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# CMRR Report

Center for Magnetic Recording Research

Number 15 Fall 1991

## IBM Visitor, Tom Stanley

Tom Stanley

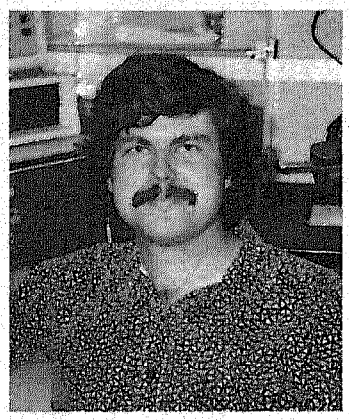
**Tom Stanley,** formerly manager of the HDA test technology group at IBM's Storage Products Division, San Jose, has just spent the past ten months at CMRR. Working with Professor Jack Keil Wolf and his group, Tom has helped introduce the capability of off-track testing for evaluating read/write channels into the Wolf laboratory.

Of major significance in bringing this project to fruition has been Stanley's negotiations with Guzik Technical Enterprises, San Jose, a manufacturer of test equipment for the computer industry. As a result of his efforts, Guzik has donated a 511 spinstand to the Center. With this equipment the Center will be able to test and evaluate the magnetic properties of the head and the read/write channel capabilities of the head for disks ranging in size from 2.5 inches to ten inches. The advantage of this equipment is that it is a turnkey system, making it ideally suited for use by students.

Along with establishing the above test equipment for the lab, Stanley participated in the undergraduate lab courses and has also served as supervisor for one of the students at CMRR. While a resident at the Center, Tom took the opportunity to audit some classes at UCSD, which served both as a refresher and in some instances as a reeducation. He also taught a series of computer graphics workshops for CMRR's graduate students, which introduced them to some useful applications for their own research projects.

Tom looks back at his stay at the Center as a productive "bridging" period between his former assignment at IBM and his new assignment at IBM after his return. •

## Salling Graduates



Craig Salling

**Craig Salling was awarded his Ph.D.** this past month upon the successful defense of his thesis. Salling completed a B.A. in physics in 1981, also at UCSD, and then went to work for Intel Corporation for a little over two years. In the fall of 1983 Craig returned to UCSD to begin his graduate studies with Professor Sheldon Schultz (the Director of CMRR) as his adviser.

Salling's thesis is entitled "Magnetization Reversal in $\gamma$ $Fe_2O_3$ Particles." Highlights of his research included developing a method to measure the switching field of an individual sub-micron particle using Lorentz TEM microscopy. This technique also allows the morphology of the particle being measured to be directly observed. He also developed a technique for separating the individual particles by coating them with multiple layers of 100 Å silica spheres. This enabled him to perform the first true packing fraction studies of the hysteresis loops. One major result is a much larger increase in coercivity than has been reported in prior studies, with values approaching 1000 Å. For further information, contact Sheldon Schultz at 619-534-6210.

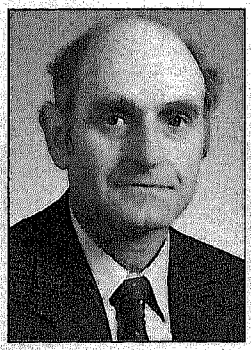
Craig also points to the expertise gained in driving two-ton trucks–the result of picking up numerous surplus equipment donated to the physics department. On leaving UCSD, Salling will be taking up a postdoctoral position at the University of Wisconsin, Madison, where he will be doing scanning tunneling microscopy with Max Lagally. He will also be teaching undergraduate physics. •

## Newest Center Sponsor

**We are pleased to announce** that Quantum Corporation has recently joined the Center for Magnetic Recording Research as a new sponsor member. Quantum is located in Milpitas, California, where they have established the headquarters for the design of their hard disk product line. Quantum's representative to the Center is Tom Howell (formerly of IBM), and we look forward to welcoming him at the next advisory council meeting in November. Tom and several of his colleagues have already become actively involved with several of the ongoing research projects at the Center, and we expect that as they get to know us better further collaborations will be developed. •

