IEEE Magnetics Society NEWSLETTER

Volume 41, No. 4. October 2003

Martha Pardavi-Horvath, Editor
Can Korman, Publicity

TABLE OF CONTENTS

IEEE MAGNETICS SOCIETY OFFICERS
2003-2004

OFFICERS:

President	Ronald S. Indeck	rsi@ee.wustl.edu
Vice President	Kevin O'Grady	kog1@york.ac.uk
Secretary/Treasurer	Carl E. Patton	patton@lamar.colostate.edu
Past President	Robert E. Fontana, Jr	Robert.Fontana@hgst.com
Executive Director	Diane Suiters-Melton	magsoc@courtesyassoc.com

STANDING COMMITTEES:

Constitution and Bylaws Chair	Kevin O'Grady	kog1@york.ac.uk
Education Chair	J. W. Harrell	jharrell@bama.ua.edu
Finance Chair	Shan Wang	sxwang@ee.stanford.edu
Membership Chair	Richard Dee	r.dee@ieee.org
Nominations Chair	Phil Wigen	Wigen.1@osu.edu
Planning Chair	Kevin O'Grady	kog1@york.ac.uk
Publicity Chair	Can Korman	korman@gwu.edu
Standards Chair	Bruce Gurney	Bruce.Gurney@hgst.com

DEPARTMENTS:

Awards		
Chair	Dave Thompson	d.thompson@ieee.org
Distinguished Lecturers	Stan Charap	charap@ece.cmu.edu
Chapters Chair	Richard Dee	r.dee@ieee.org
Conference Executive Committee		
Chair	Doug Lavers	lavers@ecf.utoronto.ca
Publications Editor-in-Chief	Ron Goldfarb	r.goldfarb@ieee.org
Technical Committees Chair	Hans Richter	hans.j.richter@seagate.com
Magnetics Society Newsletter		
Editor	Martha Pardavi-Horvath	mpardavi@gwu.edu
Press Liaisons	Stan Charap	charap@ece.cmu.edu
	Gordon Hughes	gfhughes@ucsd.edu
	John T. Scott	jscott@viconet.com\

Chapters Corner

NEWS NEWS NEWS…

New Chapter Formed

A new Magnetics Society Chapter was formed in **Seoul, Korea** under the leadership of Prof. ***Young Keun Kim*** (Korea University). Information on local activities there can be obtained from Prof. Kim at ykim97@korea.ac.kr . We wish them all the best for contributing to an active magnetics community in Korea.

UKRI Chapter

Professor ***Mike Gibbs*** was elected as the new Chair. Mike is Professor of Functional Magnetic Materials in the Department of Physics & Astronomy at the University of Sheffield, UK. He is a past Program Chair for INTERMAG (1990), and is a current member of the Technical Committee. He can be contacted at M.R.Gibbs@sheffield.ac.uk.

Denver-Rocky Mountain Chapter

Regular meetings have happened this last year in co-operation with the Colorado Center for Information Storage (CCIS) at the University of Colorado in Boulder. We even get free pizza from KnowledgeTek (Thanks! Magneticians like pizza!). Thanks go out to the local chair ***Dave Pappas*** (pappas@boulder.nist.gov) and the CCIS rep. ***Amahl Scheppach.***

Meetings held so far this year:

January 23	***Dennis Speliotis***, “Advanced Magnetic Metrology for Data Storage”.
March 20	***Richard Dee*** StorageTek, “TeraByte Tape”.
April 15	***Jordan Katine,*** Hitachi, "Nanoscale Processing for Thin Film Recording Heads”
May 22	***Mike Miller***, NRL, "Magneto-electronic based biosensors".
May 8	***Thomas Howell***, San Jose State, ""Design of advanced signal processing systems"**.
June 17	***YangQuan Chen***, Utah State, "The joy of controlling High TPI hard disk drives”.
Aug. 28	***John Chapman***, Univ. Glasgow, "Wall Watching" **.
Sept. 24	***Ken Marr***, FBI, "Forensic analysis of magnetic media" .

** Magnetics Society Distinguished Lecturer.

Romania Chapter

Magnetics is alive and well in Romania. Local chairman Professor ***Alexandru Stancu*** runs the chapter and organizes events.

One recent event was a ***workshop on Amorphous and Nanostructured Magnetic Materials*** held at "Alexandru Ioan Cuza" University**,** Iasi, ROMANIA on Tuesday, 16th of September.

Chair: Professor ***Alexandru Stancu***

"The IEEE Magnetics Society Chapter of the Romania Section (IEEE MSC-RS) was formed in 2002. This meeting is organized by the IEEE MSC-RS with the occasion of the ***2nd International Workshop on Amorphous and Nanostructured Magnetic Materials***, at "Alexandru Ioan Cuza" University.

"Alexandru Ioan Cuza" University, the first modern Romanian university, was founded in 1860 in Iaşi, the old capital of Moldavia, one of the most prestigious cultural centers of the country. It has now more than 30,000 students and is recognized as one of the top Romanian universities.

This meeting is dedicated to a selection of four invited talks presented by young Romanian scientists (from Romania or abroad) in the field of magnetism."

Talks:

Bogdan Vâlcu, and H. Neal Bertram
CMRR, UCSD, CA, USA
"Soft underlayer magnetization dynamics" – invited talk

Nicoleta Lupu[1,2], Laurenţiu Stoleriu[3], Dorin Cimpoesu[3], Alexandru Stancu[3], and Horia Chiriac[2]
[1] *Institute for Materials Research, Tohoku University, Sendai, Japan*
[2] *National Institute of Research and Development for Technical Physics, Iasi, Romania*

[3] *"Alexandru Ioan Cuza" University, Faculty of Physics, Iasi, Romania*

"Microstructures and Magnetization Processes in Nd-Fe-Al Glassy Alloys" – invited talk

Beatrice Negulescu[1,2], Luc Thomas[2], Marcel Guyot[2] , and Constantin Papusoi[1]

[1] *"Alexandru Ioan Cuza" University, Faculty of Physics, Iasi, Romania*

[2] *Laboratoire de Magnétisme et d'Optique, Univ. Versailles Saint-Quentin-en-Yvelines, Versailles, France*

"Properties of exchange coupled NiO / $NiFe_2O_4$ bilayers " – invited talk

Melania Marinescu, and Horia Chiriac

National Institute of Research and Development for Technical Physics, Iasi, Romania

"Magnetic relaxation in nanocrystalline Nd-Fe-B ribbons" – invited talk

Visitthe Romanian Chapter's website at
http://stoner.phys.uaic.ro/IEEE/index.php

Chapter Chair Meeting

There is going to be a chapter chair meeting at the Joint MMM/Intermag Conference in Anaheim in January 2004. The time and date is currently set at ***5pm on Tuesday January 6th, 2004*** (room to be announced). All chapter chairs (or chapter representatives) are encouraged to attend to discuss chapter issues at large. The meeting should last no longer than an hour.

