The masters of light

The 2009 Nobel Prize for Physics was awarded for two scientific achievements that have helped to shape the foundations of today's networked societies.

In 1966, Charles K. Kao made a discovery that led to a breakthrough in fibre optics. He carefully calculated how to transmit light over long distances via optical glass fibres. With a fibre of the purest glass it would be possible to transmit light signals over 100s of kilometres, compared to only 20 metres for the fibres available in the 1960s. Kao's enthusiasm inspired other researchers to share his vision of the future potential of fibre optics. The first ultra pure fibre was successfully fabricated just four years later, in 1970.

Today optical fibres make up the circulatory system that facilitates our communication society. These low-loss glass fibres facilitate global broadband communication such as the Internet. Light flows in thin threads of glass, and it carries almost all of the telephony and data traffic in each and every direction. Text, music, images and video can be transferred around the globe in a split second.

If we were to unravel all of the glass fibres that wind around the globe, we would get a single thread over one billion kilometres long, which is enough to encircle the globe more than 25,000 times and is increasing by thousands of kilometres every hour.

A large share of the traffic is made up of digital images, which constitute the second part of the award. In 1969 Willard S. Boyle and George E. Smith invented the first successful imaging technology using a digital sensor, a CCD (Charge-Coupled Device). The CCD technology makes use of the photoelectric effect, as theorised by Albert Einstein and for which he was awarded the 1921 Nobel Prize for Physics. By this effect, light is transformed into electric signals. The challenge in designing an image sensor was how to gather and read out the signals from a large number of image points, pixels, in a short time. It revolutionised photography, as light could be captured electronically instead of on film.

(Taken from http://www.sciencedaily.com/releases/2009/10/091006095019.htm)

EXCERCISES

1 True or false?

a. Using a fibre of the purest glass, light signals can be transmitted over 100s of kilometres. T F

b. Charles K. Kao, Willard S. Boyle and George E. Smith have worked together since 1966. T F

c. The CCD technology makes use of the photoelectric effect. T F

d. Albert Einstein was awarded the 1921 Nobel Prize for Physics for his theorisation of the photoelectric effect. T F

2 Complete.

The 2009 Nobel Prize for ..... was ..... by Charles K. Kao, Willard S. Boyle and George E. Smith. The first has been ..... for an important ..... that allows us to ..... information throughout the globe in an extremely ..... way. Low-loss ..... fibres facilitate light signal .....; a fibre of ..... glass can transmit light ..... over 100 ....., compared to only 20 ..... for the fibres available before Kao's discovery. ....., optical fibres cover the globe.

glass • signals • quick • Physics • today • awarded • shared • share • discovery • transmission • metres • purest • kilometres

3 Match questions and answers.

QUESTIONS		ANSWERS	
A	What did Charles K. Kao discover in 1966?	1	All telephony and data traffic travel in optical fibres. Text, music, images and video can be transferred around the globe in split seconds.
B	What is a CCD?	2	He discovered how to transmit light over long distances via optical glass fibre.
C	What kind of information does optical fibre carry around the world?	3	The Charge-Coupled Device was the first successful imaging technology to use a digital sensor. With this invention light could be captured electronically instead of on film.

A	B	C .....