## National Media Lab Grant

**CMRR has recently received a grant** from the National Media Laboratory. The grant will allow the Center to use Mossbauer spectroscopy and surface impedance techniques to investigate surface treatment of particulate media in order to enhance their magnetic properties and to determine the stability of metal particle media. Part of the work will involve looking at thin-film analogs of the particulate media since thin films are easier to characterize than particles and because surface treated thin films offer the promise of enhanced new thin-film media. Investigators for this project are Professor Ami Berkowitz; Drs. Fred Spada and Fred Parker, research scientists at CMRR; and graduate student David Margulies. •



# From the Director

**This month will mark** the completion of one full year as the director of CMRR, and I must confess it has been an active period for me. Although I wasn't able to make good on my rash pledge to "visit every sponsor site before the May advisory meeting," I am getting there, and hope to accomplish this goal by the winter quarter. Of course, this includes our newest sponsor, the Quantum Corporation, who joined recently.

In most cases these visits represent my first opportunity to see the physical plant and meet with a broad range of technical staff. I have really enjoyed these visits, but I always leave wishing I had more time to play the catalytic role I talked about in the last issue of the CMRR REPORT. I am more convinced than ever that many more collaborations and sponsored projects are warranted between every sponsoring member's staff and the Center. Ironically, this is even more true in these difficult economic times when fiscal restraints tend to reduce or postpone company research and development programs. In many circumstances it may be possible for a sponsor to maintain continuity in a program, or to initiate a new project, at considerably less cost (both labor and capital investment) in conjunction with the Center than solely in house. Quite a few of these "sponsored" projects are currently in progress, and we would be very pleased to discuss opportunities and options if you get in touch with us.

I would particularly like to focus attention on another way we can be more helpful to you, requiring only the most modest effort on your part. I hope every reader is aware that we have a weekly seminar series at the Center, and also a monthly seminar speaker when we host the local chapter of the IEEE Magnetics Society. In both cases, almost every talk is videotaped and then made available on request to members of CMRR's sponsoring companies for viewing at your convenience. (See a list of recent seminars elsewhere in this report). If you need a list of prior seminars please call the Information Center at (619) 534-6199 or (619) 534-6213.

Now the point I wish to make. Are there any topics that you are interested in hearing about? Because we are a university, we generally have access to speakers and other resources to address virtually any magnetically related subject of interest. All you have to do is request it! If you can also suggest a possible speaker, it is even better. In either event, we will make every effort to ensure that we provide seminars on your suggestions. So, folks, please keep those calls and cards coming in.

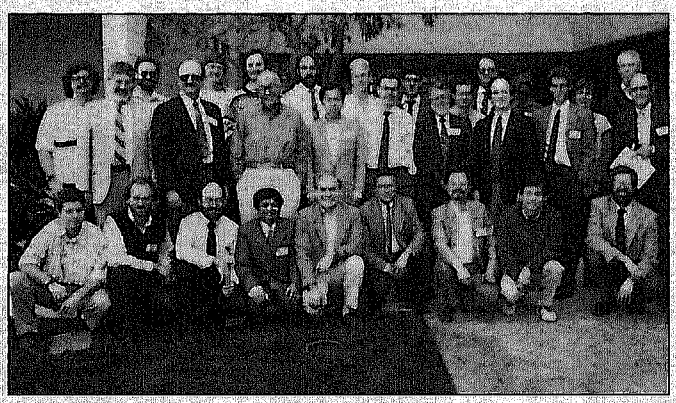
Seriously, I look forward to hearing from you with your requests, ranging from a single seminar to a seminar series or even a workshop. Please call me at (619) 534-6210, or get in touch with any of the other Center faculty. This really only takes a few moments of your time, so let's hear from you.

***Shelly Schultz***

# Micromagnetics Workshop

The Fourth Micromagnetic and Microstructural Characterization of Media and Heads for Magnetic Recording was held at CMRR February 11-13, 1991. This invited workshop chaired by Professor H. Neal Bertram was limited to thirty participants from the Center's sponsoring companies. The roundtable format provided extensive discussion time which followed each invited presentation on a focused topic.

