IEEE MAGNETICS SOCIETY NEWSLETTER

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EDWARD DELLA TORRE, EDITOR

ISSUES

Bill Doyle, President, Magnetics Society

Just about 28 years ago, I attended my first technical conference, the 1959 M3 meeting in Detroit. In those days, the first session was a plenary session, a sort of welcome to the gang. I remember very clearly sitting in the huge hall not knowing anyone but a few colleagues and frightened that I would never really be able to participate. The chairman, whose first name was Jack, gave a friendly greeting to his old friends, specifically reminding us all how good it was to see "Rick, Al and Charlie" again. Since I had no idea who those people were, it was hard to identify with that community. This commentary is an attempt to make-up for those unpleasant moments and to welcome the participation of all of you in our activities.

I'd like to discuss the problem of the "old boy's" network and how it effects the organization of our Society. But first, let me share some very good news with you.

At the Technical Activities Board (TAB) meeting in Florida, our proposal for TAB to partially reimburse the Magnetics Society for our losses on TJMJ in 1985-1987 was considered. An outright grant of $60,000, about half the amount we have lost, was approved 22-15 with the money to come from the TAB Book Fund. Since our projected net worth at the end of 1987 was only $137,000, this grant represents a significant improvement in our financial well-being. Many thanks to Al Smith (Past President) and Jim Opfer (Editor, TJMJ) who provided special material for our presentation.

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DIVISION IV DIRECTOR'S REPORT

Gary A. Thiele

The Board of Directors of the IEEE met for two days in Orlando, November 22 and 23. There are a number of items I would like to report to you.

The Board, taking note of the members majority vote for the proposed constitutional amendment, debated at length the number of candidates to put up for President-elect and Vice-President in 1988, and how best to do so. As a result of this debate, the Board voted to use approval voting in 1988. In a certain sense, this is a new concept in voting procedure, although it is presently used by a half dozen or so states. Approval voting means that you can vote for as many, or as few, candidates as you approve of. For example, there will be three candidates. Obviously voting for all three woud have the same effect as voting for zero. Thus, the real voter decision is whether to vote for one or two. Either choice is a valid vote (which makes this a friendly change in voting procedure).

After hearing testimony from an outside expert in voting procedures, the Board decided to use approval voting in 1988 since approval voting provides the best way for the majority view to prevail in contests where there are three or more candidates without the need for expensive run off elections. Additionally, it is a procedural change that will not result in an increase in invalid ballots.

Approval voting will be sort of an experiment in 1988 to see how well it works,

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Now to the main issue. How does our Society refresh itself? Let's begin with the 1988 organization. We are self-perpetuating but governed by a Constitution and By-Laws. The President names the Chairman of the Nominations Committee who prepares a list of candidates for the next year's Administrative Committee (ADCOM). Each year eight new members are elected by the entire Society for a three-year term. A member may serve only two consecutive terms but is eligible again after one year off. Also, the President may take ex-officio appointments. The President, Vice-President and Secretary/Treasurer are elected annually by AdCom from its membership. The President then appoints all the Chairmen of the Standing Committees. The Society runs conferences and publishes Transactions. The Chairman of the Conference Executive Committee selects the site for future annual conferences, i.e., Intermag and appoints a General Chairman. He, in turn, picks his own management team to run the Conference, including the Program Chairman. They then form a Program Committee of 20-30 people to review the submitted abstracts and schedule the program. The Publication Chairman sees to it that the Transactions and TJMJ appear by appointing appropriate editors to staff our several publications. The role of other committees is generally clear from the name. Some are much more active than others, often reflecting the initiative of the Chairman. All in all, excluding referees, some 100-150 people, about 4% of our membership, will play a role in our annual activities. Three popular "entry level" positions are Chapter Activities, the Local Arrangement Committee for Intermag and the Intermag Program Committee. These often lead to the Chairmanship of a major committee or a conference, and finally election to AdCom, the "old boys".

After many years service in the Magnetics Society and the organization of M3 and other conferences, I can say that the most likely reason people get re-appointed to jobs is that they are willing and able. So, I don't mean "old boy" in the pejoritave sense of cronyism, rather, in the sense of being comfortable and conservative.

If the AdCom membership in the past is compared with the 1988 AdCom, it's found that of the present membership, only one served in 1968, six in 1973, six in 1978 and eleven in 1983. Thus, we seem to change AdCom roughly at the rate of one member/year. This year two new members were added but one has served before, so our average is preserved.

Recognizing that renewal would probably not come about by major changes in AdCom, I consciously decided to change the leadership in some of our standing committees as a method of bringing in new people. This year, Karl Strnat (Fellow Evaluations), Dan Stancil (Education), Peter Wohlfarth (Advances in Magnetics Editor), Craig Perlov (Newsletter Editor), Carmen Vittoria (Technical Committees), Celia Yeack-Scranton (Membership) and Linda Meichle (Chapters) are all new additions to the organization.

It is often difficult to identify new candidates so please, let me know if you'd like to recommend someone or even better, if you'd like to participate yourself. You'd probably make a great "old boy"!

The IEEE Magnetics Society Newsletter is published quarterly by the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, NY 10017. The objective of the Newsletter is to publicize activities, conferences, workshops, and other information of interest to the membership of the Society and technical people in the general area of applied magnetics. Copy is solicited from the S-Mag membership, organizers of conferences, officers of the Society and local chapters, and other individuals or organizations with potentially relevant material. Copy should be sent to Dr. C.M. Perlov, Hewlett-Packard Labs, MS-2U, P.O. Bos 10490, Palo Alto, CA 94303 by the following deadlines, September 20, December 20, April 20 and July 20.

