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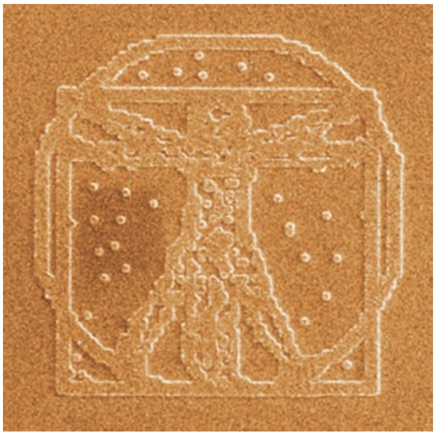
A broader spectrum

Photonics does not just mean optics performed at the chip-scale or below, at least not by the definition we use at *Nature Photonics*. Our September issue showcases research from some large-scale facilities, demonstrating the broad range of topics that the journal considers.

What does the word photonics mean to you? Perhaps because of the quantum mechanical connotations of the word, many would envisage small devices or structures; perhaps a tiny optoelectronic chip or an engineered material patterned by state-of-the-art processing so that it has features that are smaller than the wavelength of visible light. But at *Nature Photonics* we cast a much wider net. This is well illustrated in this September issue, in which three of the five primary research papers deal with the generation and manipulation of X-rays and electron beams from equipment that is at the other end of the size scale.

Optics is continuously finding a role in areas of science that have traditionally been dominated by very different technologies. Communications is the obvious example, where copper wires are constantly being replaced by high-speed optical fibres. Another very different but exciting example is that of laser-wakefield accelerators. In such systems, intense laser pulses are used to create a wave in a plasma that sweeps along and accelerates electrons (or other charged particles) to very high energies. In this way it is possible to create intense electron beams without the need for massive and expensive synchrotrons. In this issue, Nasr Hafz and co-workers report the first demonstration of the generation of stable monoenergetic gigaelectronvolt-class electron beams from a plasma just a few millimetres long using a self-guided wakefield accelerator[1]. This is a fascinating topic, not only because the combination of lasers, plasmas and relativistic particles contains a wealth of new physics but also from a practical point of view. The reduced size and cost of laser-based accelerators could bring high-energy physics to a new price point, potentially saving tax-payers and governments from the giant financial investments that are required to build traditional accelerators. In addition, the technology could make high-intensity electron-beam facilities available to many more scientists, which can only be a good thing.



Broadening accessibility is also a goal of SCSS — SPring-8 Compact SASE (self-amplified spontaneous emission) Source — an X-ray free-electron laser facility being built in Japan. At present, SCSS is scheduled for switch-on in 2010, but for now our appetite has been whetted by the impressive results coming out of a test facility[2]. The 55-m-long prototype source is now generating intense extreme-UV light. Although this is a significant step forward, as Brian McNeil from the University of Strathclyde points out in his News & Views article[3] accompanying the Letter, it is when the SCSS reaches its target wavelength of 2 Å that the “real scientific fun begins”. And this potential for “fun” is already being demonstrated at a number of other facilities across the globe. Stefano Marchesini and an international collaboration of scientists from the USA, Germany and Sweden have used short-wavelength light sources at the Advanced Light Source at the Lawrence Berkeley National Laboratory in the USA and the FLASH facility in Germany to very quickly create X-ray holographic images with nanoscale resolution. They achieve this by adopting a computational technique — coded-aperture imaging — from astronomy[4].

It is evident that the new generation of X-ray light sources will probably kick start research in a number of different fields. Before *Nature Photonics* was launched in January 2007, a decision had to be made regarding exactly what the journal would consider as photonics. One consideration was the wavelengths of radiation that would fall under its remit and feature on its pages. At long wavelengths for example, it was decided not to publish papers on microwaves and that the boundary would be the terahertz region. At the other end of the spectrum, it was initially decided to create a cut-off at wavelengths shorter than the extreme UV. But journals, like most things, evolve over time and we rapidly decided to include X-ray research within the remit to encompass this rapidly developing and exciting field.

References

1. Hafz, N. A. S. *et al. Nature Photon.* **2,** 571–577 (2008).
2. Shintake, T. *et al. Nature Photon.* **2,** 555–559 (2008).
3. McNeil, B. *Nature Photon.* **2,** 522–524 (2008).
4. Marchesini, S. *et al. Nature Photon.* **2,** 560–563 (2008).