Visible Spectrum

Purpose

Using "Borderless Lab 365" platform to observe the visible spectrum of different light-emitting sources.

Theory

- Radiation surrounds us everywhere, where the most noticeable one is visible light. A famous experiment by Sir Isaac Newton revealed that white light can be diffracted into a spectrum of visible light of different wavelengths (different colours).
- While quantum physics was founded, it was discovered that the electrons within an element can only absorb certain amounts of energy and get excited to higher discrete energy levels.
- The exact amounts of energy required to excite an electron from an element can be assessed by Planck's equation: $E = hf = h\frac{c}{\lambda}$, h is Planck's constant = 6.63×10^{-34} Js.
- An **absorption spectrum** of an element can be obtained when a white light is passed through. The unabsorbed wavelengths will appear on the spectrum while the absorbed ones will not.
- An **emission spectrum** of an element can be obtained when energy is provided to excite the electrons of an element to all available energy levels, followed by the electrons returning to their ground state to emit characteristic wavelengths. In this experiment, an emission spectrum is observed by a **spectrometer**.
- Since every element composes different energy levels, the combination of emitted wavelengths is unique for each element. As scientists bookkeep the emission pattern (also known as fingerprints) of elements, light spectrometry is an effective way to identify the components from an unknown sample.

Apparatus

- "Borderless Lab 365" Platform
- Light source: White LED/ Blue LED/ Green LED/ Red LED/ Sodium Lamp/ Mercury Lamp
- Light sensor on a movable track

Procedure

1. Log in the experiment module "Visible Spectrum" on the Borderless Lab 365 platform. https://stem-ap.polyu.edu.hk/remotelab/
2. Six light sources are provided, choose a light source by pressing the corresponding button.
3. Press "MEASURE" to measure the spectrum.
4. Download the graph by pressing "DOWNLOAD" in csv. file or clicking "Menu" and choose a format (.svg, .png, .csv).
5. Repeat step 3 and 4 with other light sources.
6. Turn off light source and press "logout" button at bottom right corner.

Data

Light Source	Position of Peak(s)/ nm

Discussion

1. What do you expect the relation between an absorption spectrum and an emission spectrum?
2. Describe the similarities and differences between visible spectrum of different light-emitting sources.
3. Why do some light sources have multiple peaks?
4. Is there any unexpected peak(s) shown in the graph? If yes, why? How do you verify?
5. What are the possible errors of the experiment?