Diffraction and the Phenomena

Name_____ ID_____ TA_____

Partners_____

Date_____ Section_____

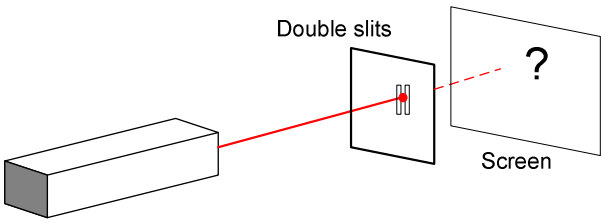
Do not look directly into the laser beam. Set up your experiment so that the laser beam in NOT at eye level.

1. Qualitative experiments for double slits:

- **Conceptual Discussion**

Look at the slit-film with a magnifying glass. Make sure how many slits each one has by referring to page 4. Do you find double slits? Where are they located?

What do you predict when you shine a laser beam on a double slit? What is the most possible shape or pattern on the screen?



- **Experiment**

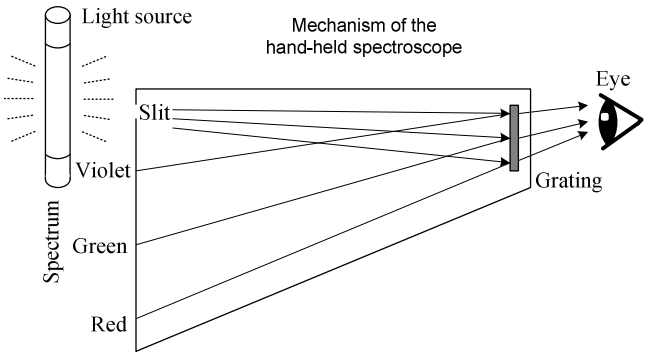
Using the laser and slit-film, obtain the diffracted images on a screen.

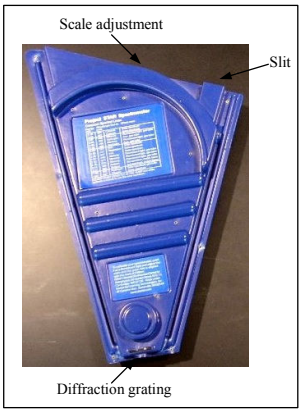
Question
Did you see an anticipated shape on the screen? Discuss the reason that you see a specific pattern.

Caution

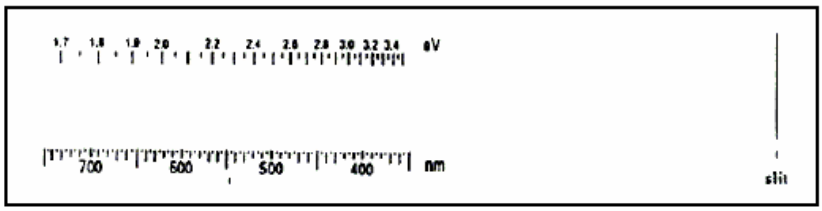
The light tubes will be very hot, and those use high voltage source. Please handle with care; otherwise it may result in serious personal injuries.

2. Spectroscopy (Emission line spectra)





Pick up the hand-held spectroscopes, and look at a fluorescent light. That has the mercury emission lines. The scale should be adjusted so that the bright green line in the spectrum of it is at 546 nm.



Brief Procedure

- **Install a known gas tube.**
- **Record the name of the gas and the apparent color on the data sheet.**
- **Record the color of the spectral lines and the wavelengths on the data sheet.**
  Hold the spectrometer horizontally so that the vertical slit is aligned with the vertical glowing tube.
- **Compare the results with the "Description of Spectra" attached to the last page.**
- **Repeat the same process for the other known gas tube.**

Go to next page and try it!

- ☑ The name of gas in tube: _____ **(I)**
- ➢ Apparent color of the glowing gas: _____

Colors	Wavelengths (nm)

- ☑ The name of gas in tube: _____ **(II)**
- ➢ Apparent color of the glowing gas: _____

Colors	Wavelengths (nm)

Question: What you observe here is matched with the reference line spectra?