✸✸✸✸

If you are the local chapter chair reading this, please share with us all what's happening in your chapter and local area (e.g. talks, people activity, magnetics news, company or university news etc.). Forward a paragraph (or two), a picture, a reference to an interesting article or something inventive or newsworthy to me at r.dee@ieee.org so we can include in the next MagSoc NEWSLETTER.

Dr. Richard H. Dee
Magnetics Society Chapters Chair

IEEE Magnetics Society Technical Committee

If you look at the inside of the front cover of the IEEE Transactions on Magnetics, you find a lot of information about the Magnetic Society. Among others, there is also a "***Technical Committee***", and you may have wondered what the Technical Committee is and what it is doing.

The Technical Committee is a group of experts in their respective fields which has an advisory function to the Magnetic Society. The members of the Technical Committee have volunteered to provide service to the Magnetics Society, such as helping with the review process of the Transactions of Magnetics and serving as Program Committee members of IEEE sponsored conferences on magnetism. Finally, not least the Technical Committee members answer general technical questions which are posed to the Magnetics Society. In the past, these questions were answered individually, but it is planned to provide an FAQ section in the Magnetics Society web page so that the questions and answers are accessible to all interested parties.

In the last years, the Technical Committee had 10 – 15 members. Currently there are 20 members and it there are plans to expand the Committee to 20 – 40 active members. The areas of expertise are chosen to reflect the main topics which are currently discussed in the field of applied magnetism. Depending on the current level of activity, an area of expertise can be represented by more than one member of the Committee.

If you have any questions or suggestions, please feel free to contact:

Hans Jürgen Richter
Chair,
Technical Committee of the IEEE Magnetics Society

Seagate Recording Media
47010 Kato Road
Fremont, CA, 94538, USA
phone 510 - 353 4988
e-mail: hans.j.richter@seagate.com

2003 IEEE Annual Elections

Did you vote?

Selection of officers for the top-level leadership positions in the IEEE begins 15 March when the candidate slates are submitted to the IEEE Board of Directors. The Board then announces its list of nominees for each office on 1 May. These include:

- president-elect
- delegate/director
- delegate-elect/director-elect
- other officers

to be elected by voting members for the coming year

Election Ballots Mailed in September

Annual election ballots for IEEE President-Elect and other officers will be mailed on 1 Sept. 2003 to all eligible voting members whose dues are current. Members, Honorary Members, Senior Members, Fellows, Life Members, Life Fellows, and Life Senior Members are eligible to vote.

To receive a ballot, your membership dues for 2003 must be paid by 31 July. Members whose dues are in arrears as of 1 Aug. 2003, regardless of grade, will be ineligible to vote.

Ballots are mailed on or before 1 September and must be returned before 12:00 noon on the first business day following 31 October. While election results are announced by the IEEE Tellers Committee, these results are unofficial until the IEEE Board of Directors accepts the Tellers Committee report at its last meeting of the year.

For more information about the election process see IEEE Bylaw I-308.

You can **meet the candidates** at

http://www.ieee.org/portal/index.jsp?pageID=corp_level1&path=corporate/elections&file=candidates.xml&xsl=generic.xsl

Your vote counts! By the time you read this information, the election process is over.

Let's wish our newly elected officers a productive and successful term.

Magnetics Society Distinguished Lecturers for 2004

Dynamics, Damping and Defects in Thin Ferromagnetic Films

Robert D. McMichael
National Institute of Standards and Technology

Modern disk drives can read and write bits every two nanoseconds, a time scale very similar to the magnetic damping time of the ferromagnetic metals used in the heads. The damping characteristics are also important for thermally-driven magnetic noise in sensors. Furthermore, it seems likely that damping will limit data rates in magnetic random access memory, since the magnetization in a memory cell must be allowed to settle between switching events. For all of these applications, measurements of damping are important, and these measurements are most commonly made by ferromagnetic resonance linewidth. The two problems that complicate measurements of damping by ferromagnetic resonance are: 1) defects contribute to the linewidth, so that the linewidth is the combined effect of defects and damping, and 2) the form of the damping itself is the subject of some debate.

Patterning is perhaps the ultimate form of magnetic inhomogeneity in a thin film. Unlike the spin-wave normal modes of a continuous film, the normal modes of patterned elements are shape and size dependent. The dynamic properties can be addressed using available micromagnetic modeling software to obtain images of the normal mode precession patterns.

In this lecture, I will discuss primarily the role of defects in magnetization dynamics. I will emphasize the competition between interactions, which promotes the collective behavior typified by spin waves, and inhomogeneity, which promotes local behavior. An understanding of these effects allows one to use linewidth data to characterize damping and inhomogeneity separately. I will show examples of line widths and modeling from nominally uniform films, exchange biased films, films with wavy substrates, and films with nonuniform magnetization.

Robert D. McMichael (M'92) received the B.S. degree in engineering-physics from Pacific Lutheran University, Tacoma, WA, in 1985 and the M.S. and Ph.D. degrees in physics from The Ohio State University, Columbus, in 1990.

In 1990, he was awarded a National Research Council postdoctoral associateship at the National Institute of Standards and Technology (NIST), and he has continued in the Magnetic Materials Group of the Materials Science and Engineering Laboratory of NIST. His research interests have touched on a diverse set of topics, including: nonlinear magnetization dynamics, ferromagnetic resonance, magnetic refrigeration, hysteresis modeling, giant magnetoresistance, exchange bias, computational micromagnetics, and magnetization dynamics. He currently serves as leader of the Nanomagnetodyamics project in NIST's Metallurgy Division.

