UltraViolet (UV) Light-Reactive Bead Investigation

Light travels in waves and some waves are bigger (UV-A) than other waves (UV-C). The beads will only react to certain wavelengths of UV light.

Infrared 750-7000 nm	**Visible** 380-700 nm	**UV-A** 380-315 nm	**UV-B** 315-280 nm	**UV-C** 280-100 nm
Makes our skin feel warm and can be detected by some animals such as snakes.	Can be seen by our eyes. It includes all the colors of the visible rainbow.	Too much exposure can result in the same damage as UV-B but to a lesser degree.	Needed for vitamin D synthesis in our bodies, but is a major cause of sunburn, skin cancer, cataracts, etc.	Extremely dangerous, but is completely absorbed by the ozone in the atmosphere and does not reach the surface.
				
> 360 nm Beads are White		360 - 300 nm Beads Change Colors		300 - 100 nm Beads are White

Predict!

Before you expose the beads to sunlight, make a prediction about which materials block UV radiation.

Material	Prediction	Result
Cotton shirt		
Polyester shirt		
Hat brim		
Sunglasses		
Umbrella		
Sunscreen		
What other materials can you think of to experiment with?		

Explore the Full Activity:
science.nasa.gov/learn/heat/resource/experimenting-with-uv-sensitive-beads/

This activity was created by a partnership between NASA and the Stanford Solar Center.

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Talking Points

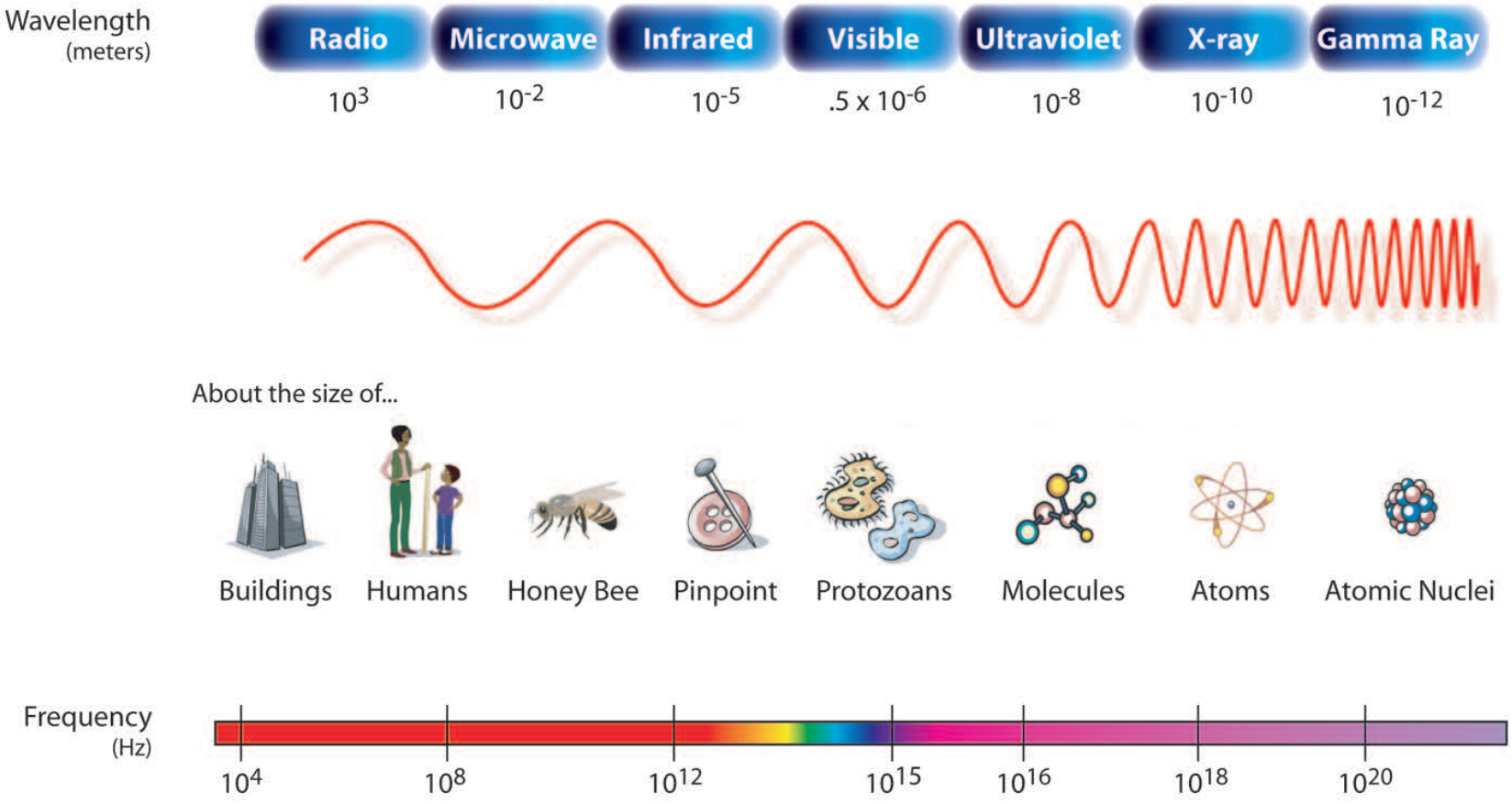
- **These beads react to Ultraviolet (UV) light.**
  - UV light is just one type of light that the Sun emits.
  - The **electromagnetic spectrum (EM Spectrum)** is a diagram of all of the different frequencies of light that exist in the universe. ***(Refer to EM Spectrum Tabletop.)***
  - The only portion of the EM spectrum that we can see is visible light, just a small portion of the full spectrum.
  - All other light, including UV light is invisible to humans.
  - Some animals can see slightly into the UV portion of the spectrum (reindeer, dogs, cats, pigs, cows, ferrets, and many other mammals can detect UV with their short blue cones).
  - Some animals can see slightly into the infrared portion of the spectrum (mosquitoes, vampire bats, and some snake and beetle species).

