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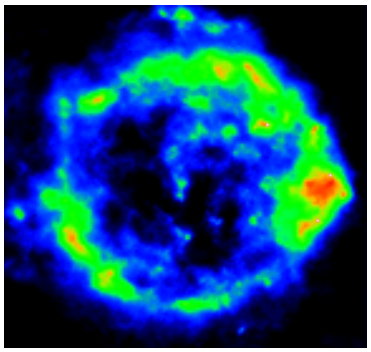
Make Your Own Radio Image
Large Public Venue Edition

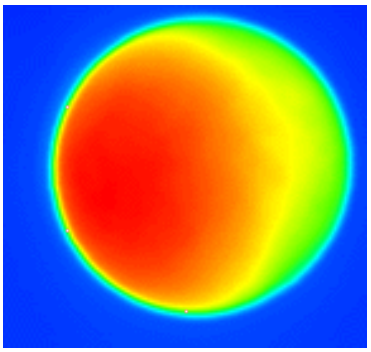
Adapted from the NRAO's Make Your Own Radio Image

Background

This Activity has been adapted from the NRAO's *Make Your Own Radio Image*. Radio telescopes do not make images that we can see right away, because radio waves are invisible. Scientists collect information onto computers, and use their computers to make images.

Examples of Radio Images:


A supernova remnant


The moon

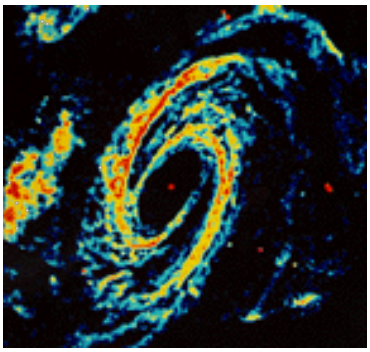

A galaxy

Image Credit: http://www.nrao.edu/index.php/learn/activities/makeradioimage

Learning Objectives

Participants are exposed to radio astronomy and the images it produces. They gain a basic understanding of pixels and the process of obtaining data.

This activity is suitable for all ages, especially family groups with children ages 6 to 10.

Materials Needed

- Data sheets (Provided in Appendix)
  - A mix of sheets 1 and 2 is suggested
- A large selection of colored markers, pencils, and crayons in at least six colors

Optional Materials

- Stickers or hand stamps as a reward
- Electromagnetic Spectrum (example provided in appendix)

Vocabulary

1. Astronomical radio sources – Sun, Jupiter, Sagittarius A (galactic center of Milky Way), active galactic nuclei, pulsars, quasars, radio galaxies, supernova remnants, and the Cosmic Microwave Background
2. Electromagnetic Spectrum – the range of all possible frequencies of electromagnetic radiation; extends beyond radio in low frequencies and beyond gamma radiation in high frequency
3. Pixel – each of the little squares on the data sheet. Each pixel stores information about the radio waves coming from a point in space. The pixel beside it stores information from the very next spot in space and so on.
4. Radio Astronomy – The study of objects in the sky that emit light in the radio part of the electromagnetic spectrum
5. Radio Image – A telescope image of an object in radio wavelengths
6. Wavelength – the distance between peaks of a wave of light

Procedure

1. Print off enough data sheets for the expected number of participants.
2. Set up the table: Layout the data sheets in piles of each sheet, and make sure markers are
1. When participants arrive, explain the electromagnetic spectrum, radio astronomy, pixels, and how radio telescopes take data. This is a great time to use any posters that you have. Here are some possible talking points:
    - The electromagnetic spectrum spans wavelengths of light from thousands of kilometers to fractions of the size of an atom. We cannot see all of the light, but we can see them with telescopes.
    - Radio waves can range in size from about 1 mm to about 100 km.
    - Pixels are the smallest element of a display. They are in cameras, televisions, laptops, and all other electronic display.
    - Radio astronomy studies the invisible universe. It is a subfield of astronomy that studies celestial objects that radiate in radio wavelengths.
    - Some sources of radio emissions are the Sun, Jupiter, Sagittarius A (galactic center of Milky Way), active galactic nuclei, pulsars, quasars, radio galaxies, supernova remnants, black holes, and the Cosmic Microwave Background.

