telecommunication optical fibre under the above-mentioned conditions, it can potentially support quantum key distribution over a distance of 300 km. *NH*

PHOTODETECTORS

Visible blind detector

Adv. Mater. http://dx.doi.org/10.1002/adma.201301828 (2013)

The development of transparent optoelectronics and electronics is potentially useful for applications involving displays, solar cells, sensors and batteries. Now, Wei Tian and co-workers, who are based in Japan and China, report an ultraviolet detector that is intrinsically 'visible blind', being highly transparent (approximately 90% transmission) in the visible region. The researchers claim that the device is simple and inexpensive to fabricate as it is based on $ZnO–SnO_2$ heterojunction nanofibres produced by electrospinning. Its photoresponse increases significantly when it is illuminated with ultraviolet light with a wavelength of ~350 nm or shorter, whose photon energy exceeds the bandgap of the $ZnO–SnO_2$ nanofibres. The researchers note that the photodetector exhibits excellent operating characteristics, including a high sensitivity, a high photo/dark current ratio and a fast response speed. The synthesis and fabrication procedure is expected to be easily extendable to other heterostructures such as $TiO_2–SnO_2$ and $ZnO–TiO_2$, which also have the potential to be used to produce transparent ultraviolet detectors. *SP*

NANO-IMAGING

Seeing chemicals

Nature **498,** 82–86 (2013)

Tip-enhanced Raman spectroscopy (TERS) can capture chemical 'fingerprints' of samples with an impressive spatial resolution that approaches the nanometre regime. However, improvements are still needed for unveiling details on molecular and submolecular levels. Now, Rui Zhang, Yao Zhang and colleagues from China, Spain and Sweden claim to have broken the 1-nm-resolution barrier for TERS spatial mapping. This has enabled them to resolve the inner structure and surface configuration of a single meso-tetrakis(3,5-di-tertiarybutylphenyl)-porphyrin molecule on a silver substrate. As in conventional TERS, a strong Raman signal was obtained by using a small tip–substrate/sample distance to realize a high field strength. The researchers further improved the sensitivity by tuning the plasmon resonance to the frequency of the vibrational transition responsible for Raman scattering. A low temperature and a high vacuum were required to realize precise tuning. Tuning was performed by controlling the tip-to-substrate distance, the tunnelling current and other tip parameters. The team hopes that the technique can be used for chemical mapping of other single molecules and also for investigating the optical processes and photochemistry of single molecules. *DP*

RAMAN LASERS

Shrinking silicon

Nature **498,** 470–474 (2013)

In 2005, researchers at Intel realized a continuous-wave all-silicon Raman laser based on stimulated Raman scattering in a rib waveguide structure. However, its practicality was limited by its millimetre-scale size and its milliwatt-scale lasing threshold. Now, Yasushi Takahashi and colleagues in Japan have demonstrated a laser based on the same principle, but whose size is of the order of micrometres and whose lasing threshold is just 1 μW. The key to these improvements was the use of a miniature photonic-crystal cavity (with a cavity size of less than 10 μm) that has a large quality factor and a small modal volume. Varying the air-hole radius of the cavity with nanometre precision made it possible to tune the frequency spacing between the even nanocavity modes so as to match the silicon Raman shift of 15.6 THz. The result was the efficient generation of Raman scattered light and enhanced Raman gain. The researchers anticipate that their design strategy could lead to a variety of Raman amplification devices based on photonic-crystal cavities and waveguides. *RW*

OPTICAL FORCES

Blackbody attraction

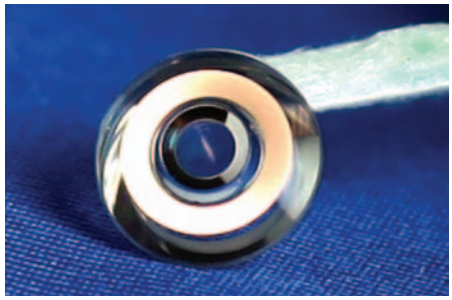
Phys. Rev. Lett. **111,** 023601 (2013)

The repulsive force associated with the radiation pressure of light is well known. Now, scientists in Austria have found that blackbody radiation can generate attractive forces on nearby neutral atoms and molecules. Matthias Sonnleitner and co-workers from the University of Innsbruck and Innsbruck Medical University say that blackbody radiation from a hot object induces a spatially varying a.c. Stark shift of the energy levels of nearby atoms, which in turn generates an attractive force. Their analysis suggests that the force decays as the inverse of the third power of the distance from the hot object. Although this force is weak in many situations, it may be significant in astrophysics, potentially exceeding gravitational forces for hydrogen atoms present in hot, large dust clouds. However, it is expected to be difficult to measure in a laboratory. The scientists say that the force should also occur for incoherent light sources that have a narrower frequency distribution and a higher photon flux than a blackbody, and that in this case it may be considerably enhanced. *OG*

OPHTHALMIC OPTICS

Two-in-one contact lens

Opt. Express **21,** 15980–15986 (2013)



Scientists have developed a miniature telescopic contact lens that can switch between normal and magnified vision. Measuring 8 mm in diameter and 1.17 mm in thickness, the lens will potentially benefit people suffering from age-related macular degeneration. Eric Tremblay and co-workers from the USA and Switzerland designed the lens based on a concentric multiple-reflection optical system that is akin to a catadioptric telescope. The unmagnified optical path passes through the central 2.2-mm-diameter clear aperture of the contact lens, giving an effective focal length of 17 mm and an F-number of 7.8. In contrast, the outer ×2.8 magnified optical path consists of an arrangement of annular concentric reflectors that gives a significantly longer effective focal length of 48 mm and an effective F-number of 9.4. Electrically operated polarization switching is used to switch between the unmagnified and magnified vision. The two optical paths are designed to be transmissive for orthogonal polarization states of light; the desired path is selected by using a pair of off-the-shelf polarization-switching liquid-crystal glasses designed for viewing three-dimensional television. Although the optical test results of a preliminary prototype lens did not meet the desired design specifications, the team considers that the lens performance could be improved by adopting an all-refractive achromatization approach. They are also planning on improving the gas permeability of the lens to make it suitable for long-term wear. *RW*

Written by Oliver Graydon, Noriaki Horiuchi, David Pile, Simon Pleasants and Rachel Won.