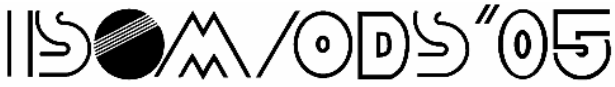
Advance Program



International Symposium on Optical Memory and Optical Data Storage

Topical Meeting and Tabletop Exhibit

July 10-14, 2005
Hyatt Regency Waikiki
Honolulu, Hawaii

Postdeadline Paper Submission Deadline:
June 10, 2005 noon EDT
Pre-Registration Deadline: June 10, 2005
Hotel Reservation Deadline: June 10, 2005

Sponsored by:
Optical Society of America
IEEE/Lasers and Electro-Optics Society
The International Society for Optical Engineering
The Japan Society of Applied Physics
The Magnetics Society of Japan
Optoelectronic Industry and Technology Development Association

In Cooperation with:
The Institute of Electronics, Information and Communication Engineers
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The Institute of Electrical Engineers of Japan
The Institute of Image Electronics Engineers of Japan
The Institute of Image Information and Television Engineers
The Japan Society of Precision Engineering
The Laser Society of Japan

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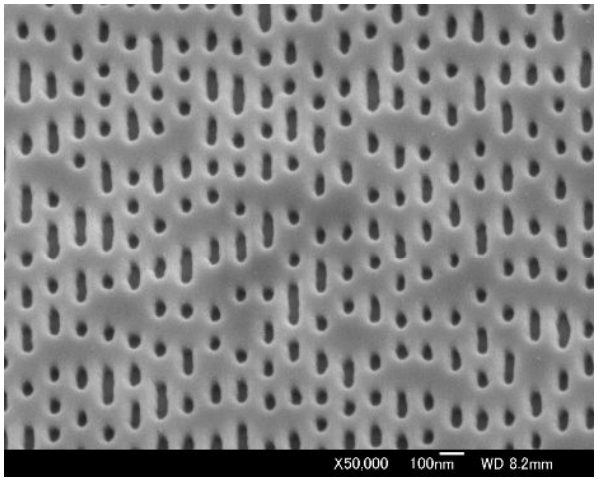
Foreword

This conference will provide an opportunity for exchanging information on the status, advances and future directions in the field of optical memory and optical data storage. In 2003 and 2004, high-density recording systems using blue lasers were introduced to the commercial market. For the next-generation systems, several alternatives such as holographic, three-dimensional, multi-level, near-field, hybrid and super-resolution technologies will be the main focus at ISOM/ODS 2005. Contributions are also encouraged from theoretical studies which play an important role in further developing these technologies.

Scope

Topics to be covered:

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



Invited Speakers

Characteristics and Limitations of Multi-Layered Optical Memories, *Tom D. Milster, Univ. of Arizona, USA*

Optical ROM Card System Based on the Talbot Effect (The T-ROM System), *Christopher Busch, Philips Res., The Netherlands*

High Density Near Field Optical Disc System, *Masataka Shinoda, Sony Corp., Japan*

Experimental Study on Multiplexing Methods for Volume Holographic Memory, *Hisayuki Yamatsu, Sony Corp., Japan*

A Novel Two-Photon Absorption Optical Recording Technology, *Rene Hamer, Mempile Drive Development Ctr., USA*

Energy Gap Induced Super Resolution (EG-SR) Optical Disc Using ZnO Thin Film, *Nobuyuki Takamori, Sharp Corp., Japan*

An Integrated Catadioptric Pick-Up with Ferrofluidic Cooling Structure, *Kazutoshi Onozawa, Matsushita Electric Industrial Co., Ltd., Japan*

Spin Stand Heat Assisted Magnetic Recording Experiments Using Near Field Waveguide Optics Fabricated on AlTiC Sliders, *Tim Rausch, Seagate Res., USA*

Near-Field Recording on Cover-Layer Protected Discs, *Coen Verschuren, Philips Res., The Netherlands*

Collaboration in 3-D Augmented and Virtual Environments — Beyond the Barrier of Distance, *Hong Hua, Univ. of Arizona, USA*

DVD RW High Speed Recording, *Hans Spruit, Philips Optical Storage, The Netherlands*

HD DVD Disc Manufacturing Process Development, *Masato Otsuka, Memory-Tech Corp., Japan*

Short Courses

Four Short Courses are planned for July 10, 2005.

8:30a.m.-12:30p.m.
SC248: Holographic Storage: Advanced Media and Systems
Lambertus Hesselink, Stanford Univ., USA
SC249: Plasmonics & Super-RENS
Din Ping Tsai, Natl. Taiwan Univ., Taiwan
Junji Tominaga, AIST, Japan
1:30p.m.-5:30p.m.
SC250: SIL-Based Near-Field Optical Data Storage: New Developments Toward Practical Systems
Tom D. Milster, Univ. of Arizona, USA
Coen A. Verschuren, Philips Res., The Netherlands
SC251: Partial Response Maximum Likelihood (PRML) Principles and Technologies for Optical Data Storage
Vijayakumar Bhagavatula, Carnegie Mellon Univ., USA

SC248: Holographic Storage: Advanced Media and Systems

Lambertus Hesselink, Stanford Univ., USA

Course Description

This short course addresses fundamental principles and issues pertaining to digital holographic data storage (DHDS). First we begin with a discussion of fundamental principles of holography, including the superposition of plane waves to form a thick diffraction grating, diffraction from such a grating, and the conditions under which diffraction is optimized. We present the Bragg effect as the key to superimposing multiple holograms inside the recording medium to achieve high densities. Several optical multiplexing techniques are discussed including angular, wavelength and phase encoding.

Next we discuss recording properties of two types of media, thin film photopolymers and thick photorefractive media. We describe the underlying physical principles of the photorefractive effect, methods for long term data storage including temperature and two-photon fixing, and noise effects that affect system performance. The recording and fixing properties of thin film photopolymer materials are described including free radical and CROP type media, as well as their mechanical properties as they affect holographic data storage.

Digital channel coding and error correction schemes are discussed in the context of holographic data storage. Emphasis is placed on techniques that are optimized for two-dimensional or paged based storage systems. Examples of different coding techniques are given and performance is analyzed in terms of capacity as a function of code rate.

Two different experimental architectures are discussed in detail, the thin film polymer based systems, typically in a rotating disc format, and the no-moving parts implementations of thick photorefractive crystals. Examples will be discussed of an extremely fast access storage implementation using a-o modulators providing data access in a few microseconds, and an ultra-fast disc based storage system having a transfer rate of over 15 Gbit/sec.

Finally, optimization of system performance and practical implementations developed under the DARPA sponsored PRISM and HDSS consortia will be reviewed. We will conclude with updates on the latest reported performance specifications of various HDS implementations around the world.

Benefits and Learning Objectives

This course should enable you to:

- Explain and use the basic principles of DHDS;
- Determine performance of DHDS systems based on established criteria;
- Design basic DHDS systems for use with photopolymer and photorefractive media;
- Compare various literature papers related to DHDS;
- List the key issues and tradeoffs in DHDS design;
- Summarize the latest results in DHDS performance; and
- Compare DHDS against conventional optical data storage systems.

Intended Audience

This course is intended for engineers and scientists interested in high density optical data storage systems. Attendees are expected to have a Bachelors degree in engineering or science, or equivalent experience, and to have familiarity with optics concepts and optical storage systems. Rudimentary knowledge of holography or holographic recording materials is helpful, but not required.

Instructor Biography

Professor Hesselink received his Ph.D. from Caltech, and is a Professor in electrical engineering and applied physics at Stanford University. He is a world leader in optical data storage research, nano-photonics, scientific visualization, and 3-D imaging, among others. He has presented over 200 invited presentations at scientific meetings, was an organizer of over 100 scientific meetings, he has written over 350 papers in scientific journals, was an editor of Applied Optics, Applied Scientific Research, IEEE Transaction on Visualization, and has over 61 patents and pending patents, and he was a visiting Professor in China, Europe, and has graduated over 35 Ph.D. students. He has received numerous awards from scientific and professional societies, including a Fulbright scholarship, the Stheeman Price, a DARPA Technology award, and an NSIC award. He is Fellow of the OSA and the SPIE, and a member of the Royal Dutch Academy of Arts and Sciences.

He was the Principal Investigator of the DARPA/NSIC/Industry $52M Photorefractive Information Storage Media (PRISM) and Holographic Data Storage Systems (HDSS) consortium from its inception in 1994 till 2000. His group at Stanford University developed the first digital holographic data storage system in 1994.

Professor Hesselink has also founded two start-up companies.

SC249: Plasmonics & Super-RENS

Din Ping Tsai, Natl. Taiwan Univ., Taiwan
Junji Tominaga, AIST, Japan

Course Description

The study of super-resolution near-field structure (super-RENS) has recently attracted many research engineers and scientists in the world because of obtaining an extremely small resolution by only a few modifications in DVD optical disc systems. Localized plasmons and optical nonlinear films enabled to resolute 50-nm marks with more than a CNR of 40 dB in the last ISOM and ODS. In this short course, the background of plasmonics and basic properties of plasmons generated in Sb and AgOx films will be discussed in part-1 by Prof. D. P. Tsai, followed by up-to-date plasmonics devices. In part 2, the detailed systems and mechanisms of super-RENS will be presented by Professor J. Tominaga. Each will be followed by a question and answer period.

Course Contents

Part-1

1. Background of optical diffraction
2. The conditions to generate SPP and LSPP (ATR, grating)
3. The history of NFR by SNOM
4. Relationship between an aperture shape and mark image
5. Characteristics of thin film: Sb and AgOx
6. FDTD computer simulation
7. Comparison between simulation and experimentals
8. Methods to concentrate SPP and LPP by hole array in Ag metal thin film

Part-2

1. Background of super-RENS
2. Role of thin film and its large optical nonlinearity
3. Combination of the thin film with recording mark
4. Super-RENS characteristics with Sb
5. Super-RENS characteristics with AgOx
6. Super-RENS characteristics with PtOx
7. Mechanism - How do several phase-change matertials show the large signal enhancement?

8. Contribution of LSPP of Ag nanoparticles to signal enhancement

Benefits and Learning Objectives
This course is designed to enable you to:

- Analyze the physical and optical differences in between a flying head system with near-field optical probes and a super-RENS disc; and
- Discuss 1TB optical memory.

Intended Audience
Attendees should have at least a background of physics, optics or material science at an undergraduate level.

Instructor Biography
Din Ping Tsai is a professor at the Center of Nanostorage Research and Department of Physics, National Taiwan University, Taiwan. He is the chair of SPIE Taiwan chapter. He is a Fellow of SPIE, Senior Member of IEEE, and Member of OSA and AVS. He is a member of the board of Optical Engineering Society and Nano Industry Promotion Association of Taiwan.
Professor Junji Tominaga is director of the Center for Applied Near-Field Optical Research at the National Institute of Advanced Industrial Science and Technology (AIST), Japan. He has been appointed as professor of Tokyo Denki University and visiting professor of Cranfield University, UK.

SC250: SIL-Based Near-Field Optical Data Storage: New Developments Toward Practical Systems

Tom D. Milster, Univ. of Arizona, USA
Coen A. Verschuren, Philips Res., The Netherlands

Course Description

In part I of the course, Prof. Milster will present the background and theory of solid immersion lens (SIL)-type near-field optical data storage. Topics to be discussed include:

- Introduction to near-field recording using SILs
- Geometrical characteristics of SILs
- Physical optics characteristics of SILs
- Theory of data readout and gap control

In part II, Dr. Verschuren will address the main aspects involved in realizing a practical near-field recording (NFR) system. Topics to be discussed include:

- Working examples of very high NA (1.4 – 2.0) lenses: design, manufacturing and testing
- Near-field set-up with an actuated SIL: light path, optical components and control signals, in particular for gap control
- Gap servo system: outline (approach, pull-in, gap control), potential and limitations, experimental results
- Recording: gap signal normalization, chromatic aberration, experimental results

Benefits and Learning Objectives

This course should enable you to:

- Review SIL technology for data storage;
- Discuss the geometrical characteristics of a SIL system;
- Understand the effects of evanescent and propagating near-field energy;
- Describe the principles of data readout and gap control with SILs;
- Summarize design and manufacturing considerations for very high NA near-field lenses;
- Discuss the basic layout of a near-field light

path and its components; and
- Describe an NFR gap servo system.

Intended Audience
This course is intended for students with a degree in physics or electronics, or equivalent. Some familiarity with conventional optical data storage systems like CD and DVD is recommended, but not required.

Instructor Biography
Prof. Tom D. Milster is a Research Professor in the Optical Sciences Center at the University of Arizona in Tucson, Arizona. His work involves studying the physical optics effects of high performance optical systems, like those used in optical data storage and lithography. For example, he did pioneering work on differential optical servo systems, data detection using magnetic circular dichroism and lens design for volumetric memories. He has also been very active in studying the properties of near-field scanning optical microscopes. More recently, he has developed a theory and simulation technique to explain the interaction of a focused laser beam and evanescent gaps, like the ones used with solid immersion lenses (SILs). An extreme ultraviolet spectrometer designed by Milster was part of the scientific package that flew in the space shuttle with Sen. John Glenn. Prof. Milster holds four U.S. Patents and has published well over 100 scientific articles. He is active in organizing professional society meetings, like ODS and ISOM. He is a Fellow of both SPIE and OSA.
Dr. Coen A. Verschuren, of Philips Research, The Netherlands, has a broad experience in optical data storage, ranging from materials science and disc manufacturing to thermal, optical and magnetic modeling, from signal processing to recorder experiments. Previous topics he worked on are a-o magneto-optical superresolution, including work on optical sliders and 30+ GB on Blu-ray Disc. His last 2 years have been dedicated to NFR. He is author and co-author of several key papers on NFR, including 3 invited papers at major international conferences (ODS'04, APDSC'04, ISOM/ODS'05), and holds 2 U.S. Patents with over 40 Patents pending.

SC251: Partial Response Maximum Likelihood (PRML) Principles and Technologies for Optical Data Storage

Vijayakumar Bhagavatula, Carnegie Mellon Univ., USA

Course Description

As recording densities in optical data storage systems increase, read channels must cope with increased intersymbol interference (ISI) and decreased signal-to-noise ratio (SNR). ISI, in theory, can be completely eliminated, but this leads to noise amplification and significant reduction in SNR. A practical alternative is to employ partial response (PR) equalization that aims at *controlling* the ISI instead of eliminating it. Since PR equalization does not try to eliminate ISI, it does not amplify the noise significantly. Since PR methods lead to known ISI patterns, optimal data detection can be achieved using maximum likelihood (ML) techniques such as Viterbi Algorithm (VA). In this course, we will discuss the basics of PRML and illustrate how PRML can be applied to optical data storage.