Dr. McMichael serves on the editorial board of IEEE TRANSACTIONS ON MAGNETICS and on the advisory committee for the Magnetism and Magnetic Materials (MMM) conference. He created the logos for several recent MMM conferences.

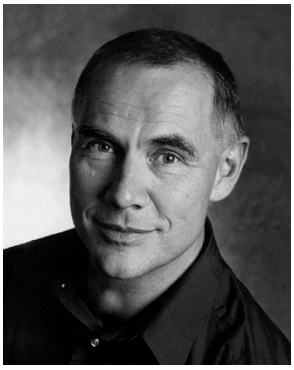
Contact: **Robert D. McMichael**, National Institute of Standards and Technology, 100 Bureau Dr., Stop 8552, Gaithersburg MD 20899; telephone: (301) 975 5121; fax: (301) 975 4553; e-mail: rmcmichael@nist.gov

Assault on Storage Density of 1 Terabit per Square Inch and Beyond

Dieter Weller
Seagate Technology

The areal density in magnetic recording has surpassed 50 Gbit/in^2 in products and 100 Gbit/in^2 in laboratory demonstrations. These densities have been achieved with recording media composed of Co-alloy nanostructured materials with horizontal orientation of the magnetization (longitudinal recording). Grain sizes are 8 to 10 nm and grain size distributions are near 20% (standard deviation divided by the mean). Going much beyond 100 Gbit/in^2 requires magnetically harder materials with smaller, thermally stable grains (5 to 8 nm) and tighter distributions (< 15%). Experiments indicate that this may be possible in perpendicular recording, where a soft magnetic imaging layer is used to enhance the write field and enable such grains to be switched. Basic technology demonstrations of about 110 Gbit/in^2 have already been reported, and modeling suggests that extensions to about 1 Tbit/in^2 should be possible using that technology.

Going much beyond Tbit/in^2, however, will require more drastic changes of heads and media. One of the fundamental limitations relates to the media sputter fabrication process, which may not allow the tight grain size and magnetic dispersions required in models. So-called "self-organized magnetic arrays" (SOMA) of chemically synthesized Fe-Pt nanoparticles are being explored as alternatives. These structures not only show extremely tight size distributions (< 5%) but are also magnetically much harder than current Co alloys. Writing will require temporal heating and cooling in a magnetic field, as in heat-assisted magnetic recording (HAMR). A combination of SOMA and HAMR may eventually lead to recording on a single particle per bit, with ultimate densities near 50 Tbit/in^2 (with 10 years storage time, ambient temperature, and Fe-Pt type anisotropies).



Dieter Weller received the Diploma in physics from the University of Marburg, Germany, in 1982 and the Ph.D. degree in physics from the University of Cologne, Germany, in 1985.

From 1985 to 1990 he worked at the Siemens AG Central Research Laboratories in Erlangen, Germany, on the design, fabrication, and characterization of magneto-optic recording materials and disks. From 1990 through 2000 was with the IBM Research Division in San Jose, CA, where he worked on electronic, magnetic, and magneto-optical properties of thin films and multilayers. He joined Seagate Research in Pittsburgh, PA, in April 2000 as Director of Media Research. His current interests include the exploration of extremely high density magnetic recording schemes and the fabrication of novel nano-phase magnetic materials. He has published over 200 scientific papers as well as several book articles. He is co-editor of *The Physics of High Density Magnetic Recording* (Springer-Verlag, 2001). He holds eight U.S. patents and has 15 pending patent applications.

Dr. Weller is a Fellow of the American Physical Society (APS) and a member of the American Vacuum Society (AVS). He has served as guest editor for the *Journal of Applied Physics* and IEEE TRANSACTIONS ON MAGNETICS and was program co-chair of the 8th Joint Magnetism and Magnetic Materials/Intermag Conference (2001).

Contact: ***Dieter Weller,*** Seagate Research Center, Seagate Technology, 1251 Waterfront Place, Pittsburgh, PA 15222; telephone: (412) 918 7128; fax: (412) 918 7222; e-mail: Dieter.Weller@seagate.com

Magnetoresistive Random Access Memory: The Path to Competitiveness

Jian-Gang (Jimmy) Zhu
Carnegie Mellon University, Pittsburgh, PA

With the first commercial product on the horizon, magnetoresistive random access memory (MRAM) is on a path to replace static random access memory (SRAM), dynamic random access memory (DRAM), and flash memory (and even disk drives in some applications) as the universal solid-state memory. Non-volatility, fast access time, and compatibility with CMOS technology are three of the most important features that make MRAM potentially superior to other existing memory technologies. To fully exploit these potentials, present MRAM designs need to overcome three major obstacles: stringent fabrication tolerances, relatively high power consumption, and response to write addressing disturbances. Although prototype memory devices have been successfully demonstrated, new, innovative designs are still required to make the technology truly competitive.

In the designs employed by today's MRAM manufacturers, the magnetic moment in a memory element is effectively linear, with its orientation representing the memory state "1" or "0." Switching between the two memory states is done by the Ampérean field generated by currents in a pair of orthogonal conducting wires, often referred to as cross-point writing. The cross-point write addressing scheme generates write disturbances because the half-selected memory elements along each of the activated wires experience one of the two field components during a write operation. The result is a stringent requirement for a narrow switching field distribution for all the elements in a memory block, and consequently a stringent fabrication tolerance. The phenomenon is further exacerbated by the possibility of undesired thermally-activated magnetization reversals, especially at small physical dimensions of the memory elements.

The lecture will cover the micromagnetic magnetization reversal processes in various types of MRAM elements. Over the past seven years, extensive micromagnetic analyses and experimental investigations have provided key understanding to obtain robust magnetic switching, and they have become the design principles for today's memory elements. I will present a comprehensive study of thermally-activated magnetization reversal at small physical dimensions for various MRAM designs and will discuss the imposed area storage density limitations due to the write disturbance. I will conclude by introducing a novel design that completely eliminates the write addressing disturbance and substantially lowers power consumption by utilizing the spin transfer effect.

