OSA
Optical Society of America

ODS

Optical Data Storage

Topical Meeting and Tabletop Exhibit

May 11-14, 2003
Hyatt Regency
Vancouver, BC Canada

Technical Program Committee

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- Michael O'Neill, *Calimetrics, Inc., USA*, General Co-Chair
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About ODS

May 11-14, 2003

This conference provides a forum for exchange of information on the status, future directions and advances of optical systems, materials, designs and applications in optical storage technology. Contributions in the data storage related fields such as scanning probe and holographic technologies are encouraged.

Meeting Scope

Topics to be covered:

- Basic Theory
- Media
- Drive Technologies
- Components
- Testing and Modeling
- Optical Storage Systems and Applications
- High Density Recording
- Markets
- Related Technologies
- Near Field Technologies
- Coding and Signal Processing

Speakers

The invited speakers for the main program include:

Two-dimensional optical storage, William M. J. Coene, *Philips Res. Labs. Eindhoven, Netherlands.*[TuB1]

Optical MEMS technology for high-density optical storage, Kazuhiro Hane, *Tohoku Univ., Japan.*[WA1]

Novel optical disc storage with polarized collinear holography, Hideyoshi Horimai, *OPTWARE Corp., Japan.*[TuC1]

Multi-level optical recording using a blue laser, Yuichi Kadokawa, *RICOH Co., Japan.* [WD1]

Phase transition mastering for Bluray ROM disc, Kiyoshi Osato, *Sony Corp., Japan.* [MD1]

Hybrid recording material candidates for storage densities beyond Tera bit/in^2 - CoCrPt, TbFeCo, Pd/Co, FePt, Norio Ota, *Hitachi Maxell Ltd., Japan.* [MC1]

Photochromic processes for high capacity optical storage, P.S. Ramanujam, *Riso Natl. Lab., Denmark.* [TuA1]

A basic concept for next generation DVD: 0.6mm substrate disk technology using violet LD, Toshihiro Sugaya, *Toshiba, Japan.* [WB1]

Fourth generation super-RENS disk with metallic nanoparticles and nanowires, Junji Tominaga, *Natl. Inst. of Adv. Indust. Sci. and Tech., Japan.* [MB1]

Highly miniaturised prototype optical drive for use in portable devices, Michael van der Aa, *Philips Res. Labs. Eindhoven, Netherlands.* [MA1]

ODS Short Courses

Short courses are a wonderful way to enhance your knowledge of the optical field. ODS routinely picks experts in their fields to provide you with an in-depth look at intriguing topics. The courses are designed to increase your knowledge of a specific subject while learning from experienced teachers. An added benefit of the courses is the availability of continuing education credits (CEUs).

CEUs are awarded to each participant that successfully completes the short course. The CEU is a nationally recognized unit of measure for continuing education and training programs that meet established criteria. To earn CEUs, a participant must complete the CEU credit form and course evaluation and return it to the course instructor at the end of the course. CEUs will be calculated and certificates will be mailed to participants.

Tuition for the short course is a separate fee. Advance registration is recommended as the number of seats in each course is limited.

Short courses sell out quickly! There will be no wait list for the short courses. Short course materials are not available for purchase.

Register now!

Schedule

9.00-13.00
SC101: Introduction to MultiLevel Optical Data storage
Sunday, May 11, 2003; 9.00-13.00
Steven McLaughlin, *Georgia Tech.*; David Warland, *Calimetrics, Inc., USA*

SC102: The Blu-ray Disc Physical Format
Sunday, May 11, 2003; 9.00-13.00
Bart Van Rompaey, *Philips Res. Lab., Storage Signal Processing, The Netherlands*

14.00-18.00
SC103: Equalizing Technology for High Density Optical Disk (Limit Equalizer)
Sunday, May 11, 2003; 14.00-18.00
Fumihiko Yokogawa, *Pioneer, Japan*

SC104: Holographic Data Storage Systems
Sunday, May 11, 2003; 14.00-18.00
Lambertus Hesselink, *Stanford Univ., USA*

Course Descriptions

SC101
Introduction to MultiLevel Optical Data Storage
Steven McLaughlin, *Georgia Tech.*; David Warland, *Calimetrics, Inc., USA*

Course Description In this course we introduce the ideas, techniques and methods for MultiLevel (ML™) optical data storage. We discuss optics, media, coding, and signal processing and systems aspects of ML recording systems for ROM, R and R/W applications.

Benefits and Learning Objectives
This course should enable participants to:

- Specify the primary system components of a multilevel recording systems
- Discuss the differences between ML and binary recording systems
- Describe the tools and metrics used to assess ML performance
- Describe the modulation and signal processing aspects of a typical ML system
- Explain at least one write strategy used to obtain ML responses
- Summarize fundamental limits of optical data storage systems

Intended Audience
This course is suited for engineers and researchers who want to both familiarize themselves with ML technology and understand how to build a ML system. Participants are assumed to have knowledge of optical recording systems such as CD-R, CD-RW and DVD.

Instructor Biographies
Steven McLaughlin is an Associate Professor of ECE at Georgia Tech and a Principal Scientist at Calimetrics. He received the B.S.E.E degree from Northwestern University in 1985, the M.S.E. degree from Princeton University in 1986, and the Ph.D. degree from the University of Michigan in 1992. His research interests are in communications and information theory and their application to data storage, optical networks and wireless communication.

David Warland is Director of Engineering at Calimetrics Inc. He received the B.A. degree in Physics and Mathematics at Macalester College in 1985 and the Ph.D. degree in Biophysics from the University of California at Berkeley in 1991. His research interests are in optical storage and information processing in biological systems.

SC102
The Blu-ray Disc Physical Format
Bart Van Rompaey, *Philips Res. Lab., Storage Signal Processing, The Netherlands*

Course Description
This course covers the Blu-ray Disc system: 25GB data storage on a 12cm diameter optical disc. The course will describe a broad set of system aspects of Blu-ray Disc. All relevant aspects are covered from the properties of phase change discs to the control and signal processing properties to read the data from the disc. The emphasis of the course will be on format issues and bit detection.

Benefits and Learning Objectives
This course should enable participants to:

- Describe the Blu-ray Disc system in general from phase change media through bit detection, including addressing scheme and data format
- Compare Blu-ray Disc with other optical disc systems

Intended Audience
Theoretical and/or technical physics background is desired especially in the field of signal processing and electronics.

Instructor Biography
The instructor has obtained a Ph.D. in theoretical physics and works for Philips Research Eindhoven in the sector Storage. In this function he has been working on the various aspects of optical recording: optics, media and data format.