Benefits and Learning Objectives

This course will enable you to:

- Quantify the advantages of using PRML approaches;
- Evaluate various partial response (PR) targets for optical data storage channels;
- Design equalizers capable of achieving the desired PR targets;
- Apply Viterbi algorithm to implement the maximum likelihood data detection;
- Quantify the performance of PRML systems using appropriate performance criteria; and
- Learn how PRML approaches being suggested for advanced optical data storage systems.

Intended Audience

Engineers, scientists and managers who need to understand the advantages and implications of PRML for optical data storage. Basic knowledge in signals and systems and probability theory and random variables will be assumed and any additional necessary background will be provided.

Instructor Biography

Vijayakumar Bhagavatula is a Professor and the Acting Department Head of Electrical and Computer Engineering at Carnegie Mellon University in Pittsburgh, USA. He also leads the data channels effort at the Data Storage Systems Center (DSSC) at Carnegie Mellon University. His research interests include pattern recognition methods and coding and signal processing for data storage systems. He has authored or co-authored about 350 technical papers. He is a Fellow of the Optical Society of America and a Fellow of SPIE.

Agenda of Sessions

Monday, July 11

8:30am-8:40am	Opening Remarks	
8:40am-9:00am	Keynote Session	
9:00am-10:30am	MA	Systems & Applications
10:30am-11:00am	Coffee Break	
11:00am-12:45pm	MB	Holographic Recording I
12:45pm-2:15pm	Lunch Break	
2:15pm-4:30pm	MC	Bitwise Volumetric Recording
4:30pm-5:00pm	Coffee Break	
5:00pm-6:30pm	MP	Poster Session I
6:30pm-8:00pm	Dinner Break	
8:00pm-9:30pm	PD	Post Deadline Oral Session

Tuesday, July 12

8:30am-10:30am	TuA	Components I
10:30am-11:00am	Coffee Break	
11:00am-1:00pm	TuB	Coding & Signal Processing
1:00pm-5:00pm	Afternoon Break	
5:00pm-7:00pm	TuC	Drive Technologies
7:00pm-9:00pm	Reception	
8:00pm-9:30pm	TuP	Poster Session II

Wednesday, July 13

8:30am-10:30am	WA	Media I
10:30am-11:00am	Coffee Break	
11:00am-1:00pm	WB	Components II Testing & Modeling
1:00pm-2:30pm	Lunch Break	
2:30pm-4:30pm	WC	Near Field I
4:30pm-5:00pm	Coffee Break	
5:00pm-6:30pm	WP	Poster Session III
6:30pm-8:00pm	Dinner Break	
8:00pm-9:30pm	Panel Discussion	

Thursday, July 14

8:30am-10:30am	ThA	Near Field II High Density/High Speed Recording
10:30am-11:00am	Coffee Break	
11:00am-1:00pm	ThB	Super Resolution
1:00pm-2:30pm	Lunch Break	
2:30pm-4:30pm	ThC	Media II
4:30pm-5:00pm	Coffee Break	
5:00pm-7:00pm	ThD	Holographic Recording II
7:00pm-7:20pm	Awards Ceremony Closing Remarks	

Technical Program

Monday, July 11

8:30am-08:40am
Opening Remarks
(Mauka and Maloko Ballrooms)

8:40am-9:00am
Keynote Session
(Mauka and Maloko Ballrooms)
Presiders: Ryuichi Katayama, NEC Corp., Japan; Ed Schlesinger, Carnegie Mellon Univ., USA

ISOM Optical Storage Roadmap
Teruo Murakami, ISOM Steering Committee Chair, Japan

9:00am-10:30am
Session MA: Systems & Applications
(Mauka and Maloko Ballrooms)
Presiders: Ryuichi Katayama, NEC Corp., Japan; Ed Schlesinger, Carnegie Mellon Univ., USA

MA1 9:00am-9:30am (Invited)
Optical ROM Card System Based on the Talbot Effect (The T-ROM System)
Christopher Busch; Philips Res., The Netherlands.
We present an overview of the current development status of the T-ROM optical card system. Special attention is given to the efficient generation of the high quality optical spot array and the integrated piezo actuator.

MA2 9:30am-10:00am (Invited)
Display Technologies For Collaborative Work In 3D Augmented And Virtual Environments
Hong Hua; Optical Sciences Ctr., Univ. of Arizona, USA.
This talk reviews state-of-art display research toward creating a 3D collaborative interface. A 3D display system that is being developed at the 3DVIS Lab, along with technical challenges involved, will be presented.

MA3 10:00am-10:15am
Hierarchical Optical Memory System Using Near- and Far-Field Accesses
Makoto Naruse[1], Takashi Yatsui[2], Wataru Nomura[3], Motoichi Ohtsu[3]; [1]Natl. Inst. of Information and Communications Technology, Japan, [2]Japan Science and Technology Agency, Japan, [3]Univ. of Tokyo, Japan.
We propose a hierarchical optical memory system in which near-fields and far-fields read detailed dipole distributions and features within a region-of-interest, respectively. With hierarchical coding, near- and far-field accesses are associated with different hierarchical information.

MA4 10:15am-10:30am
LightScribe Direct Disc Labeling
Douglas G. Stinson, Mark Maguire; Hewlett-Packard Co., USA.
Recordable CD and DVD discs enable custom content, creating the demand for custom labeling. LightScribe Direct Disc Labeling leverages optical recording technology to create labels with the same drive used to record the data.

10:30am-11:00am
Coffee Break

11:00am-12:45pm
Session MB: Holographic Recording I
(Mauka and Maloko Ballrooms)
Presiders: Kevin Curtis, InPhase Technologies, USA; Lambertus Hesselink, Stanford Univ., USA

MB1 11:00am-11:15am
Holographic Storage without Holography: Optical Data Storage by Localized Alteration of a Format Hologram
Robert R. McLeod[1], Andrew J. Daiber[2], Mark E. McDonald[2], Sergei L. Sochava[2], Tokuyuki Honda[3], Timothy L. Robertson[4], Timothy Slagle[5], Lambertus Hesselink[6]; [1]Univ. of Colorado, USA, [2]Intel Corp., USA, [3]Canon Inc., Japan, [4]Univ. of California at Berkeley, USA, [5]Foveon Inc., USA, [6]Stanford Univ., USA.
We propose and demonstrate multi-layer storage in holographic photopolymer by locally altering the reflectivity of a factory-written reflection hologram at the focus of a single objective lens. Linear, two-photon and thermal writing mechanisms are demonstrated.

MB2 11:15am-11:30am
Micro-Holograms Recorded in a Thermoplastic Medium for Three-Dimensional Data Storage
Marc Dubois, Xiaolei Shi, Christoph Erben, Brian Lawrence, Eugene Boden, Kathryn Longley; GE Global Res., USA.
A micro-holographic approach using a dye-doped thermoplastic material as a recording medium is in development at General Electric. Preliminary characterization results indicate that micro-holograms present larger dimensions than those expected from the recording beam properties.

MB3 11:30am-11:45am
Micro-Holographic Multi-Layer Optical Disk Data Storage
Robert R. McLeod[1], Andrew J. Daiber[2], Mark E. McDonald[2], Sergei L. Sochava[2], Timothy L. Robertson[3], Timothy Slagle[4], Lambertus Hesselink[5]; [1]Univ. of Colorado, USA, [2]Intel Corp., USA, [3]Univ. of California at Berkeley, USA, [4]Foveon Inc., USA, [5]Stanford Univ., USA.
We demonstrate 12-layer storage of 5.84 Gbits per square inch via micro-holograms written and read at 0.532 nm from a 125 micron photopolymer disk continuously rotating at 3600 RPM. Scaling predicts a potential TByte capacity.

MB4 11:45am-12:00pm
Holographic Data Storage Simulator for the Collinear Optical System Using Shift Correlation Multiplexing
Stella R. Lambourdiere, Atsushi Fukumoto, Kenji Tanaka, Kenjiro Watanabe; Sony Corp., Japan.
The first numerical simulator for holographic data storage using the optical collinear system was developed. The dependency of the Signal to Noise Ratio for media displacement and wavelength shift were calculated and were discussed.

MB5 12:00pm-12:15pm
Red-Sensitive Holographic Recording Media
Michael C. Cole[1], David Samuels[1], Hamlin Barnes[1], Lisa Dhar[1], Takashi Hanyu[2], Tetsuo Morimoto[2]; [1]InPhase Technologies, USA, [2]Hitachi Maxell, Japan.
A media is presented that allows for holographic data storage at red wavelengths. The newly developed media has low scatter, low shrinkage upon recording, high dynamic range, good sensitivity, good shelf life, and good archival.

MB6 12:15pm-12:30pm
Improved Sensitivity of Dye-Doped Thermoplastic Discs for Holographic Data Storage
Xiaolei Shi, Marc Dubois, Brian Lawrence, Eugene Boden, Christoph Erben, Kathryn L. Longley, Matthew C. Nielsen; GE Global Res. Ctr., USA.
Significant sensitivity improvement was achieved in dye-doped thermoplastic materials for holographic data storage at 405nm. The sensitivity characterization method and measurement results are reported.

MB7 12:30pm-12:45pm
Duplication Technology for Secured Read-Only Holographic Versatile Disc
Hideyoshi Horimai[1,2], Xiaodi Tan[1]; [1]OPTWARE Corp., Japan, [2]Japan Science and Technology Agency-CREST, Japan.
A duplication technology for secured Read-Only Holographic Versatile Disc (HVD-ROM), using collinear technology, is proposed. With this method a large amount of HVD-ROMs can be duplicated, but the HVD-ROM cannot be duplicated again.

12:45pm-2:15pm
Lunch Break

2:15pm-4:30pm
Session MC: Bitwise Volumetric Recording
(Mauka and Maloko Ballrooms)
Presiders: Ryuichi Katayama, NEC Corp., Japan; Paul J. Wehrenberg, Apple Computer Inc., USA

MC1 2:15pm-2:45pm (Invited)
Dynamic Test Results of a Novel Two-Photon Bit Serial Volumetric Media
Rene Hamer, O. M. Alpert, T. A. Wasserman; Mempile - Israel Ltd., Israel.
A novel photoisomerizable material was developed allowing two-photon absorption for symbol writing and reading, thus allowing for truly volumetric optical recording. The paper will present dynamic testing results, demonstrating potential for terabyte optical data storage.

MC2 2:45pm-3:15pm (Invited)
Characteristics and Limitations of Multi-Layered Optical Memories
Tom D. Milster[1], Sang-Ki Park[1], Yan Zhang[2]; [1]Optical Sciences Ctr., Univ. of Arizona, USA, [2]School of Optometry, Indiana Univ., USA.
The inter-layer interference and crosstalk characteristics of multiple layers under several illumination conditions are described, and limitations based on performance are introduced for various film characteristics, like reflectance, transmittance and uniform or nonuniform layer spacing.

MC3 3:15pm-3:30pm
Twenty Layers Recording and Reading of Bit Data in a Photochromic Multilayered Media Fabricated with Laminate Process
Masao Miyamoto[1], Masaharu Nakano[1], Yoshimasa Kawata[1], Sou Miyata[2], Masahito Nakabayashi[2]; [1]Shizuoka Univ., Japan, [2]LINTEC Corp., Japan.
We demonstrated the recording/reading of bit data in 20 layers multilayered medium. The multilayered medium was fabricated with laminating process of pressure sensitive adhesives. We succeeded in recording and reading each layer without crosstalk.

MC4 3:30pm-3:45pm
Recording and Readout Mechanism in Volumetric Two-Photon-Absorbing Fluorescent Al_2O_3 Media
Mark S. Akselrod, Subrata Sanyal, Sergei S. Orlov; Landauer, Inc., USA.
Optical and electronic processes during recording and readout in Al_2O_3:C,Mg fluorescent media are analyzed. Resonant two-photon absorption and high quantum yield of fluorescence permit utilization of modulated CW blue and red laser diodes.

MC5 3:45pm-4:00pm
Aberration Correction for the Writing and Read-Out of Multi-Layer Optical Memory
Martin J. Booth[1], Michael Schwertner[1], Tony Wilson[1], Masaharu Nakano[2], Yoshimasa Kawata[2]; [1]Univ. of Oxford, United Kingdom, [2]Shizuoka Univ., Japan.
We investigate using adaptive optics to improve the performance of multi-layer optical memories. A deformable membrane mirror corrects aberrations for both recording and read-out of bitwise data in stratified photochromic media, extending the useable depth.

MC6 4:00pm-4:15pm
A New Media for Two-Photon Volumetric Data Recording and Playback
Andrew N. Shipway, Thierry A. Wasserman, Ortal M. Alpert; Mempile, Israel.
A new media was developed, allowing three-dimensional serial bit data storage and retrieval by two-photon excitation. The disk is essentially of a monolithic structure, and utilizes proprietary photochromic organic fluorophores as the data storage element.

MC7 4:15pm-4:30pm
Optical Characteristics for Layer Selection Recordable Optical Disk
Akemi Hirotsune, Masaki Mukoh, Motoyasu Terao; Hitachi Ltd., Japan.
We introduced an inorganic electrochromatic layer for layer selection recordable optical disk (LS–R) by applying voltage. The material showed a large transmittance change in a wide wavelength range. The cross-talk between layers was sufficiently low.

4:30pm-5:00pm
Coffee Break

5:00pm-6:30pm
Session MP: Poster Session I
(Makai Ballroom)
Presiders: Tetsuya Iida, Pioneer Corp., Japan; Tetsuya Kondo, JVC, Japan

MP1
Micro Magnetic Suspension Motor Design for Miniature Optical Drive
Chien-Chang Wang[1], Yeong-Der Yao[2], Chien-Sheng Liu[1], Lung-Yu Cheng[1]; [1]Opto-Electronics & Systems Labs, Industrial Technology Res. Inst., Taiwan Republic of China, [2]Inst. of Physics, Acad. Sinica, Taiwan Republic of China.
To minimize micro motor vibration that causes noise to servo control in miniature optical drive, passive magnetic suspension technology has been used. A new type micro motor with 62 percent vibration has been successfully developed.

MP2

Statistical Analysis of Lifetime Distribution for Optical Recordable Disks

M. Irie[1], Y. Okino[2], T. Kubo[3]; [1]Osaka Sangyo Univ., Japan, [2]Kansai Univ., Japan, [3]T. Kubo Engineering Science Office, Japan.

