



SPECTROSCOPIC MYSTERY: Decoding Materials with the STELLA Spectrometer

Objective:

The main objective of this classroom activity is to introduce students to the concept of spectroscopy and spectral signatures using the STELLA spectrometer. By engaging in a guessing game, students will learn to associate spectral patterns with different colored materials and understand the potential applications of spectroscopy, such as detecting plant health.

Materials:

- STELLA spectrometer
- STELLA Dataviewer software
- Large screen or projector for displaying spectral signatures
- Various colored materials (fabric, paper, plastic, etc.)
- Leafy green plant or large healthy leaf
- Decaying leaf (optional)
- Full spectrum light (if indoors)
- Podium or screen to hide materials during the guessing game

Setup:

1. Arrange the various colored materials, healthy leaf, and optionally, a decaying leaf under the full spectrum light or natural sunlight.
2. Turn on the STELLA before connecting.
3. Connect the STELLA spectrometer to a computer with the STELLA Dataviewer open.

****The Dataviewer only works on the Chrome browser****

4. Link to Dataviewer: <https://landsat.gsfc.nasa.gov/stella-dataviewer/index.html>
5. Set up a large screen or projector for displaying spectral signatures.
6. Connect the computer to the large screen or projector.

Activity Steps

Introduction (10 minutes):

Briefly explain the basics of spectroscopy, emphasizing the idea that different materials have unique spectral signatures and that we obtain those spectral signatures by measuring them with an instrument called a spectrometer.

Material Display and Recording (15 minutes):

- Display the various colored materials, healthy leaf, and optionally, the decaying leaf.
- Instruct students to record their observations of what they see and the colors of each material.

Guessing Game (20 minutes):

- Hide the materials behind a podium or screen.
- Mix up their order and reveal only the spectral signatures on the large screen using the STELLA spectrometer.
- Encourage students to guess which spectral signature corresponds to each material based on their recorded observations.

Discussion (15 minutes):

- Facilitate a class discussion about the guesses and the reasoning behind each choice.
- Explain the connection between the observed colors and the corresponding spectral signatures.
- Emphasize how spectroscopy can provide valuable information about the composition of materials.

Advanced Thinking (20 minutes):

- Introduce the concept of using spectroscopy for plant health assessment.
- Display spectral signatures of the healthy leaf and the decaying leaf.
- Discuss how the Near Infrared reflectance can indicate plant health and density.

Conclusion (10 minutes):

- Summarize the key points learned during the activity.
- Encourage students to reflect on the practical applications of spectroscopy, especially in fields like agriculture and environmental science.

This activity promotes hands-on engagement, critical thinking, and an understanding of the practical applications of spectroscopy, particularly in assessing plant health using the Near Infrared portion of the spectrum, one application of many from the Landsat mission.

Further Information, Videos and Visuals:

Tour of the Electromagnetic Spectrum

A pdf to learn how we use the EM spectrum in our daily lives and for science, containing visuals.
<https://smd-cms.nasa.gov/wp-content/uploads/2023/08/tour-of-the-ems-tagged-v7-0.pdf>

Reflected Near-Infrared Waves

Contains valuable information, a video and visuals about near infrared and using it to detect plant health.

https://science.nasa.gov/ems/08_nearinfraredwaves/

Seeing Photosynthesis from Space: NASA Scientists Use Satellites to Measure Plant Health

Contains valuable information, a video and a visual about detecting plant health from space

<https://www.nasa.gov/earth-and-climate/seeing-photosynthesis-from-space-nasa-scientists-use-satellites-to-measure-plant-health/>

More on STELLA:

STELLA (Science and Technology Education for Land/Life Assessment) project. STELLA instruments are portable low-cost do-it-yourself (DIY) instruments that support science education, and outreach through scientific engagement, inquiry, and discovery while helping you understand Landsat better.

<https://landsat.gsfc.nasa.gov/stella/>

Have any good ideas, suggestions or questions? Please post them on our open-source forum:

<https://github.com/STELLA-Landsat/STELLA/discussions>

More STELLA activities:

<https://landsat.gsfc.nasa.gov/stella/stella-activities/>

<https://github.com/STELLA-Landsat/STELLA/discussions/categories/for-educators>