SC103

Equalizing Technology for High Density Optical Disk (Limit Equalizer)
Fumihiko Yokogawa, *Pioneer, Japan*

Course Description
This course will provide a technical overview of the equalizing technology so called "Limit equalizer", which is adopted as the measurement circuit for Blu-ray disks. The course will start from the optical disc channel description, the roll of the conventional equalizer, what is done in the Viterbi decoder and finally the explanation of the detail of Limit equalizer. This course will try not to use mathematical equations and will review technologies by using charts.

Benefits and Learning Objectives
This course should enable participants to:

- Confirm the traits of optical disk channel
- Recognize the purpose of the equalizer in time domain and in frequency domain
- Explain the action of Viterbi decoder
- Compare Bit-by-bit decoding and Viterbi decoder
- Describe the high density optical disc channel such as Blu-ray

- Explain the concept of Limit equalizer
- Analyze the performance of Limit equalizer
- Discuss the design of Limit equalizer

Intended Audience
Anyone interested in the equalizing technology is welcomed. This course will be explained using charts without equation. Thus not only the circuit engineer but also the disk and optical engineers, who are engaged in the measurement of disks, are expected to join this course.

Instructor Biography
Fumihiko Yokogawa, General manager of R&D Labs at Pioneer, has been working in the fields of optical disk system since 1981. He developed CD, CD for mobile use, 5.25" sample servo format drive, Video disk recorder using 30 cm MO disk and DVD. He was the chair of WG2 of DVD Forum from 1996 to 1999. He was the editor of DVD-ROM specifications of DVD-BOOK, ECMA, JIS, and ISO/IEC. He was the ISOM program committee chair in 2001 and 2002. Since 1999 he has been engaged in the development of Blu-ray disk system.

SC104
Holographic Data Storage Systems
Lambertus Hesselink, *Stanford Univ., USA*

Course Description
In this course, we will discuss:

- Physical principles underlying HDSS, including the photorefractive effect, photopolymer physics, and optical architectures suitable for HDSS, with emphasis on wavelength, angular, phase encoding and field multiplexing techniques
- Potential capabilities, the current state-of-the-art in HDSS and likely future improvements

The underlying basic principles are illustrated by considering:

- A demonstration device
- Interplay between materials properties and device performance
- Tradeoffs between practical and fundamental issues
- Experimental results are shown and related to the use of HDSS in a storage hierarchy Performance limitations are given based on current state-of-the-art components, and compared with the performance of other storage devices

Benefits and Learning Objectives
This course should enable participants to:

- Compare the state-of-the-art in holographic data storage systems with other storage technologies and to identify key development issues

Intended Audience
Course participants are expected to have a BS in engineering, science or physics with two or more years of experience in industry or higher education.

Instructor Biography
Lambertus Hesselink holds a joint appointment as Professor in the Electrical Engineering Department and in the Applied Physics Department at Stanford University. He and his Stanford University team were the first to build a fully digital holographic data storage system in 1996. He was the Principal Investigator of a $53M DARPA/NSIC/Industry/University project on holographic data storage from 1995 till 2000. He has authored or co-authored over 350 papers on optical storage technologies and photonics, and has lectured worldwide on these topics.

Publications

Advance Programs

Authors submitting papers, past meeting participants, and current committee members will automatically receive the *Advance Program.* Other individuals who wish to receive a mailed copy of the *Advance Program* should contact OSA Customer Service.

Technical Digests

The ODS *Technical Digest* will be comprised of the camera-ready summaries of papers being presented during the meeting. At the meeting, each registrant will receive a copy of the *Technical Digest.* Extra copies can be purchased at the meeting for a special price of $45 USD.

Proceedings

Authors are expected to submit a full 6-12 page manuscript for the proceedings volume that will be published by SPIE after the meeting. This is in addition to the summary that is submitted for the Technical Digest. SPIE will contact authors to provide manuscript preparation and submission instructions. Proceedings can be ordered at the time of registration.

Agenda of Sessions

Sunday May 11, 2003

Time	Event
7.00-17.00	Registration *Plaza Foyer*
9.00-13.00	SC101: Introduction to MultiLevel Optical Data Storage *Plaza A*
9.00-13.00	SC102: The Blu-ray Disc Physical Format *Plaza B*
14.00-18.00	SC103: Equalizing Technology for High Density Optical Disk *Plaza A*
14.00-18.00	SC104: Holographic Data Storage Systems *Plaza B*

Monday May 12, 2003

Time	Event
7.00-17.00	Registration/Speaker and Presider Check-In *Plaza Foyer*
8.15-8.30	Opening Remarks *Plaza A-C*
8.30-10.00	**MA:** Systems and Drive Technologies I *Plaza A-C*
10.00-10.30	Coffee Break *Georgia A*
10.30-12.00	**MB:** Super-RENS *Plaza A-C*
12.00-13.30	Lunch Break
13.30-15.15	**MC:** Media I *Plaza Foyer*
15.15-15.45	Coffee Break *Georgia A*
15.45-17.00	**MD:** Mastering *Plaza A-C*
17.30-19.30	Welcoming Reception *34th Floor*
19.30-21.00	INSIC Roadmap Symposium *Plaza A-C*

Tuesday May 13, 2003

Time	Event
7.30-17.00	Registration/Speaker and Presider Check-In *Plaza Foyer*
8.30-10.30	**TuA:** Media II *Plaza A-C*
10.30-11.00	Coffee Break *Georgia A*
11.00-12.30	**TuB:** Coding & Signal Processing

	Plaza A-C
12.30-14.00	Lunch Break
14.00-15.45	**TuC:** 3-D Storage *Plaza A-C*
15.45-16.15	Coffee Break *Georgia A*
16.15-17.15	**TuD:** Near Field *Plaza A-C*
17.30-19.30	**TuE:** Poster Session *Georgia B*

Wednesday May 14, 2003

Time	Event
7.30-17.00	Registration/Speaker and Presider Check-In *Plaza Foyer*
8.30-10.30	**WA:** Components *Plaza A-C*
10.30-11.00	Coffee Break *Georgia A-B*
11.00-12.30	**WB:** Systems and Drive Technologies II *Plaza A-C*
12.30-14.00	Lunch Break
14.00-15.45	**WC:** Postdeadline Papers *Plaza A-C*
15.45-16.15	Coffee Break *Georgia A-B*
16.15-17.15	**WD:** Multilevel *Plaza A-C*
17.15-17.30	Closing Remarks *Plaza A-C*

■ Sunday
■ May 11, 2003

Room: Plaza Foyer
7.00 – 17.00
Registration

■ Monday
■ May 12, 2003

Room: Plaza Foyer
7.00 – 17.00
Registration

Room: Plaza A-C
8.15 – 8.30
Opening Remarks

Room: Plaza A-C
8.30 – 10.00
MA ■ System and Drive Technologies I
I. Ichimura, Sony Corp., Tokyo, Japan, Co-Presider.
R. Katayama, Multimedia Res. Labs., Kawasaki, Japan, Co-Presider.