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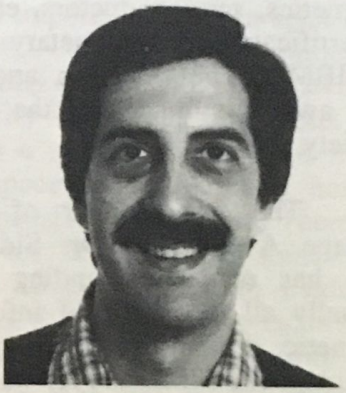
how well the members like it, and to see if it will generate increased interest in the elections as evidenced by the number of ballots cast. Please give it a try, and after you have done so, let us know how you like it.

I would like next to say a few words about Fellow nominations. The Board approved 200 Fellow nominations out of 361 nominated. This is a larger percentage than the usual 35-40% that are appproved. This reflects an attempt by the Fellows Committee to open up the Fellow process to practitioners as well as to research oriented nominations. This is good news. The bad news is that the 361 nominations for 1987 is down from 403 the previous year. There is a lot more talent out there than that! I hope to see the number of nominations improve this year. Nominators should be aware that 64% of all nominations ultimately make it on the second or third try. So, don't give up after the first round! Make the nomination stronger and put it back in. Also nominators, **you** should contact potential references, not the nominee. In the last several years I have been contacted four times by nominees asking if I would be a reference. While that may be normal practice in some situations, it is not the correct practice for Fellow nominations.

Next, I would like to follow up on two items I have mentioned in some previous newsletters. As a member of the Board, I am expected to attend at least four Board related meetings per year. These meetings, which include TAB and TABopCom meetings, extend over 5 or 6 days each time. In addition, each of the 5 societies in Division IV has at least two administrative meetings, because, in part, most matters that come before the Board are not the same things that come before the societies at their meetings. There are some disadvantages in this, one of them being reduced communication between the Board and the societies. Thus, in my second year, fortified by greater familiarity with the directorship and the issues before the board, I will attempt to attend some of the society administrative meetings. The July meeting in Vancouver appears to be a good possibility.

The final item I would like to report on is the progress on the matter of reviewing the operation of the IEEE. This year's President, Henry Bachman, has taken a personal interest in this matter and is off to a significant start in conducting a review. He will be able to spend even more time on the review in 1988 once his Presidential duties are behind him. The Board is quite interested in this issue and will be following it closely, having already participated in the initial phase with President Bachman.

CRAIG PERLOV APPOINTED NEWSLETTER EDITOR



Craig Perlov

Dr. Craig Perlov has agreed to take the position of Newsletter Editor for the IEEE Magnetics Society. Starting with the next issue he will replace Ed Della Torre who was editor for the past three years.

A native of California, Craig attended the University of California at Davis where he obtained both the B.S. and Ph.D. in physics. After completing his education he taught undergraduate physics for a year and a half. In 1983 he joined the Control Data Corporation in Minnesota, working for the Advanced Technology Division modeling media, heads and the recording/playback process. In 1985 he was the CDC fellow in residence at the Center for Magnetic Recording Research at the University of California at San Diego. He is currently working in the Mass Storage Technology Division of the Hewlett-Packard Laboratories.

MAGNETICS SOCIETY BESTOWS HONORARY LIFE MEMBERSHIP

At the November 12, 1987 meeting of the Magnetics Society Administrative Committee in Chicago, a motion was passed bestowing honorary "Life Membership" in the Society to all past recipients of the two major awards of the Magnetics Society.

These two awards are the Magnetics Society Achievement Award and the IEEE Information Storage Award. The latter is a new award first given in 1987 to honor outstanding achievement in Information Storage, in all aspects of this area such as magnetics, semiconductors, etc. It consists of a certificate and a monetary award sponsored by IBM. The selection and presentation of this award is made by the IEEE Magnetics Society.

The first winner of the Information Storage Award was Dr. Sidney M. Rubens, who has made outstanding contributions to virtually all the fields of information storage: magnetic drums, magnetic tapes, transistors, thin magnetic films, and ferrite cores.

The Magnetics Society Achievement Award is presented for outstanding technical achievements in magnetics and leadership in Society affairs. It consists of a certificate and a monetary award and is usually presented at the annual INTERMAG Conference, as is the Information Storage Award. Previous winners of the Achievement Award are:

Fred E. Luborsky	1981
Herbert F. Storm	1982
Harold W. Lord	1983
Joseph J. Suozzi	1985
Fritz J. Friedlaender	1986
Andrew H. Bobeck	1987

At present, Lord, Rubens and Storm are already Life Members as is E. Frei. Nominations for both of the above mentioned awards are now being accepted. See September 1987 Newsletter or contact F.J. Friedlaender.

CLARK JOHNSON SELECTED IEEE CONGRESSIONAL FELLOW

Magnetics Society member Clark Johnson has been selected as Congressional Engineering Fellow by the IEEE for 1988. There are three IEEE fellows included in a total of 20 Fellows from 15 Societies. It is of interest that the IEEE Fellows are all engineers with considerable experience and are all in their fifties, as contrasted with those from other societies who are mainly young post-docs. Clark plans to work with a Member of Congress, rather than with a Congressional Committee. As there are about 200 places available in Congress for the Fellows, they have a wide variety of opportunities to choose from.

