Spectroscopy – Workshop Plan

Age group: 12-15 years old

Subject: Physics – lights, spectroscopy

Workshop focus and goals:

Aim: To enjoy learning about light diffraction and spectroscopy.

Objectives:

- To make a successful spectroscope.
- To use your spectroscope to observe differences in various light sources.
- To know who uses spectroscopes and why.
- To understand the working principles of spectroscopes (diffraction).

Materials needed:

- A printed spectroscope template on thick paper OR a roughly 5 cm diameter, 20 cm long cardboard tube and some extra cardboard.
- A CD
- A pair of scissors and/or a knife
- A roll of tape
- Some pencils/markers for decoration
- Different light sources

Workshop structure:

Total duration: 90 min = 1 h 30 min

Workshop unfolding:

Set-up: If you are supplying all the needed material, place them on the available tables.

10 min (s. 1-4) – Welcome workshop participants and introduce the topic. In the word "spectroscopy", there is the word scope. Maybe participants have heard of it before, for example in "microscopes" or "telescopes". Those two objects are used to examine objects which are very small or very far away respectively. We can use that information to define "spectroscopy". It can be cut into its two parts:

1. Spectro = spectrum
2. Scopy = to examine

Therefore, spectroscopy is the science of examining spectra.

30 min (s. 5) – Make the spectroscopes:

Option 1: printed template

1. Cut out all the doted lines.
2. Gently poke a pencil through the paper for the eye-hole.
3. Roll the spectroscope into a tube shape and tape it closed.
4. Fold the tabs on the disk and tape them down to form a lid.
5. Place a CD in the slits, point the lid slit towards light and look through the eye-hole.

Option 2: cardboard roll

1. Cut a thin slit at 45° angle towards the bottom of the cardboard tube.
2. Directly across from the slit, make a small eye-hole using a knife.
3. Trace the opposite (top) end of the tube on some extra cardboard and cut it out.
4. Cut a straight slit right across the centre of your cardboard circle.
5. Tape the circle to the top of the tube.
6. Place a CD in the slits, point the lid slit towards light and look through the eye-hole.

20 min – Use the spectroscope: point it towards different light sources and note the differences in what you observe. You should see a "rainbow" appear on the CD.
/!\ It can take a bit of practice to be able to see the spectra appear on the CD. Here are a few tricks which may help out:

- try to limit the ambient light, try to only have the target light which can enter the spectroscope
- try to have the lid slit perpendicular to the CD
- try to change the angle the spectroscope is pointed towards the light

10 min (s. 6, 7) – Explain how the spectroscope works. Light is a mix of many wave which have different "wavelengths". Each wavelength has its own colour. When the light hits the CD, it is "diffracted" into its different wavelengths and therefore different colours.

10 min (s. 8, 9) – Try using the spectroscopes again now that the way it works is better understood. Show some examples of what to expect.

10 min (s. 10, 11) – Explain why spectroscopy is important and what it can be used for. Different light sources have different spectra (≈ rainbows) because they are made of different elements. Each element on the periodic table has its own spectra. Therefore, spectroscopy can help identify the different elements in a sample.

10 min (s. 12) – Discuss what you learned during the workshop and answer any remaining questions the participants may have.

Assessment:

A short quiz for example could be used to make sure the participants have fulfilled the workshop objectives.