Playing with LIGHT

SCHOOL AND VISITORS GUIDE

DESIGNED AND PRODUCED BY
scitech
Perth Australia

PRODUCED BY
imagine
Exhibitions

Contents

The exhibition

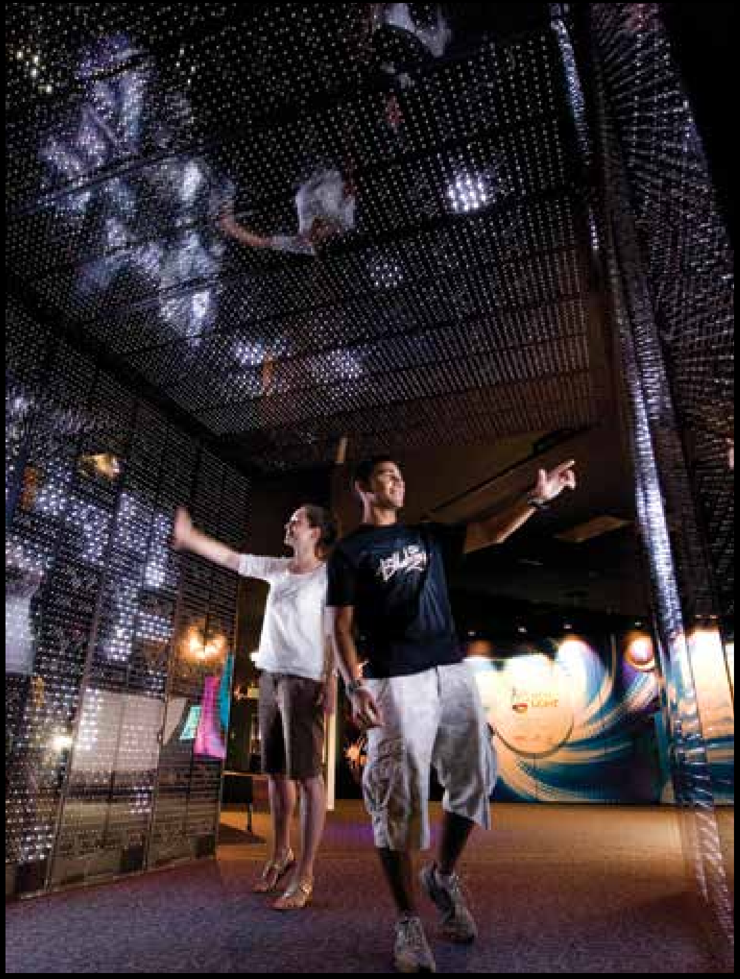
LIGHT is fundamental to our everyday lives. With so many applications; from the simplicity of vision, the beauty of rainbows or paintings, to the high-tech world of fiber optic communication, holographic security and laser surgery, light provides the basis for much of our technology and our view of the world.

PLAY is a means to ignite the imagination for people of all ages. Open-ended and without instruction, it offers the opportunity for exploration and creativity. But most importantly, it enables learning through experimentation, a key tenet of the scientific process.

In drawing together PLAY and LIGHT, Scitech has created an exhibition experience like no other. Using basic physics principles, innovative interactive experiences and a sense of fun, Playing with Light offers the opportunity to explore our world and how it is illuminated through 22 exhibits with a multitude of outcomes.

Key messages

1. Light plays a vital role in our everyday lives.
2. Science helps us describe and explain the nature of light and to discover even more about the world around us.
3. Play and experimentation are important for learning.



Entry

Visitors enter the exhibition through an interactive tunnel containing over 20,000 LEDs that switch on and off in response to a visitors' movements.

Laser dodge

Visitors are challenged to reach their next destination without activating an alarm by successfully dodging a series of laser beams that are blocking their path. This whole-body, multi-user exhibit demonstrates the properties of laser light and highlights its use in security applications.

Science Links: Lasers, security engineering.

