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Modelling Spectroscope

Age group: 10-14

Topics: phyics, spectrometry, light polution, hands-on activity

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Modelling Spectroscope:

A spectroscope decomposes light that comes to you into components in a form of spectrum with use of diffraction grating.

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Low-cost spectroscopes can be built easily using household materials !

1) Tool List:

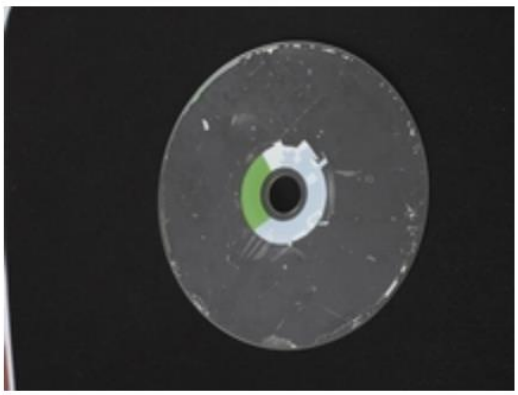
- Compact disc (CD)
- Cardboard tube approximately 30 cm long and 10 cm diameter
- Cardboard
- Razor knife
- Scissors
- Tape

2) Steps:

Scratch a bit of paint from the edge

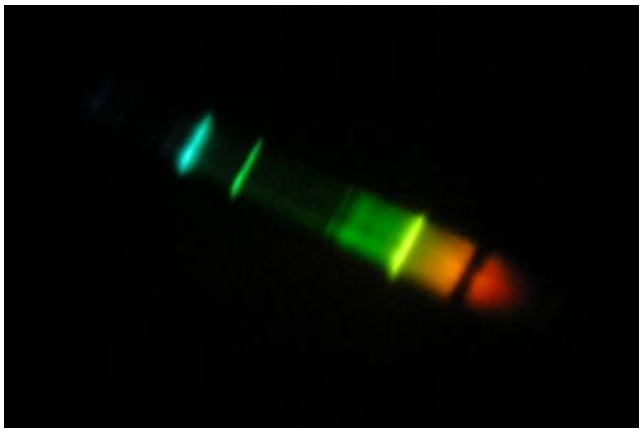
Put a tape on the scratch

Remove the tape with paint



Ready !!!

Position the CD at a 30-degree angle with the tube



LPS**	Low-pressure sodium – a nearly monochromatic yellow-orange light source used mostly in areas near astronomical observatories and sea turtle nesting beaches.	1.0	0.4
HPS***	High-pressure sodium – A golden-yellow light source, widely used throughout the world.	2.4	1.0
FLED****	Filtered warm-white light-emitting diode – a straw-yellow LED lamp with a filter that removes most emission with wavelength shorter than 500 nanometers.	3.6	1.5
LED 2400K	Light-emitting diode with "correlated color temperature" (CCT) of 2400K – a "warm-white" LED. This type of LED has not seen wide use.	4.3	1.8
LED 4100K	Light-emitting diode with CCT of 4100K – a "cool-white" LED. This is a common LED type in recent LED area lighting installations.	6.4	2.7
LED 5100K	Light-emitting diode with CCT of 5100K – a "cool-white" LED. This also is a common LED type in recent LED area lighting installations.	7.9	3.3

Use the spectroscope to explore spectra from different types of light sources. LEDs can light-pollute almost 8 times more than low-pressure sodium lamps!

3) Recommended Websites:

- International Dark Sky Association - https://www.darksky.org/
- Globe at Night Campaign - https://www.globeatnight.org/
- Dark Sky Rangers - http://dsr.nuclio.pt/
- Light Pollution Map - https://www.lightpollutionmap.info/

4) Recommended Applications:

Lux Light Meter Pro

Light Pollution Map

5) Example - The impact of light pollution:

Practical ACTIVITY for TONIGHT!

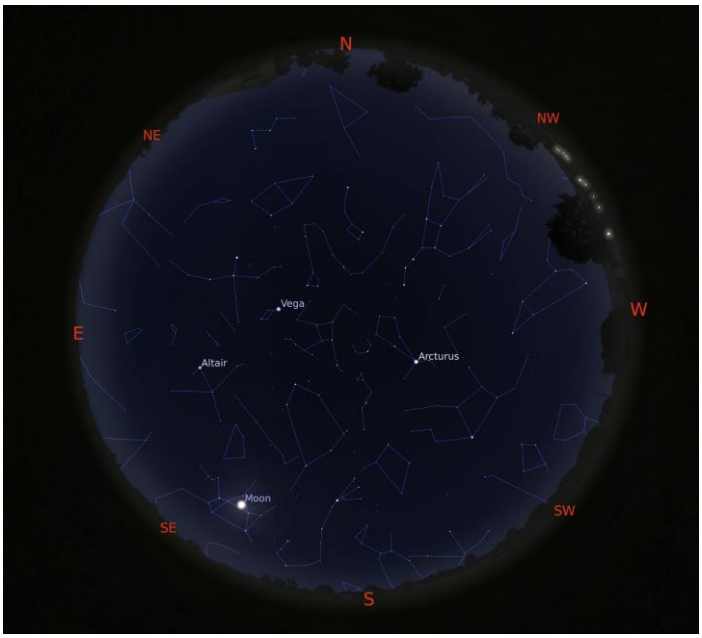
Evaluate the limiting magnitude of the location

HOW?