Jian-Gang (Jimmy) Zhu (M'89, SM'02) received the B.S. degree in physics from Huazhong University of Science and Technology, Wuhan, China in 1982 and the M.S. and the Ph.D. degrees, both in physics, from the University of California, San Diego in 1983 and 1989, respectively. In 1990 he joined the Department of Electrical Engineering at the University of Minnesota as an Assistant Professor and in 1992 was appointed to the McKnight Land Grant Professorship by the Regents. In 1997 he joined the faculty of Carnegie Mellon University, Pittsburgh, PA, where he is now the ABB Professor of Engineering in the Department of Electrical and Computer Engineering and the Data Storage Systems Center. He has authored or co-authored over 170 technical papers and presented over 40 invited talks at international conferences. He has supervised and graduated 19 Ph.D. students. Currently his research includes MRAM device design, GMR head design, thin film recording media, digital tape recording systems, patterned media, and magnetization noise in magnetic nano-sensors. He is an advisory editor for the *Journal of Magnetism and Magnetic Materials*.

Prof. Zhu was a recipient of a 1993-97 NSF Presidential Young Investigator Award. His patent, "Ultra-High Density Magnetic Sensor," won a "Top 100 Inventions" award given by *R&D* Magazine in 1996.

Contact: Professor ***Jian-Gang (Jimmy) Zhu***, Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, PA 15213-3890; telephone: (412) 268 8373; fax: (412) 268 8554; e-mail: jzhu@ece.cmu.edu

Magnetics Society Distinguished Lecturers for 2003

Wall Watching: The Progress of Domains in Small Elements

John Chapman
University of Glasgow

An understanding of magnetization processes is of direct interest to physicists and is crucial for developing high performance magnetic devices. The domain structure, and the way it changes under the influence of a magnetic field, depends not only on basic material parameters but also on the physical shape and size of the magnetic material. Thus, quite different domain configurations are found in bulk materials, thin films, and small magnetic elements made from the same material. The same is true of domain walls, whose structure can change markedly as one or more of the dimensions of the material under investigation moves into the sub-micrometer regime. Given the extreme miniaturization that occurs in magnetic storage and sensing devices, as detailed a knowledge as possible of the magnetization configuration in small elements is essential.

For many years, the Lorentz imaging mode of transmission electron microscopy (TEM) has yielded high resolution magnetic images of domains and walls in magnetic films and elements. Since only a modest amount can be learned from a single image of an element, however, recent advances -- whereby *in situ* magnetizing capabilities within the TEM have been enhanced -- have made a considerable impact.

In this talk I will illustrate the radical changes that occur as the dimensions of magnetic elements are reduced from a few micrometers to tens of nanometers. While size is a very important parameter, the detailed shape can also exert a major role, and changes here offer a way of tailoring properties to meet specific requirements. Other important influences are coupling between layers (if the element is formed from a magnetic multilayer) and the nature of the substrate. It is hoped that many of the images, as well as revealing in a very direct way how the magnetization process proceeds, will appeal to the aesthetics of the audience.

*John Chapman r*eceived both the M.A. degree in Natural Sciences and the Ph.D. degree from the University of Cambridge, United Kingdom, in 1973.

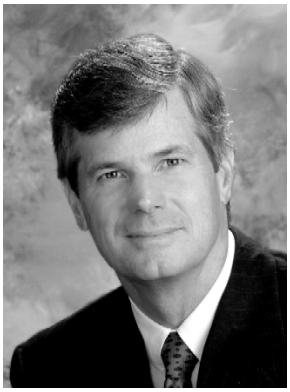
Following a Research Fellowship at Fitzwilliam College, Cambridge, he became a Lecturer at the University of Glasgow in the Department of Physics and Astronomy. Promotion to readership in 1984 and full professorship in 1988 followed; currently he is Head of Department. Professor Chapman's main research interest concerns the characterization, development, and application of advanced functional materials. Overall his aim is to gain understanding at a microscopic level of how various physical properties relate to material nanostructure and how the former can be improved by the ways in which materials are grown and processed. He studies magnetic materials extensively, with particular emphasis on magnetic nanostructures and multilayer films. Much of his work uses electron microscopy and related analytical techniques. He has co-authored about 250 papers.

In 1991 Professor Chapman was elected a Fellow of the Royal Society of Edinburgh. He is also a Fellow of the Institute of Physics and of the Royal Microscopical Society.

Contact: Prof. John N. Chapman, Department of Physics and Astronomy, University of Glasgow, Glasgow G12 8QQ, U.K.; telephone: +44 141 330 4462; fax: +44 141 330 4464; e-mail: j.chapman@physics.gla.ac.uk

Characterization of Magnetic Recording Channels: A Historical Perspective

Thomas D. Howell
San Jose State University



The design of advanced signal processing systems for recovering data stored on magnetic media requires an accurate understanding of the input/output characteristics of the storage system. The designer must be able to predict the output resulting from an arbitrary input in order to select the optimum set of signals to represent the data. He or she should also know the statistical properties of the noise and the types of distortion affecting the storage and readback processes.

Early systems used simple models of channel behavior. As densities increased and signal processing schemes became more complex, more sophisticated models were needed. It is interesting to observe how effects once considered negligible became important, and conversely, how dominant distortions, once understood, became part of the expected signal and hence of negligible importance as disturbances.

In this lecture I will examine selected developments from the history of magnetic recording channel characterization. I will discuss the changing roles of intersymbol interference and nonlinear transition shift, along with some of the techniques used to measure and model them. Magnetic recording systems continue to evolve at a rapid pace; the lessons learned from history often help speed progress and avoid future pitfalls.

Thomas D. Howell (M'81, SM'89) received the B.S. degree in mathematics from the California Institute of Technology, Pasadena, CA, in 1973 and the Ph.D. degree in computer science from Cornell University, Ithaca, NY, in 1976.

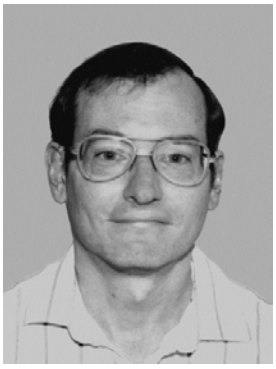
He became a Lecturer in computer science and electrical engineering at San Jose State University, CA, in 2002. From 1977 to 1990 he was a research staff member in the IBM Research Division at their San Jose, Zurich, and Almaden centers, where he conducted research on the application of advanced signal processing techniques to magnetic recording channels. After joining Quantum Corporation in 1990, he managed advanced engineering groups in a variety of areas and helped introduce new technologies including digital channels, magnetoresistive and giant magnetoresistive heads into the company's products. He held a number of positions, ending as Vice President of Research. He served on the board of directors of the National Storage Industry Consortium and on industrial advisory councils at several university research centers during the 1990s.