We investigated criteria items of lifetime measurement using the Eyring acceleration model. Results demonstrated that the statistical distribution of the lifetime data using the criterion of jitter item can apply a lognormal distribution.

MP3

Scanning Laser Microscope Incorporating a SIL Nano-Positioning System

Sarah Walters, David Jenkins; Univ. of Plymouth, United Kingdom.

Nano-positioning techniques in electronic media are vital to achieving higher data densities. Near-field optics combined with capacitive sensing will realise precise real-time control of the optical system for high-density optical imaging and recording.

MP4

Airflow Analysis in a Near Field Optical Disc System

Jung Eung Park, Jinmoo Park, Byung-ju Dan, Jeong-kyo Seo, In-ho Choi, Jin-yong Kim; LG Electronics Inc., Republic of Korea.

Flow fields in a near field recording system were analyzed using computational fluid dynamics (CFD). Numerical conditions were reviewed in detail. A robust head design against dust contamination was suggested by a parametric study.

MP5

2.4X Speed Recording Media for HD DVD Rewritable System

Noritake Ohmachi, Naoki Morishita, Keiichiro Yusu, Naomasa Nakamura, Tsukasa Nakai, Sumio Ashida; Toshiba Corp., Japan.

We have developed high speed recording rewritable media having the user data capacity of 20 GB for HD DVD system. The technologies and the characteristics of the rewritable media for 1X - 2.4X are described.

MP6

Multi-Level Encoding and Detection for Imaging Page-Oriented Optical Data Storage

Nopparit Intharasombat, Tawei Ho, Alexander A. Sawchuk; Univ. of Southern California, USA.

Imaging page-oriented optical data storage can record data bits in grayscale, with potential total capacity benefits. We describe an extension of our binary iterative decision feedback modulation detection technique to multi-level operation.

MP7

Variable Threshold and Fixed-Point Arithmetic Least Square Equalization in Page-Oriented Optical Data Storage

Tawei Ho, Nopparit Intharasombat, Alexander A. Sawchuk; Signal and Image Processing Inst.; Univ. of Southern California, USA.

We describe significant improvements from novel variable threshold and fixed-point arithmetic least square equalization modulation detection for volumetric (3D) page-oriented optical data storage (PODS) systems with extreme intersymbol interference (ISI) and interpage interference (IPI).

MP8

Application of Nonlinear Minimum Mean Square Error Equalization for Holographic Data Storage

An He, George Mathew; Natl. Univ. of Singapore, Data Storage Inst., Singapore.

We present a novel and simple-to-implement nonlinear equalization approach for holographic data storage systems. Our results show that the proposed approach significantly outperforms the linear approach in minimum mean square error and bit error rate.

MP9

Rate 5/9 Two-Dimensional Pseudo-Balanced Code for Holographic Data Storage Systems

Na Young Kim, Joohyun Lee, Jaejin Lee; Dongguk Univ., Republic of Korea.

We present a rate 5/9 pseudo-balanced code with two-dimensional (2D) 3×3 arrays. Although this code has high rate compared to other 2D code with rate 4/9, detection performances of two codes are similar.

MP10

Soft Decision Viterbi Decoding for 2/4 Modulation Code in Holographic Memory

Kazumasa Nishimoto, Fuminori Naito, Manabu Yamamoto; Tokyo Univ. of Science, Japan.

This paper discusses an approach to improve signal quality by using soft decision Viterbi decoding using newly defined reliability that corresponds to 2/4 modulation code. The effect to reduce bit errors was confirmed.

MP11

Nondestructive Readout of the Multi-States Photochromic Recording by Using IR Light

Kingo Uchida[1,2,3], Masaaki Saito[1], Akinori Murakami[2], Takao Kobayashi[2], Shinichiro Nakamura[2], Masahiro Irie[3]; [1]Ryukoku Univ., Japan, [2]Mitsubishi Chemical Group Science and Technology Res. Ctr. Inc., Japan, [3]Kyushu Univ., Japan.

A photochromic polymer film containing diarylethene derivatives whose spectra are different not only UV-Vis regions but also Infrared was used for multifrequency photochromic recording. The recording could be read out non-destructively by using IR light.

MP12

Direct Observation of Collinear Holographic Image

Hirotaka Matsumoto[1], Hideyoshi Horimai[2]; [1]Fuji Photo Film Co. Ltd., Japan, [2]OPTWARE Corp., Japan.

The first collinear holographic three-dimensional image was observed directly by laser profile microscope. We confirmed that the obtained image is almost the same as the simulated one reported already.

MP13

Use of Semiconductor Nanocrystals for Spectrally Encoded High-Density Optical Data Storage

James W. Chon, Judith Moser, Min Gu; Ctr. for Micro-Photonics, Faculty of Engineering and Industrial Sciences, Swinburne Univ. of Technology, Australia.

In this paper, we discuss the spectral encoding capability of semiconductor nanocrystals (NCs) and its application to high-density optical data storage. The effects of polymer matrix and energy transfer between the NCs are also studied.

MP14

Fourier-Transform Polarization Holographic Data Storage in Bacteriorhodopsin Film

Baoli Yao[1], Neimule Menke[1], Zhiwei Ren[1], Yingli Wang[1], Yuan Zheng[1], Ming Lei[1], Liyong Ren[1], Guofu Chen[1], Norbert Hampp[2]; [1]Xian Inst. of Optics and Precision Mechanics, Chinese Acad. of Sciences, China, [2]Inst. of Physical Chemistry, Univ. of Marburg, Germany.

Using Fourier-transform holographic setup a storage density of 2×10^8 bits/cm^2 was obtained in an optical film containing the genetic variant bacteriorhodopsin BR-D96N by the orthogonal circular polarization of recording.

MP15

Objective Lens for Holographic Worm Drives

Jideog Kim, Y. Eugene Pak; MEMS Lab, Materials & Devices Ctr., Samsung Advanced Inst. of Technology, Republic of Korea.

A generalization of the objective lens for optical disk storages is proposed to accommodate holographic data storage that uses two beams. Feasibility tests by numerical and experimental studies are presented.

MP16

X-Y Galvano Mirror System for Fractal-Angle Multiplexing Hologram and Random Access Concept for It

Jin-Young Choi, Jae-Sung Lee, Sang-Hoon Kim, Jang-Hyun Kim, Hyunseok Yang, No-Cheol Park, Young-Pil Park; Ctr. for Information Storage Device, Yonsei Univ., Republic of Korea.

Fractal-angle multiplexing using x-y Galvano mirror and 1000 pages recording in a photorefractive crystal was performed. Then, a random seek concept using page count for a HDSS to improve the random seek performance is proposed.

MP17

Inter-Frame Image Processing Method for Recovering Holographic Images with Media Shrinkage

Shigeyuki Baba[1], Shinichi Yoshimura[2], Nobuhiro Kihara[1]; [1]Sony Corp., Japan, [2]Sony-Kihara Res. Ctr. Inc., Japan.

We developed a novel inter-frame image processing method to improve image quality of holograms by synthesizing multiple holographic images. Each of these images is reconstructed from the same hologram, but under slightly different readout conditions.

MP18

Simulation of Aberration Effects for Readout of Volume Holograms

Joachim Knittel; Deutsche Thomson Brandt, Germany.

A theoretical model has been developed to investigate the influence of wavefront aberrations on the signal in a shift-multiplexed holographic data storage system.

MP19

Photochromic Memory with Electronic Functions

Tsuyoshi Tsujioka, Kyoko Masui, Rie Takagi; Osaka Kyoiku Univ., Japan.

The new aspect of photochromic memory with electronic function is introduced. Electrical carrier dissociation from photoexcited photochromic diarylethene molecules was observed. It would be applied to nondestructive readout of photon-mode memory.

MP20
Volume Holographic Recording with Spatial Spread Spectrum Multiplexing Technique
Terumasa Ito, Atsushi Okamoto; Graduate School of Information Science and Technology, Hokkaido Univ., Japan.
A novel hologram multiplexing method that increases the effective spatial bandwidth of the signal beam is proposed. Spatial Spread-Spectrum multiplexing is suitable for co-axial holographic recording, and can be combined with other multiplexing methods.

MP21
Optimal Track Format to Reduce Inter-Track Crosstalk in Holographic Read Only Memory
Kun Yul Kim, Pil Sang Yoon, Joo Youn Park, Ha Eun Nam; Daewoo Electronics Corp., Republic of Korea.
The effects of track format on the inter-track crosstalk of holographic read only memory are investigated by using an optical simulation to optimize track format for reliable retrieving signal.

MP22
High Density Recording of Collinear Holographic Data Storage
Yawara Kaneko[1], Nobuyuki Kitazaki[1], Jun Li[1], Xiaodi Tan[1], Hiroyuki Narumi[1], Masaru Kinoshita[1], Kenji Suzuki[1], Hideyoshi Horimai[1,2], Shin Satoh[3], Hiroshi Sasaki[3]; [1]Optware Corp., Japan, [2]JST, Japan, [3]Toagosei Co. Ltd., Japan.
High density data recording of holographic versatile disc was demonstrated using collinear holographic technology in static mode. The optical noise reduction and improvement of the photopolymer characteristics is the key to the success.

MP23
High-Numerical Aperture Holographic Data Storage
Frank Schuurmans, Marcello Balistreri, Teus Tukker, Gert't Hooft, Sjoerd Stallinga; Philips Res. Labs, The Netherlands.
A simple, yet diffraction limited, optical design for a Holographic Data Storage System with a high numerical aperture and large field is presented.

MP24
Simulation of Non-Stop Operation of Archival Server Using Optical Disk Cluster Drive
Kunimaro Tanaka[1], Takaaki Ueno[1], Fumio Ichikawa[1], Teruo Furukawa[2]; [1]Teikyo Heisei Univ., Japan, [2]Hiroshima Inst. of Technology, Japan.
The optical disk cluster drive is promising candidate for archival server because optical disks have long life. The seldom accessed data can be removed from the server without stopping it when the server becomes full.

MP25
Optical Storage Media and Digital Data Security
David H. Davies, Mark Gurkowski, Lane Lee; DPHI/DataPlay Inc., USA.
Optical media are ideal for storing sensitive information as they can be removed and secured. In DataPlay's technology encrypted keys are stored on the media itself, content is separately encrypted and accessed through key exchange.

6:30pm-8:00pm
Dinner Break

8:00pm-9:30pm
Session PD: Post Deadline Oral Session
(Mauka and Maloko Ballrooms)

Tuesday, July 12

8:30am-10:30am
Session TuA: Components I
(Mauka and Maloko Ballrooms)
Presiders: Jin-Yong Kim, LG Electronics Inc., South Korea; Takeshi Shimano, Hitachi Ltd., Japan

TuA1 8:30am-9:00am (Invited)
An Integrated Catadioptric Pickup With Ferrofluidic Cooling Structure
Kazutoshi Onozawa[1], Kazuhiko Yamanaka[1], Takuya Okuda[1], Tomoaki Tojo[1], Shinichi Ijima[1], Daisuke Ueda[1], Junichi Kubo[2], Seiichiro Kitagawa[2]; [1]Semiconductor Device Res. Ctr., Matsushita Electric Industrial Co. Ltd., Japan, [2]Nalux Co. Ltd., Japan.
We have developed a novel integrated catadioptric pickup with a ferrofluidic cooling structure. It realizes both integration of all optical components into a moving head and excellent heat transfer without sacrificing the head motion.

TuA2 9:00am-9:15am
An On-Chip Pickup Based on a Leaky Mode Directional Coupler: Application to a CF-II Standard Optical Disk
Dongwoo Suh, Yongwoo Park, Yeungjoon Sohn, Hee Sook Chung, Hojun Ryu, Mun Cheol Paek, Kwangyong Kang; Electronics and Telecommunications Res. Inst., Republic of Korea.
A blue light pickup was implemented on-a-chip using leaky mode waveguide. It successfully coupled out the propagating beam keeping the height smaller than 2 mm including objective lens as well as beam shaping elements.

TuA3 9:15am-9:30am
Development of Micro-Lens for High Density Small Form Factor Optical Pickup
Jin-Seung Sohn[1], Eun-Hyoung Cho[1], MyungBok Lee[1], Hae-Sung Kim[1], MeeSuk Jung[1], Sung-Dong Suh[1], No-Cheol Park[2], Young-Pil Park[2]; [1]Samsung Advanced Inst. of Technology, Republic of Korea, [2]Ctr. for Information Storage Device, Republic of Korea.
A hybrid type objective lens composed of refractive lens and diffractive lens, which follows the BD specifications and is suitable for the integrated optical pickup for small form factor ODD, was designed, fabricated and evaluated.

TuA4 9:30am-9:45am
Area Divided Leakage Mirror for Blue-LD Optical Pick-Up
Hiroshi Hirayama; Konica Minolta Opto, Inc, Japan.
Area divided leakage mirror can correct the beam profile while act as a beam splitting element for the front monitor light, and is effective to the reduction in the number of parts.

TuA5 9:45am-10:00am
Diffractive Wavelength Compensator For BD, CD and DVD Compatibility
Michael Feldman, W. H. Welch, Jeff Classey; Digital Optics Corp., USA.
Wavelength Compensators, allowing compensation of NA, focal length and aberration correction for BD, CD and DVD objective lenses, are more efficient and tolerant to temperature variations than previously reported elements have been designed & fabricated.

TuA6 10:00am-10:15am
Development of a Dual Lens Rotating Actuator for BD/DVD/CD Compatible Optical Pickups
Kwan-Woo Park, Sam-Nyol Hong, Jin-A Kim, In-Ho Choi, Eui-Seok Ko, Jin-Yong Kim; Digital Storage Res. Lab, Republic of Korea.
We have developed a rotary-type actuator with a dual lens on a single pickup for a compatibility with BD/DVD/CD system. This actuator has improved gain margin characteristics of dual lens actuator.

TuA7 10:15am-10:30am
Liquid Crystal Lens for the Compensation of Spherical Aberration in the Multi-Layer Optical Data Storage
Suk-Ho Chung[1], Young-Joo Kim[1], In-Cheol Chang[2], Ho-Seop Jeong[2]; [1]Ctr. for Information Storage Device (CISD), Republic of Korea, [2]Optical Module Lab, Samsung Electro Mechanics Co. Ltd., Republic of Korea.
Liquid crystal lens has been designed to compensate the spherical aberration due to the difference of substrate thickness for the multi-layer disk. It has a special structure consisting of concave and convex lens shape.

