# Linking the world with light

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*The Nobel Prize for Physics 2009 has been won by Charles Kao for his work in developing fibre optic communications systems. Born in China, he came to the UK to study at Woolwich Polytechnic and Imperial College in London.*

Charles then worked as an engineer at Standard Telecommunications Laboratories in Harlow, Essex. He and a small team worked on the idea of sending telephone messages using pulses of light. They found that sending beams of light through the air didn't work because small currents in the air deflected and distorted the beams, so they turned their attention to using glass fibres.

*Charles Kao at work in his lab in the 1970s. He is using an optical bench with a laser (left) to shine light through a variety of test materials.*

*Charles Kao today, with the next generation of science students.*

## Cleaning up glass

Most glass is slightly coloured, showing that it contains impurities. Charles and his colleagues developed high-purity glass fibres (99.999 999 9% pure!) through which light can travel for over 100 kilometres without being absorbed.

At the same time, he had to develop tiny solid-state lasers which would work for years without failing. Up until then, these lasers-on-a-chip had a lifetime of just a few hours.

Today, fibre optic systems are the basis of most long-distance telephone systems – there are over 1 billion kilometres of fibre in daily use. A beam of light or infrared radiation can carry many more messages than an electric current in a wire, allowing for the transmission of vast amounts of information for business, science and domestic consumers.

**Overleaf we look at how the fibre optic revolution is bringing broadband internet access to the African continent.**

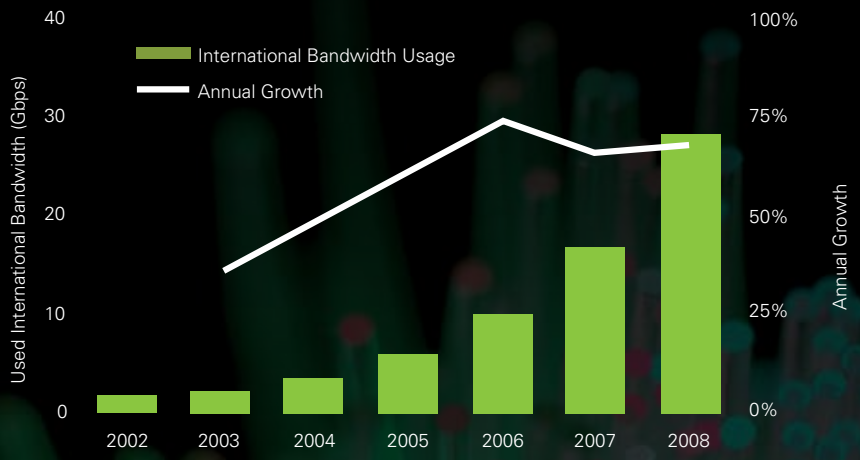
Charles Kao shared the 2009 Nobel Prize for Physics with two American physicists, Willard S Boyle and George E Smith. They are the inventors of the charge-coupled device or CCD, the electronic chip which replaces film in digital cameras (including mobile phone cameras). A CCD is an array of tiny light detectors which convert photons of light into an electrical signal which can then be manipulated, stored and shared digitally.

It is unusual for a Nobel prize to be awarded for such practical discoveries as these. You can see complete lists of Nobel Prize winners for Physics, Chemistry and Medicine at *nobelprize.org*


*A video camera – the lens assembly has been removed to show the CCD.*

# Bringing broadband to Africa

*The SEACOM fibre optic cable is bringing high-speed internet access to much of Africa, replacing expensive satellite systems. It is hoped that this will give African countries better access to world markets for their products, as well as bringing them closer to vital sources of technical information.*



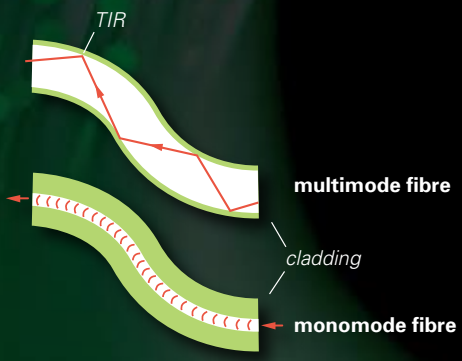

*The SEACOM cable will link major centres in West and South Africa with Europe, Arabia and India.*

*The cable-laying machine is dragged slowly across the seabed, laying the fibre optic cable as it goes.*


*The armoured cable must withstand decades on the seabed.*

*Laying the cable across rural Uganda.*

*The optical fibre through which light travels is as thin as a human hair.*




*Light travels along a multimode fibre by total internal reflection. For this to happen, the cladding must have a lower refractive index than the core.*

*The thickness of a monomode fibre is close to the wavelength of light so that diffraction causes light to follows its twists and turns.*

*Bringing a SEACOM link cable ashore from the cable-laying ship.*


*Electrical cables and optical fibres run side-by-side in a data handling centre.*