Electromagnetic Spectrum and the Chemical Composition of Stars

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GRADE LEVEL

8

CONTENT TOPICS

Earth Science
Physics
Science
Space Science

DESCRIPTION

Learn how to identify the chemical composition of stars using the spectralines of their light. This activity includes background and a worksheet to help students use the unique emission/absorption patterns of elements to identify the chemical composition of stars.

SUGGESTED STANDARDS CONNECTIONS

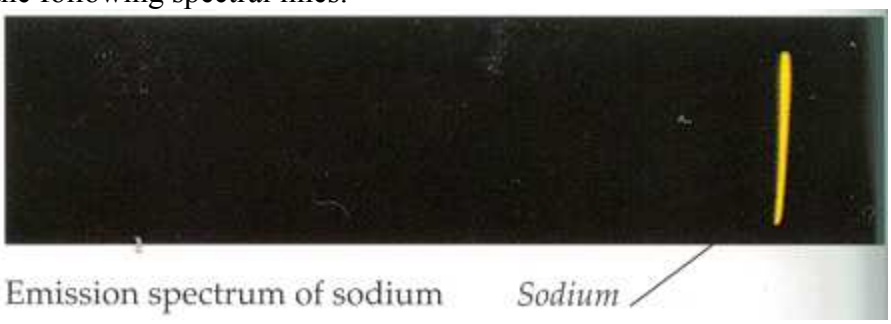
NGSS	MS-PS4 Waves and Electromagnetic Radiation

Name: _____ Core: ____

The Chemical Composition of Stars

It's All About Light

During the first half of the 19th century, scientists studied the spectra of different chemical elements in flames. Gradually, the idea that each element produces a set of characteristic emission lines was established. Each element has several prominent, and many lesser, emission lines in a characteristic pattern. For example, when Sodium is heated, it emits the following spectral lines:



Astronomers can't manipulate celestial objects in a laboratory the way chemists or biologists can manipulate the subjects of their study. Most of what we know about celestial objects comes from the light they emit, reflect, or absorb. One of the most important tools used by astronomers is spectroscopy. In spectoscopy light is broken into its components. What kinds of information can astronomers extract from such light? The answer includes the chemical composition, temperature, magnetic field and age.

In an analysis of chemical abundances, the wavelength of each line is treated as fixed. However, this is not true when the star is moving toward us (the lines are observed at shorter wavelengths, or 'blueshifted', compared to those measured in the laboratory) or moving away from us (observed at longer wavelengths, or 'redshifted'). This is the phenomenon of 'Doppler shift'.

This activity focuses on using the unique emission/absorption patterns of elements to identify the chemical composition of stars.

Identifying Emission Spectra

1. Use the space provided to sketch the emission spectra of the elements. Then write the name of the element on the line provided next to "emission spectrum."

violet red

_____ emission spectrum

violet red

_____ emission spectrum

violet red

_____ emission spectrum

Analysis Questions

1. Explain why astronomers need to know how to identify elements?

2. Helium was discovered in the Sun's corona during the eclipse of 1868. In 1888, traces of helium were isolated here on Earth. How could scientists determine that this was the same gas that had been identified on the Sun?

3. If you saw an spectrum from a star that matched Hydrogen, but was shifted slightly into the blue wavelengths, what would that suggest about the star? Explain.

Sources:
http://imagine.gsfc.nasa.gov/docs/science/how_l1/spectral_what.html
http://www.chem1.com/acad/webtext/atoms/atpt-images/atomic_line_spectra.png
http://www.pbs.org/newshour/extra/teachers/lessonplans/science/hubble_introduction.pdf
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