The first day concentrated on discussion of thin-film media: in particular noise processes and thin films, noise at very high densities, and effects of inhomogencities in thin films. The second day dealt with heads, namely instabilities in thin film, MIG, and finite heads observed by extra pulse phenomena due to domain instabilities. These sessions covered very little theory; rather, it was an exploration of the characterizations of these phenomena. The final half day covered instrumentation and a general wrap-up session. The meeting was well received. Proceedings were distributed to the attendees, and are available to other members of CMRR sponsoring companies at a cost of $100.00 a copy. •



Workshop Attendees

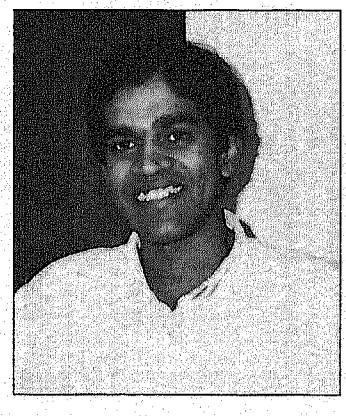
# Materials Research Group Funding Extended

**The National Science Foundation** (NSF) has announced its continued support of the Materials Research Group at UCSD with a grant of $2,060,000 for the next three and a half years. The first award began in September 1987 with an initial grant of $1,650,000.

The research at CMRR involves both experimental and theoretical investigations of the hysteresis phenomenon in various types of film and particulate media materials. The principal investigator of the project is Ami Berkowitz, holder of a CMRR endowed chair. The other investigators are Sheldon Schultz, director of CMRR and professor of physics; H. Neal Bertram, chaired CMRR professor, Department of Electrical and Computer Engineering; Donald R. Fredkin, professor, UCSD Department of Physics; and Gareth Thomas, professor in the Department of Science and Materials Engineering, and scientific director of the National Center for Electron Microscopy at the University of California, Berkeley.

A number of notable experimental and analytical successes have resulted from the work of the Materials Research Group to date, namely in the development of new materials, in measuring and modeling media micromagnetic behavior, and in developing new state-of-the-art instrumentation. New directions include surface-enhanced magnetism and giant magnetoresistive thin films. •

# Postdoctoral Research Fellow



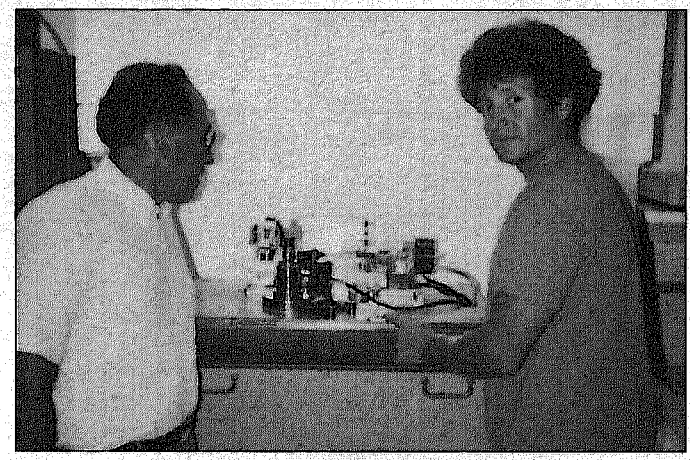
S. K. Ganapathi

**Dr. S.K. Ganapathi** joined Professor Talke's research group in October 1990 as a postdoctoral fellow. Prior to his arrival at CMRR, Ganapathi completed his Ph.D. dissertation on wear and microstructure of metals at Ohio State University. He used transmission electron microscopy (TEM) to study the deformation behavior in materials during tribological processes. In 1990, he won an International Graduate Student Award for academic and research achievements.

Since joining CMRR, Ganapathi has studied the tribology of carbon and zirconia overcoated disks during start/stop and constant speed-drag testing. He is using scanning electron microscopy (SEM) and TEM to study the evolution of damage to the overcoat and the underlying magnetic layer. He is also using Fourier-transform infrared (FTIR) and Raman spectroscopy to understand the chemical effects in the tribology of the magnetic head/disk interface. Another part of his research effort is directed towards the correlation between contact start/stop and constant speed-drag testing. Further details on Ganapathi's research can be obtained from him at (619) 534-5854. •

# Equipment Donated

**The signal processing group at CMRR**, headed by Professor Jack Wolf, recently received a high-precision disk spinstand. The instrument, manufactured and donated by Guzik Technical Enterprises, provides the head positioning accuracy necessary to measure off-track performance and interference in hard disk recording systems, as well many other types of measurements. We wish to express our gratitude to Guzik for their gift, and a special thanks to Tom Stanley of IBM who was responsible for arranging for this gift from Guzik. •



Jack Wolf and Rick Barndt with the Guzik spinstand.