MA1 8.30 INVITED
Highly miniaturised prototype optica drive for use in portable devices, *M. van der Aa, F. Penning, Philips Res. Labs. Eindhoven, Eindhoven, Netherlands*.
The realisation of a prototype miniaturised 5 mm height optical drive and 28 mm media is reported here. Using the optical light path as a starting point, this presentation will highlight the high degree of miniaturisation that is achieved in the field of the optical pickup, optical components and mechanics. Additionally we will discuss the use of newly developed disc media.

MA2 9.00
PCMCIA like ultra small form factor optical drive, *S. Kim, LG Elec. Inc., Seoul, Republic of Korea.*
A prototype of ultra small optical drive was studied and developed in order to see the feasibility of mobile application, which is targeted to be attachable into the PCMCIA II slot in small mobile devices.

MA3 9.15
Study on 200 Mbps high speed write/read using a phase-change write-once disk, *H. Minemura, CRL, Hitachi, Ltd., Tokyo, Japan.*
We report a 200Mbps write/read test results using a phase-change write-once disk and partial-response maximum-likelihood (PRML) technique.

MA4 9.30
One-laser-two-beam method for twice as high write speed in rewritable phase change optical disks, *T. Shintani, Central Res. Lab., Hitachi Ltd., Tokyo, Japan.*
A new two-beam method is proposed to realise twice as high rewrite speed as in the conventional method with low cost in phase change recording.

MA5 9.45
Push pull readout of multilayer optical disc, *J. Lehureau, J. Colineau, Thales R and T, Orsay, France.*
We have realized a 8 layer optical disc. Push Pull readout gives high signal and low crosstalk despite the 99% tranparency of the disc. Projections are given towards a 64 layer disc.

Room: Georgia A
10.00 – 10.30
Coffee Break

Room: Plaza A-C
10.30 – 12.00
MB ■ Super-RENS
C. Chong, Natl. Univ. of Singapore, Singapore, Singapore, Co-Presider.
T. Milster, Univ. of Arizona, Tucson, AZ, USA, Co-Presider.

MB1 10.30 INVITED
Fourth generation super-RENS disk with metallic nanoparticles and nanowires, *J. Tominaga, Natl. Inst. of Adv. Indust. Sci. and Tech., Tsukuba, Japan.*
We present a promising method of fabricating Ag nanostructures on optical disk and describe the optical nonlinear properties by the multiple local plasmon couplings.

MB2 11.00
Recording and readout properties of super-resolution near-field structure disc with a platinum-oxide layer, *T. Kikukawa, TDK Corp., Saku, Nagano, Japan; H. Fuji, Sharp Corp., Tenri, Nara, Japan; T. Shima, J. Tominaga, Natl. Inst. of Adv. Ind. Sci. and Tech., Tsukuba, Ibaraki, Japan.*
Super-resolution properties of super-resolution near-field structure disc have greatly improved by use of a platinum-oxide layer as a recording/mask layer.

MB3 11.15
23.5 GB disk at 635 nm red laser system using super-RENS technology, *J. Kim, I. Hwang, D. Yoon, I. Park, D. Shin, Samsung Elec., Suwon, Republic of Korea; T. Kikukawa, TDK Corp., Nagano, Japan; T. Shima, J. Tominaga, AIST, Tsukuba, Japan.*
A disk of five-times density as large as a DVD was attempted, and we obtained the CNR of over 47 dB at100 nm mark signals.

MB4 11.30
Optical nonlinearity of silver oxide super resolution structure, *F. Wu, Optical Sciences Ctr., Tucson, AZ, USA.*
Triple layer silver oxide structure is found to exhibit nonlinear absorption that is a function of oxygen content during deposition and laser power during use.

MB5 11.45
Thermal analysis of super-resolution near-field phase change optical disk, *L. Shi, W. Teo, T. Chong, J. Li, Data Storage Inst., Singapore, Singapore.*
Thermal analysis of two new super-resolution near-field disks structures was carried out. The transient thermal processes was analysed and compared with the conventional structure. It was found that the new structures showed better thermal stability.

12.00 – 13.30
Lunch Break

Room: Plaza A-C
13.30 – 15.15
MC ■ Media I
M. Mansuripur, Optical Sciences Ctr., Tucson, AZ, USA, Co-Presider.
D. Shieh, Natl. Chaio Tung Univ., Hsinchu, Taiwan Republic of China, Co-Presider.

MC1 13.30 INVITED
Hybrid recording material candidates for storage densities beyond Tera bit/in^2 - CoCrPt, TbFeCo, Pd/Co, FePt, *N. Ota, Hitachi Maxell Ltd., Yawaramura,Ibaraki, Japan.*
Advantages of Hybrid recording and material candidates like CoCrPt, TbFeCo. Pd/Co and FePt are discussed targeting the recording density beyond Tera bit/in^2**.**

MC2 14.00
15 Gbit/in^2 recording on a DWDD disc using a land/groove substrate with a red laser enabled by a side-wall-annealing process, *T. Miki, S. Kai, Y. Takeshita, G. Fujita, K. Fujiie, Sony Corp., Tokyo, Japan; O. Koyama, Y. Miyaoka, T. Hiroki, Y. Hozumi, M. Kikuchi, T. Shiratori, Canon Inc., Tokyo, Japan.*
We developed a side-wall-annealing technique and realized 15 Gbit/inch^2 using land/groove recording on a DWDD disc with a red laser.

MC3 14.15
Anneal-less DWDD for 15 Gbit/in^2 land-groove recording using a deep groove substrate and a red laser, *T. Sakamoto, Sony Corp., Tokyo, Japan.*
We developed an "anneal-less" DWDD MO having wide system tolerances at 14.1 Gbit/in^2 even with a red laser and a 0.60 NA lens.

MC4 14.30
An inorganic WO disc compatible with Blu-ray format, *K. Yasuda, Sony Corp., Tokyo, Japan.*
We developed an inorganic write once disc of which recording material is SnOxNy. The disc is compatible with Blu-ray Disc format. The jitter value obtained with the limit equalizer was 6% at 25GB user capacity.

MC5 14.45
Dual-layer write-once media for 1x-4x speed recording based on Blu-ray Disc format, *M. Uno, T. Akiyama, H. Kitaura, R. Kojima, K. Nishiuchi, N. Yamada, Matsushita Elec. Ind. Co., Ltd, Osaka, Japan.*
Dual-layer write-once media with Te-O-Pd recording films based on Blu-ray Disc format were shown to have sufficient CNR at recording speed of 1x(5.28m/s) to 4x(21.1m/s), and recording mechanisms were discussed.

MC6 15.00
Inorganic write-once disc with quadruple recording layers for the Blu-ray disc system, *K. Mishima, TDK Corp., Saku, Japan.*
We have developed an inorganic write-once disc with quadruple recording layers. The jitter value of less than 10 % was obtained for each recording layer.