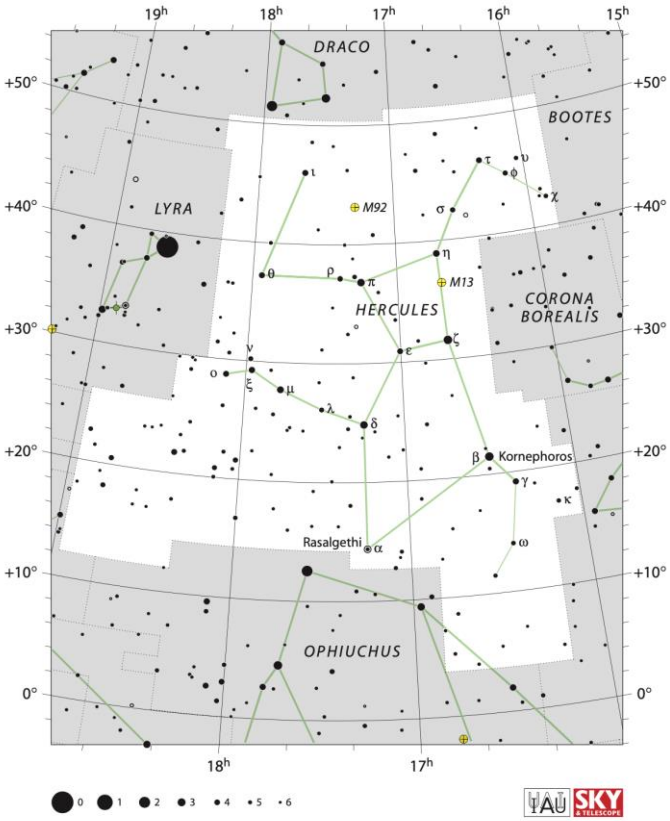
- Use a constellation near the zenith
- With a reasonable range of magnitudes (1 to 5 in steps on 0.5 mag)
- Go to a site without direct incidence of artificial lights
- Adapt your eyes to the dark (10 - 15 minutes).
- Avoid using your smartphone. If essential, keep the screen brightness to minimum.
- Use a red-light flashlight (or app) to preserve low light eye adaptation.
- Identify the faintest star you can see in the area and compare with the star chart

CAVEATS

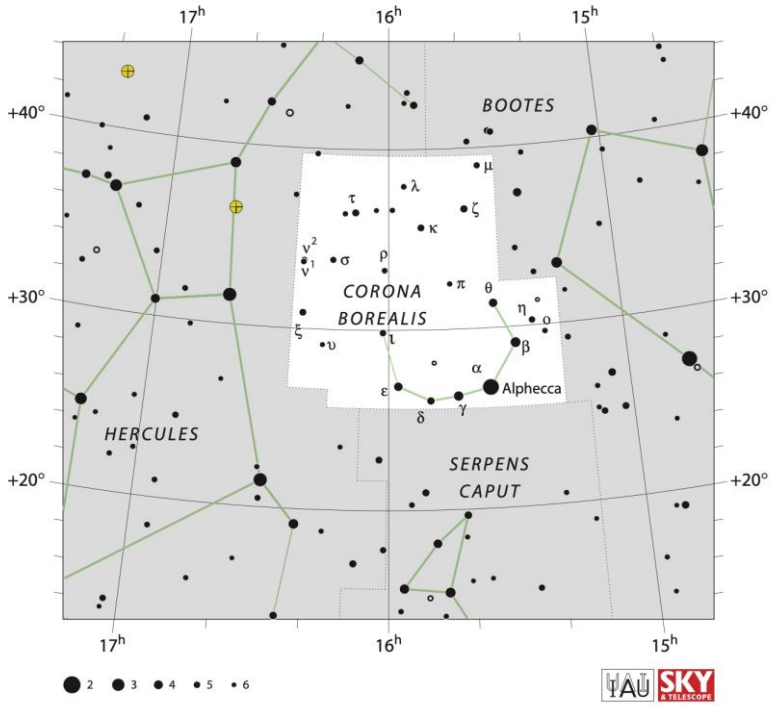
- Direct artificial light incidence
- Not enough time to adapt to the dark
- Moon
- Clouds
- Constellation not near the zenith



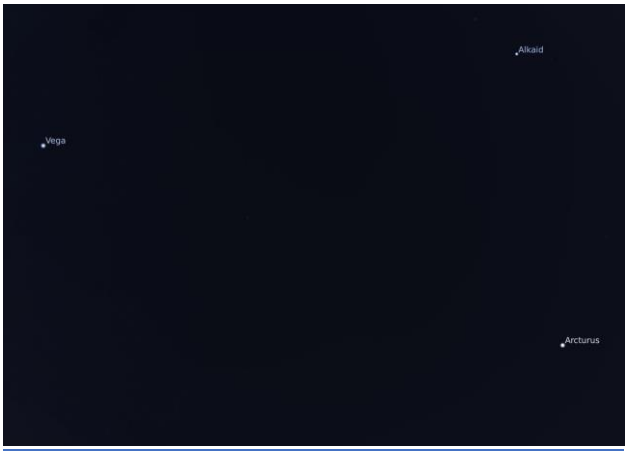
2 Regions



HERCULES



CORONA BOREALIS



Limiting Magnitude 1

Limiting Magnitude 2

Limiting Magnitude 3 **Limiting Magnitude 4**

Limiting Magnitude 5

How many Stars can you see with naked eyes?

Limiting magnitude	Number of stars
1	6
2	45
3	150
4	540
5	1700
6	4900
7	14000

-> Note to Teachers: This report highlights a simple and cost-effective way to engage students in the exploration of light spectra using low-cost spectroscopes constructed from household materials. By incorporating hands-on activities, teachers can enhance students' understanding of light pollution and its impact on the environment. The recommended websites and applications provide valuable resources for further exploration, and the practical activity for evaluating the limiting magnitude offers a tangible and insightful experience for students.

This is the opportunity to make science interactive and relevant, fostering curiosity and environmental awareness in their students through easily accessible tools and engaging activities.