# Recording Technology Consortium Formed

**The National Storage Industry Consortium** (NSIC) is a newly-formed organization of industrial companies and governmental agencies involved in the field of data and image storage–both magnetic and optical. Over twenty corporations, eight universities, and several governmental agencies have joined together to establish this consortium. Included in these are IBM, Kodak, 3M, DEC, Hewlett-Packard, Applied Magnetics Corporation, UCSD (CMRR), UC Berkeley, University of Minnesota, University of Alabama, Stanford, University of Santa Clara, University of Arizona, and several others.

NSIC's charter is to promote and support joint academic, industrial, and governmental research in information storage technologies and subsystems. NSIC will:

- Create a research strategy with industrial, academic, and governmental groups;
- Seek and provide funding assistance to appropriate university research projects focused on precompetitive technologies;
- Collaborate with academic and governmental research projects providing expertise and equipment;
- Encourage coordinated, complementary research activities, especially when multidisciplinary projects are undertaken; and
- Provide forums and other opportunities for cooperative interactions and technology transfers among industry, university, and government research units.

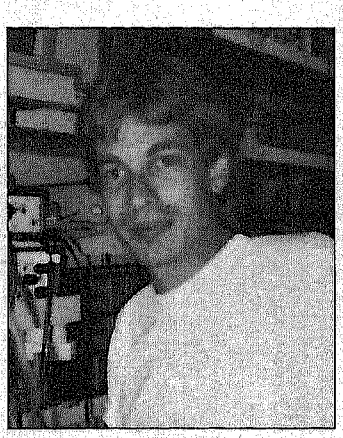
In all of the above, NSIC will work closely with UCSD's Center for Magnetic Recording Research.

**Areas of recording research which will be addressed by the consortium include**: Archival Media • Magnetic Materials • Head/Disk Interface • Instrumentation • Short-wavelength Lasers • Thin-film Deposition/Stability • Signal Processing • Advanced Transducers• Bearings • Head\Tape Interface • Actuators/Servo • Theory & Modeling

**Benefits to NSIC's members include:**

- A leveraging of member investments in long-term research with the potential of obtaining valuable patent rights to key new technologies;
- Participation in setting national objectives for focused technology investments in recording technologies;
- Enhanced communication with other companies and agencies in guiding and sponsoring new university programs of critical importance;
- Participation in topical technology workshops sponsored by NSIC; and
- Facilitated access to, and information about, university center programs.

NSIC has established a headquarters office in San Diego at 11010 Roselle Street, San Diego CA 92121-1205. Phone (619) 558-6835, e-mail jsimonds@ucsd. It is being incorporated as a tax-exempt "Business League." The newly appointed executive director of NSIC is John L. Simonds. John recently retired from the Eastman Kodak Company, where he was director of research for one of Kodak's major groups. John is also a visiting professor at the UCLA School of Medicine, where he is doing research on electronic diagnostic imaging. •



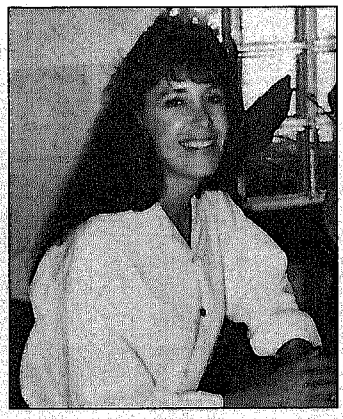
STEVE SLADE WITH B-H LOOPER

# B-H Looper

**A B-H Looper** has been designed and built for CMRR by Jon B. Haugdahl, principal electronics technician from the AMES Department at UCSD, and Steve Slade, a graduate student at CMRR in the Berkowitz group. This B-H Looper far surpasses the usual B-H Looper standards for sensitivity. The looper has sensitivity better than $10^{-6}$ emu, which is equal to that of a commercial SQUID magnetometer. This level of sensitivity has been achieved at considerably less expense than for a SQUID, and it can measure hysteresis loops in seconds rather than hours.