10:30am-11:00am
Coffee Break

11:00am-1:00pm
Session TuB: Coding & Signal Processing
(Mauka and Maloko Ballrooms)
Presiders: Vijayakumar Bhagavatula, Carnegie Mellon Univ., USA; Yutaka Kashihara, Toshiba Corp., Japan

TuB1 11:00am-11:15am
A New Data Detection Method for 33.6-Gbit/in^2 Multilevel Recording Using a Blue Laser and NA0.85 Optics
Jun Sumioka, Masakuni Yamamoto, Yasuyuki Miyaoka, Kaoru Okamoto, Eiichi Fujii; Canon Inc., Japan.
In order to suppress ISI, we have developed a new data detection method that is named CBDD (Cell Boundary Data Detection) for achieving 33.6-Gbit/in^2 multilevel recording using a blue laser and NA0.85 optics.

TuB2 11:15am-11:30am
A Robust Read Channel System Directly Processing Asynchronous Sampling Data
Akira Yamamoto, Hiroki Mouri, Takashi Yamamoto; Matsushita Electric Industrial Co. Ltd., Japan.
A robust read channel system is presented. A novel Viterbi detector and a digital timing recovery extract recorded data and timing directly from asynchronous sampling data without interpolating the sampling data.

TuB3 11:30am-11:45am
New Method for Adjusting Write Strategy Using Sequenced Amplitude Margin
Yoshihisa Adachi, Atsushi Etoh, Mitsuo Ishii, Shigemi Maeda, Kunio Kojima; Sharp Corp., Japan.
We proposed a new method for adjusting write strategy in partial response maximum likelihood systems. It utilized novel indices based on sequenced amplitude margin and the remarkable improvement of recording power margin was confirmed.

TuB4 11:45am-12:00pm
Signal Qualification Method for over 30GB Blu-Ray Discs
Junya Shiraishi, Naoki Ide, Takahiro Ohkubo; Sony Corp., Japan.
We proposed a new signal qualification method SAM2TJ for high density optical disc. This method has the same approach of MLSE etc., and is targeting over 30GB Blu-ray disc with adaptive PRML detection system.

TuB5 12:00pm-12:15pm
Novel Constrained Parity-Check Code and Post-Processor for Advanced Blue Laser Disk
Kui Cai[1], Kees A. Immink[2], Jan W. Bergmans[3], L. P. Shi[1]; [1]Data Storage Inst., Singapore, [2]Turing Machines Inc., The Netherlands, [3]Technical Univ. of Eindhoven, The Netherlands.
Novel constrained parity-check code and post-processor are proposed for advanced blue laser disk systems. Simulation results with the blu-ray disc show that an increase of 5GB in capacity can be achieved over the standard system.

TuB6 12:15pm-12:30pm
A Soft Decision Descrambler for Guided Scrambling for Optical Disc Systems Employing Low Density Parity Check Codes
Toshihiro Horigome, Seiji Kobayashi; Sony Corp., Japan.
We propose a soft-in-soft-out descrambler for guided scrambling, which realize DC suppression even with simpler RLL codes. The proposed descrambler is realized by simple probability-calculation and can be used with low density parity check codes.

TuB7 12:30pm-12:45pm
Low-Density Parity-Check Codes with DC Control
Zongwang Li, Jin Xie, B. V. K. Vijaya Kumar; Carnegie Mellon Univ., USA.
We propose a bit-flipping scheme of constructing low-density parity-check (LDPC) codes with DC control. The proposed scheme can achieve large coding gain by iterative soft decision decoding and good dc suppression.

TuB8 12:45pm-1:00pm
Comparative Evaluation of Equalization Methods for Holographic Data Storage Channel
Sheida Nabavi, B. V. K. Vijaya Kumar; Carnegie Mellon Univ., USA.
We compare the performance of different equalizers for data pages stored and retrieved holographically as well as for simulated data. The results show that the MMSE equalizer works well even at low SNR.

1:00pm-5:00pm
Afternoon Break

5:00pm-7:00pm
Session TuC: Drive Technologies
(Mauka and Maloko Ballrooms)
Presiders: Bernard Bell, DataPlay Inc., USA; Harukazu Miyamoto, Hitachi Ltd., Japan

TuC1 5:00pm-5:30pm (Invited)
DVD RW High Speed Recording
Hans Spruit; Philips Optical Storage, The Netherlands.
The DVD+RW speed race results in challenges for both disc and drive manufacturer. The stability of materials, write strategy, recording speeds and optimum power control procedure needs careful consideration for most reliable high speed recording.

TuC2 5:30pm-5:45pm
Novel One-Beam Tracking Detection Method for Dual-Layer Blu-Ray Disks
Kousei Sano, Fumitomo Yamasaki, Akihiro Arai, Shin-ichi Kadowaki; Matsushita Electric Industrial Co. Ltd., Japan.
The proposed tracking method is stable at the boundary between recorded and unrecorded tracks. It is also stable in dual-layer Blu-ray disks because the detecting areas avoid the other layer's stray light.

TuC3 5:45pm-6:00pm
Enhancement of Speed Margins for 16 X DVD-RAM
Koichi Watanabe[1], Makoto Miyamoto[2], Makoto Iimura[2], Hiroyuki Minemura[1]; [1]Storage Technology Res. Ctr., Res. & Development Group, Hitachi Ltd., Japan, [2]Hitachi Maxell, Ltd., Japan.
We successfully obtained over-write jitter values of less than 8% and bit error rates of less than 10^{-5} in 6-16x DVD-RAM. Moreover, we confirmed that the speed margins were ±20 % for a 6-16x CAV.

TuC4 6:00pm-6:15pm
Recent Advancements in DataPlay's Small Form-Factor Optical Disc and Drive
David L. Blankenbeckler, Bernard W. Bell Jr.; DPHI Inc., USA.
A small form-factor 0.85NA red laser system with 1GB capacity per 32mm cartridge will be reviewed including modifications to the miniature OPU to use a high power laser diode to support re-writable media.

TuC5 6:15pm-6:30pm
Reliable Optical Disk Geometry at High Operating Speed
Hyo Kune Hwang, Jongman Kim, Byung-Ju Dan, In-Ho Choi, Jin-Yong Kim; LG Electronics, Republic of Korea.
All polycarbonate optical disks, including BD and HD-DVD, are possible to be crushed in a disk drive. In this study, disk crushing phenomenon is investigated with fracture mechanics and new disk geometry is proposed.

TuC6 6:30pm-6:45pm
High-Speed Tracking Control System for Broadcast-Use Optical Disk Drive
Daiichi Koide[1], Haruki Tokumaru[1], Kiyoshi Ohishi[2], Kazuyoshi Kuramochi[2], Toshimasa Miyazaki[3]; [1]Japan Broadcasting Corp. (NHK), Japan, [2]Nagaoka Univ. of Technology, Japan, [3]Nagaoka Natl. College of Technology, Japan.
The proposed ZPET-FF control system suppressed tracking error to less than 9 nm at high speed in the optical recording system of NA: 0.85. We confirmed the system is effective for high-data-transfer-rate optical disk drives.

TuC7 6:45pm-7:00pm
Laser Diode Active Height Control for Near Field Optical Storage
Philipp Herget[1], James A. Bain[1], T. E. Schlesinger[1], Tomoki Ohno[2]; [1]Carnegie Mellon Univ., USA, [2]Sharp Labs of America Inc., USA.
Servo control of a laser was achieved using a piezoelectric actuator and direct laser diode feedback. A static control error of +/-10nm was measured and control on a disk was performed at low rotation speeds.

7:00pm-9:00pm
Reception (Makai Ballroom)

8:00pm-9:30pm

Session TuP: Poster Session II

(Makai Ballroom)

Presiders: Chong Tow Chong, Data Storage Inst., Singapore; Yoshinori Honguh, Toshiba Corp., Japan

TuP1

Adaptive Third-order Volterra Filter For High-density Blu-ray Disc ROM

Toshiyuki Nakagawa, Akira Itoh, Tomoyuki Hiura, Hiroyuki Ino; Sony Corporation Micro Systems Network Company, Japan.

We applied an adaptive third-order Volterra filter to compensate for nonlinearities to high density optical disks. We show that the performance improves using a Blu-ray Disc ROM with a capacity of 31.3 Gbytes.

TuP2

Partitioned Linear Interpolated Timing Recovery for Optical Discs

Satoru Higashino, Junya Shiraishi, Shoei Kobayashi; Sony Corp., Japan.

We have developed the Partitioned Linear Interpolator for ITR (Interpolated Timing Recovery), which provides the implementation of the ITR with a small memory table and the sufficient performance for optical discs.

TuP3

Bit Length of 57nm Recording on a DWDD Disk Using Turbo Codes with a Blue Laser

Shinichiro Uno, Yukinori Yamamoto, Yasushi Hozumi; Canon Inc., Japan.

Turbo code was experimentally applied to a DWDD disk using a blue laser. An effective bit length of 56.5nm was achieved, and performance of the Turbo method depends on the number of consecutive 2-bit errors.

TuP4

Adaptive Partial Response Maximum Likelihood Detection with Tilt Estimation Using Sync Pattern

Kyusuk Lee, Joohyun Lee, Jaejin Lee; Dept. of Electronic Engineering, Dongguk Univ., Republic of Korea.

We propose an improved detection method that concurrently adjusts coefficients of equalizer and reference values of branches in Viterbi detector. For easy estimation of asymmetric channel characteristics, we exploit sync patterns in each data frame.

TuP5

Design of Improved Error Correction Decoder Using Error Detecting Information of Modulation Code in DVD Systems

Joohyun Lee[1], Jaejin Lee[1], Taegeun Park[2]; [1]Dongguk Univ., Republic of Korea, [2]The Catholic Univ. of Korea, Republic of Korea.

We design an improved Reed-Solomon product code (RSPC) decoder for DVD systems. The proposed decoder exploits the characteristic of EFMPlus code, and the correctable capability of errors is increased as much as 25%.

TuP6
PRML Detection Using Signal Quality Measure Method for Asymmetric Optical Recording Channels
Aekyung Park, Joohyun Lee, Jaejin Lee; Dongguk Univ., Republic of Korea.
We propose a detection method using partial response signal-to-noise ratio (PRSNR) that evaluates signal quality of asymmetric optical recording channel. It has 2.24dB SNR gain at 4.0×10^{-6} bit error rate compared to typical detection methods.

TuP7
Maximum Likelihood Estimation of Phase from Preambles with Harmonics
Jin Xie, Lingyan Sun, Vijaya Kumar; Carnegie Mellon Univ., USA.
We propose an implementation-friendly maximum likelihood estimation of phase for 6T and 8T patterns for timing recovery. By this method, the Cramer-Rao lower bound is achieved even if these patterns have harmonics.

TuP8
A Bit Level Soft Decision Decoding of Reed-Solomon Codes for Optical Data Storage
Ivana Djurdjevic, Erozan M. Kurtas; Seagate Technology, USA.
A suboptimum bit level soft decision decoding of Reed-Solomon codes for optical data storage is proposed. It is based on the bit level structure of Reed-Solomon codes. Simulation results are provided.

TuP9
A Multilevel, Runlength Limited Encoding Scheme for Optical Recording
Estuardo Licona[1], Steven W. McLaughlin[2]; [1]LSI Logic, USA, [2]Georgia Tech, USA.
An encoding scheme for multilevel runlength-limited signaling on optical recording channels is proposed. Performance is evaluated and compared to theoretical limits and multilevel fixed-length systems.

TuP10
A New Optimal-Power-Control Parameter of the Optical Storage Systems to Which PRML Detection Is Applied
C. Y. Chang[1], Allen Liao[1], Nicky Yang[2], ChungPing Wang[2]; [1]LiteON-IT Corp., Taiwan Republic of China, [2]Optodisc Technology Corp., Taiwan Republic of China.
We present a new parameter: PM_Value. It can be used to evaluate RF quality and therefore can be used in the Optimal-Power-Control (OPC) of the optical storage systems to which PRML detection is applied.

TuP11
Modulation Codes for Multi-Wavelength and Multi-Level Photochromic Optical Recording Channel
Hua Hu, Duanyi Xu, Guosheng Qi; Tsinghua Univ., China.
Multi-wavelength and multi-level optical recording with photochromic media is a novel way to increase storage density and data rate significantly. Modulation codes for this recording channel are discussed with encoder/decoder construction and performance comparison.

TuP12
DC-Free Coding of Run-Length-Limited Codes for Multi-Level Optical Recording Systems
Joohyun Lee, Jaejin Lee; Dongguk Univ., Republic of Korea.
For multi-level optical recording systems, we present a coding scheme that DC-content is sufficiently controlled by inserting redundancy bits less than 1.25%. This method is very simple and can be applied for all run-length-limited codes.

TuP13
Design of an Adaptive Dynamic Absorber to Reduce Optical Disk Drives Vibration at Multiple Rotating Speeds
Chi-Shen Chang[1,2], Tzong-Shi Liu[2], Tzuan-Ren Jeng[1], Wen-Jen Ho[1], Hui-Chin Huang[3], Shir-Kuan Lin[3]; [1]Opto-Electronics & Systems Labs/Industrial Technology Res. Inst., Taiwan Republic of China, [2]Dept. of Mechanical Engineering, Natl. Chiao Tung Univ., Taiwan Republic of China, [3]Dept. of Electrical and Control Engineering, Natl. Chiao Tung Univ., Taiwan Republic of China.
This study designs a dynamic absorber to reduce optical disk drives vibration at multiple rotating speeds. In addition to a passive device, a voice coil motor in the proposed absorber facilitates tuning the minimum vibration.

TuP14
Dynamic Characteristics of Air-Stabilized Flexible Optical Disk
Nobuaki Onagi, Yasutomo Aman, Shozo Murata, Yasunori Sugimoto, Kazuhiro Ogawa, Junichi Kitabayashi, Keisuke Uchida; RICOH Company Ltd., Japan.
A NA 0.85 optical pickup can be used by an air-stabilized optical flexible disk system. The RF and servo signal characteristics were studied. The flexible disk could be adaptable at over 5000 rpm.

TuP15
Small Optical Pickup with Blue-Violet Laser Diode and Appropriate NA Objective for Dual-Layer Disk
Kazuhisa Ide, Youichi Maehara, Tsuyoshi Yoshimoto, Tsuyoshi Kakuta, Toshihiro Yamasaki, Yoshitatsu Kajiwara, Nobuo Jikuya, Shogo Horinouchi; Panasonic Communications Co. Ltd., Japan.
Using a 0.73 NA objective which is appropriate for a dual-layer disk and a blue-violet LD, we designed and developed a very small optical pickup with a simple optical configuration and a high-performance small actuator.

