

# 1 Terabyte Optical Storage Disks the Size of a DVD

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Physicists at Imperial College London are developing a new optical disk with so much [storage](#) capacity that every episode of The Simpsons made could fit on just one. Speaking at the Asia-Pacific Data Storage Conference 2004 in Taiwan today, Dr Peter Török, Lecturer in Photonics in the Department of Physics, will describe a new method for potentially encoding and storing up to one Terabyte (1,000 Gigabytes) of data, or 472 hours of film, on one optical disk the size of a CD or DVD.

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All 350 scheduled episodes of The Simpsons, totalling 8,080 minutes of film, could be easily stored on the new disk, dubbed MODS - for Multiplexed Optical Data Storage - by the Imperial College team.

The 1TB disk would be double sided and dual layer, but even a single sided, single layer, MODS disk could hold the Lord of the Rings trilogy 13 times over, or all 238 episodes of Friends.

MODS disks will not be the first to challenge DVDs' domination of the audiovisual optical disk market. BluRay disks, which have five times the capacity of a DVD at 25GB per layer, are expected to be released towards the end of 2005 for the home market.

The Imperial researchers, working closely with colleagues at the Institute of Microtechnology, University of Neuchâtel, Switzerland, and in the Department of Electrical and Computer Engineering, Aristotle University of Thessaloniki, Greece, estimate that MODS disks would cost approximately the same to manufacture as an ordinary DVD and that any system playing them would be backwards compatible with existing optical formats – meaning that CDs and DVDs could be played on a MODS system. Dr Török believes that the first disks could be on the shelves between 2010 and 2015 if his team are able to secure funding for further development.

“According to our experimental results, we can optimistically estimate that we will be able to store about one Terabyte per disk in total using our new method,” said Dr Török, leader of the research. “This translates to about 250GB per layer, 10 times the amount that a BluRay disk can hold.”

The Imperial researchers and colleagues at Neuchâtel and Thessaloniki filed a patent covering their ideas in July 2004.

Under magnification the surface of CDs and DVDs appear as tiny grooves filled with pits and land regions. These pits and land regions represent information encoded into a digital format as a series of ones and noughts. When read back, CDs and DVDs carry one bit per pit, but the Imperial researchers have come up with a way to encode and retrieve up to ten times the amount of information from one pit.

Unlike existing optical disks, MODS disks have asymmetric pits, each

containing a ‘step’ sunk within at one of 332 different angles, which encode the information. The Imperial researchers developed a method that can be used to make a precise measurement of the pit orientation that reflects the light back. A different physical phenomenon is used to achieve the additional gain.

“We came up with the idea for this disk some years ago,” says Dr Török. “But did not have the means to prove whether it worked. To do that we developed a precise method for calculating the properties of reflected light, partly due to the contribution of Peter Munro, a PhD student working with me on this project. We are using a mixture of numerical and analytical techniques that allow us to treat the scattering of light from the disk surface rigorously rather than just having to approximate it.”

Increasingly manufacturers are looking at miniaturising the size of optical disks, says Dr Török.

“Multiplexing and high density ODS comes in handy when manufacturers talk about miniaturisation of the disks,” he says. “In 2002 Philips announced the development of a 3cm diameter optical disk to store up to 1GB of data. The future for the mobile device market is likely to require small diameter disks storing much information. This is where a MODS disk could really fill a niche.”

Imperial College Innovations Ltd, the College’s wholly owned technology transfer company, managed and helped to prepare the patent application.

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