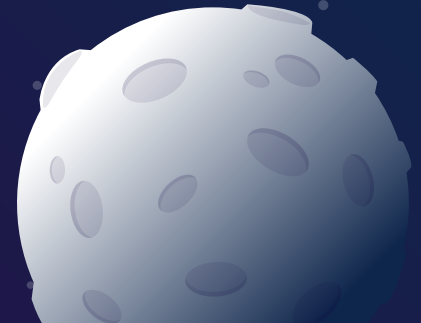




CADETTE SPACE SCIENCE RESEARCHER BADGE



HELLO! SPACE SCIENCE RESEARCHERS!

Scientists have used the observation and exploration of light to make discoveries that deepen their understanding of the sun, stars, and other objects in space. In this badge, you'll re-create some of these scientific experiments, observe the night sky with your own eyes, and explore the possibility of seeing light in new ways.

Badge Steps:

1. What more can you see?
2. Explore "invisible" light
3. See the stars in a new way
4. Expand your vision
5. Conserve the night sky



Badge Purpose: When you have earned this badge, you will understand more about the amazing properties of light and how we use it to make discoveries about the Universe and space science.

Check out these great [Women in Space Science](https://my.girlscouts.org/content/dam/girlscouts-vtk2019/local/aid/meetings/C19NASA1/Cadette-Women%20in%20Space%20Science.pdf) resource links!

<https://my.girlscouts.org/content/dam/girlscouts-vtk2019/local/aid/meetings/C19NASA1/Cadette-Women%20in%20Space%20Science.pdf>

STEP 1.

WHAT MORE CAN YOU SEE?



When we study Space Science, we are studying light from the stars and from other objects in space. Visible light reaches our eyes by bouncing off of objects, such as the color red we see from apples, the color green we see from grass and even the color silver we see from the moon. The same applies to the light we see from our bright star, the sun. It is possible that the light from our sun is made up of all the colors that we see. Let's investigate light!

Choose an activity:

Make Prism Pictures

OR

Create a Rainbow





Make prism pictures:

- ★ On a sunny day, find a window to play with the light-splitting tools until it produces a rainbow. Place one of the light splitting tools so the sunlight shines directly onto it and onto the piece of paper. If you are using a clear glass of water, place the glass half on and half off the edge of a table, and so that the sun shines directly through the water and onto the piece of paper.
- ★ Record/sketch what you observe.
- ★ What do your observations tell you about light?
- ★ Share your observations with your friends and family.

Materials needed:

- ★ Notebook or paper to record/sketch observations
- ★ Colored pencils or markers
- ★ Pen or pencil
- ★ Two of the following light splitting tools: a blank CD, prism, clear-faceted crystal, diffraction glasses (to split light), or a clear glass almost full of water
- ★ A piece of white paper (to catch the rainbow).



CREATE A RAINBOW

- ★ Go outside on a sunny day and turn your back to the Sun.
- ★ Use water from a garden hose or spray bottle to make a fine mist in the air.
- ★ What do you see?
- ★ How many colors are there?
- ★ What is the order of the colors?
- ★ Draw what you observe in your notebook and write a poem inspired by what you see.
- ★ Do your observations make you think of a song? Could you write one?

White Light

Isaac Newton discovered that when a narrow beam of sunlight passes through a prism, it emerges as different bands of colors. When writing about this discovery in his book, *Opticks*, he was the first person to describe these bands of colors using the word “spectrum.” To demonstrate that white light is made of colors, he recommended the colors with a second prism.