TuP16
New Focusing Error Detection Method Using Concentrically Separated Light Beams for Multi-Layer Discs
Kenya Nakai, Hironori Nakahara, Daisuke Matsubara, Toshiya Matozaki, Nobuo Takeshita, Toru Yoshihara, Kazuo Mori; Advanced Technology R&D Ctr., Mitsubishi Electric Corp., Japan.
We studied a new focusing error detection method for multi-layer discs. Effectiveness of this method to generate detectable and undetectable focusing error signals at layers uncompensated for spherical aberration was confirmed by simulation and experiment.

TuP17

Development of Small Form Factor Optical Disk for Mobile Device Application

Hojun Ryu, Yonggoo Yoo, Woosug Jung, EunKyung Kim, MunCheol Paek, Kwangyong Kang; ETRI, Republic of Korea.

The small form factor disk which is satisfied the blu-ray specification has been implemented. The static recording measurement has been carried out. The disk has 1 gigabyte capacity, very low deflection and good tilt margin.

TuP18

Study of Near-Field Optical Disk Recording on Styryl Dye

Shin-Shin Wang[1], Chien-Wen Chen[1], Hui-Ping Tsai[1], Chih Chin Hsu[2], Hung Wei Liu[3], Pei Hsin Chang[3], Wei Chih Lin[3], Din Ping Tsai[3]; [1]Union Chemical Labs, Industrial Technology Res. Inst., Taiwan Republic of China, [2]Inst. of Optoelectronic Sciences, Natl. Taiwan Ocean Univ., Taiwan Republic of China, [3]Dept. of Physics, Natl. Taiwan Univ., Taiwan Republic of China.

A new type of near-field optical disk with naostructured ZnOx thin film as near-field active layer and a styryl dye thin film as its recording layer is studied. Recording marks beyond diffraction limits are demonstrated.

TuP19

Non-Chalcogenide Inorganic Blue Laser Recordable Medium

Xiang Hu, Luping Shi, Xiangshui Miao, Tow Chong Chong; Data Storage Inst., Singapore.

A new non-chalcogenide inorganic Blu-ray recordable medium has been developed using a Pd-based alloy. Optical properties and thermal properties of the Pd-based alloy were studied. Dynamic recording performance and archival lifetime were evaluated.

TuP20

Inorganic Write-Once Optical Disc for Blue Laser Recording System

Pofu Yen, Jung-Po Chen, Chih-Yuan Wu, An-Tse Lee, Ching-Yu Hsieh, Tzuan-Ren Jeng; Industrial Technology Res. Inst., Taiwan Republic of China.

A new inorganic write-once material has been developed for blue laser disc. Experimental result shows that the recording characteristics of PRSNR and SbER are obtained to be respectively 16.3 dB and $9*10^{-6}$ on land/groove track.

TuP21

Initialization-Free Multi-Speed Blu-Ray Disc

Xiangshui Miao, Luping Shi, Pik Kee Tan, Jianming Li, Xiang Hu, Tow Chong Chong; Data Storage Inst., Singapore.

The initialization-free Blu-ray Disc was proposed as a candidate for multi-speed recording. Experiment results of the initialization-free Blu-ray Disc showed that the initialization-free disc had a multi-speed recording capability from 1x to 2x speed.

TuP22

Environmentally Friendly DVD-ROM Using Polylactic Acid Polymer Alloy as a Substrate

Koji Tsujita[1], Takayuki Onizawa[1], Satoshi Teradate[1], Noboru Kawai[1], Hiroyuki Ome[2], Sadanori Kumazawa[2]; [1]Victor Co. of Japan, Japan, [2]Toray Industries, Japan.

We have developed an environmentally friendly DVD-ROM using novel polylactic polymer alloy with improved heat resistance. This disc satisfied with the fundamental DVD specifications and showed the durability on room use and distribution.

TuP23
Inorganic Write-Once Disk by Complete DC Sputtering Process for Blue Laser System
Nobuhiko Kato, Masataka Yamaguchi, Toshihiko Takishita; Pioneer Corp., Japan.
We developed the Bi-Ge nitride write-once disk of high reflectivity to keep read-out compatibility with ROM disk for the Blu-ray disc system. The recording layer stacks were deposited by complete DC sputtering process.

TuP24
Small Form-Factor Optical Recording Disk - Manufacturing and Evaluation
Woo-Seok Cheong, Y.G. Yoo, H.J. Ryu, E.K. Kim, M.C. Baek; ETRI, Republic of Korea.
We made 28mm optical disks for the mobile storage. In the study, using UV-lamps the new disk initializing technique was tested. From computer simulation and dynamic tester we could evaluate the disk effectively.

TuP25
AFM Analysis of HD-DVD Stampers
Donald A. Chernoff[1], David L. Burkhead[1], Dick Verhaart[2], Ton van de Vorst[2]; [1]Advanced Surface Microscopy, USA, [2]Singulus Mastering, The Netherlands.
For an HD-DVD stamper, we report track pitch, height, width, length and wall angles as well as "AFM jitter," channel bit length, offset and the variation of size and shape with T-number.

Wednesday, July 13

8:30am-10:30am
Session WA: Media I
(Mauka and Maloko Ballrooms)
Presiders: Kazunori Itoh, Ricoh Co. Ltd., Japan; Minoru Takeda, Sony Corp., Japan

WA1 8:30am-9:00am (Invited)
HD DVD Disc Manufacturing Process Development
Masato Otsuka; Memory-Tech Corp., Japan.
This paper details processes, mastering/replication machines and raw materials Memory-Tech has been developing for HD-DVD-ROM production. It describes Memory-Tech's HD-DVD characteristics measurement system, and complete encoding and authoring processes for HD-DVD software production.

WA2 9:00am-9:15am
High-Quality High-Speed Embossing Technology for 50GB Dual Layer BD based Media
David Strand[1,2], Michael Hennessey[1], David Jablonski[1], Brenda Walton[1], Barry Clark[1], Takeo Ohta[2]; [1]Energy Conversion Devices, Inc., USA, [2]Ovonic Phase Change Inst., Japan.
L1 layers for Dual-Layer BD-ROM disks were made using a simple, high speed embossing process. The process gives high replication quality, and the thin-film disk media meets basic BD specifications including roundness, flatness and jitter.

WA3 9:15am-9:30am
Development of Practical Electron Beam Recorder for High-Density Optical and Magnetic Disc Mastering
Hiroaki Kitahara, Yoshiaki Kojima, Masaki Kobayashi, Masahiro Katsumura, Yasumitsu Wada, Tetsuya Iida, Kazumi Kuriyama, Fumihiko Yokogawa; PIONEER Corp., Japan.
We developed a practical electron beam recorder, which was improved recording stability, resolution and throughput. The stable recording performance for the whole recording area and the capability for high-density recording beyond 200 Gbit/in^2 were realized.

WA4 9:30am-9:45am
Nano-Pattern Profile Control Technology Using Reactive Ion Etching for 100 GB Optical Disc Mastering
Megumi Sato, Yasuo Hosoda, Masahiro Katsumura, Kazunobu Hashimoto, Osamu Kasono, Tetsuya Iida, Kazumi Kuriyama, Fumihiko Yokogawa; Pioneer Corp., Japan.
For high-density patterning, we tried to control the nano-pattern profile using a reactive ion etching technology. Line edge roughness could be improved and the line width fluctuation 7 nm could be realized.

WA5 9:45am-10:00am
Thermal Direct Mastering Technique Using a Deep UV Laser
Michinobu Mieda, Masanori Shimo, Ikuo Nakano, Toshihiko Sakai, Junji Hirokane, Kunio Kojima, Akira Takahashi; SHARP Corp., Japan.
The new mastering technique directly formed patterns in an organic material by heat was developed, and a high-density ROM disc of 100 GB recording capacity could be mastered applying a deep UV laser.

WA6 10:00am-10:15am
Patterning of ZnS-SiO_2 by Laser Irradiation and Wet Etching Treatment
Hiroshi Miura, Nobuaki Toyoshima, Yoshitaka Hayashi, Suguru Sangu, Noriyuki Iwata, Junichi Takahashi; Ricoh Co. Ltd., Japan.
We show a patterning method for ZnS-SiO_2, which has sufficient performance for fabricating nanometer-scale patterns. Convex patterns with steep taper profiles were fabricated. Minimum pattern sizes were about one-fourth of a laser beam diameter.

WA7 10:15am-10:30am
New Dielectric Material, Zirconium Oxide-Based Film, for an Interface Layer of a Phase-Change Optical Disk
Rie Kojima, Takashi Nishihara, Noboru Yamada; Matsushita Electric Industrial Co. Ltd., Japan.
The ZrO_2-based film simultaneously possesses a high transparency at λ=405nm and a fine adherence with chalcogenide films. It greatly contributes to establish the fine optical properties and the cyclability appropriate for the dual-layer Blu-ray Disc.

10:30am-11:00am
Coffee Break

11:00am-11:45am
Session WB: Components II
(Mauka and Maloko Ballrooms)
Presiders: Chong Sam Chung, Samsung Electronics Co. Ltd., South Korea; Tim Rausch, Seagate Technology, USA

WB1 11:00am-11:15am
Radial Tilt Detection Using Push-Pull Signals
Fumitomo Yamasaki, Akihiro Arai, Hideki Aikoh; Matsushita Electric Industrial Co. Ltd., Japan.
A radial tilt detection method that performs with high accuracy even at the boundary area between recorded tracks and unrecorded tracks was developed, and its performance was confirmed experimentally.

WB2 11:15am-11:30am
Design and Fabrication of Microlens Illuminated Aperture Array for Optical ROM Card System
Hongmin Kim[1], Jeeseung Lee[1], Jiseok Lim[1], Seok-min Kim[1], Shinill Kang[1], Rob Hendriks[2], Aukje Kastelijn[2], Christopher Busch[2]; [1]Yonsei Univ., Republic of Korea, [2]Philips Res., The Netherlands.
A microlens illuminated aperture array for optical ROM card system was designed and fabricated using monolithic lithography integration method to increase the intensity of optical probes generated by Talbot effect.

WB3 11:30am-11:45am
Acousto-Optic Parallel Read/Write Head for Optical Disk Data Storage
Robert R. McLeod, Sarah K. Walter; Univ. of Colorado, USA.
We analyze and demonstrate a 100 Mb/s parallel read/write head capable of scaling to 1 Gb/s using one laser and an acousto-optic grating to create N independently modulated, rapidly steered and mutually incoherent focused spots.

11:45am-1:00pm
Session WB: Testing & Modeling
(Mauka and Maloko Ballrooms)
Presiders: Phil Herget, Carnegie Mellon Univ., USA; Masud Mansuripur, Univ. of Arizona, USA

WB4 11:45am-12:00pm
Transmission of Light through Slit Apertures in Metallic Films
Masud Mansuripur[1], Yong Xie[1], Armis R. Zakharian[1,2], Jerome V. Moloney[1,2]; [1]Optical Sciences Ctr., Univ. of Arizona, USA, [2]Mathematics Dept., Univ. of Arizona, USA.
Optical transmission through subwavelength slits is studied based on electromagnetic field distributions obtained in computer simulations. When multiple slits are present, interference among the induced surface charges/currents can result in enhanced transmission through individual slits.

WB5 12:00pm-12:15pm
Optical Disc Simulation Program Dealing with Both Electromagnetic Field and Thermal Distribution
Yuzo Yamakawa, Kazuma Kurihara, Masashi Kuwahara, Takayuki Shima, Takashi Nakano, Junji Tominaga; CAN-FOR, AIST, Japan.
We developed a new simulation program dealing with electromagnetic field and thermal profile for rotating disc using 3D-FDTD. We found that the temperature distribution is not dependent on the disc structure but also the light-polarization.

WB6 12:15pm-12:30pm
Investigation of Longitudinal and Transverse Electric Field Components in Strongly Focused Radially Polarized Light Beam
Susanne Quabis, Geoffrey Kihara Rurimo, Michael Schardt, Stefan Malzer, Gottfried H. Döhler, Gerd Leuchs; Max-Planck Res. Group, Germany.
We experimentally demonstrate that radially polarized beams can be focused to spot sizes significantly smaller than for linear polarization and that longitudinal field components can be used to study the absorption in quantum well heterostructures.

WB7 12:30pm-12:45pm
An XAFS Study of Amorphous Crystalline Phase Transitions along the GeTe-Sb_2Te_3 Pseudobinary Tie Line
Paul J. Fons[1], Alexander V. Kolobov[1], Junji Tominaga[1], Tomoya Uruga[2]; [1]Ctr. for Applied Near-Field Optics, Japan, [2]SPring-8, Japan Synchrotron Radiation Res. Inst., Japan.
We have used x-ray absorption to systematically study the structural changes occurring during the amorphous to crystalline transition in several representative compounds lying on this tie-line including GeTe, $Ge_2Sb_2Te_5$, and $GeSb_2Te_4$.

WB8 12:45pm-1:00pm
Dynamic Data Recovery from Damaged CD Media
Tom Milster[1], Fengyi Li[2], Sashi K. Kasanavesi[1], Warren Bletscher[1], Delt Hansen[1], Matt Lang[1], Paul Hauser[1]; [1]Univ. of Arizona, Optical Sciences Ctr., USA, [2]Univ. of Arizona, Electrical and Computer Engineering, USA.
Data recovery from damaged CD media is demonstrated on a dynamic spin stand. Types of damage include broken fragments, microwave irradiation, knurling, and sanding. Digital signal processing is used to improve probability of recovery.

1:00pm-2:30pm
Lunch Break

2:30pm-4:30pm
Session WC: Near Field I
(Mauka and Maloko Ballrooms)
Presiders: Tom D. Milster, Univ. of Arizona, USA; No-Cheol Park, CISD, South Korea

WC1 2:30pm-3:00pm (Invited)
High Density Near Field Optical Disc System
Masataka Shinoda; Sony Corp., Japan.
Current status and key technologies on near-field recording/readout with SILs are reported. Additionally, we show a possibility to increase transfer rate by using a monolithic dual-beam blue laser diode.

WC2 3:00pm-3:30pm (Invited)
Near-field Recording With A Solid Immersion Lens On Polymer Cover-layer Protected Discs
Coen A. Verschuren, Jack M. van den Eerenbeemd, Ferry Zijp, Julian I. Lee, Dominique M. Bruls; Philips Res., The Netherlands.
As a next step in near-field optical recording with a solid-immersion-lens in a conventional actuator, first results are presented for read-out of discs with a 3 micrometer protective polymer cover-layer and a lens with NA=1.45.

