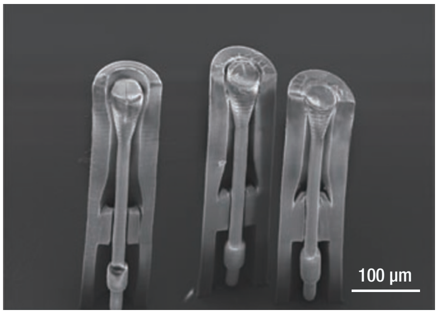
cell growth. “The cell substrate interaction is very dependent on the chemistry and topography — it strongly influences how well cells grow and live,” commented Papadopoulou. “Using an ultrafast laser to treat the silicon surface, it is possible to create an array of silicon microtips or spikes that give an excellent biocompatible material.” She added that dense neuron growth on and between such surfaces has now been observed.

The role and importance of femtosecond lasers in other applications, namely surgery and spectroscopy, was also covered. Karsten Plamann from École Nationale Supérieure de Techniques Avancées (ENSTA) in Palaiseau in France described some of the recent developments in femtosecond laser eye surgery and how it could prove useful for performing corneal transplants by cutting away dysfunctional or damaged corneas. He also explained that such lasers may in the future be useful for treating glaucoma by relieving intraocular pressure without the need for mechanical surgery, which often has complications. Plamann and his co-workers are now trying to build a complete treatment system that combines a femtosecond laser with an imaging scheme based on optical coherence tomography.



FORTH

Scanning electron microscope image of several microfluidic valves made by two-photon polymerization. The microscale devices show promise for replacing failed valves in arteries and veins.

One of the most intriguing talks that involved femtosecond laser science was by Graham Fleming from the University of California, Berkeley. He kicked off the Laserlab event with a presentation explaining how two-dimensional femtosecond spectroscopy is enabling scientists to unravel the secrets of photosynthesis. He explained how spectroscopy has shown how LHCII, a light-harvesting protein involved in photosynthesis, passes its energy to the chemical reaction centres through processes described by quantum physics and the use of multiple parallel pathways. “Perhaps we do not need to make a quantum computer as it may already exist,” he told delegates. “We just need to learn how to talk to them.”

A number of other topics were also covered over the course of the two day workshop. Paul French from Imperial College gave a presentation on fluorescence-lifetime imaging; Kishan Dholakia from St Andrews University spoke about optical tweezers and manipulation; Gert von Bally from Münster University presented research on digital holographic microscopy; Erwin Peterman from Free University in Amsterdam talked about molecular motors; and nonlinear microscopy was covered by Kazuyoshi Itoh from Osaka University. Around 70 scientists, mostly from Europe, attended the event.

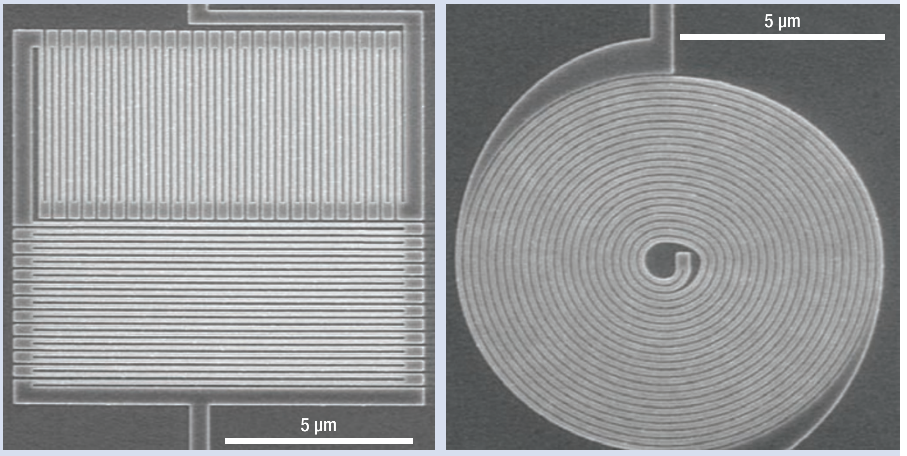
SINGLE-PHOTON DETECTOR

Free from polarization

Superconducting-nanowire single-photon detectors are potentially a highly attractive solution for many tasks in quantum optics because of their fast recovery rate, low dark-count rate and high quantum efficiency in the infrared regime. However, there’s a hitch. The quantum efficiency of conventional designs is dependent on the polarization of light, making them impractical for many applications, such as quantum key distribution.

Now, Sanders Dorenbos and co-workers from Delft University of Technology in The Netherlands, have reported two new designs of superconducting single-photon detector that eradicate the unwanted polarization sensitivity (*Appl. Phys. Lett.* **93,** 161102; 2008). The key is to use a geometry that removes any asymmetry, resulting in uniform detection for photons of any polarization.

One detector design achieves this by being divided into two subparts. Each part contains NbN nanowires (100 nm wide and 4 nm to 6 nm thick) that, importantly, are aligned perpendicularly to the nanowires in the other subpart. Thus both axes of detection (x and y) are covered.



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The detector has a fill fraction of 50% and an active area of 10 µm × 10 µm. The result is identical quantum efficiency for all polarization directions.

The second detector is made of NbTiN nanowires and is designed in such a way that the wires spiral towards and then away from the centre of the detector — again serving both axes of detection. Wires with the same width and same fill fraction as those in the first detector are used for this geometry; the diameter of the spiralling detector is 10 µm.

Dorenbos and co-workers report quantum efficiencies of 2.6% for the NbN perpendicular detector and 0.6% for the NbTiN spiral detector, at a wavelength of 650 nm. The team say that although both designs are polarization insensitive, the spiral detector is more robust against misalignment.

Rachel Won