Sticky light

Multiple users can observe and creatively interact with a beam of light as it traces the edge of surfaces placed on the table, such as shapes or even the hands of the user. This exhibit showcases the use of lasers for applications such as industrial welding.

Science Links: Lasers, computer technology, industry.

Kaleidoscope

The kaleidoscope exhibit takes visitors into a world of many reflections. A triangle arrangement of three large mirrors produces multiple images of the one or more visitors standing inside. This exhibit gives insight into the workings of a toy kaleidoscope.

Science Links: Optics, materials science (reflectivity).

Bendy mirror

Visitors can make themselves shorter, taller, thinner, wider, and more with our adjustable bendy mirror. This multi-user exhibit allows people to explore how the shape of the mirror affects the size and orientation of the image they see. The exhibit highlights the use of adaptive optics technology in astronomy and other applications.

Science Links: Optics, materials science, engineering.

Computer vision

Visitors observing their own shadow on a screen will see their shadow come to life! This multi-user exhibit showcases impressive computer vision technology, providing visitors with a full body, creative interactive experience. Graphics highlight the use of computer vision in surveillance and medical applications.

Science Links: Computer technology, experimentation.

Make a telescope

Visitors build a simple telescope and use it to see tiny pictures and messages on the other side of the exhibition. By varying the lenses used and the distance between them they can alter the magnifying power of the telescope and learn more about how telescopes work.

Science Links: Optics, astronomy.

Light lab

This multi-user exhibit allows visitors to experiment freely with a range of optical components such as lenses, mirrors and prisms using a central array of white and colored light beams. This exhibit reinforces concepts explored by other exhibits and encourages deeper experimentation. Graphics highlight the importance of scientific research in light and other fields.

Science Links: Optics, color, experimentation.

Change your view

The lens and filter effects wheel demonstrates how optical components can change the way we see our world. Visitors can rotate one of two large wheels to select a lens, filter or combination to peer through and explore its effect on light.

Science Links: Optics, experimentation.

Color shadows

Multiple users can stand, wave, jump or dance in front of a large screen and observe their 'colored shadows'. This exhibit demonstrates that three primary colors can be combined to give white light and reveals what happens when one or more of these colors are blocked.

Science Links: Light spectrum, experimentation.

Color mixing

Visitors can manipulate a red, green and blue light source to produce colorful overlapping patterns and explore primary color mixing. Graphics explain the difference between different types of color mixing and highlight applications of each.

Science Links: Light spectrum, technology, experimentation.

Paint with infrared

This high-tech exhibit allows visitors to draw on a screen using a virtual paint brush and paint bucket. This multi-user exhibit offers a creative, colorful experience and demonstrates infrared detection technology in action. Graphics explain infrared light and highlight a range of applications.

Science Links: Light spectrum, technology, experimentation.

See with a spectroscope

Visitors can use a spectroscope to examine a number of different light sources and discover the differences in their spectra. Graphics highlight different types of spectra and applications of spectroscopy.

Science Links: Light spectrum, technology.

Color changes

This exhibits demonstrates that the way objects look depends on the light that is shining on them. Visitors peer through a viewing window and rotate the container to select objects to view. They can then select various colors of illumination, including UV light, to use to examine the objects. The exhibit explores color absorption and reflection.

Science Links: Light spectrum, color perception, materials science.

Guiding light

Visitors can make light bounce down a stream of water, demonstrating total internal reflection. Depending on the curvature of the stream of water, which the user can vary, light will either partially escape or be completely trapped.

Science Links: Optics, Lasers, experimentation.

Light investigation

Visitors manipulate laser beams to explore the behavior of light as it travels from one material to another. The exhibit allows users to investigate various properties of light, such as reflection, refraction and total internal reflection of light.

Science Links: Optics, Lasers, experimentation.

Fiber optic transmission

This exhibit allows visitors to look through an optical fiber cable and see an image, such as the room around them or their own hand. The optical fibers inside the cable are spread out and displayed for the visitors to see as they experiment. This demonstrates fiber optic transmission of data.