Room: Georgia A
15.15 – 15.45
Coffee Break

Room: Plaza A-C
15.45 – 17.00
MD ■ Mastering
H. Kobori, Toshiba Corp., Kawasaki, Japan, Co-Presider.
N. Miyagawa, Matsushita Elec. Ind. Co. Ltd., Moriguchi, Osaka, Japan, Co-Presider.

MD1 15.45 INVITED
Phase transition mastering for Blu-ray ROM disc, *K. Osato, Sony Corp., Tokyo, Japan.*
Phase Transition Mastering (PTM) has been developed for a 25 GB Blue-ray ROM Disc. The principle and the characteristics will be described in detail.

MD2 16.15
Laser beam mastering of high-density d=1 RLL code ROM disc, *T. Kondo, E. Nakagawa, T. Tsurukubo, T. Ohgo, T. Saito, Victor Co. of Japan, Yokosuka, Japan.*
The paper describes technologies of direct focus servo, high contrast resist material, recording compensation for a system with 266nm laser with NA0.9 objective lens, and readout results of an over 20Gbytes discs.

MD3 16.30
Improvement of near-field mastering with a 266 nm laser, *S. Imanishi, M. Takeda, M. Yamamoto, N. Mukai, K. Takagi, T. Kono, Sony Corp., Tokyo, Japan.*
The performance of a 266 nm near-field mastering process was improved with reducing the aberration of the objective and with the photoresist of low absorption.

MD4 16.45
Electron beam mastering process realizing over 100GB/layer capacity disc, *M. Takeda, M. Furuki, M. Yamamoto, M. Shinoda, K. Saito, Y. Aki, H. Kawase, Sony Corp., Tokyo, Japan; M. Koizumi, T. Miyokawa, M. Mutou, JEOL Ltd., Tokyo, Japan.*
We have demonstrated the capability of 100GB density recording by the electorn beam mastering and Si etching process optimization.

Room: 34th Floor
17.30 – 19.30
Welcome Reception

Room: Plaza A-C
19.30 – 21.00
INSIC Roadmap Symposium

■ Tuesday
■ May 13, 2003

Room: Plaza Foyer
7.00 – 17.00
Registration

Room: Plaza Foyer
8.30 – 10.30
TuA ■ Media II
M. Horie, Mitsubishi Chemical Corp., Yokohama, Japan, Co-Presider.
N. Ohta, Hitachi Maxell, Ltd., Ibaraki, Japan.

TuA1 8.30 INVITED
Photochromic processes for high capacity optical storage, *P. Ramanujam, Riso Natl. Lab., Roskilde, Denmark.*
We describe two photochromic processes in organic thin films for high capacity optical storage in the blue and UV. Both types of storage are stable environmentally.

TuA2 9.00
A model for phase-change process in GeSbTe thin-films used for optical and electrical data storage, *S. Senkader, M. Aziz, D. Wright, Univ. of Exeter, Exeter, United Kingdom.*
We developed a comprehensive model to simulate phase-change in GeSbTe. It is based on rate equations and can successfully simulate crystallization behaviour.

TuA3 9.15
The study of crystallization process of as-deposited amorphous phase change materials by *in-situ* annealing experiments, *Z. Fan, L. Wang, Y. Peng, N. Nuhfer, D. Laughlin, Carnegie Mellon Univ., Pittsburgh, PA, USA; U. Rambabu, H. Shieh, Natl. Chiao-Tung Univ., Hsingchu, Taiwan Republic of China.*
The crystallization process of as-deposited amorphous $Ge_2Sb_2Te_5$ and AgInSbTe thin films is observed by *in-situ* annealing experiments in transmission electron microscope.

TuA4 9.30
Phase change recording media of 20GB capacity for system with 0.6-mm-thick substrate, *N. Ohmachi, A. Ogawa, N. Morishita, N. Nakamura, Core Tech. Ctr., Digital Media Network Co., Toshiba Corp., Yokohama, Japan; K. Yusu, S. Ashida, T. Tsukamoto, K. Ichihara, Corp. Res. and Dev. Ctr., Toshiba Corp., Kawasaki, Japan.*
We have developed phase change media of 20GB capacity for the system with the numerical aperture of 0.65 and light incidence on 0.6 mm-thick substrate.

TuA5 9.45
Dual-layer phase change recording media ror system with NA of 0.65 and light incidence on 0.6-mm-thick substrate, *T. Tsukamoto, S. Ashida, T. Nakai, K. Yusu, K. Ichihara, Corp. Res. and Dev. Ctr., Toshiba, Kawasaki, Japan; N. Ohmachi, N. Morishita, N. Nakamura, Core Tech. Ctr., Digital Media Network Co., Toshiba, Yokohama, Japan.*
The dual-layer phase change recording media of 36GB user data capacity has been demonstrated for system with NA of 0.65 and light incidence on 0.6-mm-thick substrate.

TuA6 10.00
Phase-change disc and dye-material disc using a spin coating for 36 to 100 Mbps recording, *I. Aoki, Samsung Yokohama Res. Inst., Yokohama, Japan.*
A rewritable disc and a dye-type-write-once disc formed by a spin-coating method for a 25 GB-capacity and a 36 to 100 Mbps recording were proposed.

TuA7 10.15
The phase-change optical disc with the data recording rate of 216Mbps, *H. Shingai, TDK Corp., Saku, Japan.*
We have developed a new phase-change material with high crystallization speed and high thermal stability. The jitter value was obtained less than 8% at 216Mbps.

Room: Georgia A
10.30 – 11.00
Coffee Break

Room: Plaza A-C
11.00 – 12.30
TuB ■ Coding & Signal Processing
D. Howe, Optical Sciences Ctr., Tucson, AZ, USA, Co-Presider.
S. Kobayashi, Sony Corp., Tokyo, Japan, Co-Presider.

TuB1 11.00 INVITED
Two-dimensional optical storage, *W. Coene, Philips Res. Lab. Eindhoven, Eindhoven, Netherlands.*
We describe a new concept for two-dimensional optical storage on a 2D hexagonal bit-lattice, based on innovative 2D signal processing, and using a multi-spot read-channel realizing a parallel read-out.

TuB2 11.30
Proposal of signal qualification method for PRML processing system, *T. Nakajima, H. Miyashita, N. Kimura, H. Ishibashi, T. Ishii, Matsushita Elec. Ind. Co., LTD., Kadoma City Osaka, Japan.*
We propose a simple PRML qualification method, calculated from mostly mistakable parts of the played-back signal stream. We confirmed the validity of the qualification method.

TuB3 11.45
New adaptive equalization method for PRML system using sequenced amplitude margin, *T. Okumura, J. Akiyama, S. Maeda, T. Yamaguchi, A. Takahashi, Sharp Corp., Nara, Japan.*
A new adaptive equalization method for partial response maximum likelihood system using sequenced amplitude margin was developed, which could improve tangential tilt margin remarkably.