Dr. Howell served as an editor of the *IEEE Transactions on Magnetics* (1997-2000) and chaired The Magnetic Recording Conference (2000).

Contact: Dr. Thomas D. Howell, Department of Computer Science, San Jose State University, One Washington Square, San Jose, CA 95192; telephone: +1 408 924 7171; fax: +1 408 924 5080; e-mail: t.howell@ieee.org

Thermal Magnetization Noise and Fluctuation-Dissipation in Magnetoresistive Heads, Sensors, and Ferromagnetic Thin-Film Devices

Neil Smith, IBM Almaden Research Center, IBM Corporation



Continuing technological development of giant magnetoresistive (GMR) spin-valve materials and devices, and tunneling magnetoresistive (TMR) sensors, has been largely driven by ever-increasing demands for greater areal storage density and data transfer rates for hard-disk drives. These technological demands will require future GMR (or TMR) materials with increasing MR coefficients $\Delta R/R$ >> 10%, and read-head/sensor dimensions at and below the scale of 100 nm. In this regime, the sensor's intrinsic electrical noise can be exceeded by resistance noise arising from thermally-induced magnetization fluctuations ("mag-noise") in the very thin, magnetically soft, ferromagnetic sensing layers of the MR read head. This mag-noise contribution scales as $P \cdot (\Delta R/R)^2 \cdot \chi_i^2/V$ (where P is the input power, χ_i is the sensor's internal magnetic susceptibility, and V is the sensor volume), whereas the signal power similarly scales as $P \cdot (\Delta R/R)^2 \cdot \chi_e^2$ (where χ_e is the external field susceptibility). Hence, mag-noise serves as a fundamental limit on GMR sensor signal-to-noise ratio that does not substantially improve with further increases in $\Delta R/R$ or sensitivity χ, but which can become more severely limiting as sensor volume decreases.

In addition to its technological implications, observation of mag-noise in sub-micrometer MR sensors provides a relatively simple electrical measurement to study basic damping properties and loss mechanisms in the constituent ultra-thin ferromagnetic films. This can include geometric finite-size effects in very small (100 nm) structures not easily probed by traditional ferromagnetic resonance experiments. The basic relationships between intrinsic magnetic damping and measured thermal magnetization fluctuations can be described by application of the fluctuation-dissipation theorem.

In this talk I will offer a brief tutorial on the fluctuation-dissipation theorem and how it may be properly employed to quantitatively model the mag-noise amplitude and spectrum observed in MR sensors. I will review some recent measurements of mag-noise in MR devices, compare experimental with model expectations, and offer scaling projections of magnetic noise vs. sensor size. In addition, I will discuss how fluctuation-dissipation arguments can discriminate between alternative phenomenological damping models in ways not obvious using traditional uniform magnetization descriptions of damped ferromagnetic resonance, and conclude with a brief consideration of excess damping contributions from inhomogeneity and finite-size effects.

Neil Smith received the S.B. degree in physics from the Massachusetts Institute of Technology, Cambridge, in 1977, and the Ph.D. degree in physics, also from MIT, in 1983.

He joined the Eastman Kodak Company in 1984 and worked in the Magnetic Heads Division of Kodak Research Labs, San Diego, CA, until 1998. His work there primarily involved the physics of magnetic recording of magnetic tape heads and systems, with particular emphasis on the development of magnetoresistive read heads and very high sensitivity anisotropic and giant magnetoresistance magnetic field sensors. In 1998 he joined the IBM corporation, working in the Recording Heads Group at the IBM Almaden Research Center, San Jose, CA. At IBM he has concentrated on both write and read head technology for hard-disk drives, including research on the basic physical and technological limits of read heads for ultra-high disk storage densities. He has recently conducted some of the first investigations into fundamental signal-to-noise limits of magnetoresistive read heads due to thermally induced magnetization fluctuations.

Contact: Neil Smith, IBM Almaden Research Center, 650 Harry Road, San Jose, CA 95120-6099; telephone: +1 408 927 2808; fax: +1 408 927 3010; email: neils@almaden.ibm.com

Nominations Requested for the

IEEE Reynold B. Johnson Information Storage Award

Nomination Deadline: 31 January

The IEEE Reynold B. Johnson Information Storage Award was established in 1991 and may be presented annually for outstanding contributions to information storage, with emphasis on computer storage. It is sponsored by IBM.

IEEE Magnetics Society members are encouraged to stimulate nominations or nominate outstanding candidates for the award.

A nomination form is accessible via the IEEE Awards web page and can be completed on-line.

Potential nominee forms are also available on the IEEE Awards web page. The potential nominee form is a vehicle to obtain feedback on whether a candidate meets the award criteria. Potential nominee forms are forwarded to the Information Storage Award selection committee.

To obtain a nomination form, a potential nominee form or to access a list of past recipients, visit "www.ieee.org/about/awards" or contact IEEE Awards Activities, 445 Hoes Lane, Piscataway, NJ, USA 08854; telephone +1 732 562 3844; fax +1 732 981 9019; e-mail "awards@ieee.org".

Past recipients

2003 - **H. NEAL BERTRAM**
Endowed Chair and Professor, Univ of California-San Diego, La Jolla, CA
"For fundamental and pioneering contributions to magnetic recording physics research, applications and education."

2002 - **CHRISTOPHER H. BAJOREK,**
KOMAG, Inc., San Jose, CA
"For leadership in the development and manufacturing of magnetoresistive recording heads for data storage devices."

2001 - TU CHEN ,
Komag, Incorporated, San Jose, CA
"For leadership in the advancement of thin-film materials, tools, and processes used for magnetic information disks, and their commercialization as products."

2000 - MARK H. KRYDER,
Carnegie-Mellon University, Pittsburgh, PA

"For leadership in data storage research and education as founding director of the Carnegie-Mellon Magnetics Technology Center and Data Storage Systems Center."

1999 - DAVID A. PATTERSON, University of California, Berkeley, CA
RANDY A. KATZ, University of California, Berkeley, CA
GARTH A. GIBSON, Carnegie Mellon University, Pittsburgh, PA
"For the development of the Redundant Array of Inexpensive Disks (RAID) systems."