MAGNETICS SOCIETY MEMBER 1988 PRESIDENT-ELECT OF IEEE

Dr. Emerson W. Pugh, Research Staff Member at the IBM T.J. Watson Research Center in Yorktwon Heights, NY has been elected 1988 President-Elect of the Institute of Electrical and Electronics Engineers, Inc. (IEEE). Dr. Pugh will serve as IEEE President-Elect during 1988, and will assume the office of Institute President on January 1, 1989. Dennis Bodson, Assistant Manager, National Communications System, Office of Technology Standards, Washington, D.C., was chosen IEEE 1988 Executive Vice-President. The IEEE is the world's largest technical professional organization with more than 280,000 members in over 130 countries.

Dr. Pugh will assume the office of President-Elect on January 1, 1988. At the same time, Russell C. Drew, 1987 President-Elect and President of Viking Instruments Corp., Sterling, VA, will become the 1988 IEEE President, succeeding Henry L. Bachman, Vice-President of Planning, Design, Assurance and Administration at Hazeltine Corporation in Greenlawn, NY. Mr. Bodson succeeds Merrill W. Buckley, Jr. as Executive

Vice President. Mr. Buckley is Manager of Program Planning at RCA Aerospace and Defense in Moorestown, NJ.

Dr. Pugh has been a member of the IEEE since 1965, and was elected an IEEE Fellow in 1972. He is 1987 Vice President of Technical Activities, and was previously elected 1986 Executive Vice President and the 1983-84 Director of the Division concerned with electromagnetics and radiation. Concurrent with these positions, he was a member of the IEEE Board of Directors. Dr. Pugh currently serves on the Finance Committee and is Vice Chairman of the Friends for the History of Electrical Engineering. He is a member of the Board of Trustees of the United Engineering Trustees, the Engineering Societies Library Board, and the Electronic Conventions, Inc. Board of Directors.

At the IBM T.J. Watson Research Center, Dr. Pugh has held several senior technical management positions in the fields of magnetic memory and research planning. He has published widely in solid-state and information storage technologies, and holds many patents in these fields. In 1974, while on leave from IBM, he served as Executive Director of the National Academy of Science's study of automobile emissions and fuel economy. He is a Fellow of the American Physical Society and the American Association for the Advancement of Science. Dr. Pugh has a Bachelor of Science degree and Ph.D. degree in Physics from Carnegie-Mellon University, Pittsburgh, PA.

IEEE members did not adopt a proposed Constitutional amendment which would have required the Board of Directors to submit annually at least two candidates each for the offices of President-Elect and Executive Vice President. Currently, according to the IEEE Bylaws, the Board of Directors must nominate at least one person for each office. The proposed amendment received 57.3% of the ballots cast, or 25,796 votes for and 19,211 against. In order to be adopted, a proposed amendment must receive two-thirds, or 66.7% of all votes cast.

LETTER TO THE EDITOR

Fred B. Hagedorn
Conference Exec. Comm. Chairman

Amikam Aharoni's letter in the September 1987 Newsletter urges that the organizers of the INTERMAG and MMM Conferences publish information about hotels which are less expensive than the conference hotels. Bill Doyle asked me, as chairman of the IEEE Magnetics Society Conference Executive Committee, to comment on this and other points raised by Aharoni.

To begin, CEC is certainly aware of and sensitive to the issue of hotel room rates. Room rates are an important factor in selecting a conference hotel. Additional important factors are the quality and quantity of meeting space and the city in which the hotel is located. There is a strong tendency for high quality meeting space to be found in hotels with relatively expensive room rates. There is also a tendency for hotels to be somewhat less expensive in cities of small to medium size. In evaluating these competing factors in recent years, CEC has placed a priority on good meeting space and then chosen smaller cities to obtain lower room rates. INTERMAG conferences scheduled for Brighton (1990), Pittsburgh (1991), and St. Louis (1992) reflect this policy.

To reserve the use of the hotel meeting space for the conference, it is almost always necessary to sign a contract with the hotel which guarantees that some minimum number of sleeping rooms will be rented by conference participants. If this number of room rentals is not realized, then the conference is obligated by contract to pay the hotel directly for the use of the meeting space. The amount of this surcharge generally depends on the amount by which the minimum room rental number is missed. The most recent instance of a Magnetics-Society-sponsored conference for which this surcharge had to be paid was the 1985 ICM in San Francisco when the conference organization ended up paying the hotel $7000 because too few sleeping rooms were rented. The organizers of this conference published a list of less expensive hotels.

Consequently, the approach advocated by Aharoni has been recently used by a magnetism conference held within the United States, and it didn't work well. As a result, the present CEC policy is to encourage participants to stay in the conference hotel. In addition to providing the required number of room rentals, this policy promotes after-hours communication, which the CEC regards as an important aspect of conference participation. However, the CEC believes that it is easy for an individual to find a cheaper hotel, either from a travel agent or from a guide book. In recent times it has also been the practice of Courtesy Associates to provide such information directly from a guide book to those individuals who make a specific request.

The policies and procedures regarding conference hotels were reviewed during the CEC meeting held on November 10, 1987. There certainly are other practical approaches to this problem, as Aharoni's letter states. However, the CEC concluded that the present procedures are well-suited to the current needs of our conferences and that these procedures allow conference participants, with relatively minor inconvenience and extra effort, to make alternative hotel arrangements if necessary.

Probably the central issue here is whether or not a policy which encourages the use of the conference hotel turns out in practice to force participants to use the conference hotel. The CEC does not intend for that to be the result, but it is evidently so perceived. By writing his letter to the Newsletter, Aharoni has stimulated this discussion, and I hope that this explanation of the policies and procedures will solve whatever problem may have existed in this regard.

