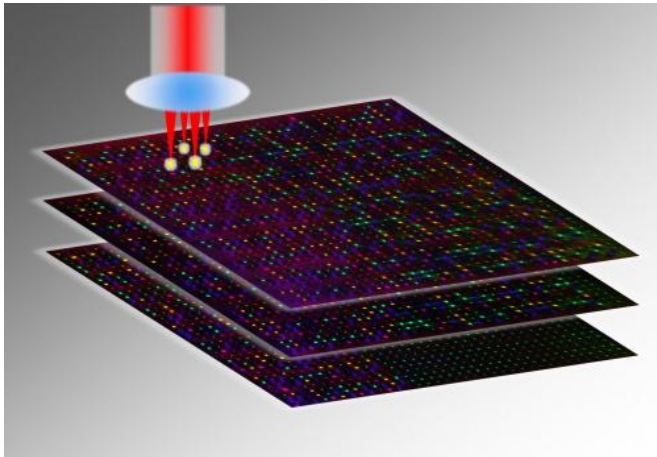


5D optical memory in glass could record the last evidence of civilization

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The image shows the digital data recorded into 5D optical data storage. Credit: University of Southampton

Using nanostructured glass, scientists at the University of Southampton have, for the first time, experimentally demonstrated the recording and retrieval processes of five dimensional digital data by femtosecond laser writing. The storage allows unprecedented parameters including 360 TB/disc data capacity, thermal stability up to 1000°C and practically unlimited lifetime.

Coined as the 'Superman' memory crystal, as the [glass](#) memory has been compared to the "memory crystals" used in the Superman films, the data is recorded via self-assembled nanostructures created in fused quartz, which is able to store vast quantities of data for over a million years. The information encoding is realised in five dimensions: the size and orientation in addition to the three dimensional position of these nanostructures.

A 300 kb digital copy of a text file was successfully recorded in 5D using ultrafast laser, producing extremely short and [intense pulses](#) of light. The file is written in three layers of nanostructured dots

separated by five micrometres.

The self-assembled nanostructures change the way light travels through glass, modifying polarisation of light that can then be read by combination of [optical microscope](#) and a polariser, similar to that found in Polaroid sunglasses.

The research is led by the ORC researcher Jingyu Zhang and conducted under a joint project with Eindhoven University of Technology.

"We are developing a very stable and safe form of portable memory using glass, which could be highly useful for organisations with big archives. At the moment companies have to back up their archives every five to ten years because hard-drive [memory](#) has a relatively short [lifespan](#)," says Jingyu.

"Museums who want to preserve information or places like the [national archives](#) where they have huge numbers of documents, would really benefit."

The Physical Optics group from the ORC presented their ground-breaking paper at the photonics industry's renowned Conference on Lasers and Electro-Optics (CLEO'13) in San Jose. The paper, '5D Data Storage by Ultrafast Laser Nanostructuring in Glass' was presented by the during CLEO's prestigious post deadline session.

Professor Peter Kazansky, the ORC's group supervisor, adds: "It is thrilling to think that we have created the first document which will likely survive the human race. This technology can secure the last evidence of civilisation: all we've learnt will not be forgotten."

The team are now looking for industry partners to commercialise this ground-breaking new technology.

This work was done in the framework of EU project Femtoprint.

Provided by University of Southampton

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