

Resources & Websites

MIT Haystack Observatory – information and education
www.haystack.mit.edu
Solar Storms to Radio Waves
www.haystack.mit.edu/edu/poa/index.html

The Discovery Museums – ongoing education programs
www.discoverymuseums.org

For daily reports on Solar Flares, Solar Wind, Sunspots,
and Auroral Activity: www.spaceweather.com

Windows to the Universe
www.windows.ucar.edu/

SOHO: Solar and Heliospheric Observatory
sohowww.nascom.nasa.gov/gallery/presentation.html

Magic Window into the Electromagnetic Spectrum
spaceplace.nasa.gov/en/kids/chandra_magic.shtml

AstroCappella, a Musical Exploration of the Universe
www.astrocappella.com/

The Cambridge Encyclopedia of the Sun, Kenneth Lang,
Cambridge Press, 2001.

Waves, the Electromagnetic Universe, Gloria Skurzynski,
National Geographic Society, 1996.

Touch the Sun: a NASA Braille Book, Noreen Grice.
Joseph Henry Press, 2005.

SOLAR STORMS TO RADIO WAVES is a collaboration
between The Discovery Museums and the Massachusetts Institute
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The Discovery Museums,
177 Main Street, Acton, MA 01720
www.discoverymuseums.org
978-264-4200



SOLAR STORMS TO RADIO WAVES **Take Home Activity Guide**

Explore the *SOLAR STORMS TO RADIO WAVES*
exhibits at The Discovery Museums.

From cell phone calls, news on the radio, and
GPS navigation systems, to TV programs and
wireless networks, YOU depend on radio waves!

Open this guide to learn how you can continue to
experiment with radio waves as you leave the
Museum and at home. Don't forget to watch for
ongoing *SOLAR STORMS TO RADIO WAVES*
programs at www.discoverymuseums.org.



As you leave the Museum:

~If you have a **remote car door opener**

- Try to block the signal with your hand. Does it work?
- Wrap your remote car door opener in aluminum foil. Press the unlock icon or button. Does the car unlock?

~ If you have a **cell phone**

- Ask someone to call you. Before they do, wrap your phone in foil. Does the signal come through? (Do not leave your cell phone wrapped in foil for extended periods of time).

~If you have **hand held GPS**, or **GPS** in your car or cell phone that displays location coordinates

- Make notes of the coordinates displayed on your Global Positioning System for particular locations over the course of a month. Are the coordinates always the same?
- GPS isn't always precise! It relies on signals from satellites, which travel through the ionosphere. Space weather can affect these signals.

As you drive home:

~Tune to an **AM radio station**.

- Does the quality of reception change as you drive along? Do you hear static when you go under wires or transformers? If you travel north on Route 27, you may notice changes in reception. Bridges with metal cables or framework, or nearby radio towers can block or change radio waves before they reach you.

At home:

~If you have a **garage door opener**

- Try to block the signal with your hand. Does it work?
- Wrap the opener in foil. Press the button. Does the garage door open or close?
- Place the opener under a fine mesh metal colander placed on a metal tray or cookie sheet. Use a thin skewer to press the button. Does the garage door open or close?

~ If you have a small **portable radio**

- Tune to a radio station and try the same experiments as above. Can you block the radio wave reception?

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At night:

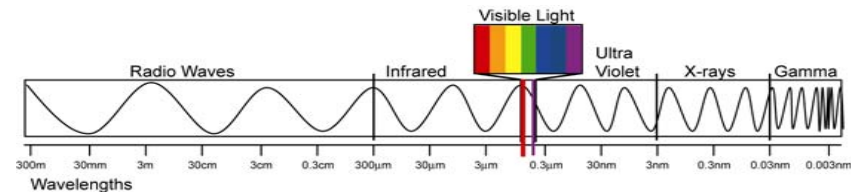
~If you have an **AM radio**

- Tune into the farthest AM radio station you can find. Wait until the top of the hour to hear the station ID and location. Make a note of the station and its frequency, or leave the radio tuned to the station. In the morning turn the radio on. Can you hear the radio station? If so, how does it sound? AM radio waves are called sky waves and can bounce off the ionosphere at night more than FM radio waves do and as a result can travel farther. For more information go to: www.haystack.mit.edu/edu/pcr/amradio/index.html

How many Radio Waves do you use at home?

Long Electromagnetic (EM) Waves at work for you!

- ~ Radio
- ~ Television
- ~ Microwave oven
- ~ Remote control toy car or plane
- ~ Wireless network for computer, internet
- ~ Wireless hand control for games (Nintendo, Wii)
- ~ Invisible fence for dogs
- ~ Cordless phone
- ~ Garage door opener



How can you test if EM Waves are long or short?

Visible light and infrared light (used in some remote controls) are short EM waves that can be blocked by your hand. Radio waves are longer EM waves and cannot easily be blocked by your hand, but can be blocked by foil or fine metal mesh with the right shape. Visible and infrared electromagnetic waves can reflect or bounce off foil or reflective surfaces. Radio waves can bounce off the ionosphere at night or when certain conditions occur.

Short Electromagnetic (EM) Waves at work for you!

- ⚡ Remote controls for TV, VCR, and DVD players often use infrared light
- ⚡ Blacklights (ultraviolet) cause fluorescent paints and white objects glow and are used for special effects
- ⚡ Visible light – lets you see and enjoy the world!