

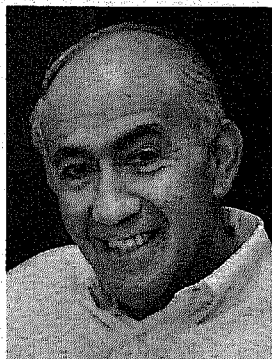
CMRR Report

Center for Magnetic Recording Research

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Ami E. Berkowitz

Renowned Materials Specialist Joins CMRR Faculty

Ami E. Berkowitz took up the fourth endowed chair at CMRR on October 1, 1986. He has also been named as a professor in UCSD's Department of Physics. A renowned expert in the field of magnetic materials, Berkowitz will study the magnetic behavior of recording materials in terms of their physical structure and intrinsic magnetic properties.

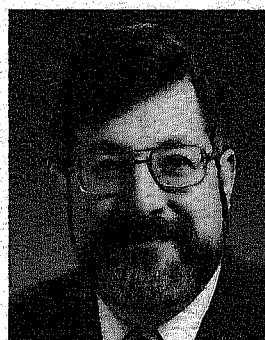
"We wanted to get a materials scientist who is an expert in the magnetic materials that are used in magnetic recording systems," CMRR director, John C. Mallinson said. "It is a coup to get someone with Dr. Berkowitz's expertise on our faculty."

Berkowitz had been at General Electric since 1968 as a research physicist in the Research and Development Center in Schenectady, New York. While there he helped develop the spark erosion technique for making fine particles of a wide range of materials including metals, alloys and various compounds. He earned his Ph.D. in physics at the University of Pennsylvania in 1953 while working for the Franklin Institute Research Laboratories in Philadelphia. While there he managed the magnetic and thermoelectricity section which looked at fine particle ferromagnetism, magnetic recording and magnetic alloys.

Some seven years later, Berkowitz moved to IBM's Research Center at Yorktown Heights, New York. There he worked on magnetic alloys and compounds. In 1965 he became manager of the materials branch at IBM Components Division in Burlington, Vermont, which investigates computer memory applications of magnetic thin films.

"Structure sensitive magnetic properties have been a major interest of mine, with the emphasis on 'hard' magnetic properties. I've been very much interested in the area of magnetic recording, particularly the development of new recording materials, over the years. Joining CMRR gives me the opportunity to pursue this interest. I expect it to be a stimulating atmosphere to work in," Berkowitz said recently.

Berkowitz holds some fourteen patents and has written over forty papers. He co-edited the two-volume work published in 1969 by Academic Press titled "Magnetism and Metallurgy." In 1982 Berkowitz was named Distinguished Lecturer by the IEEE Magnetics Society.



H. Neal Bertram

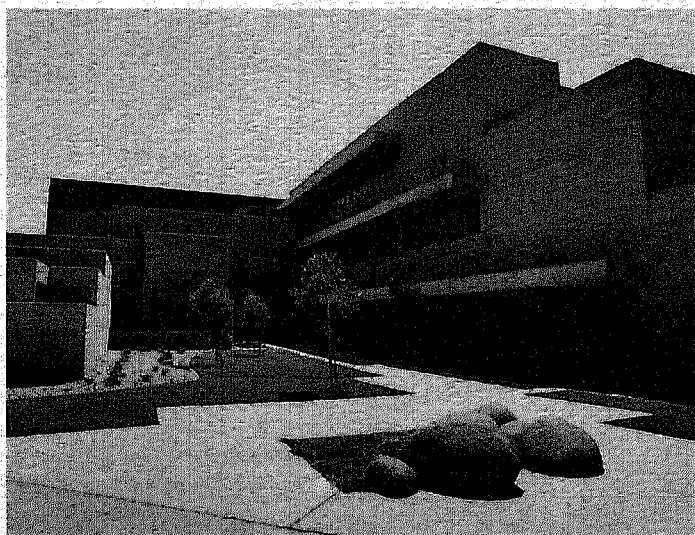
Professor Neal Bertram Elected a Fellow of the IEEE

CMRR's Professor Neal Bertram has been elected a Fellow of the IEEE for "contributions to the theory and applications of magnetic recording." This honor is reserved for fewer than 0.3% of the total IEEE membership worldwide. In Neal's case it is a richly deserved recognition of over eighteen years of seminal work in the field.

