

Using the Rainbow

(Spectroscopy and Interpolation)

Math and Optics VI

What can you do with color?



“Color” includes infrared (IR) and ultraviolet (UV).

Watch this video and see if you can tell what's going on. How does the machine know which tomatoes are green?

<https://www.youtube.com/watch?v=Lz88nsWL4kw&t=12s>

What can you do with color?



(Here is another video that shows optical sorting of French fries. What color is the illuminating light?)

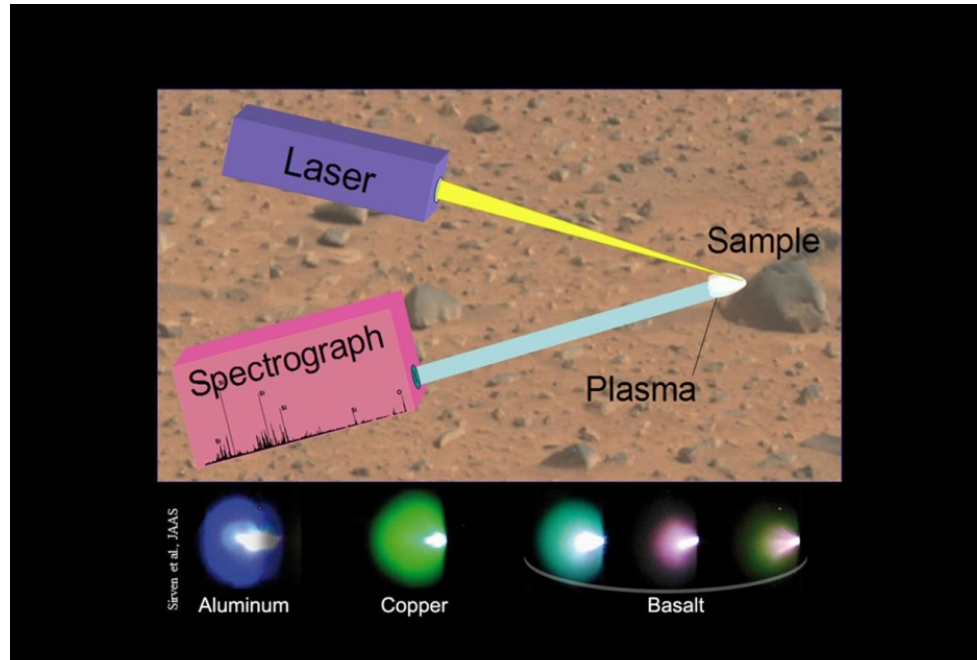
<https://www.youtube.com/watch?v=Xf7jaxwnyso>



via Wikimedia Commons, user Popo le Chien

Spectroscopy

- The study of how light is emitted, absorbed or reflected by matter.
- The spectrum can serve as a sort of "fingerprint" to identify materials, on earth and in space.



Laser Induced
Breakdown
Spectroscopy
on Mars,
NASA

Activity 1: What Color?



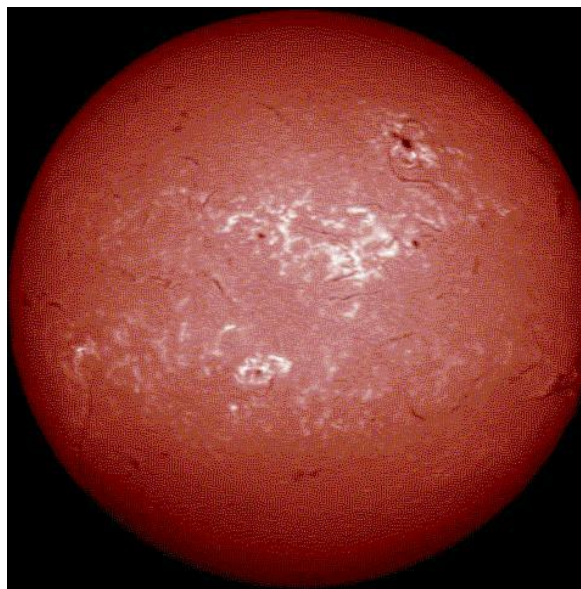
Look through the diffraction grating at each of the light sources (incandescent, fluorescent, LED, etc). Describe the colors you see. Do they form lines of color, or wide bars, or a continuous rainbow?



The Hydrogen Spectrum



- The spectral lines of hydrogen gas are important to astronomy because so much of the universe is hydrogen gas.
- The red line, called the H-alpha line, is used to study stars and bright emission nebulas in space.



The sun in
H alpha light,
NASA

Find the H alpha wavelength



- Label the violet end of the rainbow "400 nm" (nm = nanometer, or .000000001 m)
- Label the red end of the rainbow "700 nm".



Find the H alpha wavelength



- Use a ruler to find the exact middle of the rainbow. Mark this point. What wavelength is halfway between 400 and 700 nm? Label the center of the spectrum with this value.
- Continue dividing the spectrum until you can estimate the wavelength of the H-alpha line.

