SPECTRA AROUND US

(how to build a homemade spectroscope)

Application time (90min)

Objectives

- Check that white light is a mixture of different colors.
- Infer that the color is related to the energy and wavelength of the radiation.
- Verify that the spectrum depends on the emitting source.

Materials

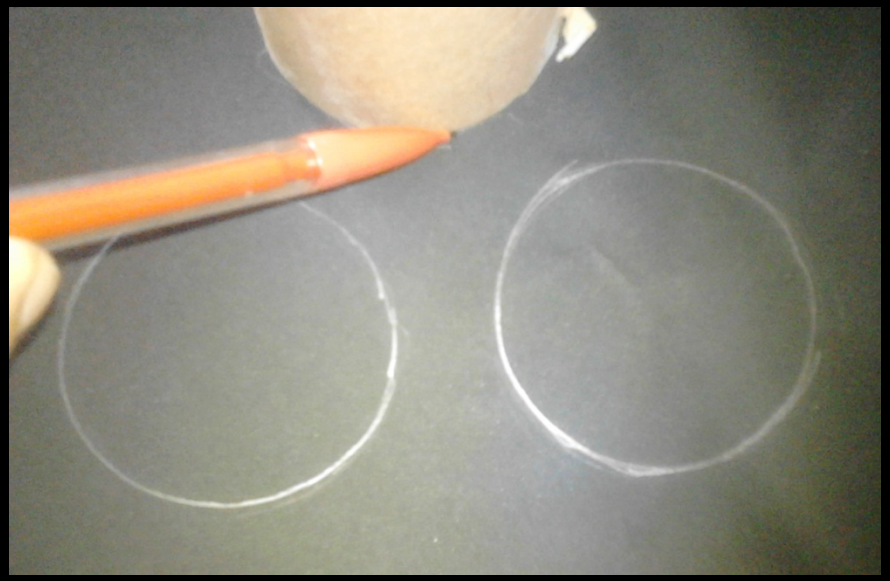
- 1 piece of a thin black cardboard
- 1 cardboarb tube (roll paper towels tube)
- 1 CD disc
- 1 solid pair of scissors
- Opaque adhesive tape (black colour)
- 1 ruler
- 1 pencil

Preparing the diffraction grading

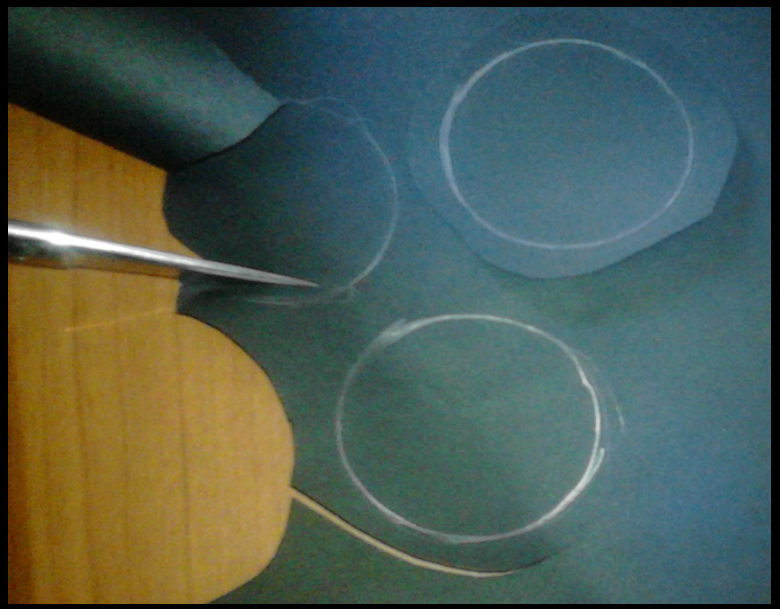
Remove the CD cover using a piece of scotch tape.