In conclusion, I want to clarify what may be yet another confusing issue. There is always a reservation cut-off date for the conference hotel. After that date, the hotel sells the remainder of the conference block of rooms to the general public. At the time of the conference, it is thus quite possible that conference participants who were late in requesting reservations could be turned away by the conference hotel but that the conference would still have to pay a surcharge. So far, this turn of events hasn't occured, but my final words are to urge all conference participants to heed the hotel reservation deadlines.

SESSION SUMMARIES

The 32nd Annual Conference of Magnetism and Magnetic Materials was held in Chicago, Illinois on November 9-12, 1987. As a service to its members the Newsletter is publishing a summary of the sessions prepared by the Chairman of the respective sessions. The full proceedings of the Conference will be published by the Journal of Applied Physics early in 1988.

Session AC, Molecular Magnetism
Chairperson: S.A. Friedberg

This session consisted of four invited papers describing exciting recent progress in the long search for ferromagnets whose preparation and fabrication exploit the powerful techniques of organic synthesis or polymer chemistry. The first speaker, Joel S. Miller (DuPont), reviewed from the chemist's viewpoint the problem of achieving ferromagnetic interactions between spins on neighboring organic or organometallic molecules or radicals in molecular crystals and polymers. Several new materials were discussed including the tetracyanoethylene (TCNE) charge transfer salt of decamethylferrocene (DMeFe) which exhibits ferromagnetic order below T_c=4.8K. The second speaker, A.J. Epstein (Ohio State), described extensive susceptibility and magnetization studies on powder and single crystal samples of (DMeFe)(TCNE) which establish the nature of the ordering process in some detail including the crossover near 16K from on-dimensional ferromagnetism in the stacks of alternating $(DMeFe)^+$ and $(TCNE)^-$ ions to 3-D behavior and eventual long-range ordering. Specific models used to fit the data were discussed as well as additional details of the mechanism of ferromagnetic interaction. The third speaker, William M. Reif (Northeastern), reported on the application of ^{57}Fe-Mossbauer spectroscopy to the study of charge transfer and magnetic ordering in (DMeFe)(TCNE) and other related systems. J.B. Torrance (IBM, San Jose) concluded the

symposium with a discussion of efforts to synthesize ferromagnets which are purely organic, i.e., the magnetic moments are associated with electrons of s- and p-character alone. Several models of such systems were reviewed. Experiments on polymers prepared by reacting 1,3, 5-triaminobenzene with iodine were described. Part of one sample was found to be ferromagnetic up to 420° C at which point the material decomposed. The reproducible preparation of useful quantities of such materials has not yet been achieved.

Session AD, Soft Magnetic Materials: Technical Properties
Chairperson: J.A. Salsgiver

This session was composed of papers from four different fields: grain oriented silicon steel, non-oriented lamination steels, amorphous materials and an Fe-Co-V alloy. Nozawa's invited paper was primarily devoted to means and mechanisms for achieving permanent domain refinement in high permeability silicon steels. The mechanism for domain refinement involves defects that lead to subdomain formation which results in the creation of additional anti-parallel domains after the application of stress. Iwayama followed with a description of the metallurgical problems involved in the commercial production of 0.18 mm (7-mil) high permeability silicon steel strip. Permanently domain refined 7-mil strip with core losses averaging 0.22 wpp at 1.3T are possible. The Puru paper on low Si steel was a study of the effects of texture, Si, P and microstructure on magnetic properties. Jiles' paper on carbon steel related the effects of carbon and the size and distribution of carbides on magnetic properties, a special point being made on the importance of morphology. Novotny in his study of Fe-Co-V alloys discovered an effect of small amounts of Ni on the 60 and 400 Hz core losses and H_c dependent on whether the heat treatment created a martensitic second phase.

Four papers on the metallurgy and physics of amorphous materials were given. Fish and Hasegawa discussed how resistivity and magnetization measurements could be used to control in situ devitrification of metallic glasses intended for high frequency use. Celasco et al presented a theoretical study of the effect of viscosity field on the power spectrum of magnetization or Barkhousen noise in amorphous materials. Hasegawa presented an interesting study on harmonic generation with metallic glasses. By appropriate heat treatment to create a stable Perminvar-like hysteresis loop, both odd and even harmonics can be generated from sinusoidal excitation. Krishnan et al detailed a study of the magnetic state (moment and alignment) of Mn in Fe 40-X $Ni_{40}Mn_XSi_8$ with magnetometry and spin echo NMR. They suggest that Mn most likely enhances the magnetic moment of Ni.

Session AP, Phase Transition
Chairperson: Peter Boni

Most of the experimental papers presented in this poster session deal with properties of low dimensional magnets. G.V. Rubenacker et al. and L. Landenberger et al. report susceptibility measurements performed on 1-dimensional spin-1/2 Heisenberg systems. In the first poster ferromagnetic order of antiferromagnetically coupled trimers is observed. In the second poster the authors observed two magnetic phase transitions evidenced by two anomalies in the susceptibility data. In a poster by J.R. Lond et al. the theoretically predicted tricritical point in a layered antiferromagnetic system is not observed in contradiction to previous experiments performed by another group.

The last two posters of the session report on Monte Carlo simulations in Ising magnets. J. Pommier et al. show that finite size effects are very significant in first order phase transitions. Therefore some previous MC results obtained with small sample sizes should be regarded with caution. D.P. Landau and S. Wansleben discuss in their poster non-equilibrium relaxation of the Ising square lattice near the percolation threshold. Contrary to theoretical predictions they observe a stretched exponential decay with a temperature dependent exponent n.

