Invention of blue LEDs wins physics Nobel

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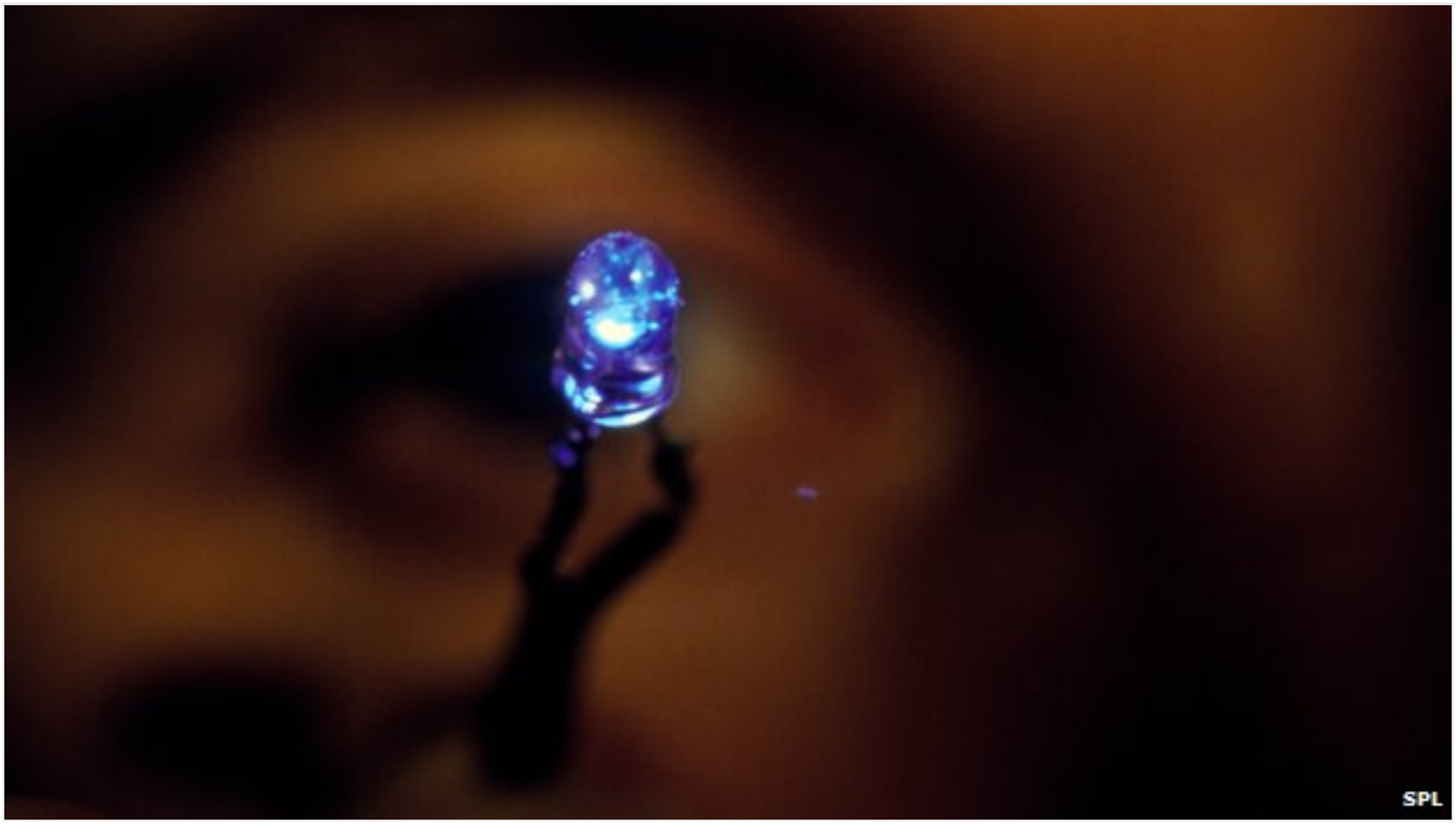
By Jonathan Webb Science reporter, BBC News



The 2014 Nobel Prize for physics has been awarded to a trio of scientists in Japan and the US for the invention of blue light emitting diodes (LEDs).

Professors Isamu Akasaki, Hiroshi Amano and Shuji Nakamura made the first blue LEDs in the early 1990s.