TuB4 12.00
Parity-check error event post-processor for optical data storage, *J. Liu, H. Song, V. Bhagavatula, Carnegie Mellon Univ., Pittsburgh, PA, USA.*
We present a parity-check error event post-processor for optical data storage and investigate its performance through numerical simulations.

TuB5 12.15
Bit-error-rate performance improvements of three-dimensional modulation codes for imaging page-oriented optical data storage systems, *D. Pansatiankul, Northrop Grumman Space Tech., Redondo Beach, CA, USA; A. Sawchuk, Univ. of Southern California, Los Angeles, CA, USA.*
We present bit-error-rate performance improvements and analyses of three-dimensional modulation codes that overcome intersymbol and interpage interference effects in imaging page-oriented optical data storage systems.

12.30 – 14.00
Lunch Break

Room: Plaza A-C
14.00 – 15.15
TuC ■ 3-D Storage
L. Hesselink, Stanford Univ., Stanford, CA, USA, Co-Presider.
P. Wehrenberg, Apple Computer, Inc., Cupertino, CA, USA, Co-Presider.

TuC1 14.00 INVITED
Novel optical disc storage with polarized collinear holography, *H. Horimai, Optware Corp., Yokohama, Kanagawa, Japan.*
A novel optical disc storage with polarized collinear holography is proposed and demonstrated.

TuC2 14.30
Information storage and retrieval using macromolecules as storage media, *M. Mansuripur, P. Khulbe, M. Giridhar, N. Peyghambarian, Optical Sciences Ctr., Univ. of Arizona, Tucson, AZ, USA; S. Kuebler, J. Perry, Department of Chemistry, Univ. of Arizona, Tucson, AZ, USA.*
To store information at extremely high-density and data-rate, we propose to adapt, integrate, and extend the techniques developed by chemists and molecular biologists for the purpose of manipulating biological and other macromolecules.

TuC3 14.45
New aluminum oxide single crystals for volumetric optical data storage, *M. Akselrod, A. Akselrod, S. Orlov, S. Sanyal, T. Underwood, Landauer, Inc., Stillwater, OK, USA.*
Spectroscopic properties of new aluminum oxide crystals for volumetric optical data storage were investigated. Magnesium impurity and double oxygen vacancy defects are responsible for the main optical properties of the new material.

TuC4 15.00
High density wavelength-multiplexed multilayer recording of microgratings in photopolymers, *S. Orlic, E. Mecher, S. Frohmann, A. Reinicke, P. Kuemmel, D. LIGHT physics GmbH, Berlin, Germany; E. Dietz, M. Trefzer, C. Mueller, R. Schoen, H. Eichler, Inst. of Optics, Tech. Univ. Berlin, Berlin, Germany.*
A novel approach to 3D optical information storage based on writing and reading of microscopic holographic gratings in a photopolymer layer is presented. Wavelength multiplexing combined with multilayer storage results in high storage densities.

Room: Georgia A
15.15 – 15.45
Coffee Break

Room: Plaza A-C
15.45 – 16.45
TuD ■ Near Field
M. O'Neill, Calimetrics, Inc., Alameda, CA, USA, Presider.

TuD1 15.45
High density near field readout over 100 GB capacity using solid immersion lens with NA of 2.05, *M. Shinoda, K. Saito, T. Ishimoto, T. Kondo, A. Nakaoki, M. Furuki, M. Takeda, M. Yamamoto, Sony Corp., Tokyo, Japan.*
We have achieved high density near field readout of a 100 GB capacity (69.5 Gbit/in^2) disc by using a solid immersion lens with numerical aperture of 2.05.

TuD2 16.00
A study of near-field aperture geometries on VSALs, *F. Chen, Data Storage Systems Center, Carnegie Mellon Univ., Pittsburgh, PA, USA.*
We have investigated apertures on VSALs with different geometries using far-field measurements, near-field measurements, and FDTD simulation methods. We have attempted to correlate the relationship between far-field power and near-field power.

TuD3 16.15
Study of high throughput aperture for near field optical data storage, *J. Olkkonen, Univ. Of Arizona, Optical Sciences Center, Tucson, AZ, USA.*
Light transmission through a sub-wavelength width slit in a thin, corrugated silver film was studied via 2D FDTD modeling. Antisymmetric (*a*-mode) SPPs were observed in the configurations that produce high light transmission.

TuD4 16.30
A new optical disk head structure of near-field evanescent wave with writable high power density to a terabyte disk surface using VCSEL, *K. Goto, Tokai Univ., Shizuoka, Japan.*
More than 10 times light power enhancement by surface plasmon on metal grating film using a 30 nm aperture array and microlens array was achieved.

Room: Georgia B
17.00 – 19.00
TuE ■ Poster Session

TuE1
Dual-level inorganic write-once blu-ray disc, *R. Perrier, R. Anciant, MPO, Grenoble, France; M. Armand, Y. Lee, CEA/LETI, Grenoble, France.*
We worked on an inorganic write-once technology based on hole formation and developed a possible stack for a dual level blu-ray disc.

TuE2
The theoretical investigation of characters of SNOM probe operating on TEM wave, *A. Lapchuk, Samsung Electro-Mechanics, Suwon, Democratic People's Republic of Korea.*
The theoretical investigation of spatial resolution, transmission coefficient, field enhancement of scanning near-field optical microscope, operating on TEM wave, has shown that it can be applied in nanoobject spectroscopy and in optical data storage.

TuE3
Phase transition of optical nonlinear AgO_x films for super-resolution near-field recording, *Y. Her, Y. Lan, Natl. Chung Hsing Univ., Taichung, Taiwan Republic of China; W. Hsu, S. Tsai, Materials Res. Lab., ITRI, Hsinchiu, Taiwan Republic of China.*
We have studied the phase transitions of single-layered AgO_x and multi-layered ZnS-SiO_2/AgO_x/ZnS-SiO_2 films prepared at various flow ratios of O_2/(O_2+Ar) between the as-deposited and annealed states.

TuE4
Efficiency of light coupling from a light delivery system to a planar waveguide for optical and hybrid recording heads, *A. Itagi, T. Schlesinger, J. Bain, D. Stancil, Carnegie Mellon Univ., Pittsburgh, PA, USA.*
The efficiency of end-fire coupling between a light delivery system and a planar waveguide for optical/hybrid recording heads is calculated using a mode-matching technique.