1998 JEAN PIERRE LAZZARI,
SILMAG, St. Egreve, France
"For contributions and key innovations in media and heads for magnetic disk drives."

1997 ALAN F. SHUGART,
SEAGATE Technology, Scotts Valley, CA
"For leadership in the evolution of disk drive technology."

1996 NOBUTAKE IMAMURA
Tosoh Corporation, Kanagawa ken, Japan
"For contributions to research, development, and commercialization of magneto optic recording media and drive systems."

1995 JAMES U. LEMKE,
Recording Physics, Inc., San Diego, CA
"For contributions to advancing the science and technology of high density magnetic data storage."

1994 DENIS MEE,
IBM Corp., San Jose, CA
"For contributions to the design of optical, magneto optical, and magnetic recording files."

1993 JOHN M. HARKER ,
IBM Labs., San Jose, CA
"For leadership in the development of information storage devices, including key contributions to the design of many generations of magnetic disk files."

Gordon Hughes,
IEEE Information Storage Committee Chair

Dr. Gordon Hughes
Associate Director,
Center for Magnetic Recording Research
University of California, San Diego
9500 Gilman Drive, Room 102
La Jolla, CA 92093-0401
858-534-5317 (phone); 858-822-1172 (fax) and 858-534-8059 (fax); 858-254-2600(cellular)
gFhughes@ucsd.edu

MagNews

IEEE News from THE INSTITUTE

IN THE OCTOBER ISSUE

1. IEEE Network Magazine Tops Annual Citation Rankings
2. Respond to the IEEE-USA Salary Survey and Get Free Access to Data
3. Election Ballots Due 3 November
4. Renew Your 2004 Membership Online
5. Needed: Student Teams to Solve Real-World Problems
6. IEEE Members Receive Discount to Electronics Trade Show
7. Virtual Community for Volunteers Proves a Valuable Tool
8. Evaluators Wanted to Review Engineering Education Programs

The most current version of The Institute can always be found at <http://www.ieee.org/theinstitute>

Tutorial in SPINTRONICS
planned for the
Joint MMM-Intermag Conference in Anaheim

The EdCom Committee has planned an exciting tutorial on ***Spin Electronics*** for the Joint MMM-Intermag Conference in January, 2004.

The session will include four speakers, each giving 45-minute presentations on timely topics in spintronics:

Dan Ralph, Cornell University:
"APPLYING TORQUES TO MAGNETS USING SPIN-POLARIZED CURRENTS"

Ronnie Jansen, University of Twente:
"SEMICONDUCTOR/FERROMAGNET HYBRID SPIN TRANSISTORS"

Kimberley Hall, University of Iowa:
"SPIN RELAXATION IN SEMICONDUCTORS: IMPLICATIONS FOR APPLICATIONS IN SPINTRONICS, OPTOELECTRONICS AND QUANTUM COMPUTATION"

Hideo Ohno, Tohoku University:
"FERROMAGNETIC SEMICONDUCTOR MATERIALS AND DEVICES"

The tutorial will take place from 6-9 pm Monday, Jan. 5. The program was arranged with the help of Tom Silva and Bruce Gurney, who are program co-chairs of the conference. Tom has graciously agreed to chair the session.

J.W. Harrell
EdCom Chair

Disk news on ZDNET

http://zdnet.com.com/2001-1103-0.html

OCTOBER

Disk-drive makers spin out strong profits

By Ed Frauenheim
CNET News.com
October 21, 2003, 4:02 PM PT

"Disk-drive makers Maxtor and Seagate Technology beat analysts' earnings expectations Tuesday, another sign of good times for the industry."

See details at http://zdnet.com.com/2100-1103_2-5094672.html

SEPTEMBER

Bright future for disk-drive industry?

By Ed Frauenheim
CNET News.com
September 11, 2003, 11:13 AM PT

"Despite a sluggish PC market, the hard-drive industry has managed to turn profits and is poised to continue enjoying good times, company leaders and analysts said at a conference this week".

Details: http://zdnet.com.com/2100-1103_2-5074678.html

AUGUST

Midlife crisis for the hard drive

By Ed Frauenheim
CNET News.com
August 11, 2003, 4:00 AM PT

"The venerable hard drive is hitting middle age**."**

Details:http://zdnet.com.com/2100-1103_2-5061923.html

VISUAL MAGNETICS

WHAT HAS THIS DO WITH MAGNETISM?

Click on either link
(or cut and paste this link into your browser's window):

http://www.trachtman.org/MIDI/Joplin/magnetic.mid

http://www.geocities.com/BourbonStreet/2783/magnetic.mid

SOLUTION?

GO TO THE END

Conference announcement 1

AVS MAGNETIC INTERFACES AND NANOSTRUCTURES DIVISION
AVS 50th International Symposium of the American Vacuum Society
November 2-7, 2003, Baltimore, MD

The Magnetic Interfaces and Nanostructures Division (MI) has planned an exciting and comprehensive technical program for the 50th International Symposium of the AVS. The program highlights recent scientific results and technological challenges in the areas of magnetic / spintronic materials, characterization, and devices. Nascent device technologies, new materials such as ferromagnetic semiconductors, and measurement techniques will be covered by invited speakers and contributed presentations in the MI sessions, several of which will be listed jointly with Semiconductors, Thin Films, and Nanoscale Science. In addition, the AVS will host a number of special events in celebration of the 50th anniversary Symposium.

