

# Optical Data Storage Workshop (ODS)

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15 June - 15 June 2012, College of Optical Sciences, Tucson, Arizona, United States

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Optical data storage has been one of the most successful commercial products ever introduced. Billions of disks and optical drives have been sold worldwide. BluRay, the latest generation of optical data storage devices is expanding its foothold, but hard disk drives and other storage media offer substantial competition. It is not clear what the next generation ODS system might look like, and what its purpose would be in the storage ecosystem.

The ODS 2012 workshop is focused on exploring the role of optics in storage systems beyond optical data storage per se. For example, future magnetic storage systems may combine optical and magnetic technology to further increase storage density and data transfer rates. The workshop will include invited speakers from academia, industry and government that present the state-of-the-art in their fields of expertise and discuss product and technology roadmaps. Topics for discussion are: optical data storage, magnetic and hybrid recording, semiconductor phase change media, novel optical storage systems, holographic data storage, quantum computing and storage, data encryption, optical communication, data distribution, long-term archival data storage.

## Chairs:

Bert Hesselink, *Stanford Univ, USA*

Yuzuru Takashima, *Univ. of Arizona, USA*

## Sponsored by:



**Optical Storage Data (ODS) 2012 Workshop**  
College of Optical Sciences – Meinel Building  
University of Arizona  
Tucson, AZ, USA

## Agenda

### 14 June 2012

18:00 – 19:30

**ODS Welcome Reception**

**Location:** [Gentle Ben's Brewing Company](#)

Room: Cellar

865 E. University Blvd.

Tucson, AZ 85719

+1.520.624.4177

### 15 June 2012

7:15 – 17:20

**ODS Workshop Registration**

Location: 8<sup>th</sup> Floor, Meinel Building

7:30 - 8:15

**Breakfast**

Location: 8<sup>th</sup> Floor, Meinel Building

8:15 - 8:30

**Welcome Remarks**

Location: Room 307, Meinel Building

8:30 - 10:00

**Invited Speaker Session**

Location: Room 307, Meinel Building

8:30 - 9:00

**The Present and Future of Hybrid Magnetic Recording;**

*Michael Alex; Western Digital Corporation, USA*

**Abstract:** Hybrid magnetic recording, as the name suggests, utilizes aspects of both magnetic and optical recording to potentially increase areal recording density beyond that of current perpendicular magnetic recording (PMR). Also known as heat assisted magnetic recording (HAMR), this technology has unique challenges that must be overcome before it can be commercialized. Achieving high recording density requires a smooth, small grain size, high signal-to-noise ratio storage medium with heat-sinking properties that maximize thermal gradient during the writing process. Data must be written to the medium with a transducer having adequate optical efficiency and high optical gradient, yet is robust under thermal stress with a design that can be integrated with the magnetic pole for optimal writing performance. Since this technology requires an optical source, there are cost and system integration issues associated with the light delivery system that aren't factors in conventional PMR systems. These and other aspects of HAMR recording will be discussed in more detail in the presentation.

9:00 - 9:30

**The Secure Content Storage Association and Its Consumer Benefits;**

*Lambertus Hesselink, Stanford Univ. and Chairman of the Board of the SCSA, USA*

**Abstract:** The Secure Content Storage Association (SCSA) was formed between Fox Entertainment, Warner Brothers, Western Digital and Sandisk to create a new secure HD content distribution

platform for storing HD premium movies on magnetic hard disks or Flash memory cards. The SCSA aims to create an ecosystem that enables the consumer to better enjoy their premium and personal content in a simple and convenient manner on a wide variety of devices, such as TVs, PCs, mobile devices and tablet computers. A home content library allows the consumer to consolidate and organize all their content and a portable copy allows viewing while on the go. In this presentation I will discuss the ecosystem, its capabilities, and the various storage media that a consumer might wish to use. The role of the SCSA versus the DECE UV standard will be highlighted and future opportunities for widespread adoption will be discussed.

**9:30 - 10:00**

**Current and Future for Optical Data Storage;**

*Kimihiko Saito, SONY, Japan*

**Abstract:** Preparing for the coming information explosion, huge capacity and reliable data storage systems are required. Optical disc system is an option for the purpose due to its low cost and long-life archival characteristics of the physically recorded marks. Recent years, we have sought technologies to realize higher recording density beyond the limit of  $\lambda/NA$ . One of such technology is super-multilayer recording/readout technique. In addition to the past topics in ODS conferences, our approaches of the recording method with key devices and a drive system will be reported.