- Radio waves are also used to study the "Dark Ages" of the Universe, the time before the formation of the first stars and galaxies. Astronomers are trying to pin point when those first stars formed.
- Radio telescopes take data by sending the radio waves into a sensitive receiver. The receiver amplifies the waves and converts them into a signal that can be stored in a computer. Astronomers use computers to turn this information into pictures. If our eyes were designed to see radio waves instead of light, the picture is what we would see.

3. Let them choose a data sheet and crayons, and begin coloring
4. When they have completed the data sheet, help them interpret the image using the images above.

Appendix

- Datasheets and Answers
  - For 2 datasheets per page, please click here:
    - Datasheet1
    - Datasheet2
- Electromagnetic spectrum

Activity adapted from the NRAO's *Make Your Own Radio Image* available at *http://www.nrao.edu/index.php/learn/activities/makeradioimage*

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Datasheet 1

0	4	4	5	5	0	0	0	0	0	0	4	5	4	0
4	4	4	5	0	0	4	4	4	0	0	0	4	5	0
4	4	0	0	4	4	5	6	5	4	0	0	0	4	5
4	0	0	4	4	5	0	0	4	5	4	4	0	0	0
4	0	0	5	0	0	0	0	0	4	5	6	4	0	0
4	0	5	5	0	0	0	0	0	0	0	4	4	4	0
4	0	4	5	0	0	3	2	3	0	0	0	5	6	4
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0	0	5	4	5	4	4	4	4	0	0	0	5	5	0
0	0	0	0	4	0	0	4	0	0	0	5	5	6	0
0	0	0	0	0	0	0	0	4	4	4	5	6	4	0

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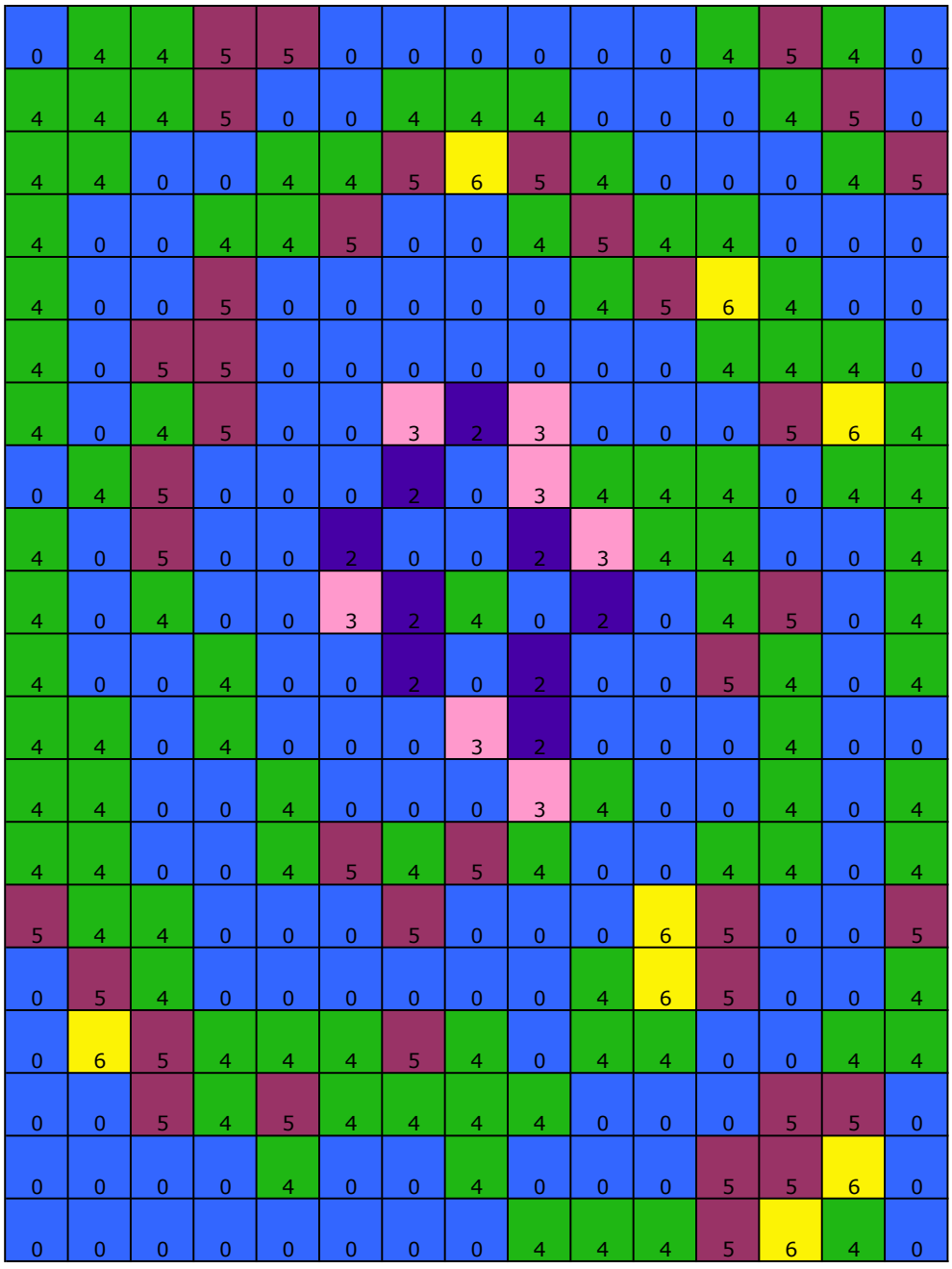
Answers to Datasheet 1