STEP 2

EXPLORE “INVISIBLE” LIGHT



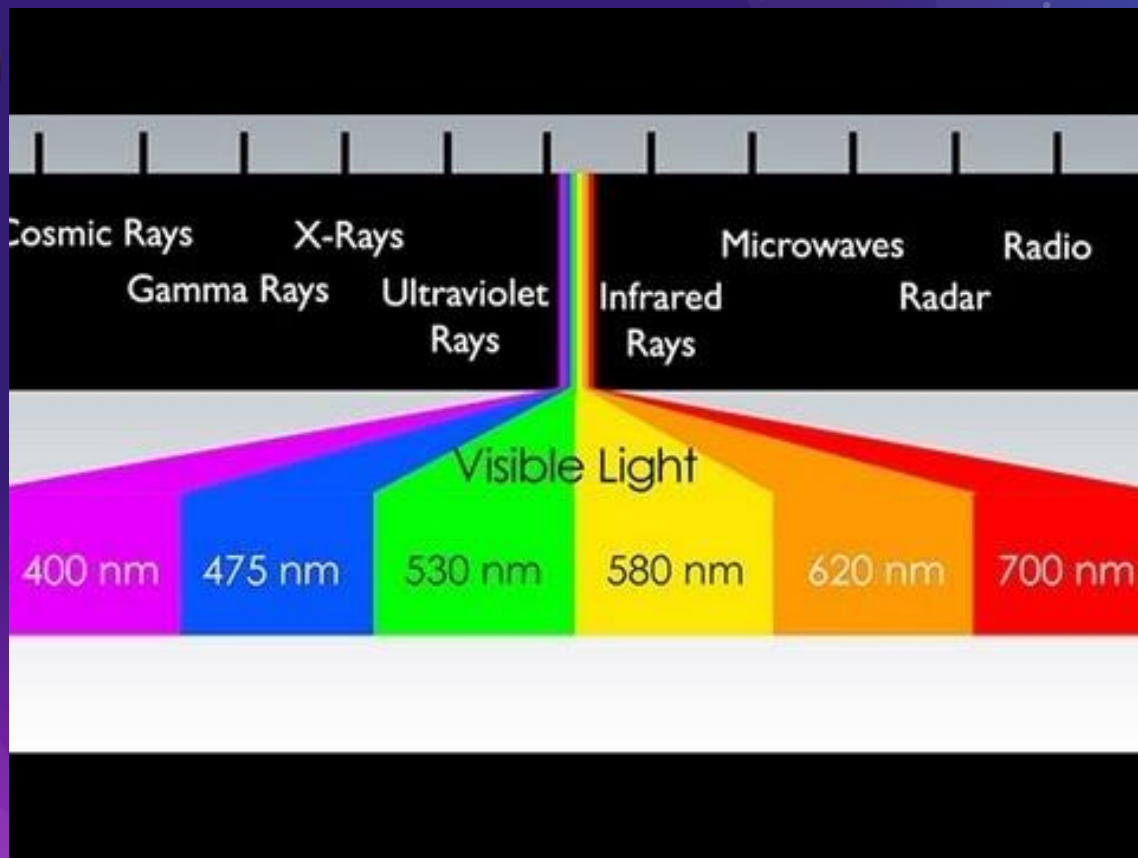
Visible light is the light that we see with our eyes; however, it is just a small part of the light around us. All light is made up of energy, and some types of light have more energy than visible light: UV, x-rays, and gamma rays. Whereas, some types of light have less: Infrared waves, microwaves waves, and radio waves. Despite the level of energy each light has, they all fall under the electromagnetic spectrum - even the light that we cannot see! Let's dig deeper to explore this “invisible” light.

Take a tour of the Electromagnetic Spectrum with NASA:

www.girlscouts.org/SpaceScienceEMS



WHAT IS THE ELECTROMAGNETIC SPECTRUM?



<https://www.youtube.com/watch?v=m4t7gTmBK3g>



STEP 2 ACTIVITY - EXPLORING INFRARED LIGHT

Infrared light is all around us. Everything that is warm emits it. For example, firefighters use infrared goggles to find people in smoke-filled buildings because our bodies give off heat and we glow in infrared light! Astronomers use infrared telescopes to see past the dust that surrounds hot stars. And remote controls use infrared light to send signals to television to turn them on.

