

# Experiment 10 -- CD Diffraction 光碟片繞射實驗

Translation: J D White (Bench ##)

## 1. Theory (See Online Links)

The key equation is the diffraction equation:

$$n\lambda = d \sin(\theta) \quad (3a)$$

where  $d$  is the separation of the diffracting elements or grooves. Using the standard trigonometry we can obtain:

$$n\lambda = d \frac{y_n}{\sqrt{y_n^2 + z^2}} \quad (3b)$$

where  $z$  is the distance between the location we observe the pattern and  $y$  is the fringe separation at that distance.

$$d = n\lambda \frac{\sqrt{y_n^2 + z^2}}{y_n} \quad (4)$$

We will use this simple relationship to find the separation between grooves on a CD.

## 2. 實驗儀器 (Laboratory instruments)

Chinese	English Name	Label
氦氖雷射(含雷射架)	Helium-neon laser (with laser frame)	HeNe
45 deg 反射鏡組	mirror group,	MG
光學桌(含空壓機)	optical tables (including air compressor)	
可調式光圈	adjustable aperture,	A
支撐棒	support rods,	
支撐座	support base,	
屏幕	screen,	
光碟片	CD	CD
光源燈座	Lamp Holder	
氣體燈管	Gas Lamps	
光譜儀	Spectrometer	
筆記型電腦	Notebook Computer	

## 3. 實驗目的 (Purpose)

- To understand the effect of the groove spacing on diffraction
- To use the diffraction pattern to calculate the groove spacing

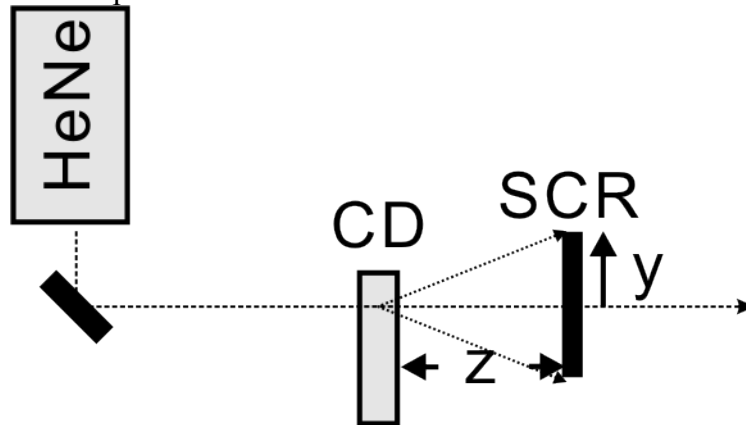
- To learn how to use a spectrometer

#### 4. 實驗步驟 (Procedure)

##### 4.1 Measuring the Groove Spacing on the CD

- Collimate the laser beam so it is parallel to the table
- Set up the Optics as in Fig. 1 so that the light passes through the grooves on the transparent CD.

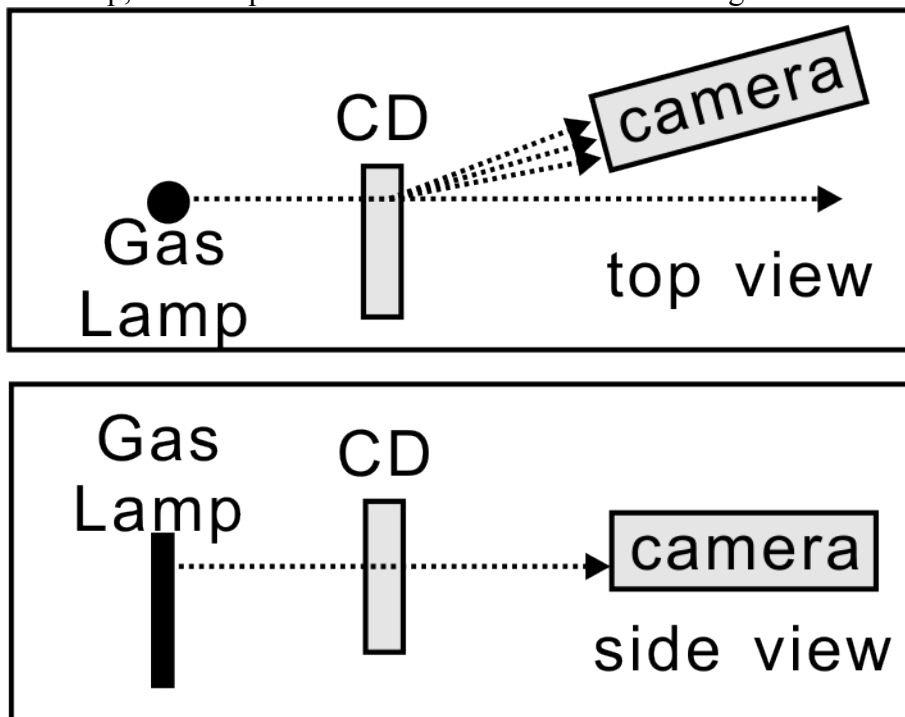
Observe the diffraction spot on the screen.



- Measure the location ( $y_n$ ) for the  $n^{\text{th}}$  order diffraction as a function of the separation between the Screen (SCR) and the transparent CD ( $z$ ).
- Calculate the value of  $d$  (groove spacing) for the CD using your measurements
- Check your measurement using reflection from the CD.

##### 4.2 Observing Spectra of Various Gas Plasmas

- Set up the arc lamp, the transparent CD and camera as shown in Fig. 2



- b. Record the spectra of the gas arc lamps using the camera.
- c. At the same time record the spectra of the lamps using the spectrometer.
- d. Compare the recording by the camera with that done using the spectrometer.

## **5. 注意事項 Safety Concerns**

5.1 Lamps get very hot if used for a long time.