# Light-harvesting nanowire could drive tiny devices

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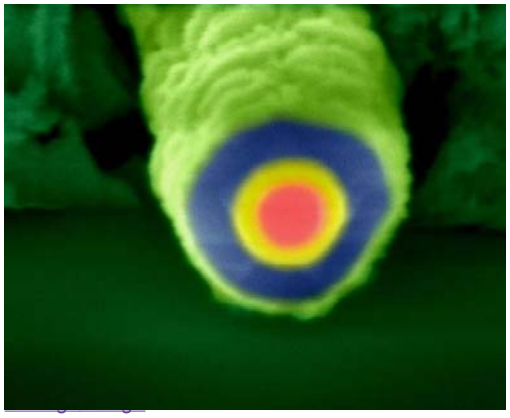
Mason Inman

A nanowire that harvests enough electricity from light to power a nanoscale circuit has been demonstrated by US researchers. The nanowire, which resembles a miniscule coaxial cable, is made of layers of silicon and is the first example of a self-contained nanoscale solar cell.



The nanowire, which resembles a miniscule coaxial cable, is made of layers of silicon (Image: Nature)

Several research groups are using nanoscale components and materials to improve solar cells. But none has yet managed to develop anything with efficiency rivalling existing solar cells, which convert between 20 and 25% of sunlight into electricity.

These research projects also mostly involve combining nanoscale elements, such as nano-particles, with larger components, notes Charles Lieber of Harvard University, who led the study.

Lieber's new nanowire functions as a complete solar cell. At its core is a rod-shaped crystal of silicon, about 100 nanometres across, doped with boron. Layers of polycrystalline silicon are added to wrap it in a 50-nm-thick layer of undoped silicon and a 50-nm-thick outer coating of silicon doped with phosphorus.



**Proof of concept**

As light hits the wire, electrons are knocked loose from the silicon crystal, leaving positively charged "holes" that can also move through the material. The electrons tend to move towards the outer layer of the nanowire, while the holes move towards its core, with the layer between keeping the two separate.

The flow of electrons and holes creates an electric current when the nanowire is connected to a circuit.

Although the proof-of-concept device only converts about 3% of light into electricity, Liever says it "allows us to study a fundamentally different geometry for photovoltaic cells, which may be attractive for improving the efficiency."

**Purer crystal**

He also believes it may be possible to boost the nanowire's efficiency by getting rid of defects in the crystal. "Our goal is to get in the 15% [efficiency] range," Lieber says."

But the most immediate promise for the nanowires, in Lieber's view, is as power sources for nanoscale electronics. The study showed that an individual nanowire can create about 50 to 200 picowatts of

electricity from sunlight – enough to power a tiny circuit.

"The idea of using single photovoltaic nano-structure to power a neighbouring nano-electric unit is really elegant," says Peidong Yang of the University of California at Berkeley, who was not involved with the work. However, Yang adds that "it is still unclear whether these devices would outperform more traditional silicon solar cells."

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