TuE5
Confocal one-bit recording and fluorescent readout utilizing aluminum oxide single crystals, *M. Akselrod, S. Orlov, Landauer, Inc., Stillwater, OK, USA.*
Two-photon absorption in new aluminum oxide single crystals is used for recording single bits in multiple layers while one-photon absorption and a confocal fluorescence detection scheme is applied for multilevel data readout

TuE6
Recording of holographic gratings in photochromic Al_2O_3:C,Mg crystals, *M. Akselrod, Landauer, Inc., Stillwater, OK, USA.*
Holographic recording is tested using Al_2O_3:C,Mg crystals. Plane holograms were recorded using 442 nm pulsed laser light from the optical parametric oscillator and were read non-destructively with 442 nm He-Cd laser.

TuE7
Optical nonlinear features and response mechanisms of PtO_2 and $PdO_{1.1}$ masks for optical data storage with super-resolution near-field structure, *Q. Liu, Lab. for Adv. Optical Tech. (LAOTHCH),Natl. Inst. of Adv. Ind. Sci. and Tech. (AIST), Tsukuba, Japan.*
Nonlinear properties and response mechanisms of PtO_2 and $PdO_{1.1}$ mask layers for optical data storage with super-resolution near-field structure were investigated and compared.

TuE8
Blue-violet 2-beam optical head for high-speed recording, *K. Sasaki, JSAP, Tokyo, Japan.*
We have developed a blue-violet 2-beam optical head that remarkably decreases the leaked light from an adjacent beam, and performed high-speed readout of 200Mbps.

TuE9
Ultrafast laser recording in optical near-field for high density optical storage, *W. Wang, M. Hong, D. Wu, Y. Goh, Y. Wu, T. Chong, Data Storage Inst., Singapore, Singapore.*
We have explored a near-field probe recording technology for subwavelength-size binary bit induced by femtosecond laser with the assistance of the near-field scanning microscopy (NSOM).

TuE10
Three dimensional optical storage by use of an ultrafast laser, *M. Hong, S. Huang, D. Wu, L. Van, T. Ong, B. Luk'yanchuk, T. Chong, Data Storage Inst., Singapore, Singapore.*
Ultrafast laser recording for multi-layer optical storage is investigated. With the extremely high light intensity and fluorescent materials as the recording media, bulk optical storage can be achieved with less cross-talk and localized writing.

TuE11
Phase-change optical recording materials based on GeSb, *D. Dimitrov, Materials Res. Labs., Chutung, Hsinchu, Taiwan Republic of China.*
GeSb based materials are investigated for phase-change optical recording. Physical properties and amorphization/crystallization behavior are determined. Recording characteristics are measured on DVD disks.

TuE12
Ultrafast photonic interface for storage networking using serial-to-parallel and parallel-to-serial conversion, *H. Suzuki, R. Takahashi, T. Nakahara, H. Takenouchi, K. Takahata, T. Yasui, N. Kondo, J. Yumoto, NTT Photonics Labs., Kanagawa, Japan.*
A novel ultrafast photonic interface is proposed for storage networking based on all-optical serial-to-parallel and photonic parallel-to-serial conversion with a >100 Gbit/s potential bandwidth.

TuE13
Scanning probe based storage on phase change media, *O. Bichet, S. Gidon, CEA Grenoble - Leti, Grenoble, France; Y. Samson, CEA Grenoble - DRFMC, Grenoble, France.*
We present an ultra high density data storage technique based on conductive AFM on phase change media. A dedicated stacking has been developed to insure the stability of the written marks.

TuE14
Thermal simulation for two-dimensional near field optical recording system using VCSEL, *K. Kurihara, Dept. of Physics, School of Science, Tokai Univ., Shizuoka, Japan; K. Nanri, Dept. of Physics, School of Science, Tokai Univ., Kanagawa, Japan; K. Goto, Dept. Info. & Comm., Tech. School of High-Tech. for Human Welfare, Tokai Univ., Shizuoka, Japan.*
To realize the optical memory using the VCSEL of 1mW, the new head is proposed and calculated. The calculation result was achieved to record by using mechanisms of plasmon resonance enhancement and thermal conduction.

TuE15
Electro-thermal process for probe storage on phase-change media, *M. Armand, D. Wright, M. Aziz, Univ. of Exeter, Exeter, United Kingdom.*
A model of the electro-thermal writing process, applied to a probe storage technique on a phase-change media, is presented. The analysis is based on the resulting current flow and temperature distribution.

TuE16
Substrate deformation studies on Direct-Overwriting (DOW) of phase-change rewritable optical disc, *P. Tan, Data Storage Inst., Singapore, Singapore.*
We have studied the deformation of polycarbonate substrate during DOW process of phase-change optical disc. This deformation was one of the factors, which reduced the overwriting cycle.

TuE17
Interaction of light with subwavelength structures in optical storage media, *A. Zakharian, J. Moloney, Dept. of Mathematics and Optical Sciences Ctr., Tucson, AZ, USA; M. Mansuripur, Optical Sciences Ctr., Univ. of Arizona, Tucson, AZ, USA.*
The Finite Difference Time Domain (FDTD) method is applied to problems in optical storage involving interaction between a focused beam of light and subwavelength pits and apertures in thin films on transparent substrates.

TuE18
Capacity improvement in omaging page-oriented optical data storage using 2-D modulation and iterative detection, *N. Intharasombat, A. Sawchuk, Univ. of Southern California, Los Angeles, CA, USA.*
We describe modulation and iterative detection techniques that improve the usable density and capacity of page-oriented optical data storage systems while maintaining acceptable bit-error rates.

TuE19
A novel method for tracking in homogeneous volumetric media, *T. Miller, J. Butz, T. Milster, Optical Sciences Ctr., Univ. of Arizona, Tucson, AZ, USA.*
We describe a novel method of tracking inside homogeneous volumetric optical storage media, compare possible instrument configurations, and present prototype results.

TuE20
Optical storage media using dye-doped minute spheres arranged on surface relief structure, *N. Kobayashi, Shizuoka Univ., Hamamatsu, Japan.*
We propose a new optical storage media using minute spheres arranged on surface relief grating. The media is expected to achieve high density and high resolution data storage.

TuE21
Dependence of recording density on Al underlayer thickness in laser-assisted magnetic recording media, *J. Sato, K. Takayama, S. Miyanishi, H. Fuji, K. Kojima, A. Takahashi, K. Ohta, Sharp Corp., Nara, Japan.*
We investigated the effect of an Al underlayer thickness from the viewpoint of a read/write performance. We found that even a 1 nm Al underlayer induces magnetic pinning sites which improve the high-density recording capability.

TuE22
Simple gap control structure in probe type head through frequency response separation scheme, *S. Lee, Elec. and Telecom. Res. Inst., Taejon, Republic of Korea.*
Simple gap control using only an actuator for z-directional regulating and resonating the tip to measure tip-media distance in non-contact probe type data storage head is proposed.