It is nearly impossible for this writer to imagine what the state of magnetic recording theory would be like today without Neal's work. For example, would it yet have been realized that anhysteresis is an intrinsic property of the dipolar interactions of large numbers of particles without particular regard to the detailed configuration of their packing? Would the close relationship between the thermoremanent and the anhysteretic magnetization processes have been recognized?

Having collaborated with Neal in his research ever since he graduated from Harvard in 1968, it is my particular pleasure to congratulate him upon the splendid achievements of his career and his election as a Fellow of the IEEE.

—John C. Mallinson



Center for Magnetic Recording Research



From the Director

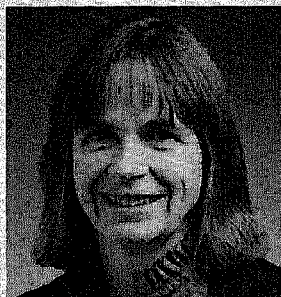
As CMRR ends its third calendar year of existence, I have been "making the rounds" of our founding sponsors seeking further financial commitments. To date, no less than seven of the original ten sponsors have agreed to continue funding at substantially the same level. I take this to be a major vote of confidence in the Center's activities and extend my personal thanks to those sponsors.

Since CMRR's beginnings in 1983, four new industrial sponsors and one governmental agency have been enrolled and I anticipate that, in the forthcoming year, another four or five industrial sponsors will join us. As I lamented in the last issue of *CMRR Report*, unfortunately there remains an almost complete lack of federal funding for magnetic recording technology. Again, I solicit your ideas and recommendations on this situation.

Ami Berkowitz joined CMRR on 1 October '86 and Neal Bertram was elected a Fellow of the IEEE. Both happy events are discussed elsewhere in this issue of *CMRR Report*.

I have recently compiled a booklet modestly entitled, "CMRR Accomplishments, 1985-86" which gives a brief biography of all the professors involved in our activities and, additionally lists all of our forty-two graduate students with their expected dates of graduation. Personnel directors and other interested parties are invited to send for a copy.

—John Mallinson



Irene Beardsley

Collaboration Between IBM and CMRR

In April 1986, Irene Beardsley began a collaborative project with CMRR's Neal Bertram to model the recording process in thick particulate media. The actual computer modeling using a detailed two-dimensional write process model, will be done at IBM's Almaden Research Laboratory where Dr. Beardsley is a member of the research staff.

Drs. Beardsley and Bertram expect to present a paper on this work entitled "Imaging effects in contact recording on particulate media" at the forthcoming Intermag conference in Tokyo, April 14-17, 1987. It is expected that Dr. Beardsley will spend a few days each month over the course of a year on this collaborative project with Dr. Bertram.

Dr. Beardsley is on familiar ground at CMRR since she is a native of San Diego. She gained her B.S. degree in physics from Stanford in 1957 and her Ph.D. in physics in 1965, also from Stanford. The topic for her Ph.D. thesis was the low temperature behavior of the Heisenberg ferromagnet.

On completion of her Ph.D., Irene Beardsley joined the Lockheed Research Laboratory. While there she worked on electron energy bands in solids. Three years later she joined IBM Research in San Jose. Research areas for Dr. Beardsley have included electronic theory of solids, amorphous semiconductors, surface science, and for the last eleven years the theory of magnetic recording. Current research at IBM's Almaden Research Laboratory involves computer modeling of the hysteretic properties of recording media, and the physics of the write process.

Dr. Beardsley is a member of the IEEE Magnetics Society and the Division of Condensed Matter Physics of the American Physical Society.

Magnetic Recording Media Conference Parma, Italy, 2-5 September '86

Some two hundred people attended this biennial conference, which was held this time in Parma, the home of Verdi, cheese and ham. About fifty regular papers and twenty-six posters were presented. Two papers and one poster were from CMRR: "Comparison of thin film and ring heads for perpendicular recording," by Zhu and Bertram; "Depth profiling of modulation noise," by Coutellier and Bertram; and "Preparation and Stability of $\text{Nd}_2\text{Fe}_{14}\text{B}$ particles," by Higgins, Oesterreicher and Pollard.

Probably one of the most important papers was given by Bonnetat of Rhone-Poulenc Reserches in the plenary session. This talk emphasized the differences between research accomplishments in the laboratory and the state of recording technology as it is practiced commercially. The virtues of particulate iron oxide and metallic iron particulate media were extolled and attributed to the fact that wear, friction and corrosion problems have already been solved. Promising research ideas, which were "going nowhere," included perpendicular recording and magneto-optical recording because the media—thin metallic films—suffered from wear, friction or corrosion problems.