Using the scissors, cut a square surface (2cm x 2cm) of the clean CD (diffraction grading)

Building the spectroscope

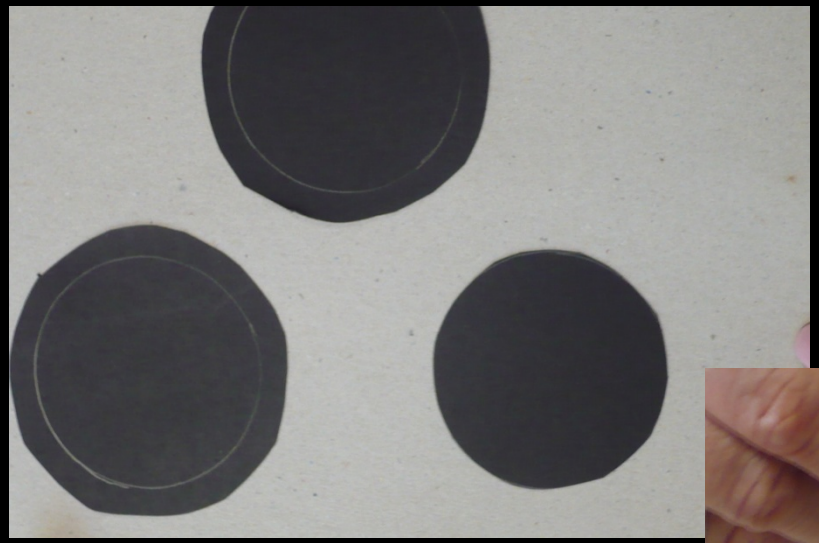


Draw 3 circles on the piece of black cardboard, using the paper towel roll as a template (be sure to leave 1 cm intervals between them).

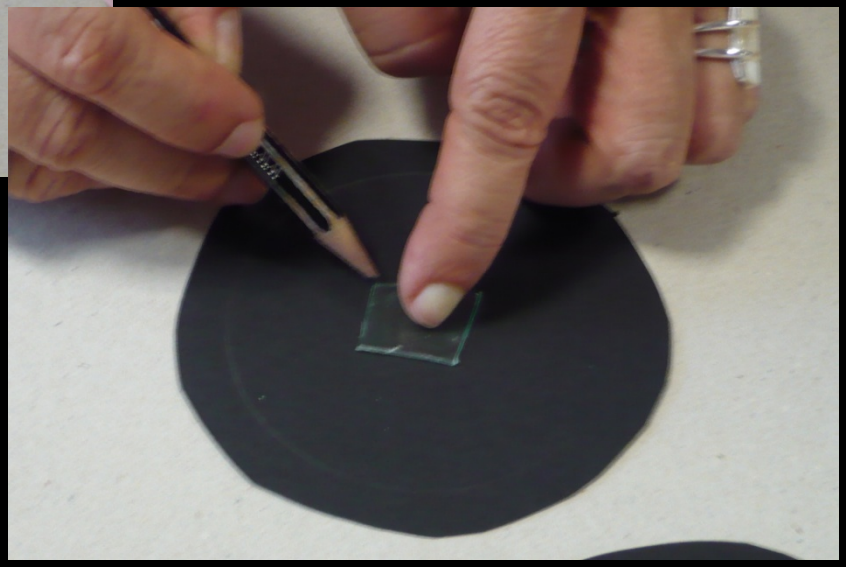


Cut two of the circles leaving an 0,5 cm outer margin to the marking and the other one slightly inside the marking.