Session BA, Critical Phenomena
Chairperson: M.E. Fisher

The session opened with an invited paper by D.P. Landau (U. Georgia) and K. Binder which reviewed finite-size and surface effects in magnetic phase transitions. Scaling theories give a good account of the rounding of both continuous (or critical) and first-order transitions that is checked in Monte Carlo Studies of Ising spin systems. A variety of surface transitions induced by exchange modifications on the boundaries have been elucidated.

Singh and Fisher tested the crossover scaling theory of impurity-induced exchange-randomness using long series for the (d=3)-dimensional Ising model with ±J bonds. The estimated crossover exponent agrees well with the prediction $\phi = \alpha$; experimental tests are still needed. A classical ($S = \infty$) Heisenberg magnet with competing exchange interactions may, at T=0, exhibit a continuous transition between a ferromagnetically aligned and a helically modulated phase. Harris and Rastelli argue that for quantal (S = 1/2, 1,...) spins this transition may become first order for some parameter ranges. New types of three-dimensional critical behavior, with the appearance of independent chiral order and fluctuations, are predicted for certain frustrated systems by Kawamura; experiments on appropriate helical and other systems are consistent with the predictions of new behavior.

Boni and Shirane reported constant-energy neutron-scattering scans from EuS, a Heisenberg ferromagnet. They argue that the observed departures from asymptotic dynamical scaling theory are related to relatively strong dipolar interactions.

Becerra, Oliveira and Migliano have measured the magnetic susceptibility of MnP in fields along the hard axis. They find the transition between the modulated cone and fan phases to be continuous, the transition line terminating at the critical endpoint on the ferromagnetic phase boundary. The (H,T) diagram of $CsNiCl_3$ exhibits a multicritical point at which three critical lines meet a first-order, spin-flop line. Caille, Plumer and Hood analyse this situation successfully on the basis of a Landau phenomenological theory.

The session closed with a report by Borsa et al (Pavia) on an NMR relaxation study of spin dynamics in the two-dimensional layers of MPX_3 compounds with M=Fe, Mn and Ni and X=S and Se. For $T > T_c$ a fairly good theoretical understanding is achieved.

Session BD, Bubbles, Bloch Lines & Other Magnetic Memory
Chairperson: F.B. Humphrey

From the title of this session, it should be clear that it is somewhat of a catch all session relating to non-recording magnetic memories. Two papers from Memtech, one on a Bi substituted wide temperature range garnet material and one on a combined swap-replicate gate showed that bubble memory technology still exists in the United States and that development is still being done. Two papers from Iowa State reported on the observed magneto-resistivity and thermal noise in small mulitlayer MR sensor elements. The use of these elements as the memory part of a silicon semiconductor hybrid non-volatile memory was discussed. Raytheon reminded us that hybrid devices can also be made on GaAs with the mostly calculated performance of a number of possible applications including memory. By far most of the papers of the session related to vertical Bloch lines (VBL) and, except for one, to Micromagnetic Memory. The invited paper by Thiaville reviewed efforts to see VBL's in in-plane material and reported on a new method for seeing them in garnet using a laser scanning microscope in the dark field mode with an asymmetric stop. The pictures he showed were very interesting. Unfortunately, the scheme requires rather thick high rotation garnet so it is not very useful for Micromagnetic Memory development at this time. Another approach using domain wall resonance was presented. As an alternative, it looks good, however, it has marginal resolution. Ryan and Mitchell showed what could be done with the Kerr effect in permalloy

with some beautiful pictures of VBL's and also some very interesting wide (2.5 micron) walls in very thick (4 micron) samples. Finally, the session closed with four papers each addressing some more detailed aspect important to the creation of a micromagnetic memory in garnet.

Session BE, Eddy Current Applications and Coupled Phenomena
Chairperson: N. Ida

This well attended session contained 9 papers on a variety of subjects related to eddy current applications and coupled phenomena. An invited paper by Y. Saito opened the session. It outlined a magnetization model for sinusoidal fields and presented a dual energy method based on the geometric duality of Delaunay trainges and Voronoi polygons. D.R. Fredkin presented calculations of fields in anisotropic crystalline structures based on a scalar potential formulation. Another new subject was presented by D.F. Ostergaard on the coupling of structural and magnetic computations in finite element analysis. Application of eddy current methods to the computation of losses in composite conductors was presented by M.T. Ahmed. J. Varonis discussed the use of finite element methods for the design of special purpose probes for nondestructive testing of bearing components. A semianalytical approach to analysis of unbalanced regimes in synchronous machines together with the introduction of an impedance boudnary condition was presented by I.D. Mayergoyz. A special model for computation of fields due to lightning, combining simultaneous application of finite element and finite difference approximation was introduced by G.M. Veca. The session was concluded with two papers on application of finite elements to high frequency problems. J.R. Brauer discussed modeling of resonators and A.B. Bruno talked about scattering from a finitely conducting cylinder.

