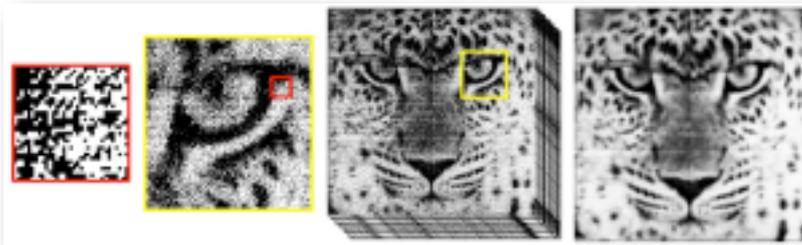




Joe's Big Idea
February 13, 2018
Heard on All Things Considered
Joe Palca

Super Sensitive Sensor Sees What You Can't

A team of engineers at Dartmouth College has invented a semiconductor chip that could someday give the camera in your phone the kind of vision even a superhero would envy.



This is a sample photo taken with the 1-megapixel Quanta Image Sensor. Instead of pixels, QIS chips have what researchers call "jots." Each jot can detect a single particle of light. Jiaju Ma

The new technology comes from Eric Fossum, a professor of engineering and his colleagues at Dartmouth's Thayer School of Engineering.

This isn't the first imaging technology Fossum has worked on. Twenty-five years ago, while working at NASA's Jet Propulsion Laboratory, he invented CMOS image sensor technology.

"There's about 4 billion cameras made every year with that CMOS image sensor technology," Fossum says.

The CMOS sensor chip turns light into electrical signals that can be processed to form digital images.

Fossum calls his new technology QIS, for Quanta Image Sensor. Instead of pixels, QIS chips have what Fossum and his colleagues call "jots." Each jot can detect a single particle of light, called a photon.

"What this chip can do because it's sensitive to single photons is it can see in the dimmest possible light," Fossum says.

A regular light bulb produces more than a billion-billion photons per second. So a single photon is pretty dim.

Other inventors have come up with chips that can see single photons, but these usually require special cooling equipment and are expensive to make.

Fossum's chip works at room temperature and uses standard manufacturing tools. He describes his new chip in the journal *Optica*.

Fossum envisions QIS will permit a new approach to creating digital images. Fast electronics allows each jot to be sampled 1,000 times per second. To build an image from the chip, the individual samples are added together and, using image processing software, a single image is produced.

It also could be useful to astronomers interested in collecting light from distant objects, or to military forces forced to work in low-light environments.

"It's really cool," says Sara Jensen, a microelectronic engineer at the Sandia National Laboratory in New Mexico. "I went and showed the paper around with some of the people I worked with in the camera field, and they were really excited about it. So I think it's a really big deal."

As impressive as it may be, don't expect to see the new chip in your cellphone any time soon. Fossum says it was more than two decades before his CMOS chip was in common use. He says the new chip is probably on a similar track.

"Maybe even a slower track, because strangely I'm trying to compete against myself with this new technology," he says. "The existing technology, my technology, is still pretty good."

Fossum is betting his new technology will become popular. He's formed a company called **Gigajot Technology** to start marketing it.