驗儀器 (Laboratory instruments)



1 目鏡	Mùjìng	Eyepiece
2 測微旋鈕	cè wēi xuánniǔ	Micrometer knob
3 調焦旋鈕	tiáo jiāo xuánniǔ	Focusing knob
4 物鏡	wùjìng	Objective lens
5 鈉燈	nàdēng	Sodium lamp
6 分光鏡	fēnguāng jìng	dichroic filter
7 壓力旋柱	yālì xuán zhù	Pressure spin column
8 牛頓環鏡組	niúdùn huán jìng zǔ	Newton ring lens group

Fig. *{Equipment}* Instrumentation

4. 實驗步驟 (Procedure)

1. Turn on the Na-lamp power supply and wait for about 10 minutes until the lamp emits strong and steady yellow light (5).
2. Rotate the dichroic mirror (6) so that it is at a 45 degree angle relative to the incoming light. Make sure that the reflected light makes the Newtons Rings visible.
3. Adjust the three pressure screws (7) so that many Newton rings can be seen clearly.
4. Use the micrometer knob (2) to measure the distance between the dark rings. (Compare the micrometer readings obtained turning clockwise and anticlockwise. How much is the difference?)
5. Record in Table 1 the locations of successive dark rings from 3 to 17. (Be careful to only turn the micrometer in one direction for a set of readings.
6. Use Equation 5 to fill in the second table, and thus calculate the value of radius of curvature (R)

5. 注意事項 (Items to concern)

1. If the system is not clean, gently wipe with lens paper.
2. Be careful when focussing not to break the objective lens
3. Because equation 5 makes use of squared terms, it is best to use a large k to minimize uncertainty

6. Experiment Data 實驗記錄

Micrometer head smallest interval is 0.01mm

6.1 Data Set

Dart Fringe	3	4	5	6	7	8	9
Left							
Right							
Diameter							

Dark Fringe	10	11	12	13	14	15	16
Left							
Right							
Diameter							

6.2 Use eq. 5 to find R=radius of curvature

(Na λ=589.0nm & 589.6nm，R Theoretical:868.5mm)

k=10			k=5		
m	n	R	m	n	R
<R>			<R>		

m=Choose m dark fringe n=Choose n dark fringe k=m-n