Session CA, Thin Films: Longitudinal Recording
Chairperson: P.K. George

The papers in this session were related to media signal-to-noise improvements and underlayer and media film morphology. J. Zhu and H.N. Bertram examined the origins of zigzag transitions and the effect of interparticle interactions on them using the Landau-Lifshitz equation. A paper by H. Suhl and X. Zhang derived the stability conditions for a head-to-head wall and the wave length dependence of the transition width. Contact to the Williams-Comstock results were made. M. Jefferson and I. Beardsley revisited the spacing dependence of magnetic recording and raised some new issues regarding read and write spacing losses. J. Moon, L. Carley and R. Katti showed that the supralinear dependence of noise in metal media could be explained by variations in transition width. This work also showed that position jitter continues to be the dominant noise mechanism in practical applications. J. Christner, R. Ranjan, R. Peterson, and J. Lee demonstrated that a very high S/N (40 dB) could be obtained in thin film media by decoupling the grains. They also eliminated any supralinear behavior. J. Howard examined the effect of Cr, CrV, and W underlayers on the coercivity, squareness, and moment of CoCr and CoPt films. By introducing nitrogen into the Cr underlayers H. Lee and D. Barat were able to demonstrate that the epitaxial growth of the media on the underlayer affected its properties. Papers by H. Ho et al. and J. Lee et al. respectively dealt with film microstructure and domains in CoNi and CoNiCr. For oblique incidence CoNi no zigzag structure was observed beyond a critical angle. Papers by C. Hwang et al. and M. Chen et al. respectively dealt with the effect of temperature and O_2 flow on grain size and wear. It was shown that a 70A° film was formed during oxidation that promoted wear resistance. The dependence of friction coefficients on film deposition conditions was also discussed.

Session CB, Magnetic Semiconductors
Chairperson: A.K. Ramdas

The session CB focused mainly on II-VI semiconductors in which the magnetic ions Mn^{2+} or Fe^{2+} replace the group II caption. The novel aspects of Fe^{2+} as a deep donor in the wide band gap $Cd_{1-x}Fe_xSe$ and $Zn_{1-x}Fe_xSe$ and as a donor resonant with the valence band in the narrow band gap $Hg_{1-v-x}Cd_vFe_xSe$ were highlighted by A. Mycielski. Prinz, Jonker and co-workers reported on the fascinating properties of $Zn_{1-x}Fe_xSe$ films grown by molecular beam epitaxy. Geschwind et al. addressed the question of the magnetic ordering in $Cd_{1-x}Mn_xTe$ as revealed through high frequency Faraday effect studies and concluded that for $x \leq 0.65$, a type III AF rather than a spin glass transition occurs below a critical temperature. On the basis of magnetic susceptibility measurements in $Cd_{1-x}Mn_xTe$-CdTe superlattices Awschalom et al. obtained invaluable insights into the dimensional constraints on the spin-glass transition as the magnetic layer $Cd_{1-x}Mn_xTe$ is reduced in thickness. Inelastic neutron scattering in $Zn_{1-x}Mn_xTe$ (Giebultowicz et al.) yielded excitation lines from which J_{NN}, the nearest neighbor Mn-Mn exchange constant was deduced; fundamental energy gap and excitonic levels were the basic issues in the paper by Stankiewicz and Fermin on $Zn_{1-x}Mn_xSe$ with either the zinc blende ($x \leq 0.3$) or the wurtzite ($x \geq 0.35$) structure.

Some aspects of transport phenomena in Ca^{2+} Ge^{4+}: YIG System were discussed by Yuan et al.

Session CC, R-Fe-B Magnetic Hardening and Microstructure
Chairperson: C.D. Grahm, Jr.

The central unresolved scientific problem in the field of rare earth permanent magnet materials is the origin of the coercive field. The existence of a strong uniaxial anisotropy is one condition for the creation of a useful magnet material, but this alone does not ensure high coercive field and energy product. Experience shows that in certain rare-earth compounds high coercive fields can be achieved by adjustments to the composition, plus appropriate heat treatments, but the reason for the success of these operations remains in dispute. Work on the problem continues vigorously, partly because it is an interesting technical as well as scientific problem, and partly because of the conviction that if the origin of the coercive field were known, better magnets would result.

Most of the papers in these session attempt to solve this problem, specifically in the FeNdB magnets. Taken together, the papers illustrate the range of human ingenuity in tackling a difficult microstructural question. Compositions are modified in clever ways, samples are prepared by melt spinning or more conventional means, temperature and field are varied and the magnetic response is observed, and the power of the electron microscope is used to determine the location and composition of multiple phases and their interaction with domain walls. The arguments as well as the experiments are often rather complex, and cannot be adequately summarized in a paragraph.

We can say that there continues to be uncertainty and disagreement in this field, and that it seems likely that the origin of the coercive field is not the same in all magnets. Fortunately, exceptionally good magnets continue to be produced despite our ignorance of the exact reasons for their excellence.

Session CD, Microwave Propogation, Resonance, and Devices
Chairperson: Dan Stancil

Session CD consisted of three papers pertaining to magnetostatic waves and resonance, two papers on optical mode probing and detection, two papers on FMR linewidth and loss mechanisms, and one microwave device paper.

The session began with a paper by P. De Gasperis, R. Marcelli, and G. Miccoli which pointed out that care must be taken when using implicit differentiation to calculate the dispersion of magnetostatic waves. Next, D.J. Halchin reported the observation to

magnetostatic waves propogating in unbiased films of Bi-YIG. Elimination of the need for a bias magnet could greately reduce the size of magnetostatic wave devices.

In the third paper, J.C. Peuzin and J.C. Gay reported the observation of magnetostatic resonance modes of holes in ferrites, in contrast to the more familiar case of resonance in solid samples.

G. Srinivasan, C.E. Patton, and J.G. Booth reported the detection of ferromagnetic resonance in thin films using Brillouin light scattering. This technique requires a much smaller sample volume than conventional microwave techniques. O.V. Geisau, U. Netzelmann, and J. Pelzl described how the microwave power absorption in a ferrite can be profiled using the deflection of a laser beam by refractive index changes in the air next to the sample.