WC3 3:30pm-3:45pm
High-Density Near-Field Readout Using a Solid Immersion Lens of $KTaO_3$
Masataka Shinoda[1], Kimihiro Saito[1], Takao Kondo[1], Motohiro Furuki[1], Minoru Takeda[1], Ariyoshi Nakaoki[1], Masahiro Sasaura[2], Kazuo Fujiura[2]; [1]Sony Corp., Japan, [2]NTT Corp., Japan.
We developed solid immersion lenses made of $KTaO_3$ mono-crystal. We observed a eye pattern of 150 GB capacity with 130 nm track pitch and 47.6 nm bit length. The areal density is 104.3 Gbit/in^2.

WC4 3:45pm-4:00pm
Improved Near-Field Recording System for First-Surface Media with an NA=1.9 Solid Immersion Lens
Coen A. Verschuren, Ferry Zijp, Jack M. van den Eerenbeemd, Julian I. Lee, Dominique M. Bruls; Philips Electronics N.V., The Netherlands.
We present our progress on the development of a single blue-wavelength near-field recording system and an NA=1.9 Solid Immersion Lens in a conventional actuator. Improvements in system and recording results on first-surface media are presented.

WC5 4:00pm-4:15pm
Effects of Polarization on Design and Manufacturing of Solid Immersion Lenses for Near-Field Optical Recording
Ferry Zijp, Paul Urbach, Jack van den Eerenbeemd, Coen Verschuren; Philips Res. Labs, The Netherlands.
We report on the analysis and correction of polarization induced spurious wave front aberrations in NA>1 Solid Immersion Lenses, in particular for the NA=1.9 and NA=1.45 lenses used in our experimental near-field optical recorder.

WC6 4:15pm-4:30pm
High NA Diamond Lenses for Near-Field Optical Storage
Thomas J. Schaich, B. M. van Oerle, H. P. Godfried, P. A. Kriele, E. P. Houwman, W. G. Nelissen, G. J. Pels, P. G. Spaaij; Element Six BV, The Netherlands.
Diamond is the ultimate lens material for near-field optical data storage, allowing disk capacities up to 1000GB. Synthetic diamond super-hemispherical lenses were manufactured with surface accuracy of 15nm rms, and peak-to-value variation of 86nm.

4:30pm-5:00pm
Coffee Break

5:00pm-6:30pm
Session WP: Poster Session III
(Makai Ballroom)
Presiders: Yoshimasa Kawata, Shizuoka Univ., Japan; Joo-Ho Kim, Samsung Electronics Co. Ltd., South Korea

WP1
Design of Aplanatic Singlet for Pickup
Maxim E. Frolov[1], Alexei M. Khorokhorov[1], Alexander F. Shirankov[1], Yuri B. Golubkov[2]; [1]Samsung Optical Design Ctr. at Bauman Moscow State Technical Univ., Russian Federation, [2]Samsung Res. Ctr., Russian Federation.
Synthesis of aplanatic singlet for optical pickups is described. Numerical solution of proposed differentiation equations allows to receive required surfaces at once providing attainment of axial stigmatism and sine condition for required numerical aperture.

WP2

Design of Rotary Type VCM Actuator for SFF ODD

Dong-Ju Lee[1], Se-June Park[1], Je-Seung Oh[1], No-Cheol Park[1], Young-Pil Park[1], Ho-Seop Jung[2]; [1]Ctr. for Information Storage Devices, Republic of Korea, [2]Central R&D Inst., Samsung Electro-Mechanics Co. Ltd., Republic of Korea.

We proposed the miniaturized rotary type VCM actuator that had an effective focusing mechanism and secured sufficient bandwidth for small form factor optical disk drive.

WP3

All-In-One Optical Pickup Lens

Chi-Lin Wang, Wei-Chung Chao, Chir-Weei Chang; Opto-Electronics & System Lab, Taiwan Republic of China.

Objective lens comprises two elements that be able to read and write CD, DVD and BD. Adjusts axial position of one piece of lens, to changed the NA value. Simultaneously compensate spherical and chromatic aberration.

WP4

BD/DVD/CD Compatible Actuator with Radial Tilt Function for 9.5mm Slim Optical Disc Drives

Sam-Nyol Hong, Seong-Hun Lee, Chul-Min Kim, In-Ho Choi, Eui-Seok Ko, Jin-Yong Kim; Digital Storage Res. Lab, LG Electronics, Republic of Korea.

We present a new 3-axis actuator for CD/DVD/BD compatible pickups, applicable to 9.5mm slim disc drives. The various numerical analyses and test results proved the effectiveness of the proposed model.

WP5

Halbach Magnet Array Based Focusing Actuator for Small Form Factor Optical Storage Device

Sung Q Lee, Kang-Ho Park, Mun-Cheal Paek; ETRI, Republic of Korea.

In small form factor optical data storage devices, since the thickness is limited tightly, Halbach magnet array is adopted to increase the magnetic flux of one side without using yoke for focusing actuator.

WP6

Focusing Objective Module of Waveguide Pickup Head for Mobile Optical Storage

Yeungjoon Sohn[1], Dongwoo Suh[1], Yongwoo Park[1], Hee Sook Chung[1], Mun Cheol Paek[1], Kwangyong Kang[1], Soon-Ryong Park[2], Sung Chan Park[3]; [1]ETRI, Republic of Korea, [2]LGS Co. Ltd., Republic of Korea, [3]Dankook Univ., Republic of Korea.

A couple of aspheric lens of diameter of 1.4 mm and numerical aperture of 0.85 for blue-violet light of 405 nm was fabricated by glass molding method.

WP7

Enhanced Readout Signal of Elliptic Bubbled Super-RENS by Temperature Dependent Complex Refractive Index of Phase Change Medium

Sang Youl Kim, Sang Uk Park, Xue Zhe Li, Sang Jun Kim, Sung Hyuck An; Ajou Univ., Republic of Korea.

The temperature dependence of the complex refractive index of GST is determined by in situ ellipsometry. A model revealing the essential aspect of the elliptic bubbled Super-RENS is proposed for understanding its readout mechanism clearly.

WP8

Super-Resolution Structure Optical Disk with Semiconductor-Doped Glass (SDG) Mask Layer Containing CdSe Nanoparticles

Hung-Chuan Mai[1], Tung-Ti Yeh[1], Tsung-Eong Hsieh[1], Jr-Hau Wang[1], Han-Ping D. Shieh[2]; [1]Dept. of Materials Science and Engineering, Natl. Chiao-Tung Univ., Taiwan Republic of China, [2]Dept. of Photonics & Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan Republic of China.

This work demonstrates a distinct super-resolution phenomenon and signal properties of optical disk with a semiconductor-doped glass (SDG) mask layer containing CdSe nanoparticles.

WP9

Near-Field Characteristics and Signal Enhancement of Super-RENS Disk with Metal Nanoparticles

JianMing Li, LuPing Shi, XiangShui Miao, Kian Guan Lim, HongXin Yang, Pik Kee Tan, Tow Chong Chong; Data Storage Inst., Singapore.

Investigation focuses on near-field characteristics and surface plasmon (SP) induced with uniform- and none-uniform-size Ag nanoparticles in mask layers of super-RENS structures. Signal enhancement mechanism of the super-RENS disk is discussed.

WP10

Super-Resolution Near-Field Structure with Nanocomposite Mask Layer Prepared by Co-Sputtering Method

Wei-Chih Hsu, Min-Jen Deng, Mei-Rurng Tseng, Song-Yeu Tsai, Chum-Sam Hong; Materials Res. Labs, Industrial Technology Res. Inst., Taiwan Republic of China.

The readout properties and microstructures of super-resolution near-field structure with nanocomposite mask layer prepared by cosputtering were studied. The CNR of 100nm mark length is 40dB, which is measured by 635nm wavelength and 0.6 NA.

WP11

Change in Data Marks And Groove Structure of CD-Recordable Disks in Response to a High Power Laser Beam

Taeyoung Choi, Tom D. Milster; Optical Sciences Ctr., Univ. of Arizona, USA.

It is studied how data marks and the groove structure change when a high power laser beam (>0.5W) is focused on the data layer.

WP12

Extraordinary Optical Transmission Enhancement of Asymmetric Nano-Aperture with Surface Corrugation

Yu-Chieh Chen, Jen-Yu Fang, Chung-Hao Tien, Han-Ping D. Shieh; Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan Republic of China.

We presented an asymmetric nano-aperture with surface corrugation characterized by propagation mode and surface plasmon polaritons to provide extraordinary optical transmission enhancement of 10^5 compared with a 60-nm square aperture at spot size of 0.2λ.

WP13

Erasure Characterization of CD-Recordable Disks in Response to a High Power Laser Beam

Taeyoung Choi, Tom D. Milster, Warren Bletscher, Neil Beaudry, Paul Hauser; Optical Sciences Ctr., Univ. of Arizona, USA.

Several commercial CD-Recordable disks are exposed to high power laser beam at different exposure doses. Degrees of erasure are characterized for CD-R media using time-domain signals and histograms of data retrieved from the exposed disks.

WP14

Vertical Birefringence Measurement for Optical Polymer Films

Pingfan Wu, Moitreyee Sinha, Sofia Soloveichik, Donald J. Buckley; General Electric, USA.

This paper introduces technique for measuring vertical birefringence. We locate the in-plane axes of a film and rotate the film around the axes. Data show that VBR can be measured to a precision of $0.2*10^{-3}$.

WP15

Resolving Nano Recording Bits on Phase-Change Rewritable Optical Disk

Peilin P. Yang, Wei Chih Lin, Chih Ching Hsu, Din Ping Tsai; Ctr. of Nanostorage Res. and Dept. of Physics, Natl. Taiwan Univ., Taiwan Republic of China.

Nano-recording bits on DVD+RW were recorded by a dynamic optical disk tester and studied by a high spatial resolution conductive-AFM with excellent contrast. Writing strategy and energy dose of nano-recorded bits are studied in detail.

WP16

Experimental Setup for In situ Investigation of Phase Changing Behavior in Pram Medium by Micro-Focusing Nanosecond Time Resolved Ellipsometry

Younhwa Kim, Sang Jun Kim, Sang Youl Kim, Sung Hyuck An; Ajou Univ., Republic of Korea.

Experimental setup for investigating in real time the phase changing behavior of GeSbTe heated by electrical pulse of few tens ns is proposed. This system also comprises micro-focusing lens system to respond to micro spot.

WP17

Z-Scan Study of Nonlinear Optical Coupling of PtO_x and $Ge_2Sb_2Te_5$ of the Near-Field Optical Recording Structure

Yuan Hsing Fu[1,2], Yan Lan Lu[2], Din Ping Tsai[1,2], Wei-Chih Hsu[3], Song-Yeu Tsai[3]; [1]Dept. of Physics, Natl. Taiwan Univ., Taiwan Republic of China, [2]Ctr. for Nanostorage Res., Natl. Taiwan Univ., Taiwan Republic of China, [3]Materials Res. Labs, Industrial Technology Res. Inst., Taiwan Republic of China.

Strong local nonlinear optical coupling properties of a sandwiched 5 nm PtO_x thin film by two sandwiched $Ge_2Sb_2Te_5$ phase-change structures of a new type super-resolution near-field optical disk are investigated and observed by Z-scan experiments.

WP18

Crystallization Kinetics of a-Si/Al Bilayer and its Potentiality for Write-Once Blue-Ray Recording

Yung-Chiun Her, Chih-Wei Chen; Natl. Chung-Hsing Univ., Taiwan Republic of China.

The crystallization kinetics of a-Si/Al bilayer recording films with thickness ratios of 0.5, 1, and 1.5, and their potentialities for use in the write-once blue ray disk were studied.

WP19

Design of Elliptic Solid Immersion Lens for Dual Layer Near Field Recording

Wan-Chin Kim, Hyun Choi, TaeSun Song, No-Cheol Park, Young-Pil Park; Ctr. for Information Storage Device, Yonsei Univ., Republic of Korea.

As well as advantage of data protection, inside near-field recording has prominent technology for multi-layer recording for ultra high data capacity. We suggest dual layer near-field recording concept using elliptic solid immersion lens.

WP20

Microprobe with Wedge-Shaped Graded-Index Fiber Lens for Near-Field Recording Applications

Jen-Yu Fang, Yu-Chieh Chen, Chung-Hao Tien, Han-Ping D. Shieh; Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan Republic of China.

We demonstrated a microprobe with wedge-shaped graded-index fiber lens as near-field optical source, which provides maximum power throughput up to 1.7 at 45^{O} incidence, an enhancement factor of 10^{4} compared with a 60-nm square aperture.

WP21

Near-Field Optical Microprobe Array of Waveguide Mode for the Optical Data Storage Application

Jongkeun Oh[1], Young-Joo Kim[1], A. S. Lapchuk[2], Chun Su Kyong[2], Kenya Goto[3]; [1]Ctr. for Information Storage Device (CISD), Republic of Korea, [2]Samsung Electro-Mechanics Co. Ltd., Republic of Korea, [3]Tokai Univ., Japan.

To develop new high density optical data storage, we have studied near field optical microprobe array of waveguide mode, including the design optimization of microprobe structure, fabrication using micro-fabrication processing and evaluation of optical efficiency.

WP22

Compensation of Aberrations Due to Shift of Solid Immersion Lens for Media Inside Recording

Wan-Chin Kim, Hyun Choi, TaeSun Song, No-Cheol Park, Young-Pil Park; Ctr. for Information Storage Device, Yonsei Univ., Republic of Korea.

In near field recording, large amount of SIL shift from optical axis due to disk eccentricity degrade spot quality on recording layer. We suggest aberration compensation method using galvano actuator.

WP23

Auto-Alignment for the Focusing Unit of NFR System by Pattern Recognition of Neural Network

Hyoung Kil Yoon[1], Jun-Hee Lee[2], Jae Hwa Jeong[2], See-Hyung Lee[1], Dae-Gab Gweon[2]; [1]LG Electronics Inst. of Technology, Republic of Korea, [2]Korea Advanced Inst. of Science and Technology, Republic of Korea.

In the viewpoint of the assembly, the auto-alignment methodology of the focusing unit of NFR system is proposed and verified experimentally. Mainly, the pattern recognition by the neural network was used to methodology.

