



Our universe is full of wonders. Among them are the amazing **electromagnetic** (e-LEC-tro-mag-NEH-tic) waves.

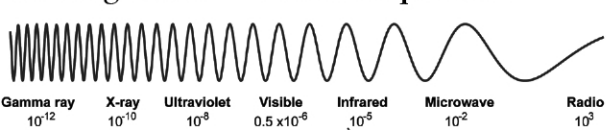
These occur when **electricity** and **magnetism** interact to carry energy through space.

Just about everything in the universe gives off these waves in all directions. They are all around us. So humans and objects on Earth and in space are natural sources of these electromagnetic waves.

Making waves

Through the years, scientists have discovered how we can make these invisible electromagnetic waves work for us.

Scientists found that waves of different lengths do different things. Different wavelengths have different **frequencies**.



The light and colors that we see are made by electromagnetic waves.

When the waves are very close together, they have a high frequency.

When they are far apart, they have a low frequency.

X-ray waves

If we make the wavelengths very close together with a very high frequency, we can make X-ray pictures that doctors use to see what's going on inside our bodies.

Microwaves

If we make a wavelength longer, we can make the waves that cook our food in microwave ovens.

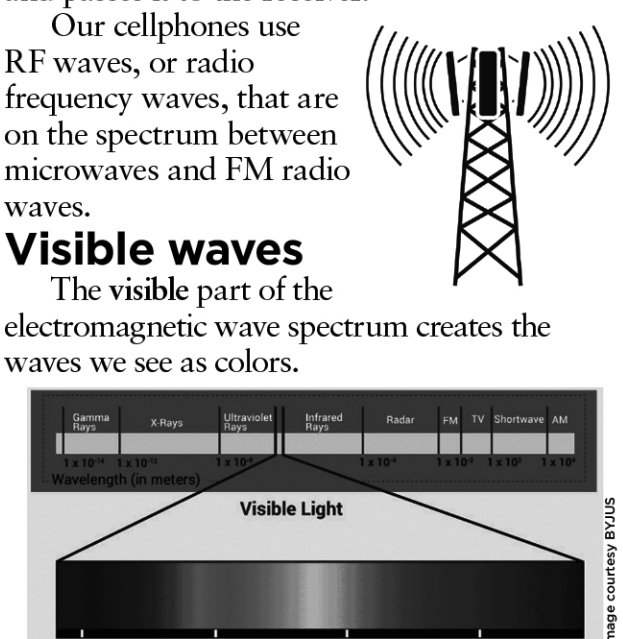
Radio waves

The longest waves of all are radio waves. While we call them “radio” waves, they are also used for TV and cellphones and other ways to communicate.

For radios to work, you need a transmitter, broadcasting antenna, receiving antenna and receiver. The **transmitter** generates, or creates, the radio signal. The radio waves are sent out into the world. An antenna picks up the signal and passes it to the **receiver**.

Our cellphones use RF waves, or radio frequency waves, that are on the spectrum between microwaves and FM radio waves.

The **visible** part of the electromagnetic wave spectrum creates the waves we see as colors.



Try 'n' Find

Words that remind us of electromagnetic waves are hidden in this puzzle. Some words are hidden backward, and some letters are used twice. See if you can find:

ANTENNA, FREQUENCY, GALAXY, HIGH, LOW, MICROWAVE, PLANET, RADIO, RECEIVER, SCIENCE, SPACE, SPECTRUM, STAR, TELESCOPE, TRANSMITTER, VISIBLE, WAVES, X-RAY.

X N J A N T E N N A C H I G H
R E V I E C E R V Y X A L A G
S L O W A F R E Q U E N C Y O
S P E C T R U M J V W A V E S
F L X Q E V A W O R C I M A N
L A R U Q A T E L E S C O P E
N N A I T S P A C E R A D I O
Z E Y F O V I S I B L E L L B
C T S C I E N C E R A T S J F
A T R A N S M I T T E R P Q W



Cook's Corner

Fancy Fudge

You'll need:

- 1 1/2 cups sugar
- 1 tablespoon butter
- 1/2 cup evaporated milk
- 2 cups miniature marshmallows

What to do:

1. Place sugar, butter and evaporated milk in a medium, microwave-safe bowl. Microwave on high for 4 to 6 minutes, or until mixture comes to a boil. Stir halfway through cooking.
2. Remove from microwave and stir in marshmallows and chocolate chips. Mix well. Microwave 2 minutes or until smooth. Stir halfway through cooking.
3. Remove from oven. Stir in pecans and vanilla. Mix well.
4. Spread mixture evenly in a greased 8-by-8-inch pan. Cool and cut into squares. Makes about 16 pieces .

- 1 (12-ounce) package semisweet chocolate chips
- 1 cup pecans, chopped
- 1 teaspoon vanilla



* You'll need an adult's help with this recipe.

7 Little Words for Kids

Use the letters in the boxes to make a word with the same meaning as the clue. The numbers in parentheses represent the number of letters in the solution. Each letter combination can be used only once, but all letter combinations will be necessary to complete the puzzle.

1. refuse to accept (6)_____
2. king, queen or twin (8)_____
3. awkward (6)_____
4. frog or toad (9)_____
5. a little water on the ground (6)_____
6. farm structure (4)_____
7. celebrity's signature (9)_____

AUT	AMP	DLE	ECT
IAN	MATT	OGR	BA
CLU	RN	REJ	HIB
PUD	APH	RESS	MSY



Answers: reject, mattress, clumsy, amphibian, puddle, barn, autograph.

Mini Fact:

The Green Bank Telescope's dish is about 300 feet across, about the length of a football field.

Looking beyond Earth

What's way out there in the universe? Scientists use radio waves to find out.

Of all the different types of electromagnetic waves, radio waves are the longest. Radio waves are silent. Scientists don't listen to them; they study them.

Green Bank Telescope

In the mountains of West Virginia is the largest movable radio telescope in the world.

The GBT's job is to collect naturally occurring radio waves. By studying them, scientists can find out what is going on way out in space.

Space is filled with radio wave energy. Planets, stars, galaxies and even clouds of dust and gas give off radio waves that can be detected on Earth. The telescope collects radio waves. It can only receive them; it does not send any. It takes a long time for some of the waves to reach Earth. Some of them might be millions of years old before they do.

Resources

On the Web:

- science.nasa.gov/ems/01_intro

At the library:

- “Let's Ride a Wave!” by Chris Ferrie
- “Energy and Waves Through Infographics” by Rebecca Rowell

Mini Jokes

Tanya: What's the hardest key to open a door with?

Tyne: A piano key!

Eco Note

Researchers have found that pigs can be trained to play video games, using only their snouts to manipulate a joystick in front of a computer monitor. Scientists at Pennsylvania State University tested two Yorkshire pigs named Hamlet and Omelette, and two Panepinto micro pigs, Ebony and Ivory. The highly intelligent swine plowed through levels of difficulty to excel at the game. But Hamlet and Omelette were forced to retire after 12 weeks because “they had grown too large to stand long enough to complete sessions.”

adapted with permission from Earthweek.com

For later:

Look in your newspaper for articles about science.

Teachers: Follow and interact with The Mini Page on Facebook!



Books from The Mini Page are wonderful resources and make great gifts! See all of our Mini Page products at [MiniPageBooks.com](https://minipagebooks.com), or call **800-642-6480** for more information. Mail payment to: Andrews McMeel Universal, Mini Page Books, 1130 Walnut, Kansas City, MO 64106. Include \$4.00 shipping and handling per order.