By combining blue light with existing red and green LEDs, this enabled a new generation of bright, energy-efficient white lamps.

The winners will share prize money of eight million kronor (£0.7m).

They were named at a press conference in Sweden, and join a prestigious list of 196 other Physics laureates recognised since 1901.

Staffan Normark, Royal Swedish Academy of Sciences, announces the physics prize

Prof Nakamura, who was woken up in Japan to receive the news, told the press conference, "It's unbelievable."

Making the announcement, the Nobel jury emphasised the usefulness of the invention, adding that the Nobel Prizes were established to recognise developments that delivered "the greatest benefit to mankind".

"These uses are what would make Alfred Nobel very happy," said Prof Olle Inganas, a member of the

prize committee from Linkoping University.

The committee chair, Prof Per Delsing, from Chalmers University of Technology in Gothenburg, emphasised the winners' dedication.

"What's fascinating is that a lot of big companies really tried to do this and they failed," he said. "But these guys persisted and they tried and tried again - and eventually they actually succeeded."

Professors Akasaki, Amano and Nakamura made the first blue LEDs in the early 1990s

Although red and green LEDs had been around for many years, blue LEDs were a long-standing challenge for scientists in both academia and industry. Without them, the three colours could not be mixed to produce white light in lamps, as well as in computer and TV screens.

Today, blue LEDs are found in people's pockets around the world, inside the lights and screens of smartphones.

White LED lamps, meanwhile, deliver white light to offices and households around the world. They use much less energy than both incandescent and fluorescent lamps.

> **“Start Quote**
>
> **With 20% of the world's electricity used for lighting, it's been calculated that optimal use of LED lighting could reduce this to 4%”**
>
> Dr Frances Saunders
> President, Institute of Physics

That improvement arises because LEDs convert electricity directly into photons of light, instead of the wasteful mixture of heat and light generated inside traditional incandescent bulbs. Those bulbs use current to heat a wire filament until it glows, while the gas discharge inside fluorescent lamps also produces both heat and light.

Inside an LED, current is applied to a sandwich of semiconductor materials, which emit a particular wavelength of light depending on the chemical make-up of those materials.

Gallium nitride was the key ingredient used by the Nobel laureates in their ground-breaking blue LEDs. Growing big enough crystals of this compound was the stumbling block that stopped many other researchers - but Profs Akasaki and Amano, working at Nagoya University in Japan, managed to grow them in 1986 on a specially-designed scaffold made partly from sapphire.

Four years later, Prof Nakamura made a similar breakthrough, while he was working at the Nichia Chemicals. Instead of a special substrate, he used a clever manipulation of temperature to boost the growth of the all-important crystals.

Previous winners of the Nobel Prize in Physics

Englert (L) and Higgs were awarded the prize for the theory that explains why particles have mass

2013 - Francois Englert and Peter Higgs shared the prize for formulating the **theory of the Higgs boson particle**.

2012 - Serge Haroche and David J Wineland were awarded the prize for their **work with light and matter**.

2011 - The discovery that the **expansion of the Universe was accelerating** earned Saul Perlmutter, Brian P Schmidt and Adam Riess the physics prize.

2010 - Andre Geim and Konstantin Novoselov were awarded the prize for their discovery of the **"wonder material" graphene**.

2009 - Charles Kuen Kao won the physics Nobel for **helping to develop fibre optic cables**.

In its award citation, the Nobel committee declared: "Incandescent light bulbs lit the 20th Century; the 21st Century will be lit by LED lamps."

Commenting on the news, the president of the Institute of Physics, Dr Frances Saunders, emphasised that energy-efficient lamps form an important part of the effort to help slow carbon dioxide emissions worldwide.

"With 20% of the world's electricity used for lighting, it's been calculated that optimal use of LED lighting could reduce this to 4%," he said.

"Akasaki, Amano and Nakamura's research has made this possible. This is physics research that is having a direct impact on the grandest of scales, helping protect our environment, as well as turning up in our everyday electronic gadgets."

LED lamps have the potential to help more than 1.5 billion people around the world who do not have access to electricity grids - because they are efficient enough to run on cheap, local solar power.

Professor Sir Colin Humphreys from the University of Cambridge commented: "This is a tremendous achievement and Akasaki, Amano and Nakamura are very worthy winners. Their invention of efficient blue LEDs has paved the way for the development of bright, cost effective and, importantly, energy efficient white lighting."

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