A major theme at MRM was the state of research and development of barium ferrite particulate media. Despite two papers by Speliotis of Advanced Development Corporation, only hysteresis loop data and not magnetic recording data were shown. The conclusion may be drawn that, at the moment, chaos reigns: barium ferrite exists in three crystal habits, exhibits pronounced particle agglomeration effects and is usually expensive to make in the proper particle shapes and sizes. Several pigment manufacturers stated that they could not start serious study of the material until more definite specifications are forthcoming from the researchers. One pigment house observed that they were still waiting for a substantial world market to materialize for metallic iron particles and that, with an iron particle factory waiting in mothballs, they did not look favorably upon the potential emergence of yet another "wonder particle!" Nevertheless, many tape manufacturers claim superlative frequency response of BaFe media. Unfortunately except for the work of Toshiba, no calibrated data has yet been published.

As usual, MRM was fascinating because of its unique blend of research, development and production personnel.

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CMRR Report is published quarterly.



Lineu Barbosa

Sabbatical from IBM

In April, 1986 Dr. Lineu C. Barbosa began a year's sabbatical at CMRR. At IBM he is a member of the Almaden Research Center. Dr. Barbosa's broad range of interests include signal processing, communications, stochastic processes, optimization problems, operations research, applied mathematics and numerical analysis. His approach to magnetic recording as well as communications problems in general is as a form of inversion of

operators. He is concerned with understanding the mechanism of errors in magnetic recording. This includes an understanding of the noise process as well as several potential detection and coding schemes.

Current research at CMRR for Dr. Barbosa includes investigating the trade-offs between linear and track densities. He has derived an equalizer that removes side and track interference as well as intersymbol interference from transitions in the same track. This equalizer can be used as a basis for the simultaneous detection of signals from more than one interfering track.

Dr. Barbosa has also initiated a study group with Drs. Neal Bertram and Jack Wolf and their graduate students. The goal of this group is to develop a better understanding of some of the cross-disciplinary areas of magnetic recording.

During the fall quarter, Dr. Barbosa taught a graduate course on information theory in the Department of Electrical Engineering and Computer Sciences (EECS 258A). The purpose was twofold according to Barbosa—"It serves as a means to strengthen ties between IBM and the university and afforded me a great deal of personal satisfaction since I love the interaction with young students."

Among Lineu Barbosa's personal interests is a strong love of music, particularly jazz and classical music. He admits to playing with a saxophone and owns a flute and cello. We are not told whether he also plays at playing with these instruments as well. While at the University of California, San Diego, Barbosa is auditing the Jazz Improvisation class in the Department of Music.

Dedication Ceremony for Engineering Building

The highlight of the October 24 dedication ceremony to celebrate the construction of Engineering Building Unit 1, was the placement of a "high technology" time capsule filled with examples of state-of-the-art technology. The capsule, a section of PVC pipe donated by the general contractors for the building, Hensel-Phelps Construction Company, contains submissions from industry and faculty. Items submitted from industry included a 32-bit processor chip from NCR and from Spin Physics/Eastman Kodak Company, a solid-state sensor containing 1.3 million photosensitive elements designed to transfer information at a rate of up to 1 billion bits per second. Faculty submissions included a thin film magnetic recording head with schematic from Dr. Frank Talke of CMRR.

Dr. Frank Mayadas, director of IBM's Almaden Research Center in San Jose, was the featured speaker. He addressed the issue of closer university-industry ties, citing CMRR as one example of this new climate of cooperation. Dean of Engineering, M. Lea Rudee and Chancellor Richard C. Atkinson also participated in the ceremony.

An outdoor reception on the balcony of the Central University Library overlooking the Engineering Building Unit 1 site followed.

Tribology Symposium

The third annual symposium on Tribology and Mechanics of Magnetic Storage Systems was held in Pittsburgh in October, 1986. More than one hundred people participated in the meeting, with a large group of Japanese participants. The topics of the more than twenty-five papers presented ranged from frictional polymers and stability of tape lubricants to wear of ferrites, numerical methods, head/slider dynamics, to tape flutter and accelerated wear tests.

The symposium proceedings are available from the American Society of Lubrication Engineers, 838 Busse Highway, Park Ridge, IL 60068.

