

Filtered Light

Discover how scientists use colored filters to study the universe, and see images in a new light!



Materials:

Space Images printable, blue and red colored filters*, blue and red grease pencils*, blue and red markers, black sheet of paper, white sheet of paper.

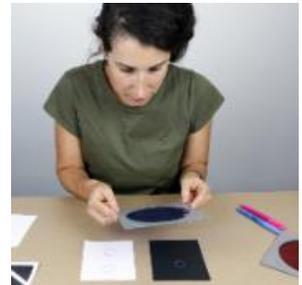
**Note:* Any translucent red and blue material will work as filters. Colored transparency sheets or overlays work well; they can be found at office supply stores. Grease pencils (also called wax or china pencils) can be found at craft or art supply stores.

Instructions:

Step 1: Draw two small circles on the white piece of paper, one with the blue marker and one with the red marker. Then use the red and blue grease pencils to draw similar circles on the black paper.



Step 2: Use the blue and red colored filters to look at your circles. What happens when you look through one of the filters but not the other? Do any of the circles disappear? Do any appear brighter?



Step 3: Draw your own picture on the white or black paper! Observe your drawings with the filters. What changes do you notice? *Hint:* Use the markers on the white paper and the pencils on the black paper!



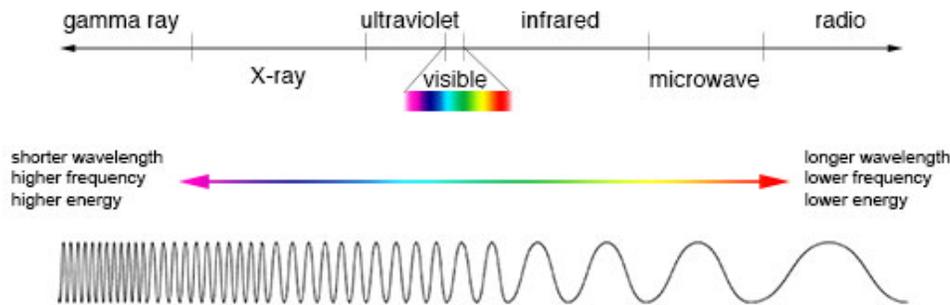
Step 4: Use the filters, one at a time, to look at the space images. Do some features stand out more if you look through the blue or red filter? Which filter shows you a clearer image? How could this tool be useful to space scientists?



Activity and images adapted from National Informal STEM Education Network:
www.nisenet.org/catalog/exploring-universe-filtered-light-2018

Light, Filters, and Outer Space

Our eyes see only visible light, but we live in a universe that spans the **electromagnetic spectrum**. This spectrum consists of light energy travelling in waves, from very short waves like gamma rays to very long waves such as radio waves. Visible light is in the middle, running from lower-energy red to higher-energy purple.

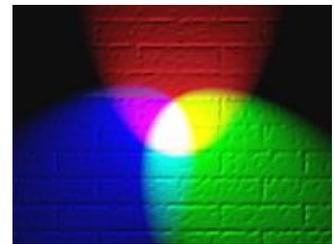


Electromagnetic Spectrum. [Image: NASA's Imagine the Universe.](#)

Filters block certain energy levels of light while allowing others to pass through.

In this activity, the red and blue colored filters changed how those colors appeared on the white paper versus the black paper.

When you hold the red filter to your eye, only red light makes it through. Red light reflects off both the red colored marker and the white paper, because white contains all colors. The red marker disappears because it blends in with the red light from the white paper.



Wikimedia Commons.

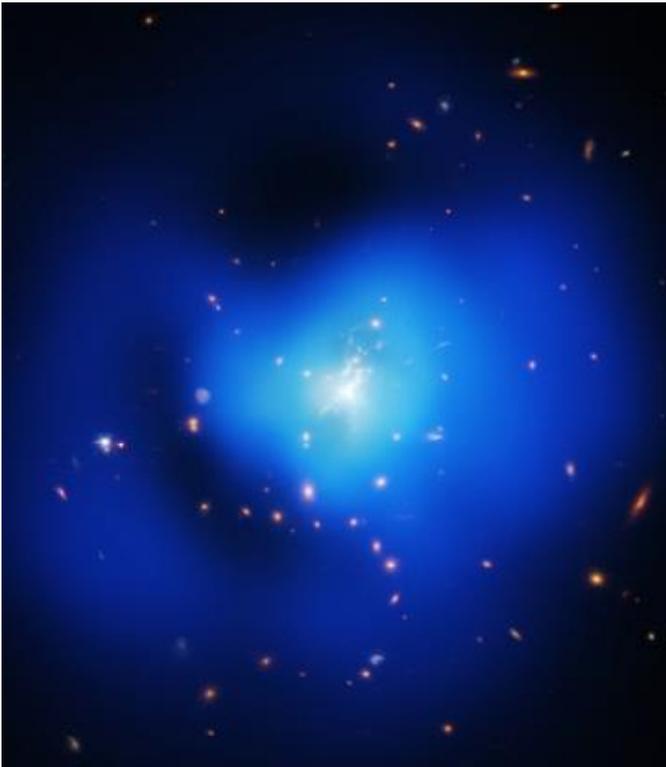
But background color matters! Looking at the red pencil against the black paper actually enhances the red color, because the filter blocks all the other energy levels of light (colors) reflected off the paper, improving the red's visibility.



This dusty cloud appears dark in visible light, but looking in infrared light reveals stars shining through. *Image: ESO / M. Kornmesser.*

Astronomers use light from distant objects to make observations about the universe. Objects in the universe radiate light across the electromagnetic spectrum, and scientists use telescopes and other instruments to capture and filter different energies of light. They study these images to learn more about planets, stars, galaxies, nebulae, black holes, and even mysterious dark energy!

Space Images



Phoenix Galaxy Cluster in X-ray, ultraviolet, and visible light wavelengths.

Image: NASA/CXC/MIT/M.McDonald/STScI/TIFR/GMRT.



NGC604 region of star formation in the M33 galaxy.

Image: NASA/Chandra X-ray Observatory/Hubble.



NGC 2818 nebula. *Image: NASA/ESA/Hubble Heritage Team.*