http://loco.lab.asu.edu/epo/RadioImage.pdf

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Datasheet 2

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0	0	0	2	2	2	4	2	2	2	2	2	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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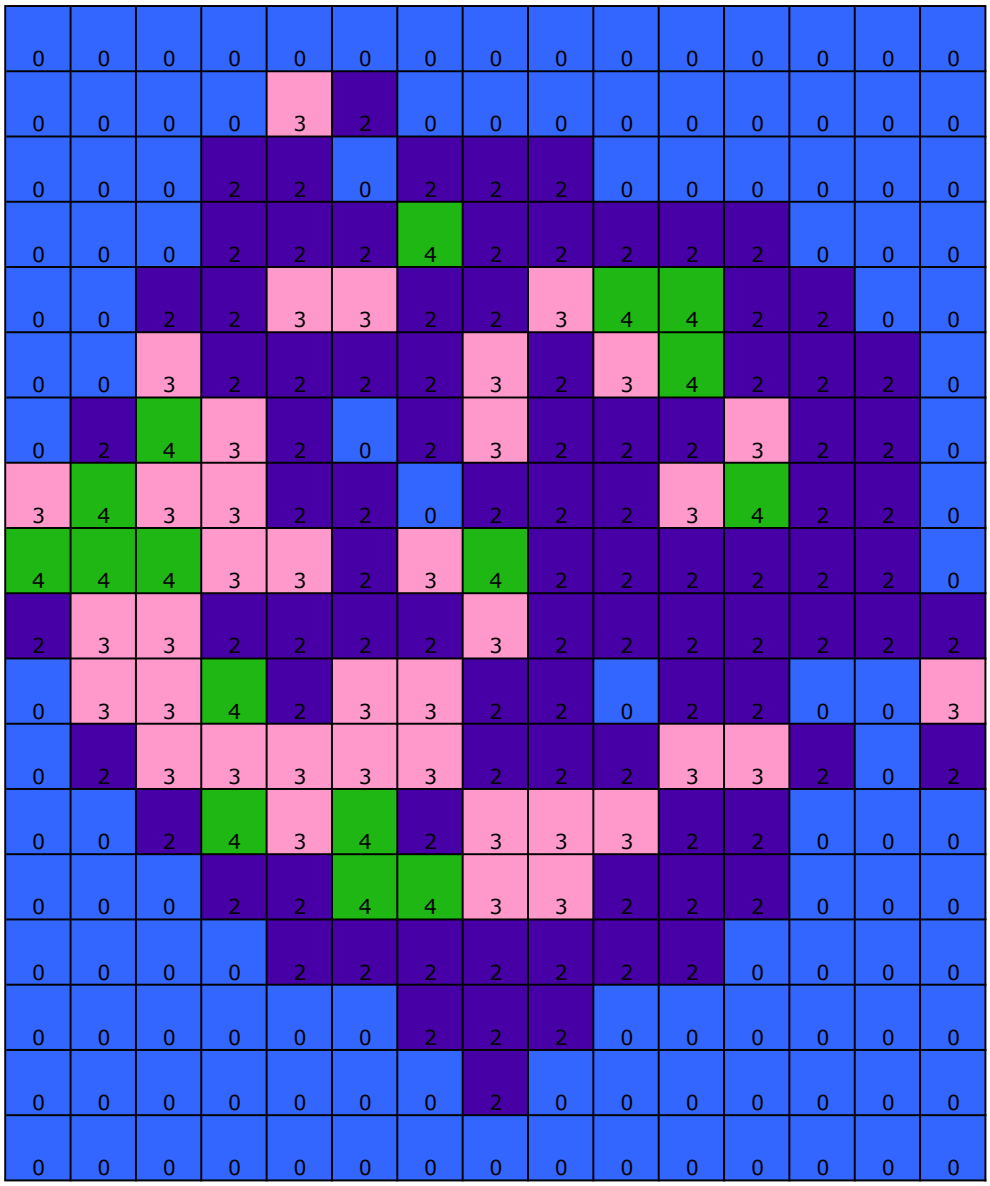
Answers to Datasheet 2