WP24
Cantilever with High Throughput Multiaperture for Near-Field Optical Data Storage
Eun-Kyoung Kim, Sung-Q Lee, Sang-Choon Ko, Kang-Ho Park; Electronics and Telecommunications Res. Inst., Republic of Korea.
High throughput near-field optical cantilever probe is prepared for high-density recording. Multiaperture cantilever is designed to enhance data transfer rate. Two-legged cantilever is proposed to regulate distances between the tips and media.

WP25
Platform for Heat Assisted Magnetic Recording Applications
Baoxi Xu, Shengbin Hu, Hongxing Yuan, Yunjie Chen, Jun Zhang, Rong Ji, Xiangshui Miao, Jingsheng Chen, Tow Chong Chong; Data Storage Inst., Singapore.
HAMR platform structure is introduced. Its functions for related researches, such like slider flying stability, high temperature lubricant and media are discussed. The general functions of HAMR are demonstrated and the lubricant research is presented.

6:30pm-8:00pm
Dinner Break

8:00pm-9:30pm
Panel Discussion: Archival Life of Optical Disks
(Mauka and Maloko Ballrooms)
Moderator: Tom D. Milster, Univ. of Arizona, USA

Thursday, July 14

8:30am-9:30am
Session ThA: Near Field II
(Mauka and Maloko Ballrooms)
Presiders: Kimihiro Saito, Sony Corp., Japan; Ferry Zijp, Philips Res., Netherlands

ThA1 8:30am-9:00am (Invited)
Spin Stand Heat Assisted Magnetic Recording Experiments Using Near Field Waveguide Optics Fabricated on AlTiC Sliders
Tim Rausch, Christophe Mihalcea, Kalman Pelhos, Duane Karns, Keith Mountfeld, Yukiko Kubota, Xiaowei Wu, Ganping Ju, William A. Challener, Chubing Peng, Lei Li, Yiao-Tee Hsia, Edward C. Gage; Seagate Research, USA.
This paper describes a series of spin stand experiments using a novel 2D waveguide near field optical condenser. The effects of laser power, external field and alignment on the play back signal are reported.

ThA2 9:00am-9:15am
Near-Field Optical Recording Using a Near-Field Focusing Element
Chubing Peng, Christophe D. Mihalcea, Dorothea Buechel, William A. Challener, Edward C. Gage; Seagate Technology, USA.
A near-field focusing element integrated on a planar waveguide has been developed and applied to phase-change recording. Using a NFFE fabricated on a Ta_2O_5 waveguide, we have recorded marks with dimensions of $\lambda/4$.

ThA3 9:15am-9:30am
Writing 40-nm Marks Using a Beaked Metallic Plate Near-Field Optical Probe
Takuya Matsumoto, Yumiko Anzai, Toshimichi Shintani, Kimio Nakamura, Tetsuya Nishida; Storage Technology Res. Ctr., Hitachi Ltd., Japan.
A near-field optical probe that uses a metallic plate with a beaked apex has been developed. Marks with diameters of 40 nm were written on phase change recording media using this probe.

9:30am-10:30am
Session ThA: High Density / High Speed Recording
(Mauka and Maloko Ballrooms)
Presiders: Isao Ichimura, Sony Corp., Japan; Tom D. Milster, Univ. of Arizona, USA

ThA4 9:30am-9:45am
High-Speed Write/Read Techniques for a Blu-Ray Write-Once Disc
Hiroyuki Minemura[1], Koichi Watanabe[1], Kazuyoshi Adachi[2], Reiji Tamura[2]; [1]Hitachi Ltd., Japan, [2]Hitachi Maxell, Ltd., Japan.
We have been developing high-speed write/read techniques for Blu-ray discs. In 9X write/read tests on a phase-change-write-once disc, bit error rates of under 10^{-6} and a power margin of ±18% are obtained.

ThA5 9:45am-10:00am
Low Jitter in BD-R with Optimized Cu/Si Bilayers
Ton Kuiper, Ruud Vullers, Donato Pasquariello; Philips Res., The Netherlands.
Recording experiments performed on BD-R stacks with 4nm/4nm Cu/Si layers prove that jitter values as low as 4% are achievable. The writing mechanism is identified as a diffusion-driven process, probably that of Si into Cu.

ThA6 10:00am-10:15am
HD DVD-R Disc With Organic Dye Having Low To High Polarity Recording
Koji Takazawa, Naoki Morishita, Yasuaki Ootera, Kazuyo Umezawa, Naomasa Nakamura, Seiji Morita; Toshiba corporation, Japan.
We developed the disc which adopted organic dye for the recordable high resolution digital versatile disc (HD DVD-R) system with the user data capacity of 15GB which can be recorded.

ThA7 10:15am-10:30am
HD DVD-R Disc Produced in the Current DVD-R Mass-Production Line with Excellent Read Stability Low-to-High Polarity Organic Dye
Seiji Morita; Toshiba Corp., Japan.
HD DVD-R disc (15GB/DVD size) has been produced in the current DVD-R mass-production line with only changing a stamper and an organic dye. Excellent readout stability was achieved by using low-to-high polarity organic dye.

10:30am-11:00am
Coffee Break

11:00am-1:00pm
Session ThB: Super Resolution
(Mauka and Maloko Ballrooms)
Presiders: Din Ping Tsai, Natl. Taiwan Univ., Taiwan; Kiichi Ueyanagi, Fuji Xerox Co. Ltd., Japan

ThB1 11:00am-11:30am (Invited)
Energy Gap Induced Super Resolution (EG-SR) ROM Disc With High Readout Stability
Nobuyuki Takamori, Masaki Yamamoto, Go Mori, Hideharu Tajima, Kunio Kojima, Akira Takahashi; Sharp Corp., Japan.
We have developed a super resolution ROM disc with high readout stability using EG-SR technology. Applying the reversible optical constant change, we can successfully achieve the super resolution effects beyond the optical diffraction limit.

ThB2 11:30am-11:45am
bER Characteristics of Super-RENS WORM Disk
Jooho Kim[1], Inoh Hwang[1], Jaecheol Bae[1], Jinkyung Lee[1], Hyunsoo Park[1], Insik Park[1], Takashi Kikukawa[2], Narutoshi Fukuzawa[2], Tatsuhiro Kobayashi[2], Junji Tominaga[3]; [1]Samsung Electronics, Republic of Korea, [2]TDK Corp., Japan, [3]Natl. Inst. of Advanced Industrial Science and Technology, Japan.
bER of 10-2 level at 50GB and 10-3 level at 40GB was obtained using new signal processing techniques and Super-RENS WORM disk. This result shows high feasibility of super-RENS technology for practical use.

ThB3 11:45am-12:00pm
Low Frequency Noise Reduction of Super-Resolution Near-Field Structure Disc with Platinum-Oxide Layer
Takashi Kikukawa, Narutoshi Fukuzawa, Tatsuhiro Kobayashi; TDK Corp., Japan.
We have analyzed the origin of the low frequency noise (LFN), the reason of the high LFN of PtO_x super-RENS, and succeeded in reducing the LFN greatly.

ThB4 12:00pm-12:15pm
Random Signal Characteristics Of Super-RENS ROM Disc
Hyunki Kim, Jooho Kim, Changmin Park, Moonil Jung, Myongdo Ro, Insik Park; Samsung Electronics, Republic of Korea.
We obtain the bER of 4.6×10^{-4} at 50GB capacity level through the improvement of signal quality with random pattern signal of the super resolution near field structure disk in a red laser optical system.

ThB5 12:15pm-12:30pm
Pit Shape Dependence of Super-RENS ROM Disc
Kazuma Kurihara, Takayuki Shima, Takashi Nakano, Masashi Kuwahara, Junji Tominaga; Natl. Inst. of Advanced Industrial Science and Technology, Japan.
We propose a fabrication method of Super-RENS ROM disc using PtOx thermal decomposition. The pit shape dependence was also investigated by fabricating elliptical pits. It was confirmed that the CNR can be improved by 7dB.

ThB6 12:30pm-12:45pm
Toward the Implementation of Practical Super-RENS System Using a Commercial Drive
Jen Wu Fang[1], Chia Che Wu[1], Allen Liao[1], Wei Chih Lin[2,3], Din Ping Tsai[2,3]; [1]LITE-ON IT Corp., Taiwan Republic of China, [2]Dept. of Physics, Natl. Taiwan Univ., Taiwan Republic of China, [3]Ctr. for Nanostorage Res., Natl. Taiwan Univ., Taiwan Republic of China.
Implementation of practical Super-RENS system by using the existing commercial drive is achieved. The commercial drive can perform mark position recording with 220nm mark size and correctly retrieve the recorded signal for ZnO-type Super-RENS discs.

ThB7 12:45pm-1:00pm
Investigation on Mechanism of Aperture Type Blu-Ray Super-Resolution Near-Field Optical Disk
L. P. Shi, T. C. Chong, X. Hu, J. M. Li, X. S. Miao; Data Storage Inst., Singapore.
The mechanism of the aperture-type Blu-ray super-resolution near-field phase-change disk with a mask layer of Sb_2Te_3 was studied theoretically and experimentally. The thermal stability problem has been solved by developing a new thermal shield layer.

1:00pm-2:30pm
Lunch Break

2:30pm-4:30pm
Session ThC: Media II
(Mauka and Maloko Ballrooms)
Presiders: Junji Tominaga, AIST, Japan; Noboru Yamada, Matsushita Electric Industrial Co. Ltd., Japan

ThC1 2:30pm-2:45pm
Field Enhancement by Surface Plasmon Polariton for Self-Assembled Nano-Patterning Media
Tsuyoshi Matsuyama[1,2], Yoshimasa Kawata[1]; [1]Faculty of Engineering, Shizuoka Univ., Japan, [2]Pulstec Industrial Co. Ltd., Japan.
We fabricated nano-dots array on the gold by self-assembly of a diblock copolymer. The surface plasmon polariton was excited at the interface between gold and nano-dot array with the Kretschmann configuration.

ThC2 2:45pm-3:00pm
Super-Resolution ROM Disc Using GeAl Reflective Absorption Layer
Kazuhiko Aoki, Hideki Tanabe, Shuichi Ohkubo, Eiji Kariyada, Ryuichi Katayama, Yutaka Yamanaka; NEC Corp., Japan.
We have developed a super-resolution ROM disc using a newly designed GeAl reflective absorption layer. The optical resolution limit in high readout power expanded more than 1.5 times compared with that in low readout power.

ThC3 3:00pm-3:15pm
The Feasibility of High-Speed Recording on Oxonol Dye Double-Layer DVD+R Discs Produced Using the Inverted Stack Method
Tomokazu Umezawa, Hirokazu Hashimoto, Michihiro Shibata, Hiroshi Kubo, Masuji Motoki, Hisashi Mikoshiba; Fuji Photo Film Co. Ltd., Japan.
The feasibility of high-speed recording on oxonol dye double-layer DVD+R discs produced using the inverted stack method is investigated. L0 jitter of 7.6% and L1 jitter of 7.4% was achieved at 12x recording speed.

ThC4 3:15pm-3:30pm
Phase Change Media for High-Speed and High-Density Recording
Shuichi Ohkubo, Eiji Kariyada, Tatsunori Ide; Media and Information Res. Labs, NEC Corp., Japan.
The feasibility of 4X HD DVD-RW has been confirmed with In added Ge-Sb-Te based nucleation dominant recording film which has not only high crystallization speed but low cross-erase.

ThC5 3:30pm-3:45pm
High-Speed Deposition of New Dielectric Film Having the Low Refractive Index for the Rewritable HD DVD Media
Tsukasa Nakai, Keiichiro Yusu, Yasuhiro Satoh, Sumio Ashida; Toshiba Corp., Japan.
We have developed a new material "SiOC" for the rewritable HD DVD media. The refractive index is similar low that of SiO_2. The deposition rates are much higher with either RF or DC power supply.

ThC6 3:45pm-4:00pm
Disc Technology for 2.4x - 4x Dual-Layer Rewritable DVD
Bas Feddes[1], Wim Koppers[1], Pierre Woerlee[1], Mark van Schijndel[2], Paul Weijenbergh[3]; [1]Philips Res., The Netherlands, [2]Philips Optical Media & Technology, The Netherlands, [3]Philips Intellectual Property & Standards, The Netherlands.
Rewritable DVD+RW dual-layer technology for 2.4x and 4x recording velocity is presented. For both information layers, low jitter and high modulation values were achieved. An N/2 write strategy was needed to record in the L_1.

ThC7 4:00pm-4:15pm
Organic Dye 25 GB Write-Once Disk With In-Groove Structure
Hiroshi Nishiwaki[1], Eiji Muramatsu[1], Kazutoshi Kitano[1], Shoji Taniguchi[1], Akiyoshi Inoue[1], Fumihiko Yokogawa[1], Michikazu Horie[2], Kenjirou Kiyono[2], Takashi Miyazawa[2], Yutaka Kurose[2]; [1]Pioneer Corp., Japan, [2]Mitsubishi Kagaku Media Co. Ltd., Japan.
We realized organic dye 25GB media, which is optimized for 405 nm laser recording, and in-groove disk structure. To optimize the condition of in-groove structure, the computer simulation was used.

ThC8 4:15pm-4:30pm
Massively Multi-Level Optical Data Storage Using Subwavelength-Sized Nano-Grating Structures
Fred Thomas[1], Hubert Kostal[2], Jian Jim Wang[2]; [1]Iomega Corp., USA, [2]NanoOpto Corp., USA.
Can 3D reflective nano-grating structures molded in plastic optical ROM media be interrogated by a diffraction-limited focused spot for the retrieval of massively multilevel information? Empirical data for nano-grating encoded data states is presented.

4:30pm-5:00pm
Coffee Break

5:00pm-7:00pm
Session ThD: Holographic Recording II
(Mauka and Maloko Ballrooms)
Presiders: Seiji Kobayashi, Sony Corp., Japan; Robert R. McLeod, Univ. of Colorado, USA

ThD1 5:00pm-5:30pm (Invited)
Study On Multiplexing Methods For Volume Holographic Memory
Hisayuki Yamatsu, Megumi Ezura, Nobuhiro Kihara; Home Electronics Development Group, HENC, Sony Corp., Japan.
Several important hologram multiplexing methods such as phase-code, shift, speckle, angle, and polytopic multiplexing were evaluated experimentally. Those methods were compared from the viewpoints of recording density, data transfer rate, and media interchangeability.

ThD2 5:30pm-5:45pm
High Speed Holographic Data Storage at 100Gbit/in^2
Edeline Fotheringham, Ken Anderson, Adrian Hill, Bradley Sissom, Kevin Curtis; InPhase Technologies, USA.
We present a holographic system and experimental results that demonstrate data densities of 100 Gbit/in2 with a write user rate of 235 Mbit/s and a read user rate of 117 Mbit/s.