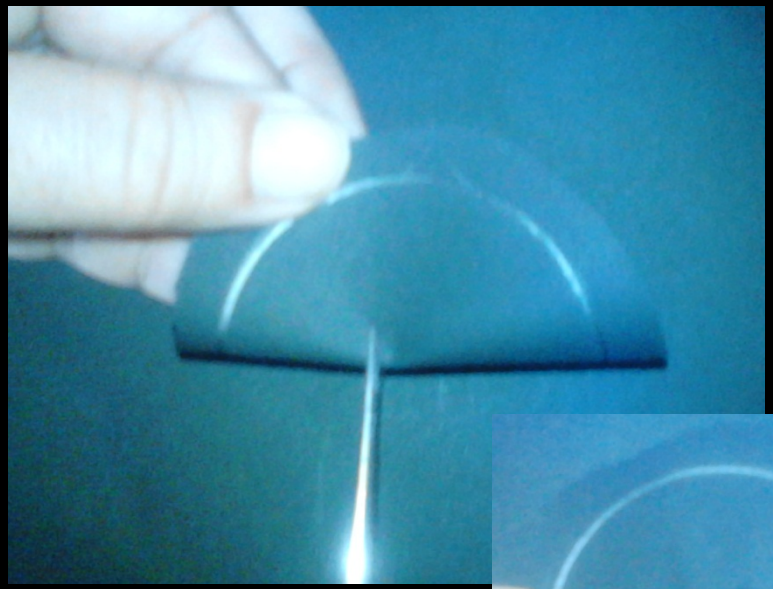
Building the spectroscope



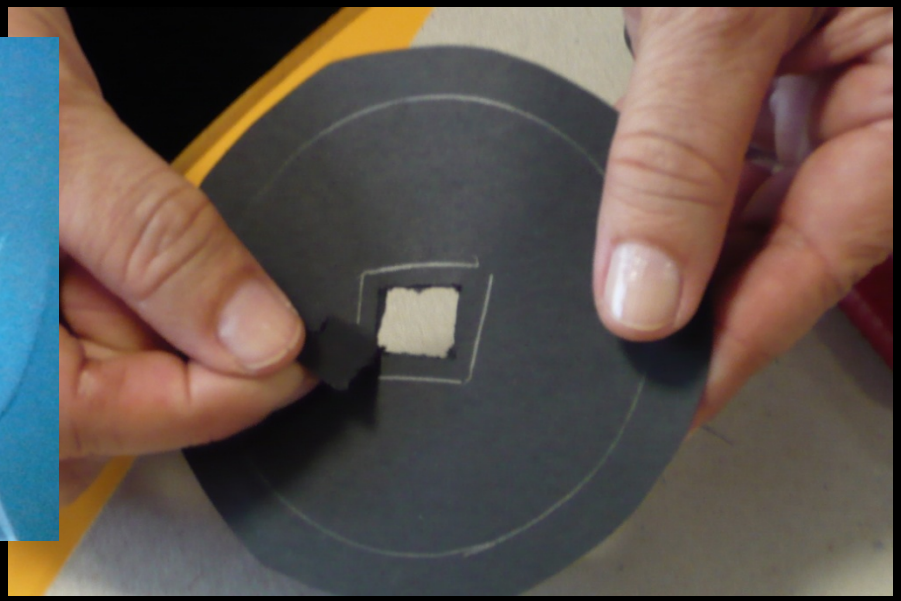
Choose one of the bigger circles and draw, in the middle, the size of the diffraction grading you just prepared.



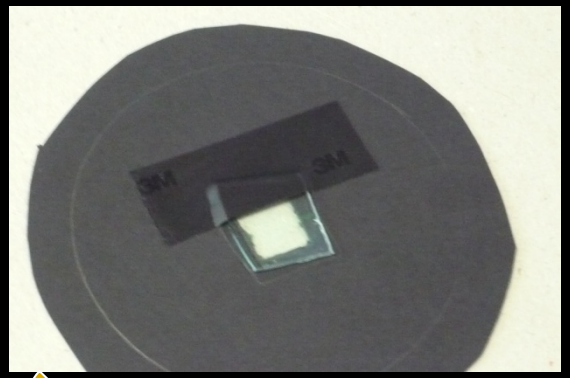
Building the spectroscope



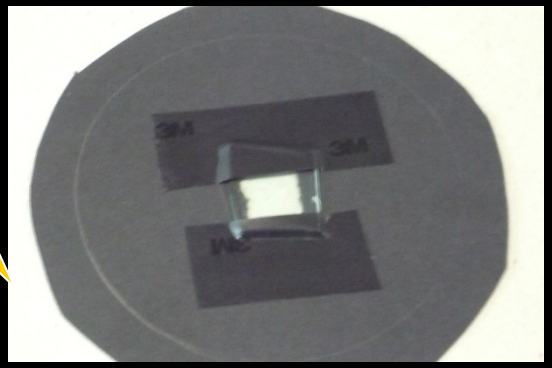
Using a sharp knife, cut inside the diffraction grading mark, to obtain a smaller square.

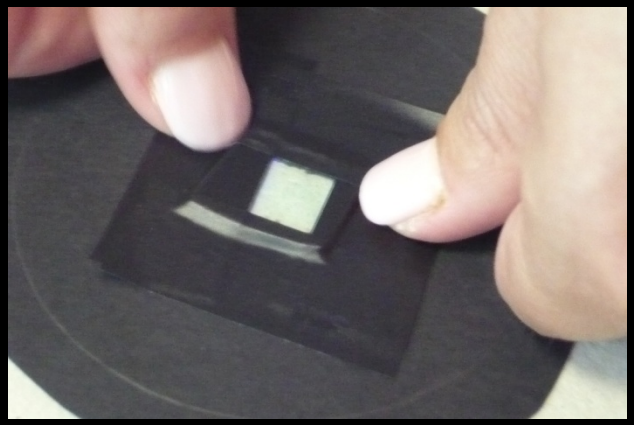


Building the spectroscope



Hold all the 4 sides of the diffraction grading, using opaque adhesive tape, to the cardboard circle where you cut out the window.