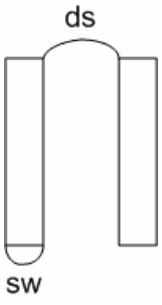
Cornell Interference and Diffraction Slitfilm Demonstrator

(The National Press, Palo, Alto, CA)

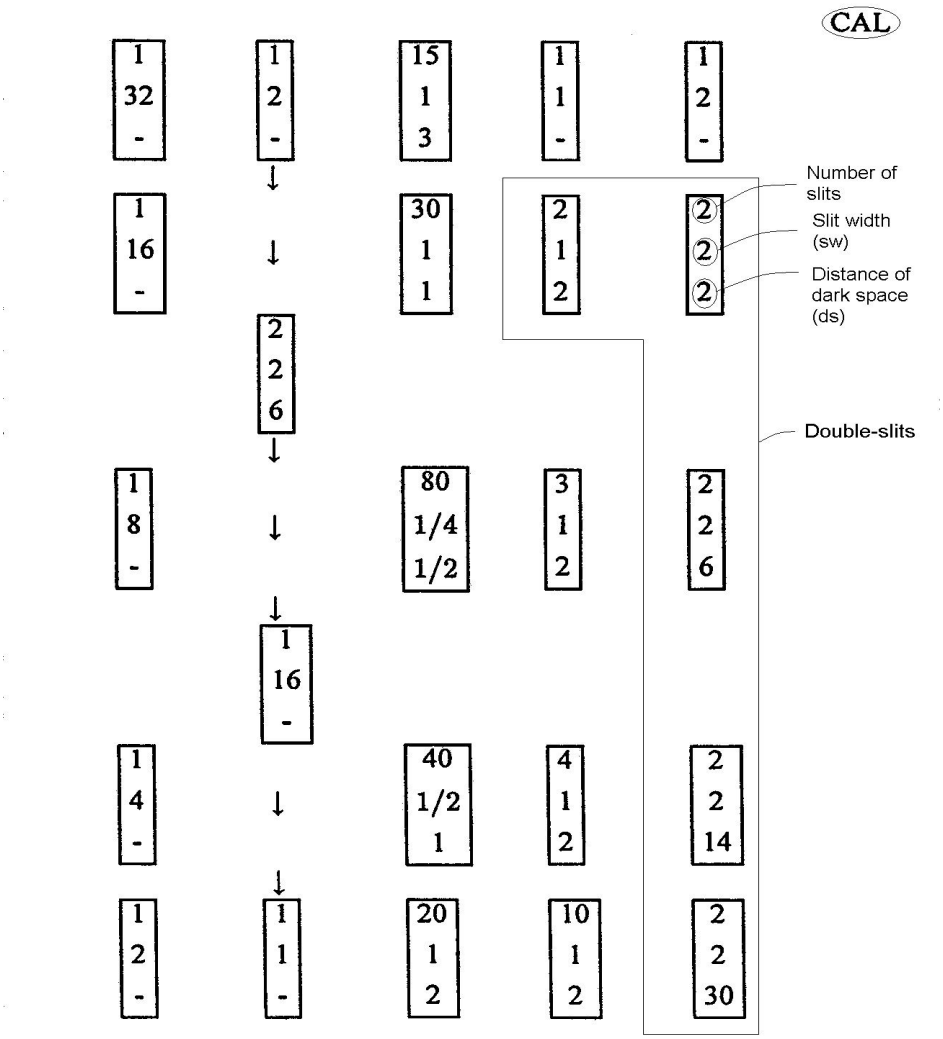
The following figure expresses the parameters of a slit pattern. Each rectangle has several kinds of slit-patterns, such as single, double, and multiple slits. This explains the location of certain slit patterns on the Slitfilm, and variables like the slit width, etc.

1. **Each Slitfilm has basically three variables**.
   Top → number of the slits
   Middle → slit width (sw)
   Bottom → distance of dark space (ds)

2. **The unit of the variables is called "point" based on a printer's "point size."**
   1 point = 4.393×10^{-5} m



Multiply by the second number by 4.393×10^{-5} m to obtain the actual slit width



Description of Spectra

Model 4605 HYDROGEN (H_2 gas). Strong violet, blue and red lines are obvious, although others may be seen.

Color	Wavelength, nm
Violet	420
Violet	440
Blue	490
Red	670
Red	670

Model 4617 DEUTERIUM (isotopic variant of H_2). Spectrum is the same as for H_2, unaffected by neutron.

Color	Wavelength, nm
Violet	420
Violet	440
Blue	490
Red	670

Model 4604 HELIUM (He gas). Strong spectrum with 2 violet, 2 green, 1 yellow and 2 red lines being prominent.

Color	Wavelength, nm
Violet	400
Violet	400
Violet	400
Blue	450
Blue	455
Blue	455
Blue	480
Green	500
Green	510
Yellow	585
Red	650
Red	680
Red	720

Model 4609 NITROGEN (N_2 gas). Strong spectrum of many lines from violet to red.

