has been a large effort in the development of tabletop EUV sources in the water window (2.3–4.4 nm), a wavelength range in which carbon is highly opaque while oxygen and water are largely transparent. This provides a natural contrast mechanism that opens up applications for the high-resolution imaging of biological samples.

Hertz *et al.*[4] have developed a soft-X-ray/EUV microscope in the water window that achieves sub-visible-light resolution. The microscope consists of a laser-plasma source and zone-plate optics to focus the radiation. The concept of the laser-plasma source is similar to the technology used for tin laser-plasmas in EUV lithography. A pulsed infrared laser is focused into a jet of either methanol or liquid nitrogen to create an EUV source at 3.37 or 2.48 nm, respectively. This radiation is focused using high-quality zone plates and multilayer optics onto a back-illuminated CCD camera. The microscope has been used to perform stereo imaging and tomography of soil particles and diatoms, with a resolution down to several tens of nanometres.

An extension of this technology could be an alternative option for next-generation, sub-13.5-nm lithography. Many of the technical issues, such as target regeneration and high-repetition-rate operation, are already solved. However, improving the low conversion efficiency (about 0.5% for 2.48 nm) remains a critical point. ❒

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HOLOGRAPHY

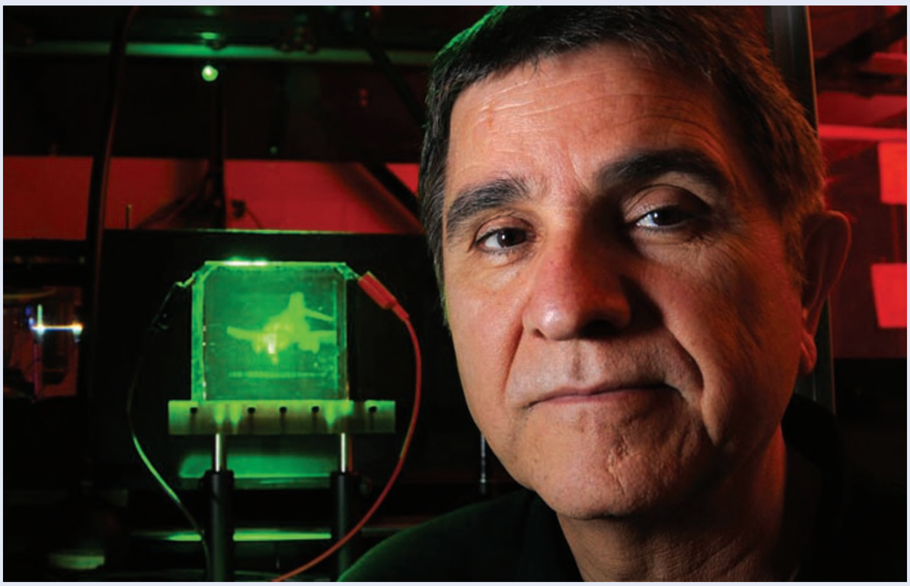
Polymer yields 3D video

The use of holography to create impressive three-dimensional (3D) virtual images in free space is a well-established technique that can be experienced first-hand at a variety of museums around the world. However, as beautiful as such images are, they have one major drawback — they are static.

Nasser Peyghambarian and co-workers from the University of Arizona and Nitto Denko in California, USA, have now overcome this limitation, allowing the generation of 3D multicolour holographic video at a refresh rate of 0.5 frames per second (*Nature* **468,** 80–83; 2010). The researchers have also demonstrated that it is feasible to transmit the data over a network for creating the holographic video in a remote location.

Although the quality is far from optimal and the frame rate is still ten times less than conventional video, the researchers believe that with improvements the technology could find applications in telemedicine, prototyping and entertainment. They also comment that no special eyewear is required by the observer, unlike the plethora of 3D televisions and movies currently on the market.

The key breakthrough in making such holographic video possible is the use of a new fast-response rewritable holographic medium made from a large-area photorefractive polymer. A single frame of the video is made from an array of 100–120 hogels (holographic pixels), each written by a 6-ns-long, 200 mJ pulse from a laser operating at 50 Hz.



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This technique makes it possible to write a frame with a hogel resolution of 1 mm in a 4 inch × 4 inch sample in just two seconds. Multicolour functionality is achieved by using angular multiplexing recording, which involves recording holograms of different colours at different angles within the polymer.

The hogels contain data captured from 16 digital cameras, each viewing the scene from a different angle. Illuminating the scene with a reference beam from an LED provides a dynamic 3D image suspended in free space that is bright enough to be visible under ambient light conditions.

By transmitting the digital data required to make each frame over a 100 Mbit s^{-1} link to a holographic recording system, it is possible to generate the holographic video in a remote location. Each newly created hologram simply overwrites the previous one in the polymer, and the researchers say there are no signs of any ghost imaging or degradation over time.

"2D images were taken at multiple angles from one place and sent to another location using the Ethernet communication protocol and then printed with the holographic set-up," explain the authors in their paper. "To the best of our knowledge, this is the first demonstration of holographic telepresence."

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