

Electromagnetic radiation enhances how we sense our world.



Activity

Electromagnetic Radiation Mnemonic

A mnemonic (neh-mon-ik) is a trick you can use to remember a list of names or words. For example, a mnemonic that can help you remember the seven different types of electromagnetic radiation is Radical Musicians In Vanderhoof Undo Xylophone Glue. Each word starts with the same letter as a type of electromagnetic radiation. Create your own mnemonic to help you remember the types of electromagnetic radiation.

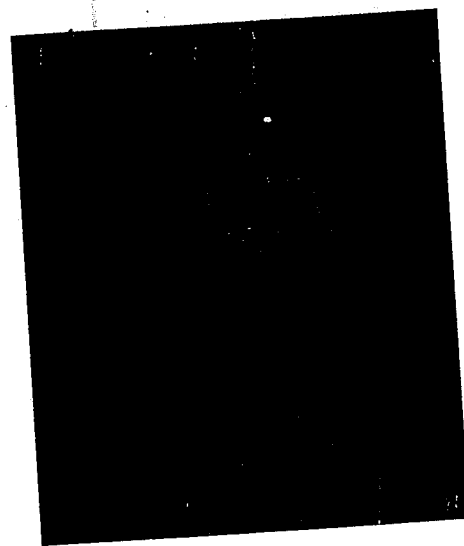
You are an electromagnetic radiation detector. Special cells in your skin sense infrared radiation and send a message to your brain that is interpreted as heat. Your eyes sense visible light to see brightness, objects, and colour. Modern technology has also opened the door to new ways for humans to sense the world, and beyond. **Figures 3.3 to 3.6** explore just a few ways that law enforcement officers, medical professionals, and scientists use electromagnetic radiation and technology to “see” in a whole new way.

Solving Crimes

Electromagnetic radiation helps criminal investigators find evidence that is invisible to the unaided eye.

- Luminol is used to find traces of blood at a crime scene, as shown in **Figure 3.3**. This chemical undergoes a reaction with the iron in blood to give off visible light.
- Infrared photography creates images by sensing temperature differences. It is often used to find hidden evidence, such as weapons and other objects placed within walls.
- Investigators use X-ray, infrared, and ultraviolet radiation to uncover art forgeries. The radiation can help show an artist’s unique brushstrokes, identify pigments and varnishes, and uncover other paintings an artist has painted over.

Figure 3.3 Luminol is sprayed at a crime scene to test for blood.



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Figure 3.4 This MRI image shows a cross-section of a human abdomen. It has been coloured to help show the different organs.

Diagnosing Disease

Different kinds of electromagnetic radiation are used to identify medical problems.

- Radio waves and magnets work together in magnetic resonance imaging (MRI). The signals generated are used to create an image of the tissues being tested. Unhealthy tissues look different from healthy ones. An MRI image is shown in **Figure 3.4**.
- X-ray imaging is useful for diagnosing conditions like broken bones and cavities in teeth. X-rays are absorbed by bones and teeth but pass through most other body tissues.
- The B.C. Cancer Agency was the first to develop a handheld device that dentists and doctors can use to shine blue light into the mouth to detect cancer. The tongue normally glows under blue light or ultraviolet radiation, but cancerous tissue looks dark.

Seeing Earth from Space

Electromagnetic radiation gives us a unique view of Earth. Satellites orbit high above Earth's surface. They use different types of electromagnetic radiation to gather information about our planet. This technology is called *remote sensing*.

- Weather satellites use reflected visible light and infrared radiation coming from Earth to obtain information about weather conditions (**Figure 3.5**). They can detect the location and movement of clouds and the amount of moisture in the atmosphere.
- LANDSAT is a satellite that measures visible light and infrared radiation coming from Earth's land surface to map it. Its images help with everything from monitoring loss of rain forests to finding near-shore shipwrecks.



Figure 3.5 Satellite images of Earth help meteorologists forecast the weather.

Viewing the Universe

Electromagnetic radiation is being used to study the universe.

- The Hubble Space Telescope orbits Earth. It uses mirrors, one of which is over 2.4 m wide, to collect and focus visible light. *Focus* means to bring light to a point to form a clear image. The images produced are clearer than those from telescopes on Earth, because the blurring effect of Earth's atmosphere is avoided. Other instruments on the telescope sense ultraviolet and infrared radiation.
- The Very Large Array is the largest radio telescope on Earth. It consists of 27 receivers that work together to sense radio wave radiation from space. Other telescopes sense microwave, X-ray, and gamma ray radiation (Figure 3.6) to view the universe.

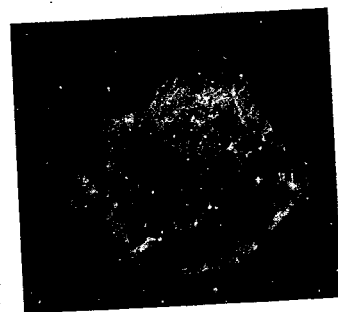


Figure 3.6 This image of a supernova (exploding star) combines data from telescopes sensing different kinds of electromagnetic radiation.

Activity

Electromagnetic Radiation Detective

Choose one of the problems below that interests you. Then carry out research as an electromagnetic radiation detective to solve it.

- A. Crime Scene Challenge:** You are a rookie detective in Fort St. John. You arrive at a crime scene with your supervisor. "The forensics team is here already. They're looking for body fluids with that ultraviolet light," says your supervisor. "Can you tell me which body fluids ultraviolet radiation can detect and how it detects them?" How do you respond?
- B. Diagnosing Patient X:** You are a student doctor in Victoria. You suspect that one of your patients has poor circulation in his hand. The senior doctor recommends a type of medical image called a thermogram. "Can you tell me how medical thermography works and what sort of electromagnetic radiation it uses?" the senior doctor asks. "What will the thermogram look like if the hand has poor circulation?" How do you respond? (Hint: A hand with poor circulation is cooler than a hand with normal circulation.)

Before you leave this page . . .

1. Describe how you are an electromagnetic radiation detector.
2. Use the information in this Concept to create a scenario like the ones in the activity above. Exchange scenarios with another student and try to solve the one you receive.

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