

Light

Visual(s): pierced metal and/ or glass lamp(s) with candle(s) inside. If more than one lamp, try and ensure that each is different in size and design to all the others. Light the candle(s) and begin.

I wanted to look at light today – it's an ongoing interest – and I had a particular idea that I wanted to get more detail on. I discovered that I'd been partly wrong about what I thought I knew, and what I discovered really helped.

This next bit will be partly historical, partly scientific, and partly spiritual.

This section is adapted from

http://www.nobelprize.org/nobel_prizes/physics/articles/ekspong/ and
<http://www.howstuffworks.com/light1.htm>

What is light?

Ray – emitted, bounces and can be distorted

Particle – concentration of energy with other properties in space and time

Wave – spreads out over a larger area of space and time

Historical overview

Ancient Greeks said 'It's a ray'. Pythagoras and Epicurus disagreed on how it worked...

- Pythagoras (remember from Maths?) said, 'It's emitted from the eye'
- Epicurus said, 'Objects produce light rays'

In the 11th century, Ibn al-Haytham (Iraq, 965-1039AD) said 'Light rays bounce from objects into the eye'

Christiaan Huygens, 1690, said 'It's a series of vibrations caused by an object in the ether'

Isaac Newton, 1704, said 'It's a particle'

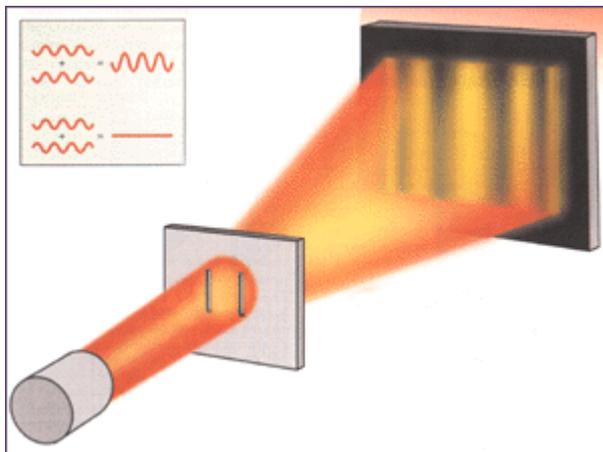
Breakthrough

Thomas Young's experiment in 1801: he said, 'It's a wave'

He used a light source, shining a beam of light through a pinhole onto a thin card with two holes cut side by side and then onto a screen. Ibn al-Haytham had actually invented the pinhole camera, so there's a tie-in there.

He reckoned that if light contained particles or simple straight-line rays, it would pass through the slits and travel in a straight line to the screen and form two bright spots.

Instead, he saw a bar code pattern of alternating light and dark bands on the screen.



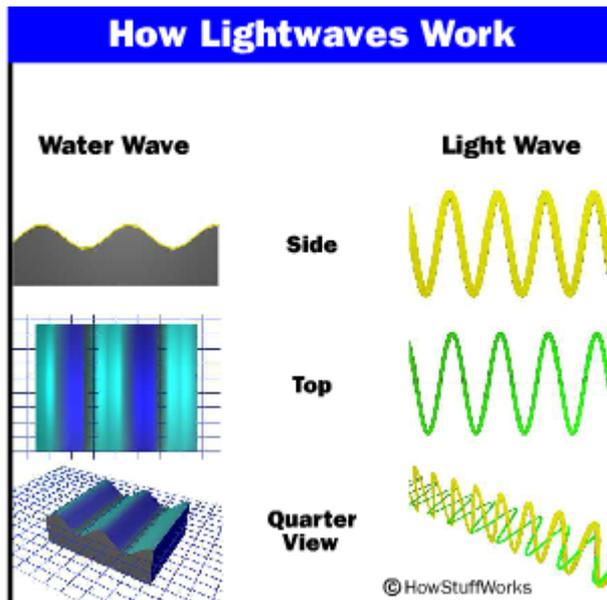
Thomas Young's experiment with two narrow slits inserted between the light source (here a laser) and the detector (here a screen). Waves emerging from one slit are superimposed on waves from the other slit, producing the observed interference pattern with alternate dark and bright lines on the screen.

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To explain this unexpected pattern, he imagined light traveling through space like a water wave, with crests and troughs, concluding that light waves traveled through each of the slits, creating two separate wave fronts.

As these wave fronts arrived at the screen, they interfered with each other. Bright bands formed where two wave crests peaked together. Dark bands formed where crests and troughs canceled each other out.

In the 1860s, Scottish scientist James Clerk Maxwell proposed that light was a combination of two types of waves: electrical and magnetic, capable of travelling through a vacuum, i.e. space. No ether required. This was the Theory of Electromagnetism.



1900 – Max Planck did a LOT of maths and said that light carries energy in distinct quantities (packets of energy)

Five years later, in 1905, Albert Einstein said that light is made up of particles called photons, which can transfer their energy to electrons in metal. He also talked about 'wave-particle duality': that light is both a wave and a particle, and that's absolutely fine. This was the Photo-Electric Theory and paved the way for his Theory of General Relativity, which in turn led to quantum mechanics, atomic power and all sorts of other stuff.

Anyway, eight years after that, in 1913, Niels Bohr said that Einstein's theory had implications for atoms. He said that electrons orbit a nucleus at a distance determined by their level of energy. If they change to an orbit closer to the nucleus, they give off photons. This process happens in neon lights or sodium vapour lights.

Incandescence and combustion

This process you see in front of you, in the candle, is similar but is a chemical process instead of an electrical one. In this case, the heat of the reaction produces light.

Origins

I wondered what scientists would have to say about where light came from in the first place. The Big Bang Theory says that all four forces (electromagnetic, strong nuclear, weak nuclear, gravity) in the universe and all matter were combined in what's called a 'singularity': a unique event or phenomenon.

According to the theory, all these arrived in spontaneous creation at the same time and released a tremendous amount of energy. Once the universe had cooled a little, photons began to be emitted and the forces became more distinct.

So, light can be defined as

A series of small particles – photons - with mass, impact and velocity

A magnetic wave, with a large area of effect

And an electrical wave, again with a large area of effect

The Bible

I think it's interesting that the first recorded words of God in the Bible are 'Let there be light.' He could have said, 'Let there be *stuff*,' but He didn't.

Light comes up repeatedly in the Bible. Jesus said He was the light of the world, and then extended that to His disciples, saying that they were the light of the world. If we're His disciples, WE are the light of the world too!

He said, "You are the light of the world. A city on a hill cannot be hidden. Neither do men take a lamp and put it under a bowl. Instead, they put it on a stand and it gives light to everyone in the house."

Explain briefly about lamp 'shelves' in first-century Jewish houses

"In the same way, let your light shine before others, that they may see your good deeds and praise your Father, who is in heaven."

We're all different. Some of us are well-rounded, some of us are angular, some big, some small. Some of us are easy on the eye, some are not. But there's something of God in each of us, and if we're in Christ, this is a flame: a light that shines out of us, in spite of our flaws or even because of them, and as we become more transparent to others.

This light has an effect. Light is electrical, galvanising and energising; magnetic, drawing others in; and has impact. Every time you see a candle, a street lamp or a neon tube, you can remember this.

Finally, it also speaks of the Trinity: three in one, all with distinct characteristics. As we go out to serve each other and those around us, discipling the world in the name of the Father, the Son and the Holy Spirit, let us pray.

Pray spontaneously, using imagery from the above...