Science Links: Technology, optics.

Freeze your shadow

Visitors stand, wave, jump, dance in front of a screen and experience a flash of light. Their shadows appear frozen on the screen behind them before slowly fading away. This multi-user, full body exhibit allows people to explore phosphorescence. Visitors can also draw on the screen using a UV wand.

Science Links: Phosphorescence, light spectrum, experimentation.

See in slow motion

Visitors use a strobe light to examine a piece of machinery with components moving at high speed. By varying the frequency of the flashes of light from the strobe they can make some of the components appear to slow, stop or even move backwards. The exhibit highlights the use of strobe lights in industrial applications.

Science Links: Optics, industry, technology.

Hologram

Holograms are photographic images that appear to be 3-dimensional when viewed under illumination. Visitors can investigate the appearance of two holograms as they view them from different positions and even peer through them. Graphics highlight a range of holographic applications.

Science Links: Optics, technology.

Concave reflections

Visitors will be amazed with this exhibit that uses reflection to allow them to 'shake their own hand'. As they reach into a large black dome, a 'spooky' inverted image of their hand appears to reach right out back at them. Visitors can investigate the different images formed at different positions within the dome. The exhibit allows people to explore the range of images that that can be produced by a concave mirror.

Science Links: Optics, technology, experimentation.

Polarized light

Visitors can explore what happens when polarized light passes through a variety of objects followed by a polarizing filter. They can rotate the polarizing filter and objects and investigate the effect on the colors and patterns seen. Graphics highlight applications of polarized materials.

Science Links: Optics, technology, experimentation.

Did you know?

The famous mathematician and scientist Isaac Newton stuck a darning needle into his own eye in an attempt to understand how we see color?

Did you know?

Humans actually glow because of chemical reactions inside of us, but the glow is too dim for us to see!

Do you like to play?

If you do, you are a scientist! Playing is one of the most important things we can do to find out about the world around us. In this exhibition, you will need to do some playing to find the items on this brilliant scavenger hunt. As you find each item, tick it off and write the name of the exhibit where you found it.

At what exhibit did you find:

Question 1. A way to see the back of your own head? ______________________

Question 2. Your frozen shadow? ______________________

Question 3. A light that chases your hand? ______________________

Question 4. Lots of different colored shadows? ______________________

Question 5. Light trapped inside a stream of water? ______________________

Question 6. A rainbow? ______________________

Find the exhibit Color Mixing.

Question 7. How do you make a yellow light?

____

Question 8. How do you make white light?

____

At what exhibit did you find:

Question 1. A way to see the back of your own head. Kaleidoscope or Fiber Optic Transmission

Question 2. Your frozen shadow. Freeze Your Shadow

Question 3. A light that chases your hand. Sticky Light

Question 4. Lots of different colored shadows. Color shadows

Question 5. Light trapped inside a stream of water. Guiding Light

Question 6. A rainbow. Light Lab or See With a Spectroscope

Question 7. How do you make a yellow light? Mix the green and red lights

Question 8. How do you make white light? Mix all three lights together

Research Questions, ages 8 - 12

Did you know that playing is one of the most important things you can do? Playing and experimenting is how we learn about the world and it is a big part of how scientists make new discoveries and inventions.

To find out some more about light in our illuminating exhibition, play and experiment your way through this scavenger hunt. For each item you find, name the exhibit where you found it and how you think it works. You might need to read the signs to figure out how some of the exhibits work.