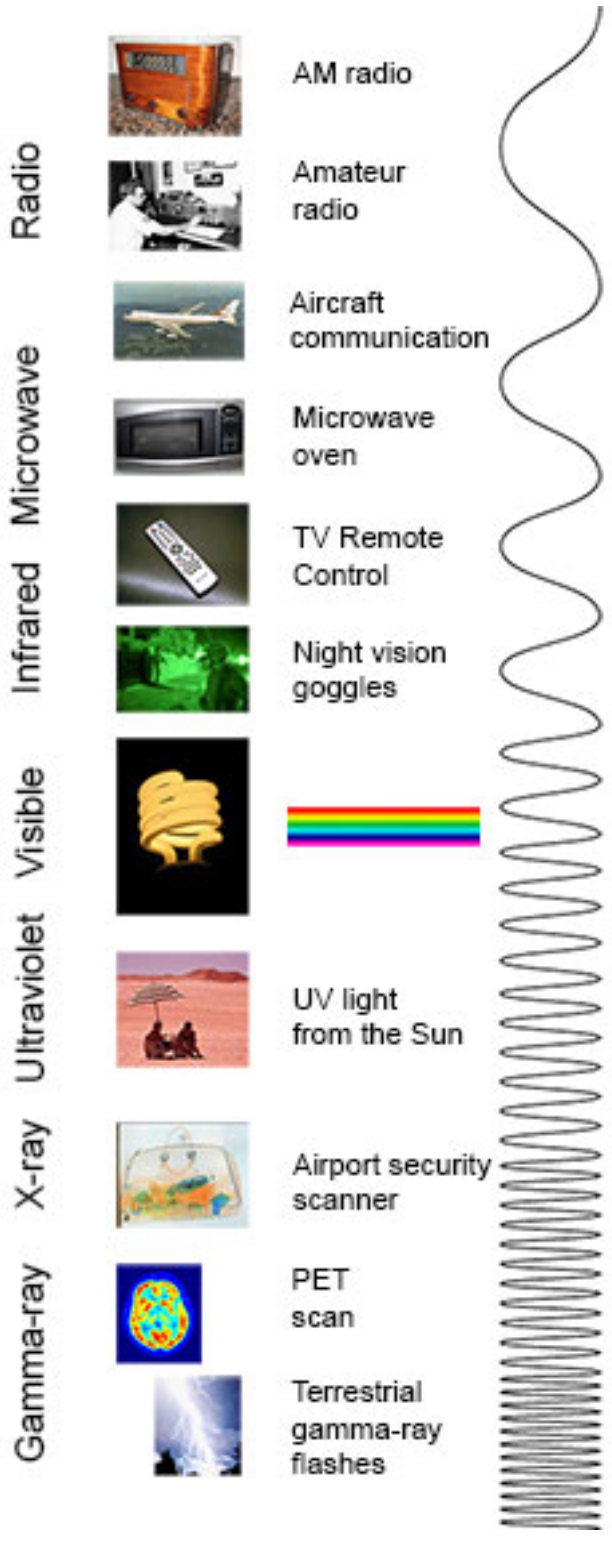


Image Credit: http://imagine.gsfc.nasa.gov/docs/science/know_l1/emspectrum.html

http://loco.lab.asu.edu/epo/RadioImage.pdf