A new two-magnon scattering process that may contribute to the FMR line width of barium ferrite was proposed by E. Tsantes and L.M. Silber. The scattering is a result of time-dependent fluctuations in the anisotropy energy caused by oscillations in the position of the iron ion in the 2b site. Effective line widths at 36 GHz were reported for barium ferrite, W-type ferrites, and LiZn ferrite by W.D. Wilber and L. M. Silber.

The session concluded with a paper by M.D. Young describing a wide bandwidth Y circulator. A novel matching technique and bias field modulation were used to obtain operation from 2.5-9 GHz.

Session CE, Magnetic Field Computation
Chairperson: A. Konrad

Thirteen presentations were scheduled for this session. Two papers were not, however, presented. The remaining eleven papers can be grouped into three groups: 1) Magnetostatic Field Calculation Schemes and Post Processing, 2) Fields of Magnetic Recording Heads and Media and 3) Computer-Aided Engineering/Design/Instruction and Equation Solvers.

Kotiuga's papers in the first group are for the mathematically-minded person; lots of theory and some interesting concepts are presented but do not look for solutions or computational results. Lowther presented an interesting new scheme for finite element based magnetostatic force calculation. The method is based on the integration of a generalized Lorentz force density guided by a co-energy related field accuracy measure. The strategic dual image method presented by Saito is an extremely simple procedure for solving unboudned linear magnetostatic field problems. In the last paper of the first group Saito presented a method for improving first-order triangular finite element solutions. His practical method for obtaining smooth contour plots from first-order triangles is based on the orthogonality of Delaunay triangles and Voronoi polygons.

A good paper on head saturation effects in magnetic recording was presented by Varner. Two methods of analysis were described: the nonlinear multiple subdomain finite element method and the boundary integral method. There was an extensive discussion of the results as well as comparison with experimental data. Lowther's presentation on 3D finite element analysis of recording heads contained a comparison of results obtained with 3D, 2D and axisymmetric finite element models of a particular recording head. The solutions were obtained via a two scalar potential formulation. Wiesen's presentation on erasing mangetic recording media described a 2D simulation based on a vector Preisach hysteresis model showing how in this application the Preisach model is able to predict the trends found in experiment. Simulations for longitudinal particulate media and longitudinal thin film media have been carried out with a difference method applied to a cell model. Another interesting paper in this session was presented by Bloomberg on the subject of 3D side-fringing field of magnetic recording heads. An analytical expression is given for the 3D magnetic field from an idealized beveled ring-type recording head. The quasi-exponential fall-off of the spectral response for side-

reading is compared for a probe head and a recording head.

Vidyasagar's presentation on a scheme for reducing the complexity of a finite element model by automatically finding lines of symmetry and defining boundary conditions was aimed at improving 2D and axisymmetric CAE packages. Anandaraj's presentation on matrix solvers in repeated finite element solutions contained controversial and perhaps premature conclusions about the PCGG method.

This session was generally well attended and there were often lively discussions between the presentors and the audience.

Session DA, Particulate Recording Materials
Chairperson: S. Oseroff

Several papers in this session were devoted to barium ferrite media. R.H. Victora used micromagnetic theory to calculate hysteresis loops of barium ferrite particles. D.E. Speliotis discussed the over-write modulation and the magnetization reversal in Ba ferrite, concluding that the mechanism for the last is one of incoherent rotation, most probably fanning. C.H. Chang found that the second order anisotropy constant K_2 cannot be neglected when studying uniaxial ferromagnets. Data on magnetization time decay in particulate media measured down to 1.7 K was presented by S.B. Oseroff. The data shows that for fields near the coercivity, when approaching low temperatures, the rate of decay goes to zero approximately as $T^{1/2}$.

Session DB, Crystalline Magnetic Multilayers
Chairperson: B. Heinrich

The first two invited talks followed by two contributed papers comprised a mini-symposium on Rare Earth Magnetic Superlattices. In the first invited presentation, C.F. Majkrzak reviewed magnetic structures of Gd-Y, Dy-Y, Gd-Dy and Ho-Y single crystal superlattices (studied by polarized neutrons at the Brookhaven Nat'l Lab). These samples were prepared by MBE at AT&T Bell Labs (J. Kwo et al.). Perhaps the most interesting results were obtained on $[Gd_{10}Y_{10}]$ and $[Gd_5Dy_{10}]$ and structures. The sample with 10 ML of Y (N_y=10) $[Gd_{10}Y_{10}]$ showed a markedly different behaviour from previous studies on Gd-Y superlattices. Spin-flop reflections corresponding to a doubling of the chemical bilayer were reflections corresponding to a doubling of the chemical bilayer were observed. It was argued that the measured volume-integrated neutron intensities are consistent with a slightly canted antiphase domain structure which is symmetric about the applied magnetic field direction.

Superlattices combining the ferromagnetic Gd layers and helimagnetic Dy layers are relatively recent additions to the family of rare earth superlattices. Detailed analysis of polarized neutron diffraction data show that the moments of adjacent ferromagnetic layers are approximately at right angles to each other with one layer aligned along the direction of the applied magnetic field. Dy moments fan out from nearly ferromagnetic alignment with the Gd layers at the interface to a maximum interplanar turn angle at the center of the Dy layer.