Find	Exhibit	How it works
A way to see the back of your own head		
Your frozen shadow		
Ultraviolet light		
A laser beam trapped inside a stream of water		
A way to turn white light into a spectrum (or rainbow)		
A way to make small things look big		
An upside down reflection		
A laser beam changing direction		

Research Answers, ages 8 - 12

Find	Exhibit	How it works
A way to see the back of your own head	Kaleidoscope OR Fiber Optic Transmission	Kaleidoscope: The mirror behind reflects light from your head to the mirrors you can see. Fiber Optics: The light bounces down the fiber and doesn't escape till it gets to the end where you can see it.
Your frozen shadow	Freeze Your Shadow	The screen absorbs the flash of light and then lets the light go again slowly. Your body blocks the light from getting to the screen which causes the shadow.
Ultraviolet light	Color Changes OR Freeze Your Shadow	Color Changes: Things look different under UV light. Freeze Your Shadow: The screen absorbs and releases UV light just like visible light.
A laser beam trapped inside a stream of water	Guiding Light	When you get the angle of the water and the laser just right, the laser bounces off the inside of the water stream and is trapped inside.
A way to turn white light into a spectrum (or rainbow)	Light Lab	Shining white light through a prism makes it break into a rainbow
A way to make small things look big	Make a Telescope	Curved lenses bend the light and make things look big.
An upside down reflection	Concave Reflections	When the light hits the mirror it does not bounce straight back but changes direction, so that the reflection is upside down.
A laser beam changing direction	Light investigation	When the laser beam goes into the water, it bends and starts traveling at a different angle to when it is in the air.

Post-visit classroom activities

Humans manipulate light in many ways. These activities investigate light and the technologies we use to harness it.

Mirror Activities

How do mirrors work? What are they used for?

Materials

- Mirrors or other reflective objects (such as compact discs)
- Flashlights
- Class 1 laser pointer if available
- Shiny spoons
- Examples of technologies where mirrors are used if available.

Activities

Discuss how mirrors work with children. How does light interact with a mirror? You can demonstrate the way light bounces of the mirror using a laser if one is handy.

Give children the mirrors and flashlights. Can they bounce light around a corner? Can they see the back of their own head? Children could attempt to write backwards messages with the aid of a mirror, to be decoded by a classmate.

Does the shape of a mirror make a difference? Allow children to experiment with convex and concave mirrors and how they change the reflected image (shiny spoons are an easily obtainable option).

After this experimentation phase, discuss ways of using mirrors with children. What could curved mirrors be used for? Where are mirrors found in their everyday life?

Extension

Assign children into groups to research and construct some common technologies using mirrors:

- Periscopes
- Kaleidoscopes
- Solar cooker

Each group can then show and explain their creations to the rest of the class.

Colors

Teach your class about the color spectrum and how light is mixed to produce colors in screens and projections.

Materials

- Prisms and/or compact discs
- Spray bottle with water
- Cellophane
- Flashlights
- Sticky tape

Activities

Have children draw and discuss rainbows. When do they see rainbows? What are rainbows associated with?

Take your class outside with a spray bottle and experiment with getting a rainbow in the spray. Where do you have to be positioned relative to the sun?

Discuss how the rainbow is made. What color is the sun's light? How come it turns into a rainbow?

Give children prisms and CDs to experiment with.

Next, discuss with children what happens if you block out some of the light.

Have children sticky tape different colors of cellophane over the flashlights in groups. What colors are shining through? What colors are being blocked out?

Allow students to shine colored flashlights onto pieces of white paper. What colors can they produce?

Discuss how light colors are mixed to produce all the colors we see on screens and projections.

Extension

- Students could research color absorption, reflection and refraction. Why do objects take on certain colors – for example, why is the sky blue? Why is a bird's feather blue? How is this different from the reason paint is blue?
- Find out about spectrometry. Have students investigate how spectrometry can teach us what materials are in a fire or a star.

Invisible Light

Investigate the invisible portions of the light spectrum with students. Topics may include:

- Animals which can see different colors from humans – e.g. bees can see in ultraviolet and some snakes can see in infrared;
- How invisible light is emitted in nature – e.g. infrared from warm objects, x-rays from neutron stars, radio waves from quasars;
- How humans have harnessed and used invisible light – e.g. x-ray

machines, radio waves, microwave ovens, infrared cameras.

Make a Spectrum

Make a model of the electromagnetic spectrum as a class project. Students will research each different category of wavelength in groups and then combine their knowledge to produce a large electromagnetic spectrum.

