



## How LEDs use quantum physics to shine

**Animation transcript: Custom animation explaining how LEDs work made for BBC iWonder, narrated by Prof Danielle George.**

*PROF DANIELLE GEORGE:*

For over a hundred years, we've lit up our homes with incandescent light bulbs that work in a pretty simple way.

An electrical current goes through a thin wire tightly coiled inside the glass bulb. The current makes the wire get very hot and glow. And that gives off the light, but it's pretty inefficient. 90% of the energy is lost as heat.

LEDs make light in a completely different way – and they use the curious world of quantum mechanics to do it.

Inside an LED are two layers of special material made from semiconductors. One layer contains a lot of energetic electrons. The other layer is filled with holes – which are really broken chemical bonds between atoms.

When an LED is hooked up to a battery, the electrons and holes flood towards the place where the two layers of the semiconductor meet. As soon as an electron meets a hole in this region, it falls into it, and repairs that chemical bond. In a flash, it releases the energy that it was using to move about – as a bright light.

And that keeps happening, as the battery keeps pushing electrons and holes towards each other.

Because most of the energy goes into making light rather than heat, LEDs are super-efficient.

And as new types of semiconductors are being developed, scientists are rapidly improving the efficiency of LEDs. In a few years, LEDs on the high street could be 10 times more efficient as incandescent light bulbs of the same brightness.

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