- ★ Find a remote control and a digital camera or a smartphone.
- ★ Look at the bulb on the end of the remote control and press a button. What happens?
- ★ Now look at the bulb through a digital or smartphone camera. (Hint: You may need to put your phone in “selfie” mode. Try a few different remote/camera combinations. What are the differences?)
- ★ What happens when you push different buttons? Write or sketch what you see in your notebook.
- ★ Why do you think you can see the signal from the remote through the camera but not with your eyes?
- ★ Now see if you can block the infrared signal. Try putting a black plastic trash bag over the remote. Can you still see it?
- ★ How about sending the signal through a pane of glass or someone’s eyeglasses? Does it work with sunglasses? What other materials can you try?
- ★ Both visible and infrared colors are forms of light but with different energies. How do these experiments show the different properties of each?

STEP 3

SEE THE STARS IN A NEW WAY



Our view of the sky changes continuously as the Earth orbits the Sun.

We see these changes from night to night and when the seasons change.

Use your eyes to take a new look at the stars.

Try one of these activities:

[Learn more about women in Space Science](#)

Or

[Try Astrophotography with a Smartphone](#)



Annie Jump Cannon - Astronomer

Step 3

ACTIVITY:

LEARN MORE
ABOUT WOMEN
WHO STUDY THE
STARS.

Visit the
Nasa website for
more about [Women
in Space!](https://women.nasa.gov/)

<https://women.nasa.gov/>



"AS
INSPIRING
AS THE
STARS SHE
IDENTIFIED."

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



STEP 3 ACTIVITY: ASTROPHOTOGRAPHY

Astrophotography Guidelines - Use these tips to successfully capture celestial images.

- ★ To avoid blurry images, use a tripod, beanbag, or bag of rice to hold your camera or smartphone steady.
- ★ Get the right app for your smartphone—look for “low light photography” apps.
- ★ Turn off the flash.
- ★ Learn how to take timed photos from one second up to one hour. • Find a dark location—city lights wash out images!
- ★ Pick a safe place and bring an adult, appropriate clothes, snacks, and a flashlight.
- ★ Cover your flashlight with red plastic or cellophane so that your eyes will dark adapt. • Practice makes perfect—you may need to take several images to get one you like!

STEP 4 - EXPAND YOUR VISION



When the stars were first cataloged thousands of years ago, they were organized by their brightness and were groups into constellations and named. In the 1600's the invention and use of telescopes expanded our view of the stars. Today, you can expand your own experience of the stars by looking up and exploring the sky at night.





STEP 4 ACTIVITY - BE A NIGHT SKY OBSERVER

Preparation: Check out sky maps to familiarize yourself for the stars placement in the sky - www.girlscouts.org/SpaceScienceSkyMaps Optional: there are several free smartphone Stargazer or Night Sky apps.

Materials needed: notebook/paper, pencil/pen, optional flashlight covered with red cellophane (to keep your eyes adjusted to the darkness)

Steps:

- ★ Go outside on a clear and moonless night (with an adult) and look up at the sky
- ★ What do you observe?
- ★ What colors are the stars that you see? How bright are they?
- ★ Can you identify any of the stars or constellations?
- ★ Write down or sketch photos of your observations, including color, brightness, and star names if you are able to identify them.





STEP 5 - CONSERVE THE NIGHT SKY



Do you know what Light Pollution is?

Darkness at night is good for all living things. Too much light at night has a negative impact on animals and plants.

Light Pollution is an artificial light in the night sky. This useless use of energy makes it more difficult for Astronomers to observe stars and planets.

Find out ways that you can help to reduce Light Pollution.



https://www.youtube.com/watch?v=V_A78zDBwYE



STEP 5 ACTIVITY: OBSERVING LIGHT POLLUTION

Now that you know more about Light Pollution, you will look at light through new eyes.

Take a nighttime visual or photographic survey of your neighborhood.

Look for examples of:

- ★ Glare
- ★ Light trespass
- ★ Unshielded lights
- ★ Excess lighting

Brainstorm some ways that you can take action to reduce bad or excess light nearby.

Ask your family for help putting your plan into action.



Congratulations!

You've earned your
Space Science Researcher
Badge!

The Space Science Researcher
badge can be purchased
through our
[GSWNY Council Shop](#).





Questions?

Contact:

CustomerCare@GSWNY.org

or

Girl.Experience@GSWNY.org