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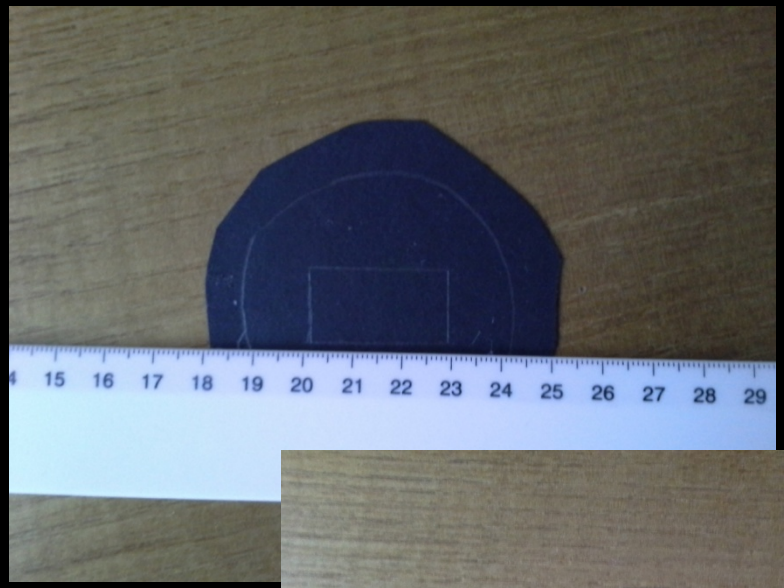
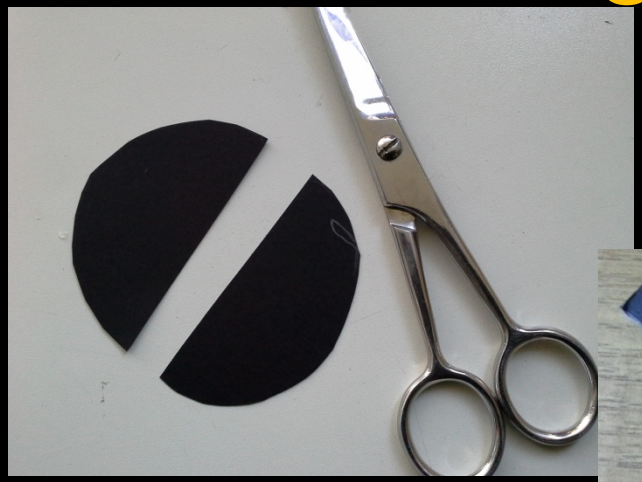
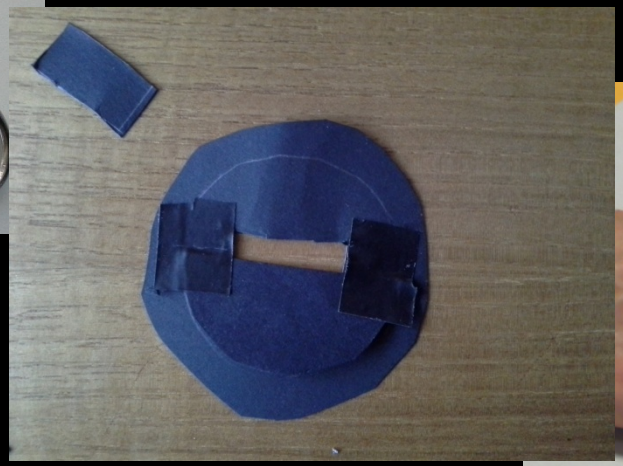


On the other big circle, cut out a rectangle (3cm x 1,5cm), following the previous procedure.

Building the spectroscope



Cut the smaller circle in halves with one move of scissors (so the cut edges become very thin and smooth surfaces).