Slade will use this B-H Looper as both a magnetometer and a susceptometer in his basic studies of magnetic viscosity. This instrument is capable of operation over a temperature range from 4K to room temperature. As a susceptometer it is capable of measurements from DC to 200 KHz. Despite its high sensitivity and broad temperature range, this instrument is as convenient to use as an ordinary room-temperature B-H Looper. •

# New Staff Member



LYNN FIELD-KARSH

**We are pleased to announce** that Ms. Lynn Field-Karsh has recently joined the Center staff on a part-time basis. Ms. Field-Karsh was formerly an administrative assistant in the biology department at UCSD, but left in the fall when she started to attend the University of San Diego School of Law as a full-time student. Visitors to the Center will notice that the side lobby area has been rearranged to provide office space for both Lynn and Betty. Ms. Field-Karsh is rapidly becoming familiar with the full range of CMRR activities, and she will help us in providing a variety of services to our sponsors. Please do introduce yourself to her, either when you next visit, or perhaps if she is answering your call to the Center. •

# Sources for Japanese Information Published

**Dawn Talbot, manager of information services** for CMRR has recently published an annotated guide to English language sources of information from Japan. Titled *Japan's High Technology*, this sourcebook provides over 500 entries to directories, online databases, abstracting and indexing tools, newsletters, translation guides, and other sources. Entries are listed according to type of source and feature a full description and complete bibliographic information. Useful appendices list booksellers, libraries, and other sources of information, and online vendors. Indices by subject, title, author, and publisher help researchers target the sources they need.

Further information can be obtained from the publisher,
Oryx Press
4041 N. Central at Indian School Road
Phoenix, AZ 85012-3397
(800) 279-ORYX
(800) 279-4663 Fax •

# Tribology Workshop

**The seventh workshop** on the "Tribology of the Head/Disk Interface" was held March 4-6, 1991 at the Center for Magnetic Recording Research. More than twenty-five representatives from the Center's sponsoring companies and several universities attended this invited workshop. The program began with instrumentation issues of the head/disk interface being discussed. Professor Lauer from Rensselaer Polytechnic Institute, NY, followed with a review paper on chemical effects in tribology. The afternoon session covered the tribology of carbon overcoats, with papers on STM analysis, environmental effects, and start/stop evaluations of carbon coatings.

The second day covered boundary lubrication and wear modeling in the morning session, followed by a review of flexible media tribology in the afternoon. The final morning session of this two-and-a-half-day meeting discussed air-bearing analysis, including papers on step-slider bearings, load/unload, and airflow effects in HDA's.

The next tribology workshop is planned for March 1992. Exact dates have not yet been set. Contact Prof. Frank Talke for further information at (619)534-3646. •

# Electronic Mail Addresses

**The following list** provides e-mail addresses for CMRR faculty and staff. Many of the graduate students are also on the network. Please contact them directly or send an e-mail message to Betty Manoulian if you need their e-mail addresses.

| | |
|---|---|
| **BERTRAM, H. Neal** | bertram@sdmag1.ucsd.edu<br>(619) 534-6588 |
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| **WOLF, Jack** | ir629@sdcc6.ucsd.edu<br>(619) 534-6218 |

# CMRR Seminar Series

**CMRR holds a weekly seminar series with invited speakers from industry as well as presentations from graduate students and faculty of CMRR. We also host the monthly seminars of the IEEE Magnetics Society, San Diego chapter.**

Shtrikman, Shmuel. Weizmann Institute of Science, Rehovot, Israel. "Moment Method and Singularities (or Westmijze's Head Revisited)." January 15, 1991.

Jeffers, Fred. Eastman Kodak San Diego Research Laboratories. "Magnetoresistive Heads." January 22, 1991.

Bertram, Neal H. Center for Magnetic Recording Research, UCSD. "Role of Microstructure in Magnetic Recording Properties of Thin Film Media." January 24, 1991.