CMRR Seminar Attracts Full House

The annual CMRR/UCSD Extension fall research seminar, "Advanced Topics in Magnetic Recording" was held this year on December 15 and 16, 1986. The two-day program attracted over fifty people from throughout the United States. The seminar covered current research in magnetic recording. Topics included research findings in areas of: magnetic recorder as a communications channel, coding and detection schemes for digital recording, magnetic particles for recording, amorphous magnetic materials—properties and stability, the non-magnetic properties of recording materials, professional digital video recording, mechanical design considerations in magnetic disk recording technology, and reversible optical recording techniques.

To be included on the mailing list for future Extension programs in this and other related areas please call (619) 534-6947.

UCSD Bookstore Offers Technical Books

The UCSD Bookstore located on Warren Campus sells a complete line of technical books in a wide range of disciplines. To insure the selection keeps up with the rapid advances in all scientific fields, they receive automatic shipment of books at time of publication from many scientific and technical publishers. Additionally, they will special order any book not in stock, which is in print.

On-campus customers can use the four-digit recharge number while off campus customers can use a credit card or personal check. Telephone orders are accepted. Customers need not be affiliated with the University. Local companies can establish a store-charge account.

For further information call: Debbie Foreman, (619) 534-3149 or write to University Bookstore, Q-008, UCSD La Jolla, CA 92093.

Hours: Monday-Friday	8:00 a.m.-4:45 p.m.
Saturday	10:00 a.m.-4:00 p.m.

Calendar

February, 1987	CompCon '87, San Francisco, CA	April 20-22, 1987	International Symposium on Magnetism of Intermetallic Compounds, Kyoto, Japan For further info: Prof. Y. Nakamura, Dept. of Metal Science and Technology, Kyoto University, Kyoto 606, Japan (075) 751 2111
February 10-12, 1987	International TOC Conference on Optical Memory Technology, London, England For further info: Rothchild Consultants, P.O. Box 14817, San Francisco, CA (415) 681-3700	April 20-22, 1987	International Symposium on Magneto-Optics, Kyoto, Japan For further info: Dr. K. Tsushima, NHK Science and Technical Research Laboratories, 1-10-11, Kinuta Setagaya-ku, Tokyo 157, Japan (03) 415 5111
February 25-27, 1987	IEEE International Solid-State Circuits Conference, New York, NY	April 21-25, 1987	Spring Meeting of the Materials Research Society, Anaheim, CA For further info: Gregory L. Olson, Hughes Research Labs, 3011 Malibu Canyon Rd., Malibu, CA (213) 317-5457
March 11-13, 1987	4th Topical Meeting on Optical Data Storage, Stateline, NV For further info: Optical Society of America, 1816 Jefferson Place, NW, Washington, DC (202) 223-0920	May 6-8, 1987	Optical Storage 87, Denver, CO For further info: Cartledge & Associates, Inc., 1101 S. Winchester Blvd., Suite M259, San Jose, CA 95128 (408) 554-6644
March 16-20, 1987	6th International Seminar on Magnetism, Dresden, East Germany For further info: Prof. K. Elk, Hochschule für Verkehrswesen, Wissenschaftsbereich Physik, DDR - 8072 Dresden	May 11, 1987	Mass Storage Systems Symposium, Tucson, AZ For further info: Patric Savage, Shell Development Co., P.O. Box 481, Houston, TX (713) 663-2384
April 6-9, 1987	Magnetic Media Manufacturing Methods, Honolulu, HI	June 9-11, 1987	TOC Conference on Optical Storage for Large Systems, New York City For further info: Rothchild Consultants, P.O. Box 14817, San Francisco, CA (415) 681-3700
April 9-11, 1987	International Symposium on Physics of Magnetic Materials (ISPM '87), Sendai, Japan For further info: T. Miyazaki, Dept. of Applied Physics, Faculty of Engineering, Tohoku University, Sendai 980, Japan (0222) 22-1800, x4720	June 15-18, 1987	National Computer Conference, Chicago, IL For further info: American Federation of Information Processing Societies, Inc., 1899 Preston White Drive, Reston, VA (703) 620-8926
April 14-17, 1987	Intermag '87, Tokyo, Japan For further info: Secretariat of INTERMAG '87, c/o International Congress Service, Inc., 2-14-9, Hihombashi, Chuo-ku, Tokyo 103, Japan (03) 272 7981 or FAX (03) 273 2445		

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