ThD3 5:45pm-6:00pm
Optical Collinear Holographic Recording System Using a Blue Laser and a Random Phase Mask
Koji Ishioka, Kenji Tanaka, Naoto Kojima, Atsushi Fukumoto, Mikio Sugiki; Sony Corp., Japan.
A new multiplexing technique for optical collinear holography is introduced. The result shows that 12x12 at 16μm pitch multiplexing was attained. And a possibility to the user bit density of 42Gbits/inch^2 was implied.

ThD4 6:00pm-6:15pm
Image Oversampling for Holographic Data Storage
Mark R. Ayres, Alan Hoskins, Kevin Curtis; InPhase Technologies Inc., USA.
A method is presented for reading holographic data pages with a non-pixel matched detector array. The method employs sub-Nyquist oversampling and a system of alignment fiducials that can compensate for slowly varying image distortions.

ThD5 6:15pm-6:30pm
Temperature Tolerance Improvement with Wavelength Tuning Laser Source in Holographic Data Storage
Mitsuru Toishi, Tomiji Tanaka, Mikio Sugiki, Kenjiro Watanabe; Sony Corp., Japan.
We show the method to increase temperature tolerance with wavelength tuning in holographic data storage and demonstrate to keep high SNR with temperature change by using the wavelength tuning blue ECLD that is under development.

ThD6 6:30pm-6:45pm
Holographic Versatile Disc (HVD)
Hideyoshi Horimai, Yoshio Aoki; OPTWARE Corp., Japan.
Data interchangeability is the most important issue for the removable storage media. A recording format of Holographic Versatile Disc (HVD) is proposed to assure the data interchangeability.

ThD7 6:45pm-7:00pm
2-D Equalization and Error Correction Using Low Density Parity Check (LDPC) Codes for Holographic Data Storage
Lakshmi D. Ramamoorthy, B. V. K. Vijaya Kumar; Carnegie Mellon Univ., USA.
We demonstrate bit error rates of about 10^{-7}, using rate ½ Low Density Parity Check codes and minimum mean squared error equalizer in a holographic data storage channel suffering from two-dimensional intersymbol interference and noise.

7:00pm-7:20pm
Awards Ceremony and Closing Remarks
(Mauka and Maloko Ballrooms)

Author Index

Postdeadline Submissions

Postdeadline papers for ISOM/ODS 2005 is now being accepted online at www.osa.org/ods. Authors reporting extraordinary results should submit their papers electronically before the deadline (see below).

Electronic Submission Deadline:
June 10, 2005 noon EDT

A complete submission will include the following:

- Completion of Submission Page Required Fields
- 35-Word Abstract
- 3-Page Summary
- Copyright Agreement
- OCIS Codes
- Presentation Preference

Adherence to the instructions for preparation of the paper is imperative. Emailed or faxed submissions will not be accommodated. Failure to complete any of the preceding requirements may result in rejection of a paper. It is incumbent on the authors to obtain appropriate approval to present their work to this conference.

35-Word Abstract

This abstract should be a brief summary of the paper topic.

3-Page Summary

The summary must be formatted for 8 ½-inch x 11-inch with 1-inch margins on all sides. Within three pages, the author must include all text, equations, tables, figures and references. The title of the paper and the author(s)'s name(s), affiliation(s), address(es), phone and fax numbers, and e-mail address(es) must appear on the first page. The 35-word abstract should be repeated in the summary. Do not use asterisks, acknowledgments, job descriptions or footnotes. The style guide is provided at the above website. Papers can be submitted in Microsoft Word or PDF format. Please make sure that your paper contains no non-English

fonts (Japanese fonts, Korean fonts, Chinese fonts, etc.) in the text as well as in the tables and figures. If the paper is accepted, the summary will be distributed at the conference.

Copyright Agreement

The submission process incorporates an electronic copyright transfer agreement. No additional mailed documentation is required.

OCIS Codes

As part of the submission process, authors will be asked to indicate which of the several broad optics categories best characterizes their paper.

Presentation Preference

On the submission process, authors will be asked for their presentation preference. The options are oral only, oral preferred, poster only and poster preferred. The final mode of presentation will be decided by the Technical Program Committee.

Notification of Acceptance

Authors will be notified of the status of their paper by the end of June, 2005. Notification will be sent only to the corresponding author.

Modes of Presentation

Oral Presentation

The presentation times for oral sessions are as follows: invited papers are 30 minutes each including 5 minutes for questions, contributed papers are 15 minutes each including 3 minutes for questions.
The conference room will contain the following:

- LCD projector
- Podium microphone
- Screen
- Projection pointer
- Computer

Please note that the conference room equipment will not include a 35mm slide projector or an overhead projector. Additional equipment will be made

available only by special arrangement. The attendee will be responsible for the cost of any additional equipment. Write or call the OSA Meetings and Exhibits Department with your request for other equipment at +1.202.416.1989 (Phone), +1.202.416.6100 (Fax), avrequests@osa.org (Email) by June 6, 2005.

Poster Presentation

Poster sessions are scheduled to provide an opportunity for selected papers to be presented in greater visual detail and should facilitate vivid discussions with attendees. For poster sessions, each author is provided a 4-foot high x 8-foot wide (122 cm x 244 cm) bulletin board on which to display a summary of the paper, a sign indicating your paper number, and push pins or adhesive tape. Presenters should display the paper title and authors and affiliations on their posters. Please note that poster papers are not supplied with electricity or audiovisual equipment. Authors must remain in the vicinity of the bulletin board for the duration of the session (90 minutes) to answer questions.

Presenters may set up their poster presentations starting 1 hour before the poster session. All presentations must be posted 30 minutes before the session starts. Presentations should be removed from the poster boards 15 minutes after the conclusion of the poster session. Presentations should not be removed prior to the end of the poster session.

Awards

The ISOM/ODS Awards for best oral and poster presentations will be presented during the awards ceremony. In addition, for the best student paper presentation, the ISOM/ODS Student Award will be presented during the ceremony. ISOM/ODS welcomes student presentations from university level students. To be considered you must be presenting an oral or poster presentation and be a currently enrolled student at a university. Each of the best papers will receive a certificate and prize.

Publication of Conference Papers

In addition to the Technical Digest available at the conference, conference papers will be published as a special issue of the Japanese Journal of Applied Physics (JJAP) in February, 2006. The authors who will have, by themselves, presented papers at ISOM/ODS 2005 will be allowed and strongly encouraged to submit their papers for publication in this special issue.

Each author will be requested to download author's kits including an application form and a copyright form for the paper at www.isom.jp. The deadline for submission of manuscripts is August 15, 2005. Submitted papers will be reviewed based on the JJAP standard.

Tabletop Exhibits

A highly focused exhibit opportunity that meets your marketing needs is offered. Exhibit at ISOM/ODS 2005 and you will:

- Get one complimentary registration list
- Receive one complimentary technical registration and two exhibit personnel registrations
- Receive one copy of the Technical Digest
- Share an event that draws the world's experts in the field of optical memory and optical data storage
- Have an opportunity to bring the latest research and findings back to your company
- Enjoy valuable exposure during breaks and poster sessions

Exhibit space is:

- Limited. You will have the opportunity to meet one-on-one with each attendee.
- Unique. The exhibit is the focal point during all breaks.
- Cost effective. For only $990, you can exhibit at this targeted event to meet new prospects and attend all sessions to hear about the latest research.

To reserve tabletop exhibit space at this conference, please download the space reservation contract at www.osa.org/ods. Complete the form, including your payment information, and fax it back to the OSA Exhibits Department at +1.202.416.1408. A confirmation of your space will be emailed to you within 2-3 business days of receipt of your faxed contract. If you have questions about exhibiting at this conference, please contact the OSA exhibit sales staff at +1.202.416.1928 or exhibitsales@osa.org.

Registration

Registration Hours

Day	Time
Sunday, July 10, 2005	7:30a.m.-5:30p.m.
Monday, July 11, 2005	7:00a.m.-5:00p.m.
Tuesday, July 12, 2005	7:30a.m.-1:00p.m. 5:00p.m.-7:00p.m.
Wednesday, July 13, 2005	8:00a.m.-5:00p.m.

4 Ways to Register

1. Online
   Complete the online registration process at www.osa.org/ods and pay online by credit card. Please keep your e-mail confirmation as proof of your registration.
2. Mail
   OSA Finance Department
   ISOM/ODS 2005 Registration
   2010 Massachusetts Ave., NW
   Washington, DC 20055-0214, USA
3. Express Courier
   OSA Finance Department
   ISOM/ODS 2005 Registration
   2010 Massachusetts Ave., NW
   Washington, DC 20036-1023, USA
4. Fax
   Send your registration form with credit card payment to +1.202.416.6100. To avoid duplicate payment DO NOT fax your form more than once. Please keep your fax confirmation as proof of your registration.

Full Conference Registration

The registration fee for ISOM/ODS 2005 includes admission to the technical sessions, the conference reception, refreshment breaks, the technical exhibit and a copy of the printed Technical Digest and the Technical Digest on CD-ROM.

Student Registration

Full-time students (graduate and undergraduate) are entitled to the same privileges as regular registrants. To be eligible to receive the discounted student rate, students must be enrolled in a full-time PhD or Masters program. Students are required

to present valid identification at the time of registration.

Emeritus Registration

Emeritus members may also register at the discounted rate. To qualify for emeritus status, members must be fully retired and must have been a member for at least 10 years. The member's age plus the number of years of membership must equal 75 years or more.

Registration Fees

Member Type	Before/On June 10, 2005	After June 10, 2005
Regular Member (OSA/LEOS/SPIE/JSAP/ MSJ)	$530	$630
Regular Nonmember	$680	$780
Student/Emeritus Member (OSA/LEOS/SPIE/JSAP/ MSJ)	$190	$260
Student/Emeritus Nonmember	$230	$320

Short Course Registration

Separate registration for short courses is required. Attendees may register for short courses only or can register for courses in addition to either of the registration types listed above. The short course only registration includes admission to the course, a copy of the short course notes, admission to the Exhibit Hall, a copy of the exhibit guide and a copy of the conference program.

Please note: Each short course requires a separate fee and ticket. Pre-registration is advised, as there will be no wait list for sold out courses. In addition, short course notes are not available for purchase.

Short Course Registration Fees

Member Type	Before/On June 10, 2005	After June 10, 2005
Member	$225	$275
Nonmember	$300	$350

Checks and Money Orders

All checks must be in US dollars and made payable to the Optical Society of America. Please indicate the check number on the registration form.

Bank Drafts and Wire Transfers

Please indicate on your registration form which bank was used and when the deposit was made. Also, please notify OSA of the transfer to avoid any lost or unidentified payments.

Refund Policy for Registration

A $50 service charge will be assessed for processing refunds. A letter requesting the refund should state the registrant's name and the amount of payment and should be faxed to +1.202.416.6100. Requests for refunds that are received by June 22, 2005, will be honored.

Housing

A block of sleeping rooms has been reserved for the convenience of conference attendees at the Hyatt Regency Waikiki. The conference rates are:

Room Type	Rate
Single Room	$150
Double Room	$150
Extra Person	$35

Reservations may be made by calling the toll-free reservations number +1.800.554.9288 or the hotel directly at +1.808.923.1234 and requesting the group rate, or by faxing the housing form to the hotel. The Hyatt Regency Waikiki must receive reservations by no later than June 10, 2005. After this date, the balance of the rooms will be released to the hotel.

These nightly rates do not include any applicable state sales and lodging tax. All reservations must be accompanied by a first night room deposit or guaranteed with a major credit card. Attendees canceling a reservation must cancel 72 hours before the scheduled day of arrival to receive a full refund of the deposit. Group rates are in effect for the dates of July 7-16, 2005.

Transportation

Airline Travel

United Airlines has been appointed the official airlines for ISOM/ODS 2005. Several pricing options are available to meet your needs. You may choose a 5% discount off any United domestic published airfare or a 10% discount off the unrestricted mid-week coach fare. Receive an additional 5% discount on tickets purchased at least 60 days in advance of travel. Or you may choose Area Pricing, a fixed airfare rate based on geographical location. Area Pricing must be purchased at least seven days in advance. These discounts apply on United Airlines, Shuttle by United and United Express.

You or your travel agency can call United's toll-free number +1.800.521.4041 and refer to the conference ID number 598BW. Dedicated reservationists are on duty seven days a week, 7:00 a.m. to midnight EDT. Book early to take advantage of promotional fares that give you the greatest discount. Mileage Plus members receive full credit for all miles flown to this conference.

Rental Cars

Avis Rent-A-Car is pleased to offer low rates with unlimited mileage to participants attending the conference. For Avis contact +1.800.331.1600 and refer to the Avis Worldwide Discount Number D004076. Reservations may also be made online at www.avis.com.

Transportation to Hotel from Honolulu International Airport

By Car

- Follow "Honolulu/Waikiki" signs east on Nimitz Hwy. (becomes Ala Moana Blvd. downtown.)
- Exit at Kalakaua Ave.
- Proceed to Ka'i'ulani Ave. and turn left.
- Turn right at Koa Ave. (at King's Village.)
- Proceed to Uluniu Ave.
- Turn right to hotel's main entrance.

By Shuttle

Please visit the Honolulu International Airport homepage at www.state.hi.us/dot/airports/oahu/hnl for information on the Waikiki Express.

About Oahu, Hawaii

Oahu is the most popular of the Hawaiian Islands and it's easy to understand why — there's so much to do on Oahu!
With Waikiki as a central hub, you can explore the legendary North Shore of Oahu one day and spend the next day on the east side snorkeling at Hanauma Bay, a protected marine sanctuary with tons of colorful fish. It's clear that Oahu offers just the right amount of diversity for the adventurous as well as the cautious visitor. Thrill seekers can skydive at Mokuleia while daydreamers can relax peacefully on the beach. Exquisite dining and exciting nightlife also entice people to Oahu again and again. To learn more about Oahu, Hawaii, please visit www.gohawaii.com.

Messages

Messages for participants at the conference should be directed to the ISOM/ODS Registration Desk. The address, telephone number and fax number for the Hyatt Regency Waikiki are as follows:

2424 Kalakaua Avenue, Honolulu, Hawaii, 96815-3289, USA
Tel: +1.808.923.1234
Fax: +1.808.923.7839

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For questions concerning ISOM/ODS 2005, please contact:

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