Lauer, James L. Rensselaer Polytechnic Institute. "Analysis of Thin Carbonaceous Surface Layers by Raman Spectroscopy." January 29, 1991.

Howe, Dennis G. Eastman Kodak Company. "Shift Error Correcting Modulation Codes." February 5, 1991

Harrison, Joshua. Center for Magnetic Recording Research, UCSD. "Disk Surface Acceleration Effects due to Air Flow Induced by Rotation." February 19, 1991.

Mularie, W.M. National Media Lab, 3M. "Anomalous Surface Adsorption Effects in Material Science: Influence on Magnetics?" February 26, 1991.

Tsang, Ching. IBM Almaden Research Center. "The Magnetoresistive Head and Its Applications in High Density Magnetic Recording." February 28, 1991.

Miller, David. Professor, Department of AMES, UCSD. "Thin Film Growth and Magnetic Properties for Fe/GaAs (100)." March 12, 1991.

Kumaran, Aric. Seagate Technology. "Mechanics and Tribology Issues of the Next Generation Head/Disk Interface." March 21, 1991.

Tauxe, Lisa. Associate Professor of Geophysics, Scripps Institute of Oceanography, UCSD. "Chemical Remanent Magnetism." April 9, 1991.

Murdock, Ed. Hewlett Packard Laboratories. "Noise in Thin Film Magnetic Recording Media." April 16, 1991.

*Mate, Mathew C. IBM, Almaden Research Center. "Atomic Force Microscopy of Lubricants in Magnetic Recording." April 23, 1991.

Spada, Fred. Center for Magnetic Recording Research, UCSD. "Microtribology Discussion: The Need for Understanding the Chemical and Physical Processes Occurring During Head-Media Contacts." April 30, 1991.

Miller, Mark S. Seagate Technology. "The Influence of Deposition Variables on the Magnetic and Recording Properties of Longitudinal Magnetic Media." May 7, 1991.

*Koechler, T.R. IBM, Almaden Research Center. "Modeling Magnetization Reversal in Small Permalloy Particles." May 14, 1991.

*Phillips, William B. StorageTek, Louisville, CO. "DASD Futures and a Paradox Resolved." May 23, 1991.

Ganapathi, Dr. S.K. Center for Magnetic Recording Research, UCSD. "Applications of Electron Microscopy in Tribological Studies of the Magnetic Head-Disk Interface." May 28, 1991.

Slade, Steven B. Center for Magnetic Recording Research, UCSD. "From Superparamagnetism to Spin Glasses: A Review of Thermal Activation Phenomena in Magnetic Materials." June 4, 1991.

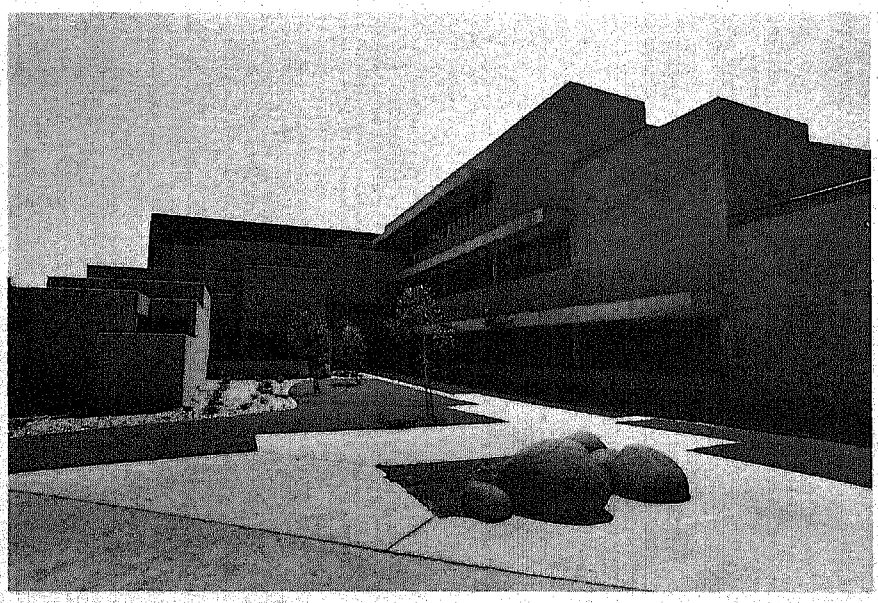
Tong, Po. LSI Logic Corporation. "A 320-Mbps Encoder-Decoder Chip Generated by a Reed-Solomon Code Complier." August 21, 1991.