Activity

First, copy this image of the light spectrum so it crosses over several pieces of paper. Write in the wavelengths, but not the names of each type of wave. Can we insert a picture of the spectrum here? Here's one from the internet but it's not ideal and also not sure about copyright.

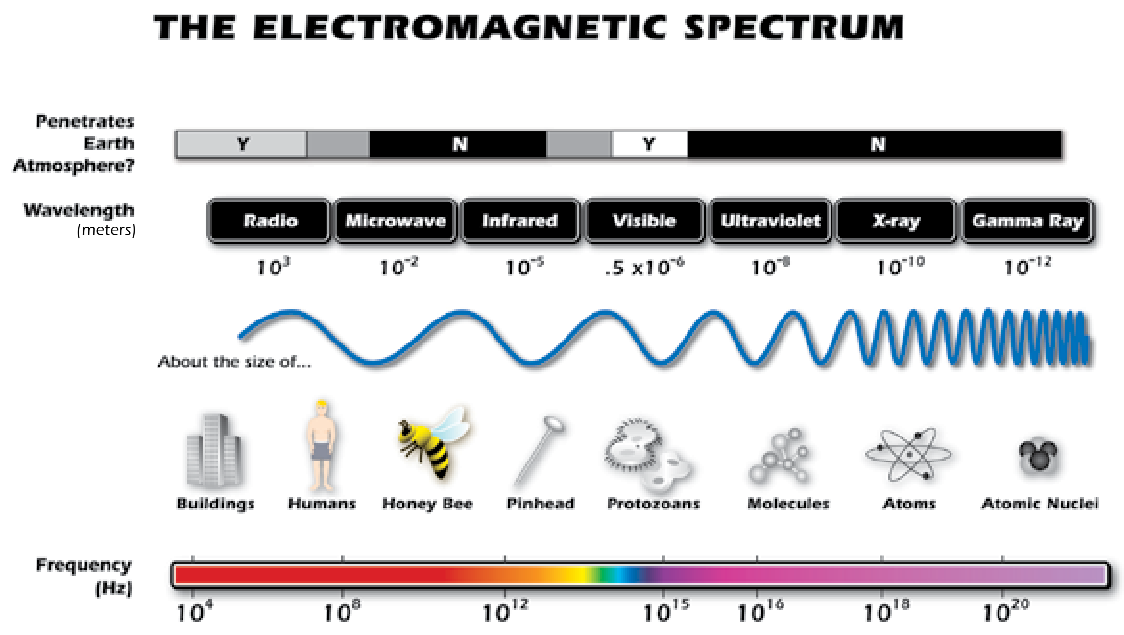
Distribute the segments of paper at random, one to each group of students. Have them do some research to find out what the wavelength is called (infrared, visible, gamma rays, etc.) and where and how it is produced or used.

They will write this information on the sheet.

For example: a group of students may have the wavelength segment labelled 10-8 – 10-12 meters. They would do some research on the light spectrum and find out that these are called X-rays. They might find out about the uses of X-ray machines, or that X-rays are produced by supernovas. They might find out that an X-ray is about the size of an atom. They would then write all this information down on their sheet.

Lastly, have students piece together the sheets so that they make the whole spectrum from longest to shortest wavelength.

Tape the sheets together and stick your spectrum up on the classroom wall to use as a reference.



Post-visit classroom activities

Gummy Lasers

Use gummy snakes or pieces of wool to model how light works and why lasers are special.

