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## THE IMPORTANCE OF BEING BRIGHT!



The fact that light can travel through the vacuum of space does not seem very important but actually I think it is one of those facts, or principles, that turns out to be crucial for us all. Here's why...

Waves usually need something to travel within or on: sound needs air, vibrations need solid things, sea waves need water etc. but light waves are different, they need nothing to travel within!

Firstly, by light, I mean the waves of the electromagnetic spectrum: radio waves, heat, light, ultraviolet, X-rays ... etc. If light could not travel through a vacuum, we would get no sunlight on Earth, we would see nothing: no stars, no Moon, no you or me. There would be virtually no heat (just the tiny left over heat coming up from the centre of the Earth from its ancient origins and from the

radioactive decay of the rocks). The seas would be frozen, there would be little chance for life, nothing would grow, little would move or develop.

Light is also the 'information messenger' - pretty much all we know about the universe comes from the study of these electromagnetic waves of 'light'. Without light, we really would be in the dark! Let's explore.

### CHALLENGE 1



**I want you to think about the impact light has on the world: the way it provides heat and warmth; illumination and clarity.**

**For example, what role does light have on our notions of time passing; on what's 'out there' in space; on communication and the communication of information?**

**Does it matter that light takes time to travel - that it doesn't go instantly from one place to another?**

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Dr Jonathan Hare is a freelance science communicator. His PhD work with Sir Harry Kroto led to a method of making the football molecule C<sub>60</sub>, Buckminsterfullerene. He has worked as a 'Time Lord' at the National Physical Laboratory, where he worked with atomic clocks. He has also worked on developing a gas-powered car with British Gas. His many television appearances include Rough Science, Hollywood Science, COAST and Horizon. He is currently a Visiting Lecturer on Science Communication at Sussex University. He loves making things, juggling, hill walking, amateur radio and painting.

**CHALLENGE II:**  
**YOUR VOICE ON A LIGHT BEAM**

- ★ The Transmitter: take a tube, say 10cm long and about 5cm in diameter and wrap aluminium foil around one end to form a tight cap or diaphragm. If you talk into the other end of the tube you can feel the foil vibrate. Allow light to fall on the foil and watch what the reflected light does when you speak into the tube. See how it jiggles around? Amazingly, much of the information in your voice (its frequencies and amplitudes) has been transferred in the process. You have "amplitude modulated" the light. It's one of those experiments you wouldn't think would actually work in real life but it does - you have put your voice on a light beam!
- ★ The receiver: get a small solar cell from an old garden light (or from a hardware shop or online retailer) and wire it into the input of battery powered amplified computer speakers (the small voltage from the cell will not harm the amplifier). If you shine the reflected light from the transmitter onto the solar cell as you talk into the tube, you will hear your voice coming out of the speakers. You have light beam communications!

**For more details see my website:**  
**[www.creative-science.org.uk/lightbeam.htm](http://www.creative-science.org.uk/lightbeam.htm)**

- See how far you can get the communication to work.
- Which is best - sunlight or torchlight?
- Is the loudness best when the foil is tight or slack. What about the quality?
- Would this work for space communications?
- If we ever had the opportunity to communicate with alien life, would a light beam be better than radio?