***** Student travel assistance is available – see the AVS web site!***

We invite your participation and abstract submission. Visit the AVS web site for a complete listing of the program and submission instructions: http://www.avs.org/call/
Please see the MI web site for further information on the ***Leo Falicov Award:***
http://divisions.avs.org/min/

SESSIONS AND INVITED SPEAKERS

MI 1 + NS SELF-ASSEMBLY & NANOMAGNETISM
M. Farle, *Gerhard-Mercator-Universität Duisburg*
C.A. Ross, *Massachusetts Institute of Technology*

MI 2 + SC SPINTRONICS I: SEMICONDUCTOR SPIN INJECTION & TRANSPORT
P. Bruno, *Max Planck Institute of Microstructure Physics*
A.T. Hanbicki, *Naval Research Laboratory*

MI 3 + SC SPINTRONICS II: MATERIALS AND DEVICES
C.R. Abernathy, *University of Florida*
P. Van Dorpe, *TU Delft, The Netherlands*

MI 4 MAGNETIC RECORDING: HEADS & MEDIA
K.M. Minor, *Seagate*

MI 5 + NS MAGNETIC IMAGING
A. Schneider, *Max-Planck-Institute for Solid State Research*
D.J. Smith, *Arizona State University*

MI 6 MAGNETIC SPECTROSCOPIES
D.R. Gamelin, *University of Washington*

MI 7 MAGNETIZATION DYNAMICS
M.R. Freeman, *University of Alberta*
J.P. Park, *University of Minnesota*

MI 8 + TF MAGNETIC THIN FILMS
P. Allongue, *Univ. P&M Curie, France*

MI 9 HIGHLY POLARIZED MATERIALS
J. Z. Sun, *IBM T.J. Watson Res. Ctr.*

MI 10 TUNNELING AND GMR
S. Yuasa, *National Institute of Advanced Industrial Science & Technology, Japan*
A. Zangwill, *Georgia Institute of Technology*

MI 11 POSTER SESSION

The LEO M. FALICOV STUDENT AWARD has been established by the Magnetic Interfaces and Nanostructures division to recognize outstanding research performed by a graduate student. Finalists will receive a $500 award. For further information, please contact ***Berry Jonker*** jonker@nrl.navy.mil,or visit *http://divisions.avs.org/min/*

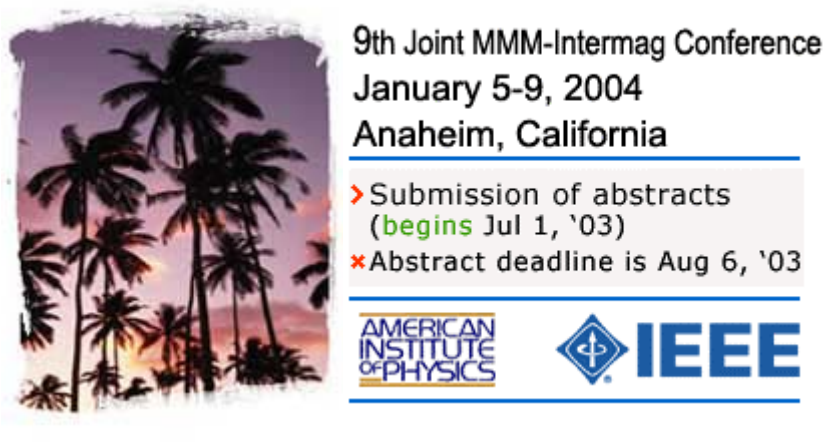
Conference announcement 2

MMM 2004

9th Joint MMM-Intermag Conference

Anaheim, California - January 5-9, 2004

This conference annually brings together scientists and engineers interested in recent developments in all branches of fundamental and applied magnetism. Emphasis is placed on experimental and theoretical research in magnetism, the properties and synthesis of new magnetic materials, and advances in magnetic technology. The Program consists of invited and contributed papers. Abstract booklets will be made available at the Conference, and Proceedings will be published in the *Journal of Applied Physics* and the *IEEE Transactions on Magnetics*.



http://www.aip.org/mmm/index.html

Conference announcement 3

4th International Symposium on Metallic Multilayers (MML '04)

When: June 7 – 11, 2004

Where: **National Institute of Standards and Technology,** Boulder, Colorado, USA

We wish to inform you of the Metallic Multilayers Symposium to be held in Boulder, Colorado, in June 2004 (MML '04). This upcoming meeting continues the tradition of giving scientists a single-session venue for the presentation of outstanding, cutting-edge research in a relaxed, picturesque setting. Past conferences were held in Kyoto 1992, Cambridge 1995, Vancouver 1998, and Aachen 2001. MML '04 will be held on the campus of the National Institute of Standards and Technology. Topics for the conference include both fundamental and applied aspects of magnetic metallic multilayers. The subject matter spans the range from devices to film properties; from spin injection into semiconductors to spin-dependent tunneling; from magnetization dynamics to exchange bias; from magnetic recording media to patterned structures … to name just a few exciting topics of research. Please mark your calendars, and we look forward to seeing you in Boulder in 2004!

Symposium Co-chairs:

Dr. Thomas J. Silva
Magnetic Technology Division
NIST, US Dept. of Commerce
Boulder, Colorado
USA

Prof. Zbigniew Celinski
Physics Department
University of Colorado at Colorado Springs
Colorado Springs, Colorado
USA

Conference announcement 4

5th Magnetic Microsphere Meeting

Scientific and Clinical Applications of Magnetic Carriers

May 20 - 22, 2004

Lyon, France

Not far from the Grenoble High Magnetic Field Laboratory!

DEADLINES

Topics:
Preparation and Modification of Magnetic Particles
Characterization of Magnetic Particles
Application in Cell Separation and Analysis
Applications in Molecular Biology

Clinical Applications:
Cancer Treatment
Hyperthermia
Magnetic Resonance Contrast Enhancement
Drug Delivery

Organized by:
Cleveland Clinic Foundation, Cleveland, Ohio, U.S.A.
Urs Häfeli and Maciej Zborowski
hafeliu@ccf.org

For further information, please check as always our website
http://www.magneticmicrosphere.com/meet2004.htm
http://www.magneticmicrosphere.com

Conference announcement 5

Second Seeheim Conference on Magnetism

Seeheim, Germany
June 27- July 1, 2004

SCM is a series of Conferences held every three years under the auspices of the Darmstadt University of Technology. Scientists from 36 countries attended the last Seeheim Conference on Magnetism in 2001. The conference covers the latest developments in the magnetism of nanostructured materials, surfaces, interfaces and nanoparticles.

The location is Lufthansa Training Centre Seeheim. The idyllic climatic resort of Seeheim is situated 43 km south of Frankfurt Airport. The Training Centre is embedded in the Odenwald forest overlooking the Rhine river valley. Here the participants of SCM will find a quiet, natural country environment with everything it takes for concentrated discussions.