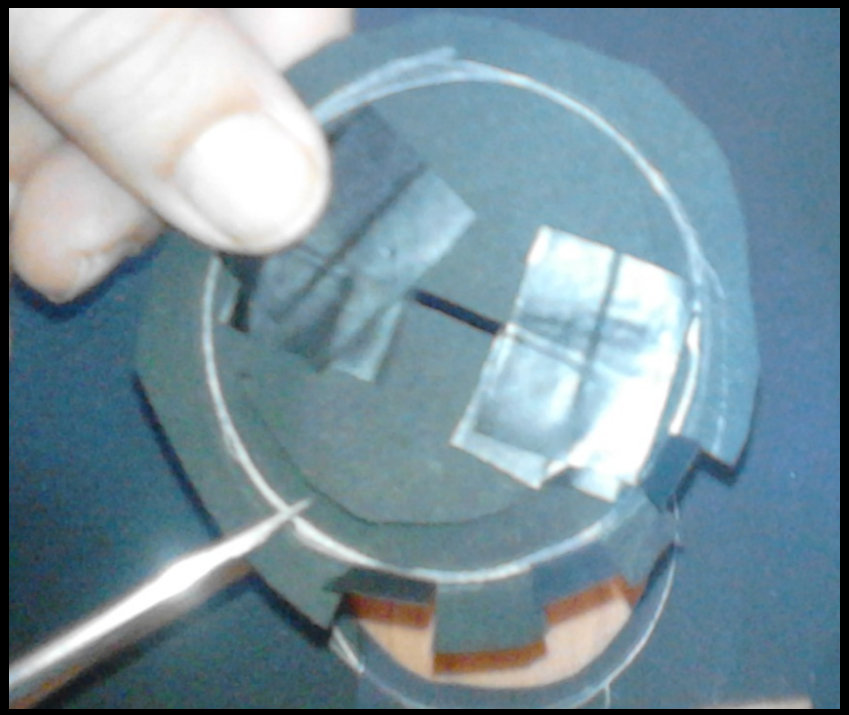


Stick, over the square hole, with black adhesive tape, each one of the half circles at a time,

Leave a narrow split (about 1mm) between them.

Building the spectroscope

Now you have both tops ready



Make small cuts round the borders of the two circles as you can see in the picture.

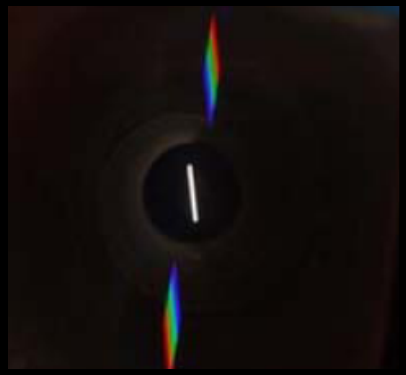
Building the spectroscope

Attach the circle that has the slit to one end of the cardboard tube, using opaque adhesive tape.

Building the spectroscope

Before attaching the circle with the diffraction grading to the cardboard tube, have a look through it, pointing the opposite side slit to a lighted lamp.

Turn the circle with the diffraction grading until you see a spectrum with the stripes parallel to the slit (a spectrum appears on each side of the slit).



Wrong

Right

Building the spectroscope

With the diffraction grading in the correct position, attach the circle to the cardboard tube using the opaque adhesive tape, as you did previously.

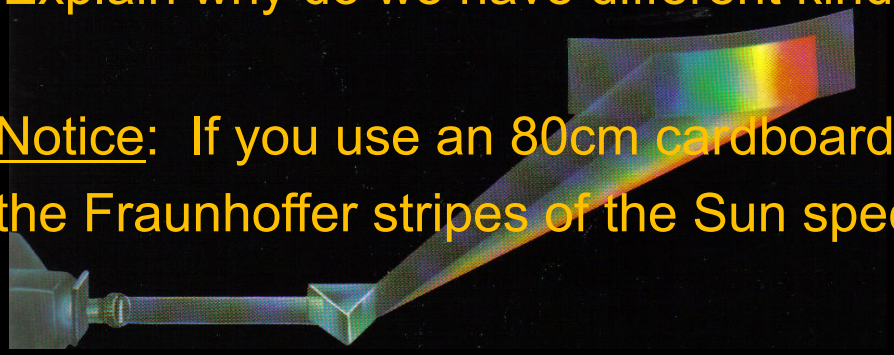
Notice: the longer the tube more defined the spectra will be (for instance, you can use tubes to store drawings or cardboard tubes inside paper rolls).

Suggested exercises

•Do all lamps give rise to the same kind of spectra?

•Check what kind of spectrum is originated by a filament lamp, an energy saving lamp and a fluorescent tube.

•Explain why do we have different kinds of spectra.



Notice: If you use an 80cm cardboard tube, you will be able to see the Fraunhoffer stripes of the Sun spectrum.

(NEVER point the spectroscope directly to the Sun. Look for a reflecting surface like water or a mirror)