



Light Antennas

Small Antennas That Pick Up Light Waves



Natick, MA (Army Research Lab) -- Scientists are conducting research and making tiny antennas inspired by the Luna moth. This cutting-edge research looks at how light interacts with nanotubes to develop a new way to turn light into electricity. Scientists continue to find interesting patterns, behavior, and functioning in nature that can become a part of everyday technologies.

"The really interesting thing about nanotechnology is that because these features are so small, these materials interact with nature, with light, or with sound, or with really anything in new ways." **Brian Kimball, research physicist**

Framework

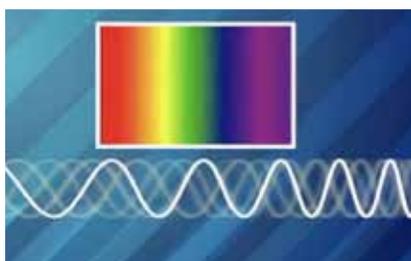
Middle School

Standards

- NSES - B.iii.1 ➤ Energy is transferred in many ways.
- STL - 3.F ➤ Knowledge from other fields of study is applied to technology.
- STL - 10.G ➤ Invention and innovation play a role.
- STL - 10.H ➤ Problems are solved through experimentation.

Content Illustrated

- Animation of the electromagnetic spectrum.



Content



Life Science

- ▶ Luna moths can locate their mates from miles away because they have very sensitive antennae. The female's antennae can send out an invisible infrared light wave and the male moth's antennae can pick it up. The signal then travels to the moth's brain as a message.

Physical Science

- ▶ Infrared light waves are measured in microns. Visible light waves are smaller. They are measured in nanometers (400-800nm).
- ▶ Because nanoparticles have sizes on the order of a wavelength of visible light, they interact very strongly with light.
- ▶ Radio waves can be longer than a meter.
- ▶ Light and electrical charge are both forms of energy.

Technology

- ▶ Light antennas are being designed to interact with wavelengths of visible light. These antennas are made from carbon nanotubes.
- ▶ Carbon nanotubes are like tiny rolled-up sheets of carbon.

Engineering

- ▶ Engineers use lasers to study the interaction between light and materials when developing the tiny antennas. Lasers are useful because they are controllable. They are intense sources of light that is all the same color, which can be focused and directed. Engineers can tell which wavelength of light is interacting strongly with the nanotubes.
- ▶ Engineers are figuring out what to do with the strong coupling of energy between light and nanotubes. A goal is to connect light with an electric circuit. They are looking for ways to turn light energy into an electrical charge.

Math

- ▶ 1 micron = 1000 nanometers
- ▶ 1 nanometer = 1 billionth of a meter

Guiding Questions

- ▶ What can we learn from nature that will help us solve problems for humans?

Suggested Activities

To think about as you watch:

- ▶ Research other animals that have antennae.

Keywords

antenna, carbon nanotubes, coupling, infrared light, lasers, Luna moth, microns, nanometers, nanoparticles, radio waves, visible light, wavelength

- ▶ *Light Antennas* can be found online at www.ndep.us/Light-Antennas. Visit www.ndep.us/LabTV for a list of process skills modeled in webisodes.