TuE23
Implementation of a micro optical pickup using a focusing grating coupler, *M. Paek, Elec. and Telecom. Res. Inst. (ETRI), Daejeon, Republic of Korea.*
A focusing waveguide grating coupler was implemented for a an ultra-small size optical head. The focal length and the numerical aperture of the grating coupler were 530nm and 0.92 for 632.8nm He-Ne red laser.

TuE24
Uniform illumination with a band-limited diffuser in volume holographic storage system, *L. Cao, Q. He, H. Wei, M. Wu, G. Jin, State Key Lab. of Precision Measurement Techn. and Instruments, Beijing, China.*
Uniform illumination on the object plane is achieved by using a band-limited diffuser. Vibrating the diffuser reduces speckle noise and smoothes the spectrum for storage.

TuE25
Ultrafast reversible phase transitions in GeSbTe films triggered by femtosecond laser pulse, *Q. Wang, Data Storage Inst., Singapore, Singapore.*
The ultrafast reversible crystalline and amorphous phase transitions in thin Ge1Sb2Te4 films triggered by femtosecond laser pulse were studied by reflectivity measurement and optical microscope.

TuE26
Study of wavelength deviation model of DBR-SHG laser system, *H. Senga, K. Kasazumi, H. Ishibashi, Matsushita Elec. Ind. Co., LTD., Kadoma, Japan; K. Orita, Matsushita Elec. Ind. Co., LTD., Takatsuki, Japan.*
The behavior of the light modulated DBR-SHG laser was cleared by the model that wavelength deviation was caused by thermal effect and plasma effect.

TuE27
Three-dimensional $(FD)^2TD$ analysis of light-beam scattering and detected signal characteristics from land/groove phase-change optical disk structures, *T. Kojima, Kansai Univ., Suita-shi, Japan.*
We treat three-dimensional frequency-dependent FDTD method analysis of the light-beam scattering from a land/groove recording phase-change optical disk model with a metal reflective layer.

TuE28
High-density optical disk structure analysis with finite-difference time-domain (FDTD) method, *J. Li, L. Shi, K. Lim, X. Miao, R. Zhao, T. Chong, Data Storage Inst. (DSI), Singapore, Singapore.*
A method for high-density optical disk structure design using computational electromagnetic FDTD analysis is proposed. The land-groove structures of phase-change optical disk with blue laser and high-NA system are investigated.

TuE29
Initialization-free multi-speed phase-change optical disk, *X. Miao, L. Shi, P. Tan, X. Hu, H. Yao, J. Li, T. Chong, Data Storage Inst., Singapore, Singapore.*
The initialization-free phase-change optical disk was proposed as a candidate for multi-speed recording. Experiment results of the initialization-free DVD-RAM disk showed that the initialization-free disk was compatible with a broad range of recording speed.

TuE30
Effective design and new measuring method of small size MO coil, *H. Jung, LG Elec. Digital Media Res. Lab, Seoul, Republic of Korea.*
This paper presents the new MO coil design scheme and the new measuring method for the magnetic field intensity of the MO coil.

TuE31
Changes in the local structure of $Ge_2Sb_2Te_5$ upon reversible crystallization-amorphization, *A. Kolobov, AIST, Ibaraki, Japan.*
Local structure of GST in a real device has been studied by EXAFS at K-edges of all constituent elements. Results of concurrent multi-edge analysis are discussed.

TuE32
Blue-violet laser write-once optical disc with spin-coated dye-based recording layer, *Y. Usami, T. Kakuta, T. Ishida, H. Kubo, Fuji Photo Film Co., Ltd, Odawara, Kanagawa, Japan; N. Saito, Fuji Photo Film Co., Ltd, Fujinomiya, Shizuoka, Japan; T. Watanabe, Fuji Photo Film Co.,Ltd, Ashigara, Kanagawa, Japan.*
Recording capacities of 23.3GB achieved on a blue-violet laser write-once optical disc with spin-coated dye-based recording layer.

TuE33
Substrate for ultra small optical disks, *J. Kim, Devices and Materials Lab., LG Elite, Seoul, Republic of Korea.*
Injection molded substrates for ultra small optical disks using polyetherimide were prepared and their mechanical properties were investigated.

TuE34
Optical head with single-beam writing and multi-beam retrieving using a liquid crystal diffractive optical element, *H. Shih, Natl. Chung Hsing Univ., Dept. of Mech. Eng.,Taichung, Taiwan Republic of China.*
This paper proposes the design of an optical head with single-beam writing and multi-beam retrieving by using a liquid crystal diffractive optical element.

TuE35
Optimal power control procedure for all optical disc types, *T. Van Endert, Philips Optical Storage, Eindhoven, Netherlands.*
The proposed Optimal Power Control (OPC) method based on jitter measurements is disc information independent, fast, space efficient and can be used for all disc types.

TuE36
Multiplex coding in 2-D optical correlation for high density signal processing, *B. Benkelfat, Inst. Natl. des Télécom., Evry Cedex, France.*
We report the application of coherence modulation in two-dimensional multichannel processing. The system is described and experimental results in two-channel shadow casting correlator are presented.

TuE37
High NA focusing grating coupler using blue laser, *Y. Sohn, Y. Park, D. Suh, H. Ryu, M. Paek, Elec. and Telecom. Res. Inst., Daejeon, Republic of Korea.*
A focusing grating coupler of a high NA (0.55) operating at the wavelength of 400 nm was characterized. The measured spot size was 0.45 μm that is 1.04 times the diffraction limit of the beam.

TuE38
Characterization of a three dimensional bit wise volumetric storage media in a space environment, *Y. Zhang, M. Tom, Optical Science Ctr., Tucson, AZ, USA.*
We report playback performance results after exposure to a simulated space environment of three-dimensional volumetric storage disks, which are made from a new class of light-absorbing (photo-chromic) compounds.

TuE39
A new test stand for dynamically testing coupon samples, *Y. Zhang, T. Milster, Optical Science Ctr., Tucson, AZ, USA.*
A new dynamic test stand is being built to test coupon samples. An unconventional rotating head, fixed sample design is employed.

TuE40
Readout measurement using high throughput GaP probe for two-dimensional optical data storage system, *K. Endo, M. Takai, K. Goto, K. Kurihara, Tokai Univ., Numazu, Shizuoka, Japan.*
The signal to noise radio was evaluated as 15.6dB by using the GaP probe of 200nm aperture size with 3% high optical throughput.

TuE41
Recording of Multi-Level Run-Length-Limited (ML-RLL) modulation signals on phase-change optical discs, *K. Wu, D. Howe, Optical Sciences Ctr., Tucson, AZ, USA; S. Tsai, Ind. Tech.Res. Inst., Hsinchu, Taiwan Republic of China.*
Writing and reading of 3-level ML-RLL modulation signals on two different write-once phase change materials is discussed. These recordings represent a linear storage density enhancement of 50% Vs conventional (2-level) RLL modulation.