- **Some of the light on the EM spectrum is harmless to humans: visible light, radio waves, and some frequencies of microwaves, infrared, UV, and X-rays.**
  - As you know from getting sunburned, some UV light emitted by the Sun can damage your skin.
  - Fortunately much of the UV spectrum, all Gamma rays, and other harmful wavelengths of light are absorbed by Earth's atmosphere.
  - UV light can be helpful! It provides essential vitamin D, which is required for the body to absorb calcium. It is also important for killing harmful bacteria and viruses, used in some water filtration systems, for example.

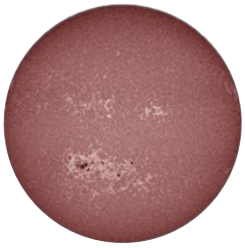
- **The black light, or UV flashlight emits both UV light and some visible light. What our eyes see as purple light is the visible light.**
  - You cannot see the ultraviolet light coming from the flashlight. You may notice on the EM Spectrum that what our eyes see as purple visible light is very close to UV light on the EM Spectrum, which is why the flashlight emits both.

- **NASA looks at the Sun in UV wavelengths to learn more about how it works.**
  - **The Atmospheric Imaging Assembly (AIA)** is a four-telescope array aboard SDO images the solar atmosphere in multiple wavelengths to link changes in the surface to interior changes. ***(Refer to SDO Tabletop.)***
  - UV light can give us information about the temperature and elements in the Sun's outer atmosphere, the corona.
  - Why do you think these images of the Sun in Extreme Ultraviolet Light are in different colors? [If we didn't add color to the images, then we wouldn't be able to see them!]
  - The AIA telescopes collect data, that is invisible to us. We add color to the data so we can see it.
  - Refer to https://sdo.gsfc.nasa.gov/data/channels.php to find out more about the AIA channels.

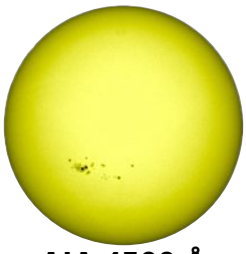
THE ELECTROMAGNETIC SPECTRUM



NASA's Solar Dynamic Observatory (SDO) Studies the Sun in Multiple Ultraviolet Wavelengths



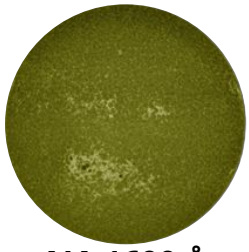
AIA 1700 Å
4500 Kelvin
Photosphere



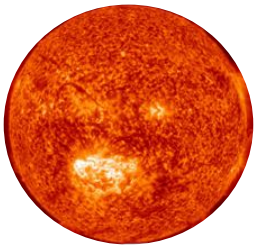
AIA 4500 Å
6000 Kelvin
Photosphere

Why do you think these images of the Sun are in different colors?

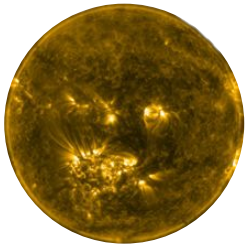
Hint: Ultraviolet light is not visible to the human eye.



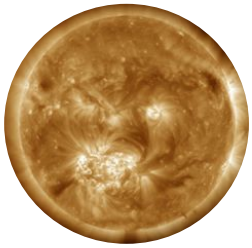
AIA 1600 Å
10,000 Kelvin
Upper Photosphere/
Transition Region



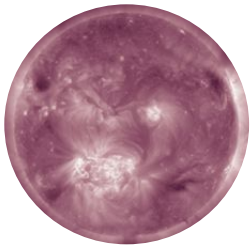
AIA 304 Å
50,000 Kelvin
Transition Region /
Chromosphere



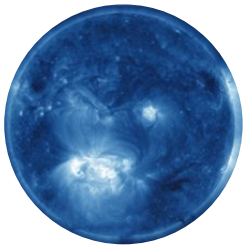
AIA 171 Å
600,000 Kelvin
Upper Transition Region /
Quiet Corona



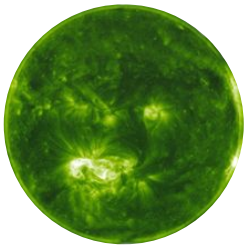
AIA 193 Å
1 Million Kelvin
Corona / Flare Plasma



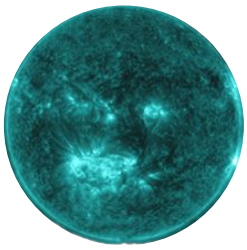
AIA 211 Å
2 Million Kelvin
Active Regions



AIA 335 Å
2.5 Million Kelvin
Active Regions



AIA 094 Å
6 Million Kelvin
Flaring Regions



AIA 131 Å
10 Million Kelvin
Flaring Regions

The Atmospheric Imaging Assembly (AIA) is a four-telescope array aboard SDO images the solar atmosphere in multiple wavelengths to link changes in the surface to interior changes.

Explore More

https://sdo.gsfc.nasa.gov/data/

10,000 ^{0}K = 17,540 ^{0}F