CONFERENCE COORDINATORS

M. Ghafari , H. Hahn

Darmstadt University of Technology

Petersenstr. 23

64287 Darmstadt

Germany

Tel: + 49-6151-16 63 25 Fax: + 49-6151- 16 63 35

scm@tu-darmstadt.de

The complete information on

THE SECOND SEEHEIM CONFERENCE ON MAGNETISM

is now available at:

http://www.tu-darmstadt.de/magnetism/

Conference announcement 6

Joint European Magnetic Symposia

JEMS'04

September 05 – 10, 2004
Dresden, Germany

SCOPE

The Joint European Magnetic Symposia, **JEMS**, are the unification of the two most important conferences on magnetism regularly organized in Europe, namely EMMA (European Magnetic Materials and Applications) and MRM (Magnetic Recording Materials). JEMS focus on magnetism research and applications as well as new magnetic materials.
Information about the conference is available at:

http://www.ifw-dresden.de/imw/jems04/

TOPICS (PRELIMINARY)

- Soft magnetic materials and their applications
- Magnetic recording materials
- Spin electronics and magnetic semiconductors
- Giant magnetoresistive and giant magnetoimpedance materials
- Artificially structured materials, small structures
- Magnetic materials and advanced characterisation
- Micromagnetism, magnetisation processes and magnetic viscosity
- Sensors and micro-devices
- Numerical modelling, devices and machines
- Imaging and probe techniques
- Permanent magnetic materials and their applications
- Magnetocaloric, magnetostrictive and ferromagnetic shape memory materials
- Magnetic materials in high magnetic fields

IMPORTANT DATES

September 15, 2003	Call for papers
February 1, 2004	Deadline for abstract submission
March 15, 2004	Notification about abstract acceptance
May 15, 2004	Deadline for advanced registration
June 30, 2004	Deadline for paper submission

CONTACTS

For further information, please contact the organisers at the following address:
A. Kirchner: IFW Dresden, P.O. Box 27 00 16, 01171 Dresden, Germany
Phone: +49 351 4659 405 / 460
Fax: +49 351 4659 541
email: jems04@ifw-dresden.de

T-MAG Publication news

IEEE TRANSACTIONS ON MAGNETICS on the web

THE IEEE LAUNCHES IEEE XPLORE(R) RELEASE 1.5:

The IEEE launched IEEE Xplore(R) Release 1.5 during July. The upgrade provides free abstract/citation records for guests and enhanced linking to complete abstract/citation records for IEEE members and subscribers, as well as:

- Title history for related journals and magazines
- Ask *IEEE link for referenced articles not in IEEE Xplore
- Google to index IEEE abstracts, enabling searches to locate IEEE content directly from a Google web search
- Thomson ISI now includes links from their Web of Science products directly to articles in IEEE Xplore(R).

In addition, through IEEE Xplore 1.5, subscribers to the IEEE Member Digital Library can now sort information in their personal file cabinets by publication name, primary author and original filing date.

For more information on this release, visit
<http://ieeexplore.ieee.org/xpl/ReleaseNotes.jsp>

Starting in 1965 with *vol*. 1, now all papers published in **IEEE TRANSACTIONS ON MAGNETICS** are available at ***IEEE Xplore,*** as well as the searchable
Cumulative Index 1985-2000, Volumes 21-36

IEEE Magnetics Society Membership renewal

The IEEE has mailed membership renewal materials for 2004. This message is to clarify two items on your invoice.

Beginning in 2004, members of the IEEE Magnetics Society will receive electronic access to the IEEE Transactions on Magnetics (via IEEE Xplore) plus an annual CD-ROM PDF compilation (to be shipped early in the following year). The annual dues will be $20, down from $30.

Subscriptions to the paper edition of the IEEE Transactions on Magnetics will be a separate option for $20 plus tax. When you renew your membership, you may choose to strike out the item labeled "IEEE Trans on Magnetics" and reduce the total accordingly.

Registrants of conferences that publish selected papers in the IEEE Transactions on Magnetics will continue to receive paper copies of the special journal issues associated with those conferences.

Ron Goldfarb

Editor in Chief

r.goldfarb@ieee.org

Book Review

Magnetic Resonance in Chemistry and Medicine

by

Ray Freeman

Oxford University Press, 2003

This relatively slim volume (278 pages) is an attempt to explain a complicated topic "in the simplest possible terms" in order to be valuable to a wide range of readers, from patients to undergraduate students to practicing clinicians. The publisher describes the book as having an "expanded-outline format". The result is mostly successful. Many topics are covered in the application of nuclear magnetic resonance (NMR) to chemistry, and magnetic resonance imaging (MRI) to medicine, including a chapter on new developments in the functional MRI of the brain. The underlying physical principles involved are described with very little mathematics or weighty chemistry or physics.

The book is very readable. Quantum mechanics is treated almost entirely by simplified pictorials. Acronyms and abbreviations are reduced to a minimum, and all that are used are given in a table.

There are some shortcomings. There is no author list. The subject index could be improved; for instance, the word "artefacts" is listed as page 76, which is correct, but there is a discussion of motion artefacts on page 203. Artefacts, as described, cover only some types of these unwanted signals. Another important type of artefact is one in which the MRI signal is lost because of the presence of a nearby metal, such as an aneurism clip.

In view of the recent award of the Nobel Prize in Medicine for MRI, books such as this one will get renewed interest. In this book, the fundamental paper of both new Nobel Laureates, Paul C. Lauterbur and Peter Mansfield, are appropriately referenced. I recommend Ray Freeman's book.

Reviewed by

Larry H. Bennett

Members who would like to volunteer their services as technical reviewers are needed.

Society members with **ideas for new books** or candidates for the ***Classic Re-Issue*** series are urged to get in touch with:

John T. Scott,
Magnetics Society Liaison to IEEE Press
E-mail: john.scott@physics.org

Visual Magnetics – SOLUTION

Click on either link
(or cut and paste this link into your browser's window):

http://www.trachtman.org/MIDI/Joplin/magnetic.mid

http://www.geocities.com/BourbonStreet/2783/magnetic.mid

Scott Joplin: Magnetic Rag (1914)

http://w ww.247sheetmusic.com/pdf/joplinmagneticrag.pdf

Historical factoid:

A memorable performance of this rag happened at the 1984 INTERMAG in ***St. Paul*** by an ad-hoc ragtime band of the Magnetics Society.

If you were either playing or listening, and you remember the members of the band, please help to identify them.