**10:00 - 10:30**

**Coffee Break**

Location: Room 307, Meinel Building

**10:30 – 11:30**

**Invited Speaker Session (continued)**

Location: Room 307, Meinel Building

**10:30 - 11:00**

**High Capacity Data Storage Inspired from Lippmann Interference Photography; Giles**

*Pauliat, Inst. de Optique, France*

**Abstract:** Lippmann interference architectures are alternatives to holographic memories for high capacity data storage. In these systems, the image beam carrying the information data interferes with its reflection onto a mirror: no external reference beam is required. We implemented such a page-oriented architecture using wavelength multiplexing and we report results obtained in a photopolymer material. We will also discuss the main advantages/drawbacks of such architectures compared to more conventional holographic arrangements.

**11:00 - 11:30**

**3D Coding System in Holographic Memory;**

*Tsutomu Shimura, Univ. of Tokyo, Japan*

**Abstract:** We propose a new holographic data storage system with the coding scheme in spatially 2D and temporally 1D. The optical system is identical to the co-axial (collinear) system. In the new system, temporal signal is assigned to each pixel of the page data. With the shift of the media, temporal signal is recorded and read at each pixel of the page. The number of the channel of the temporal signal is equal to the number of signal pixels. Required minimum media shift which corresponds to the minimum mark length of the Run-length limited (RLL) coding can be shorter than page oriented holographic memory system and the potential storage density will be larger than conventional holographic systems.

**11:30 - 13:30**

**Lunch**

Location: 8<sup>th</sup> Floor, Meinel Building

**13:30-15:00**

**Work Group Session**

One of the objectives of the ODS 2012 workshop is to provide an opportunity to conduct a frank exchange of views on the current state and the future of optical data storage. To achieve this

objective, all the attendees are encouraged to participate in workgroup and discussion sessions in the afternoon.

In the workgroup session, attendees select one of the five topics and locations listed below:

**a) Hybrid Magnetic Recording Work Group**

*Co-chairs: No-Cheol Park, Yonsei Univ., Korea, and Michael Alex, Western Digital, USA*

Location: Room 307, Meinel Building

**b) Content Distribution Work Group**

*Co-chairs: Bert Hesselink, Stanford Univ., USA, and David Brankenbeckler, Western Digital, USA*

Location: Room 305, Meinel Building

**c) Frontier for Optical Data Storage: Near-field, Nano and Quantum Memories Work Group**

*Co-chairs: Masud Mansuripur, Univ. of Arizona, USA, and Kimihiro Saito, SONY, Japan*

Location: Room 554, Meinel Building

**d) Current and Future in Multi-layer Recording Work Group**

*Co-chairs: Giles Pauliat, Inst. de Optique, France, and Tom Milster, Univ. of Arizona, USA*

Location: Room 747, Meinel Building

**e) Holographic Recording Work Group**

*Co-chairs: Tsutomu Shimura, Univ. of Tokyo, Japan, and Ken-ichi Shimada, Hitachi, Japan*

Location: Room 821, Meinel Building

Each participant is encouraged to prepare 5-6 page slides for use in the discussion related to identifying the following issues:

1. State of the art
2. Roadblocks
3. Research and development road map
4. Five most important items for future optical data storage
5. Proposal from the work groups for topics to be included in future ODS meetings

In the following discussion session, proposals from each workgroup will be presented by workgroup session co-chairs, so that all the attendees to the ODS 2012 workshop will have a common understanding of the state of the art in the five major topics, as well as share a detailed vision on the future of optical data storage and the ODS meeting.

**15:00 - 15:30**

**Refreshment Break**

Location: 8<sup>th</sup> Floor, Meinel Building

**15:30 - 17:15**

**Work Group Presentations and General Discussion**

Location: Room 307, Meinel Building

**15:30 - 16:15**

**Presentation from working groups**

The co-chairs of the work group present their proposals.

**16:15 - 17:15**

**General Discussion**

Moderator: Bert Hesselink, Stanford Univ., USA

**17:15 - 17:20**

**Concluding Remarks/Adjournment**