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Abstract: Focuses on the significance of infrared energy in digital communications. Details on infrared radiation; Origin of the term infrared; Procedure on transmitter and receiver calibration.

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PLAYING WITH WAVES

This invisible energy makes toys fun, Keyboards smart, and TV's turn on like magic!

Watch two electronic pets at play and you'd swear they were chattering in some secret language. When one Wee-Bot starts to chirp, the other hums. They blink and purr. When your Poo-chi sings or growls, your friend's cyber-dog joins in.

You may think that the whirrs, chirps, purrs, and beeps you hear are the language of these electronic pets. But really, they communicate silently, with invisible waves called infrared energy. You do, too, whenever you use a TV remote control or an electric garage door opener, or when your parents zap an e-mail from a Palm Pilot to a desktop computer.

Why is infrared popping up all over the electronic world? Because it is the simplest, cheapest, and most reliable way to make devices communicate without wires. Using infrared, keyboards can "communicate" with computers without a connecting cable. And Wee-Bots can dance.

Invisible Rays

Infrared radiation is part of the electromagnetic spectrum (EMS). The EMS includes many different kinds of energy, from X-rays to microwaves to radio waves.

Each energy wave has a unique wavelength and frequency. The wavelength is the distance between the crest or top of one wave to the crest of the next. Frequency is based on the number of times the wave repeats itself in one second.

Radio waves have the longest wavelength and the lowest frequency—they can be longer than a football field! Gamma rays are the shortest, highest frequency waves; they're short they're measured in nanometers, or billionths of a meter (25 million nanometers equals one inch).

Right in the middle of the spectrum is visible light, which is the only part of the EMS we see.

Snake Vision

Infrared got its name in 1800 when scientists realized it was there, just out of range of our sight. Infrared means "below the red" or colored light range. But we can sense infrared—as heat! And though it is invisible to us, some animals do see infrared. For example, instead of the colors of visible light, snakes see the body heat of the mice and lizards they stalk for dinner—even at night!

Look Ma, No Wires!

Today, infrared is by far the most popular way to make things wireless. Toy designers love it because it uses less energy than visible light, so it doesn't eat up battery power. (Wee-Bots can chat for hours!) They also like its simplicity; it doesn't require many parts, only a transmitter and a receiver.

Speaking in Flashes

The transmitter that sends the message from the remote is a tiny light-emitting diode (LED). It sends flashes of infrared radiation—as many as 40,000 to 50,000 a second! A lens in the toy or in your television receives the light flashes and decodes the pattern. Of course, the transmitter and receiver must be calibrated, or have the same coding. Otherwise, your TV remote might open your neighbor's garage door!

Luckily, calibration is easy. Designers program a computer chip in the transmitter to send a specific pattern of infrared flashes. They program the receiver to recognize only that flash pattern. It ignores everything else.

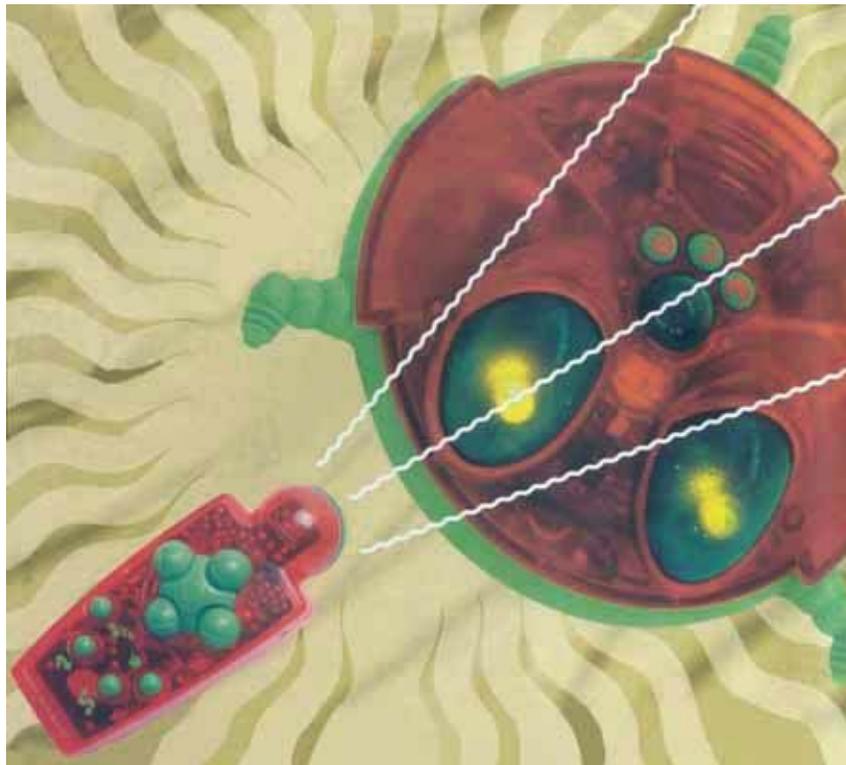
Mistakes could happen, though. "It's at least theoretically possible that you could get a Wee-Bot that somehow has the exact same coding as your television receiver, so when you try to put your Bot to sleep, you accidentally turn on your TV," says Tristan Christianson, the engineer who designed the toy for he Sharper Image. "But it's never happened yet."

Safe Waves

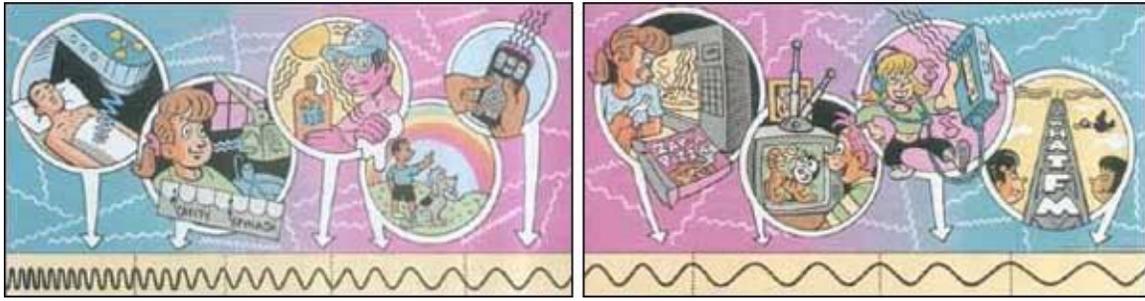
Infrared is used for much more than remote controls. Both astronomers and Earth scientists use infrared telescopes to learn about objects in space and on our planet.

Web link: To learn more about the electromagnetic spectrum, visit:

<http://kids.msfc.nasa.gov/science/>



Electromagnetic Spectrum • Communication



S (COLOR): HELPFUL WAVES



Special film shows reflected infrared waves from grass and leaves as red.

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By Gretchen Reynolds

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