

“RFI Detectives” Activity for Large Public Venues

Adapted from the NRAO’s “Be An Interference Detective” activity

Background

Most people living near big cities are familiar with light pollution and how it hinders optical astronomy, but few realize that common objects like electronics can be sources of “pollution” for astronomers working in radio wavelengths. This activity has been adapted from the NRAO’s *Be an RFI Detective* to introduce radio frequency interference, or RFI, to people at large public events.

Learning Objectives

Participants will gain a basic awareness of sources of radio interference, and the challenges that radio astronomers face from everyday objects.

This activity is for children roughly ages 6 to 12, and is ideal for family groups.

Materials Needed

- 6 Handheld Radios
- Checklist (provided in appendix)
 - We print about 300 sheets for a total expected crowd of 3,000 people. About 400 people came by our table.
- 6 Small Clipboards
- 12 Pens

Optional Materials

- Stickers or hand stamps
- Electromagnetic Spectrum (example provided in appendix)
- Posters
 - Radio Frequency Allocation Chart: Available at <http://www.ntia.doc.gov/page/2011/united-states-frequency-allocation-chart>
 - Frequency Interference Map: Available at

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. Frequency – number of wave occurrences per unit time
4. Radio Astronomy – The study of objects in the sky that emit light in the radio part of the electromagnetic spectrum
5. RFI or Radio Frequency Interference – “pollution” for radio astronomers; interference from everyday objects
6. Wavelength – the distance between peaks of a wave of light

Procedure

1. Customize the Checklist in the Appendix to your venue
 - Any digital electronics will provide interference, so you can customize the checklist accordingly.
2. Print off 300 checklists per 400 expected visitors.
3. Set radios to a low frequency AM station that is not picking up stations.
4. Set up table: Layout radios, put a checklist and a pen with each clipboard.
5. When participants arrive, explain the electromagnetic spectrum and radio astronomy. 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.
 - 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.



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6. Give them a radio and a clipboard (with the list and pen) and take them to a nearby electronic device, such as a TV. Show them how the radio static gets louder.
7. Let them explore the building and find sources of interference for themselves and ask them to come back up to the table when they are finished.
 - We have found that it is best to make sure that the kids understand what is going on, and that their parents aren't doing it for them!
8. Check in with them periodically to answer any questions.
9. When they have finished, take back the radios, and give them a sticker for completing the activity.
 - Be sure to ask them if they had fun, and if they found anything that wasn't on the list.

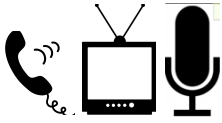
Appendix

Checklist
Electromagnetic Spectrum

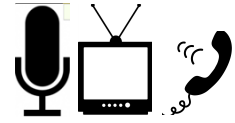
*Adapted from the NRAO's "Be An Interference Detective" activity
<http://www.gb.nrao.edu/epo/interf.html>*



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Radio Frequency Interference (RFI) – It’s All Around Us!



Radio astronomers study the radio waves of cosmic objects like comets, exploding stars, and even black holes in distant galaxies!

But radio waves from objects used by people, such as radio and TV stations, microwave ovens, and cell phone towers, can make it impossible to detect these much weaker signals from space. Radio astronomers call human-made radio waves:

“radio frequency interference” or RFI.

Radio frequency interference (RFI) is all around us! Borrow a handheld radio to find sources of RFI in this room. If you wave the handheld radio near an object emitting RFI, you will hear a louder sound.

See if you can find some of these sources of RFI in this room:

- Television
- Electric outlet
- Computers
- Florescent lights
- A personal cell phone
- Key-card reader
- Light switch
- ... did you find anything else? _____



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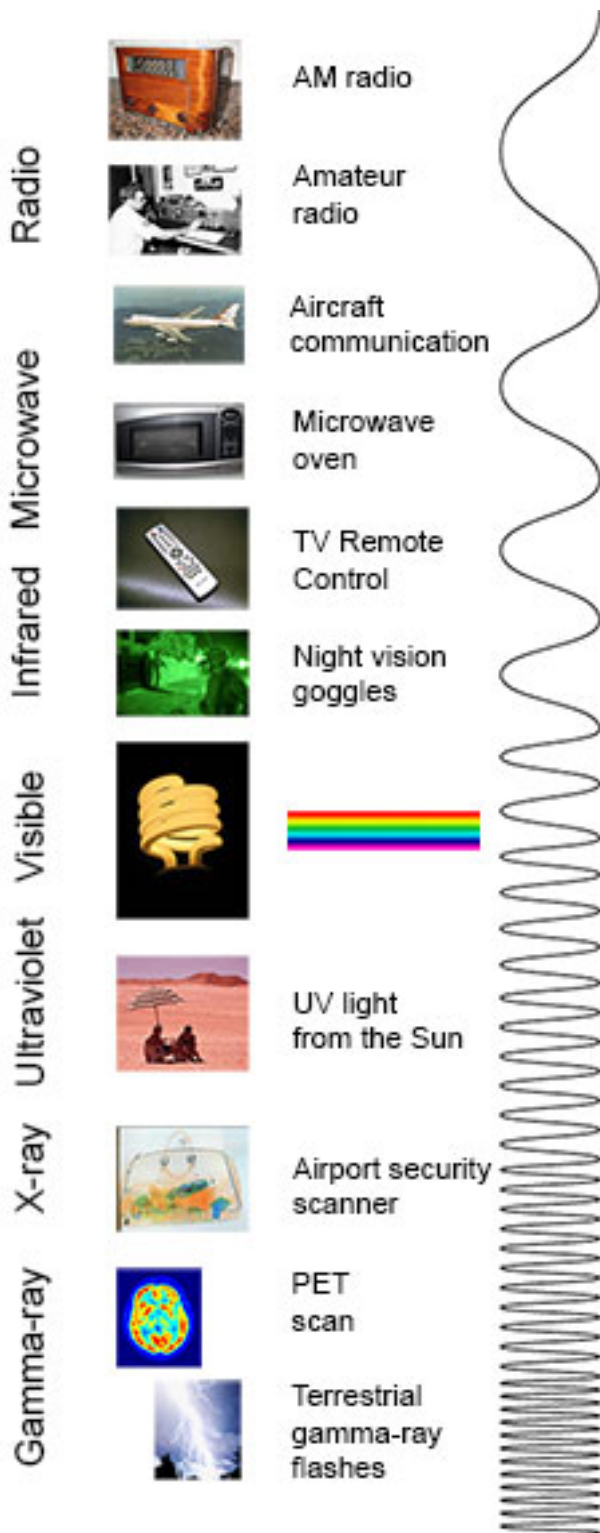


Image Credit: http://imagine.gsfc.nasa.gov/docs/science/know_11/emspectrum.html

<http://loco.lab.asu.edu/epo/RFI.pdf>