■ Wednesday
■ May 14, 2003

Room: Plaza Foyer
7.00 – 17.00
Registration

Room: Plaza A-C
8.30 – 10.30
WA ■ Components
C. Chung, Samsung Elec. Co., Ltd., Suwon City, Kyongsang, Republic of Korea, Co-Presider.
E. Schlesinger, Carnegie Mellon Univ., Pittsburgh, PA, USA, Co-Presider.

WA1 8.30 INVITED
Optical MEMS technology for high-density optical storage, *K. Hane, Tohoku Univ., Sendai, Japan.*
An optical data storage system based on the near-field technology is proposed. Micro-fabrication technique for the three-dimensional structure has been developed.

WA2 9.00
New 3-axis optical pickup actuator for high-density rewritable system, *I. Choi, LG Elec. Inc., and LG Elec. Inc. Digital Media Res. Lab. DCT, Seoul, Republic of Korea.*
We present a new 3-axis optical pickup actuator to compensate for the tilt variation of an optical disc in high density rewritable system.

WA3 9.15
3-axis slim actuator with a hybrid bobbin for heat dissipation, *Y. Cheong, J. Lee, K. Kim, Samsung Elec., Suwon, Republic of Korea.*
We proposed new type high sensitive 3-axis slim pickup actuator with the magnesium-inserted hybrid bobbin for stiffness improvement and heat dissipation at high temperature.

WA4 9.30
Ultra small optical pick-up module, *S. Kim, S. Lee, LG Elec. Inst. of Tech., Seoul, Republic of Korea; Y. Kim, M. Lee, J. Kim, Digital Media Lab., Seoul, Republic of Korea.*
We have developed a small optical pick-up module within its dimension of 3.0X3.0X5.5mm by integrating refractive and diffractive optical elements with laser diode and photo diodes assembly.

WA5 9.45
Radial tilt detection for blue DVD-ROM/R/Rewritable disks, *R. Katayama, Y. Komatsu, NEC Corp., Kawasaki, Japan.*
An improved radial tilt detection method using a 5-beam optical head is proposed and demonstrated for the blue DVD read-only, recordable and rewritable disks.

WA6 10.00
Phase shift element for Blu-ray Disc/DVD compatibility, *K. Koike, Pioneer Corp., Tsurugashima-shi, Japan.*
The concept of the optical design and the experimental results of the Phase Shift Element for Blu-ray Disc and DVD compatibility are described.

WA7 10.15
Analysis of chromatic aberration of single objective lens and correction of that of a NA=0.85 objective lens, *M. Itonaga, F. Ito, T. Saito, Victor Co. of Japan, Ltd., Yokosuka, Japan.*
The chromatic aberration of single lenses is analyzed by using paraxial theory. Thicker lenses showed better performances not only chromatic aberration but also other performances.

Room: Georgia A
10.30 – 11.00
Coffee Break

Room: Plaza A-C
11.00 – 12.30
WB ■ Systems and Drive Technologies II
C. Liedenbaum, Philips Res. Lab., Eindhoven, Netherlands, Co-Presider.
T. Shimano, Hitachi Ltd., Tokyo, Japan, Co-Presider.

WB1 11.00 INVITED
A basic concept for next generation DVD: 0.6mm substrate disk technology using violet LD, *T. Sugaya, Toshiba, Yokohama, Japan.*
Image compression technology, applications and their storage size, and high density high capacity technology are discussed from the viewpoint of advantages for users and disk manufactures.

WB2 11.30
Analyses for design of drives and disks for dual-layer phase change optical disks, *T. Shintani, T. Maeda, T. Ariyoshi, H. Miyamoto, A. Hirotsune, Y. Anzai, M. Terao, Central Res. Lab., Hitachi Ltd., Tokyo, Japan.*
Designs of drives and disks for dual-layer optical disks are discussed based on a newly proposed theoretical model to estimate the layer cross talk approximately.

WB3 11.45
A zero-field MAMMOS recording system with a blue laser, NA=0.95 lens, fast magnetic coil and thin cover layer, *F. Zijp, R. Vullers, H. van Kesteren, M. van der Mark, B. van Someren, C. Verschuren, Philips Res., Eindhoven, Netherlands.*
A 10 micron free working distance recording head for blue, cover-layer incident MO recording has been developed with NA=0.95 and integrated high bandwidth MFM coil. ZF-MAMMOS recording experiments are described.

WB4 12.00
Dynamic copy window control in RF-MAMMOS readout, *C. Verschuren, A. Immink, M. Blüm, Philips Res., Eindhoven, Netherlands.*
A method is proposed to accurately control the MAMMOS copy window based on the reproduced signals, thus solving the readout power margin problem.

WB5 12.15
Front surface MO recording over 17 Gbit/in^2 and its prospect for double density, *K. Shono, T. Kaminura, T. Tanaka, Fujitsu Labs. Ltd., Akashi, Japan.*
Front surface recording over 17Gbit/in^2 was demonstrated for a normal MO media using blue laser optics with high NA lens. The prospect for the double density is discussed, assuming domain expansion media.

12.30 – 14.00
Lunch Break

Room: Plaza A-C
14.00 – 15.45
WC ■ Postdeadline Papers
V. Bhagavatula, Carnegie Mellon Univ., Pittsburgh, PA, USA, Co-Presider.
H. Kobori, Toshiba Corp., Kawasaki, Japan, Co-Presider.

Room: Georgia A
15.45 – 16.15
Coffee Break

Room: Plaza A-C
16.15 – 17.15
WD ■ Multilevel
D. Strand, Energy Conversion Devices Inc., Rochester Hills, MI, USA, Presider.

WD1 16.15 INVITED
Multi-level optical recording using a blue laser, *Y. Kadokawa, A. Shimizu, K. Sakagami, K. Takeuchi, H. Maekawa, K. Takatsu, RICOH Co., Ltd., Tsuzuki-ku, Yokohama, Japan.*
Coupling Data Detection using Pattern Recognition (DDPR) with LSB Limited Modulation (LLM) was effective to reduce data errors in a blue laser optical disc system.

WD2 16.45
Comparison of multilevel runlength and fixed-length modulation for optical disc storage, *E. Licona, S. McLaughlin, Georgia Inst. of Tech., Atlanta, GA, USA.*
This paper compares fixed and variable length marks for multilevel recording
and gives the relative advantages and disadvantages of both.

WD3 17.00
Enabling multilevel modulation through adaptive channel linearization, *D. Lee, D. Warland, G. Lewis, J. Stinebaugh, Calimetrics, Inc., Alameda, CA, USA.*
Precompensation and postcompensation, enabling Calimetrics' technologies for multilevel ML^{TM} recording and readback that adaptively linearize the native nonlinear recording channel, are described.

Room: Plaza A-C
17.15 – 17.30
Closing Remarks