Color	Wavelength, nm
Violet	400
Violet	405
Violet	410
Violet	415
Violet	420
Violet	425

NITROGEN (Continued)

Violet	440
Violet	445
Blue	500
Blue	505
Blue	520
Green	530
Green	540
Green	550
Green	560
Yellow	580
Yellow	585
Yellow	590
Red	600
Red	615
Red	620
Red	625
Red	630
Red	635
Red	640
Red	645
Red	650
Red	660
Red	670
Red	675
Red	680
Red	685

Model 4610 OXYGEN (O_2 gas). Very weak spectrum covering violet, blue/violet, green and red (2 lines) regions.

Color	Wavelength, nm
Violet	440
Violet	440
Blue	490
Green	525
Green	540
Green	540
Green	550
Green	565
Red	615
Red	625
Red	660
Red	665

Model 4611 WATER (H_2O vapor). Three strong hydrogen lines and weak spectrum from oxygen.

Color	Wavelength, nm
Violet	430

Violet	440
Blue	490
Green	520
Green	540
Green	550
Green	560
Red	605
Red	610
Red	665

Model 4612 AIR (About 80% N_2, 20% O_2 gasses). Strong spectrum is effectively the same as that of pure N_2. See NITROGEN.

Model 4613 CARBON DIOXIDE (CO_2 gas). About 6 intense lines from carbon (C) superimposed on the spectrum from oxygen (O). See CARBINIC ACID.

Model 4602 CARBONIC ACID (H_2CO_3 vapor). Spectrum resembles that of carbon dioxide, plus conspicuous red line from hydrogen.

Color	**Wavelength, nm**
Violet	415
Violet	425
Violet	445
Violet	455
Blue	490
Green	510
Green	520
Green	530
Green	540
Green	565
Red	610
Red	620
Red	630
Red	660

Model 4608 NEON (Ne gas). Strong spectrum of multiple lines in green, yellow, orange, red. Note absence of violet lines. Used in "neon lights."

Color	**Wavelength, nm**
Blue	475
Blue	490
NEON (Continued)	
Green	510
Green	525
Green	560
Green	570
Yellow	580
Yellow	590
Yellow	600
Red	605
Red	610
Red	615
Red	620
Red	660
Red	665
Red	670
Red	685
Red	705
Red	715

Model 4600 ARGON (Ar gas). Weak multiple lines, most intense in violet, least intense in red.

Color	**Wavelength, nm**
Violet	420 (Hazy)
Violet	440 (Hazy)
Violet	460
Green	495
Green	525
Green	550
Green	550
Green	560
Green	570
Yellow	595
Red	610
Red	625
Red	630
Red	640
Red	650
Red	660
Red	670
Red	680
Red	710
Red	720

Model 4614 KRYPTON (Kr gas). Strong spectral lines in violet, green, orange and red portions.

Color	**Wavelength, nm**
Violet	430 (Hazy)
Violet	440 (Hazy)
Violet	450
Violet	455
KRYPTON (Kr gas) (Continued)	
Blue	490
Green	560
Green	565
Green	570
Yellow	590

Red	610
Red	630
Red	650
Red	665

Model 4616 KRYPTON 86 (^{86}Kr gas). Isotopic variant of naturally occurring krypton, which is mainly ^{86}Kr. Spectrum is not noticeably changed, as with hydrogen and deuterium.

Model 4615 Xenon (Xe gas). Weak spectrum of 2 violet and 2 green lines.

Color	**Wavelength, nm**
Blue	470
Blue	470
Green	485
Green	485
Green	500
Green	500
Red	625
Red	640

Model 4607 MERCURY (Hg vapor). Strong spectrum composed of 3 violet, 1 green, 1 yellow and 1 orange lines. Mercury lamps are used as light sources for these wavelengths.

Color	**Wavelength, nm**
Violet	450
Violet	450
Violet	450
Violet	460
Green	500
Green	505
Green	560
Yellow	590
Yellow	590
Red	610
Red	625
Red	660
Red	680
Red	720
Red	730

Model 4603 CHLORINE (Cl_2 gas). Medium intensity multiline spectrum from violet to orange, with 3 stronger lines in the blue/green region.

Color	**Wavelength, nm**
Violet	445
Violet	455
Blue	485
Blue	485
Green	510
Green	520
Green	520
Green	540
Green	545
Green	570
Yellow	590
Red	600
Red	625
Red	635
Red	655
Red	665

Model 4606 IODINE (I_2 vapor). Strong spectrum with lines so closely spaced that appearance is "blurry", especially in orange/red region.

Model 4601 BROMINE (Br_2 gas). Strong, multiple line spectrum from violet to red, with about 7 prominent lines.

Color	**Wavelength, nm**
Violet	420
Violet	425
Violet	450
Violet	450
Blue	475
Blue	480
Blue	480
Blue	480