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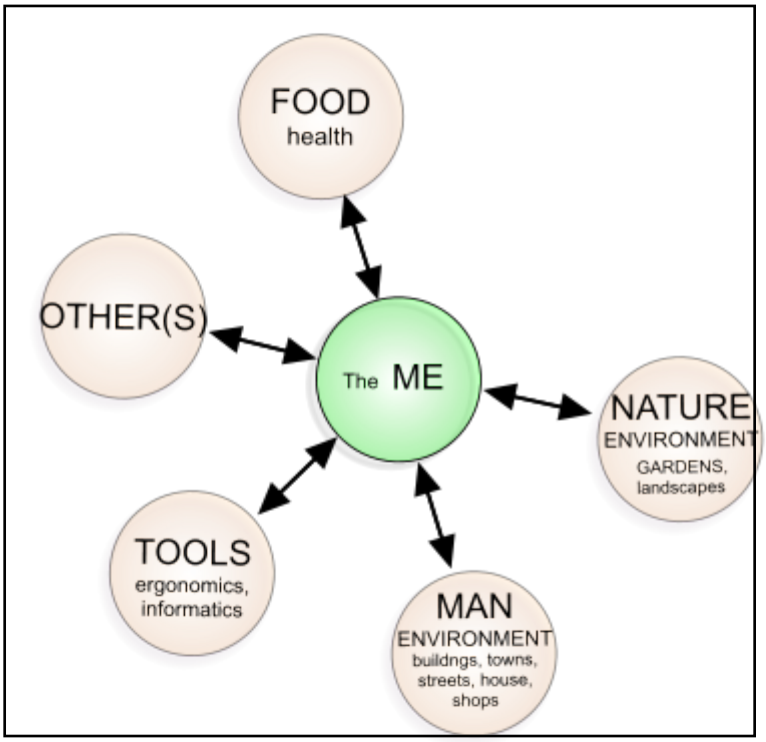
Lasers print ultra high-res images narrower than a human hair



Narrower than a human hair
Technical University of Denmark

By **Matt Reynolds**

They might not look like much but these miniature masterpieces are the width of a human hair. And despite their size, each packs in more pixels per square centimetre than the highest resolution screens available today.

This level of detail is all down to a laser printing technique developed by Anders Kristensen and his team at the Technical University of Denmark in Copenhagen. By blasting lasers at a material made up of thousands of nanoscale plastic pillars covered with a thin layer of the element germanium, Kristensen has printed some of the highest resolution images ever made.

The laser heats up each pillar to over 1000°C for a few nanoseconds, causing the germanium layer on its tip to change shape – which changes the colour of light it reflects and thus what colour it appears. Low intensity laser blasts cause it to reflect blue light, while ramping up the intensity shifts the colour towards reds and yellows. In this way, the surface of the material can be tuned so that each pillar reflects a different colour, ultimately allowing different images to be printed.

The pillars are only a few tens of nanometres apart, which lets the team cram tens of thousands of spots of colour across every centimetre of the surface. The images above are just 50 nanometres wide and were printed at a resolution of 127,000 DPI (dots per inch). The display on an iPhone 7, for comparison, is 326 DPI.

Colour spectrum

These are impressive results but don't plan on trading in your HDTV just yet, says Debashis Chanda at the University of Central Florida. To start with, the colour spectrum of these images is extremely limited – there are no greens and the blues and reds are fairly dull.

Kristensen thinks one way to get around this could be to replace the germanium layer with silicon, which reflects a slightly different colour spectrum when deformed. Once he gets his material to reflect green light he hopes to tackle the full colour spectrum.

A bigger problem is turning the material into a screen that could display moving images. Adding the transistors and other electronics that make a display change colour would mean hugely increasing the size of the pixels in these images, Chanda says. As there is currently no way to keep such a high resolution and make the screen dynamic, he suggests that the technique could be useful for printing security labels or watermarks that are impossible to remove.

Kristensen thinks that the technique could make it easier to adapt materials after they have been made – making it cheaper to customise car interiors, for example. A manufacturer could print off lots of interiors made of the plastic material and then use lasers to finish them off with different coloured designs. Because the technique doesn't use any ink, the surface can be edited simply by firing lasers at it to produce a new pattern.

Laser printing could also make recycling easier, Kristensen says. Plastics often need to be sorted into similar colours before they can be processed. But when the new material melts it loses its colour, ready to be remoulded and printed on again.

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