Gibson, Gary A. Department of Physics, UCSD. "Toward Quantitative Magnetic Force Microscopy." September 26, 1991.

Lauer, James L. Rennsselaer Polytechnic Institute. "Formation and Tribology of Carbonaceous Coatings: Applications of Low Energy Raman and Infrared Spectroscopies." October 8, 1991.

Arovas, Daniel. Department of Physics, UCSD. "Quantum Magnetism." October 15, 1991.

Armstrong, Alan. Research Assistant, Center for Magnetic Recording Research, UCSD. "Nonlinear Effects in High Density Recording." October 22, 1991.



Argyle, Bernell E. IBM Thomas J. Watson Research Center. "Optical Imaging of Magnetic Domains and Implications for Magnetic Recording." October 24, 1991.

Wassermann, E.F. University of Duisburg, Germany. "New Structural and Magnetic Properties of FeNi Alloy Films." October 29, 1991.

Elmer, Franz-Joseph. Physics Dept, University of Basel, Switzerland. "Pattern Formation in High Power Ferromagnetic Resonance." November 5, 1991.

**Videotapes of the above seminars, except those marked *, are available to members of CMRR's sponsoring companies.** •

# Future Conferences

**January 14-15, 1992**
THIC, San Diego CA.
For info: (312) 567-4457.

**January 16-17, 1992**
Magnetic Thin Films, Stanford Center for Research on Information Storage Materials; Stanford Dept. of Materials & Engineering, Stanford University.
For info: (415) 723-0698 (415) 725-4034 Fax
Program info: Prof. Robert White, (415) 723-4431.

**February 6, 1992**
IDEMA Dinner Program, David Claridge, Hambrecht & Quist, San Jose CA.
For info: IDEMA (408) 720-9352.

**March, 1992**
Invited Workshop Tribology of the Head/Disk Interface, San Diego, CA.
For info: Prof Frank Talke, CMRR, UCSD, La Jolla, CA, 92093 (619) 534-3646 (619) 534-2720 Fax.

**March 24-26, 1992**
Short Course on Magnetic Recording Technology, Santa Clara, CA.
For info: IIST, School of Engineering, Santa Clara University, Santa Clara, CA 95053 (408) 554-6853.

**April 13-16, 1992**
Intermag '92, St. Louis, MO.
For info: Courtesy Associates, 655 15th St., NW, Suite 300, Washington, DC 20005 (202) 639-5088.

**May 14, 1992**
IDEMA Dinner Program, San Jose CA.
For info: (408) 720-9352.

**June 7-19, 1992**
NATO Advanced Study Institute on High Density Recording, II Ciocco, Castelvecchio Pascoli, Italy.
For info: Prof. Dr F. Grandjean, Université de Liege, Institute de Physique, B5 Liege, Belgium 32-41-56-3632, Fax 32-41-56-2355, Bitnet U2121FG @BLIULG11.

**June 14-18, 1992**
IEEE International Conference on Communications (ICC'92), Chicago IL.
For info: David G. Leeper, Technical Program Chair, Newman Springs Road, Rm 1A230, Red Bank, NJ 07701-7020 (908) 758-4590.

**June 16-17, 1992**
Controlling Intelligent Storage Devices, Santa Clara, CA.
For Info: IIST, School of Engineering, Santa Clara University, Santa Clara, CA 95053 (408) 554-6853.

**July 3-8, 1992**
2nd International Symposium on Physics of Magnetic Materials (ISPMM '92) Beijing, China.
For info: Prof. Yang Luo, San Huan R/D Center, Academia Sinica, P.O.Box 603, Beijing 100080, P.R. China 86-1-256-1268 Fax.

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**Sheldon Schultz, Ph.D.**
Editor
**Dawn E. Talbot**

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