Materials

- Flashlight
- Laser pointer
- Different colors of lolly snakes or wool

Activity

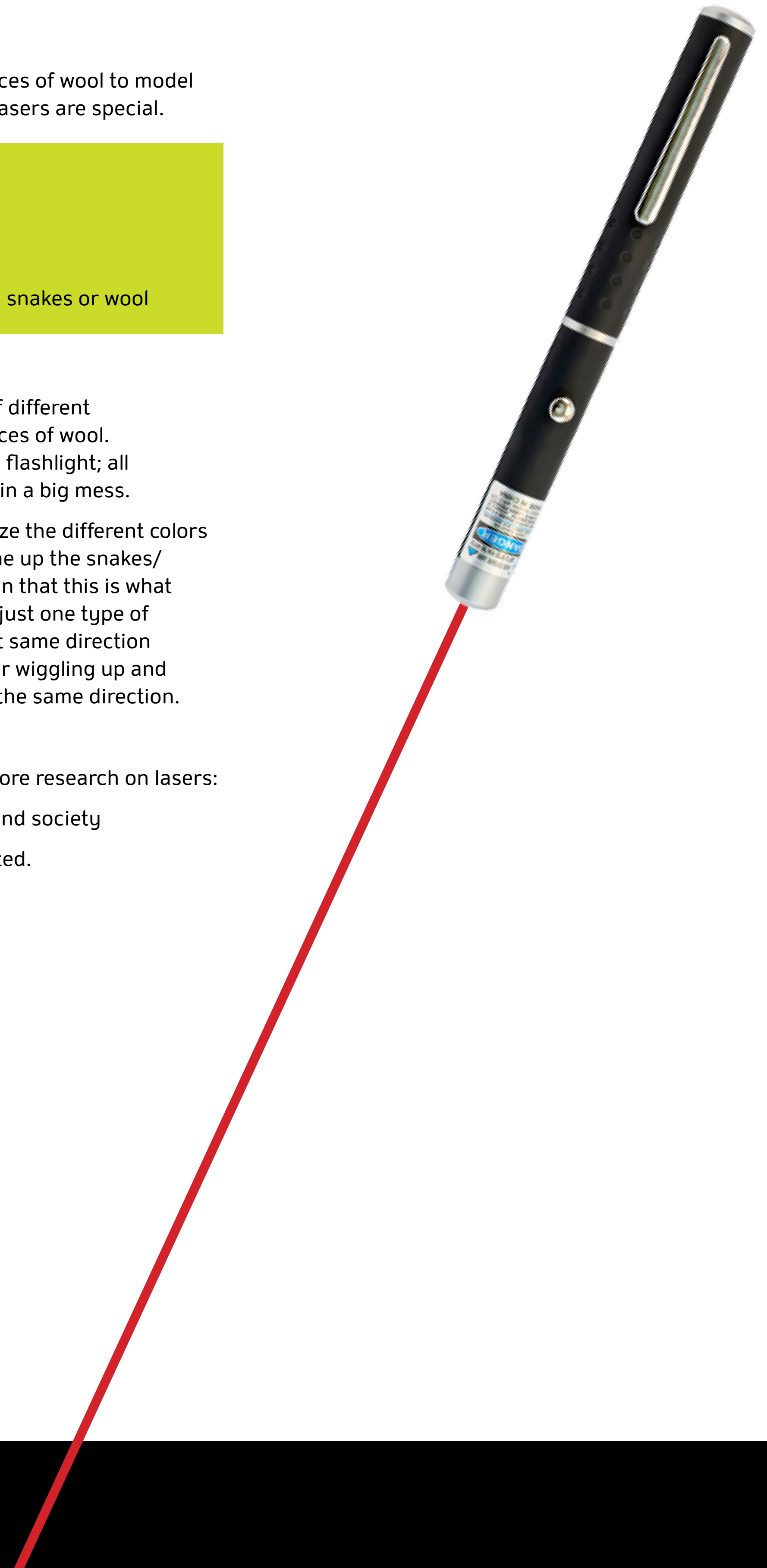
Give each group a mess of different colored lolly snakes or pieces of wool. Explain that this is like the flashlight; all the colors are jumbled up in a big mess.

Now have children organize the different colors into groups. Have them line up the snakes/ wool pieces exactly. Explain that this is what laser light is like – light of just one type of color, all going in the exact same direction and all exactly 'in phase' or wiggling up and down at the same time in the same direction.

Extension

Have students do some more research on lasers:

- Their uses in science and society
- How laser light is created.



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