R.W. Erwin presented neutron diffraction studies, carried out at NBS, on very novel $[Er_xY_y]$ superlattices. The magnetic Er was chosen because it exhibits a rich diversity of magnetic phases: In addition to a basal plane spiral, the Er spins form a c-axis modulated structure. At T_c=20 K Er undergoes a first order transition to a ferromagnetic state in which the c-axis moments align while the basal plane spiral remains unchanged - conical ferromagnet. The most interesting result, in superlattices, is the absence of a first order transition to a conical ferromagnet at low temperatures. $[Er_xY_y]$ superlattices represent systems where the exchange is considerably weaker compared to magnetic-elastic energies. This enhances the role of lattice "clamping effects". The basal plane distortions are clampled by a nonmagnetostrictive Y at interfaces which result in the suppression of the ferromagnetic

transition. Magneto-elastic effects are so strong that the basal plane and c-axis turn angles differ by several degrees from their bulk values. $[Er_xY_y]$ superlattices were grown at the University of Illinois using the MBE technique. J.A. Borchers presented magnetic properties of $[Er_xY_y]$ superlattices which were measured by a SQUID magnetometer. Their results show that complex periodic structures of bulk Er are modified in $[Er_xY_y]$ superlattices. Their measurements confirm neutron diffraction results that the ferromagnetic transitions at low temperatures are suppressed. The lattice clamping is also responsible for the large critical field values and the reduced transition temperatures.

It is important to note the above studies were carried out on samples exhibiting extremely well defined crystalline superlattice structures which are only obtainable by using MBE techniques.

The second invited paper presented by Y. Yafet dealt with RKYY exchange interaction between layers of a magnetic rare earth metal separated by Yttrium. The calculation is semi-phenomenological but its advantage is that it uses measured quantities in bulk materials. The calculation of the Fourier transform of the exchange interaction in [GdY] superlattices is based on an intuitive approach: Firstly it assumes that the s-f exchange interaction on a Gd ion is th esame as it is in bulk Gd. Secondly, two Gd monolayers are embedded in an infinite Y matrix, and therefore the wave-dependent susceptibility χ (q) is approximated by that of the Y bulk. These calculations predicted correctly that N_y=5 results in a ferromagnetic interaction and N_y=10 leads to an antiferromagnetic coupling of Gd layers in [GaY] superlattices.

The talk presented by P. Grunberg described the exchange coupling between Fe layers which are separated by a Cr interlayer. It was argued that a Cr interlayer leads to antiferromagnetic coupling between Fe layers. The authors believe that the Cr itself is not anitferromagnetic. They assume that the antiferromagnetic coupling is facilitated by the polarization of Cr electrons similarly as in the Gd-Y superlattices. Obviously further measurements carried out on samples with different Cr interlayer spacing will clarify this particular point.

J. Krebs introduced the subject of large uniaxial anisotropies in ultra-thin b.c.c. Fe (001) films grown on Ag (001) substrates. SQUID measurements showed that at low temperatures (~10K) the multilayer samples [Fe (001) 1,7 ML/Ag (001) 21 ML]$_N$ have the easy axis of magnetization normal to the film surface. This implies a large surface anisotropy. The unsaturated value of remanent magnetization suggests that the domain walls are present in ultra-thin films and thermal motion of domains results in its strong temperature dependence.

J. Dutcher presented a very detailed study of the metastable f.c.c. Fe (001) grown on Cu (001) substrates. Results obtained on the single Fe layer (3 ML thick) and superlattices [Fe (001) 3 ML/Cu (001) 10 ML]$_{10}$ were shown. The work of D.A. Steigerwald and W.F. Egelhoff, Jr. (NBS) showed the importance of growth conditions. MBE grown f.c.c. Fe forms well-defined crystalline layers at the ambient temperature only when the growth is carried out at low substrate temperatures (~120K) and a minimum of 3 ML of Fe is grown. Brillouin light scattering (BLS) experiments, performed by the Simon Fraser group, showed that the saturation magnetization in the f.c.c. Fe (001), 3 ML thick, is parallel to the sample normal. A large uniaxial anisotropy with the easy axis perpendicular to the sample surface was unambigously proven by the presence of the second resonance branch in the BLS measurements. The [Fe Cu] superlattices also displayed a strong 4th order anisotropy with the easy axis again perpendicular to the sample surface.

This session showed very clearly that the magnetic superlattices grown by MBE techniques are a very exciting field of current magnetism involving a fruitful cooperation of many laboratories.

Session DC, Itinerant Magnetism and Electronic Structure
Chairperson: V. Korenman

In an invited paper, J. Kubler reported on the extension of local spin density functional theory to electronic systems where the spin direction may have a regular spatial variation. Self consistent solutions were found for ordered γ-FeMn with a tetrahedral spin configuration, and for Mn_3GaN with a triangular one. D.D. Johnson described a KKR-CPA calculation for chemically disordered $Fe_{.50}Mn_{.50}$. The spin ordered state was found to have large antiparallel moments on Fe and Mn sites, giving a small net magnetization. Studies of the disordered local moment limits of fcc FeMn, Fe and Mn elucidated the dependence of Fe and Mn moments on local chemical and spin disorder. J. Callaway presented a calculation of the temperature dependence of magnetic neutron scattering from nickel, using semi empirical bands, and a temperature dependent interaction given by mode-mode coupling. Propagating spin waves are not predicted above $T-_c$. Commenting on this paper, H. Mook showed a slide of neutron scattering data from Ni above and below T_c, which seemed to show propagating spin waves near the zone boundary.

In an invited talk, E. Kisker described spin resolved photoemission experiments from Fe_3Pt Invar. Changes in the energy distribution function with temperature, compared with calculations of the density of states in pure γ-Fe as a function of volume, give some support to Weiss' 2γ-state model for Invar. In another invited talk, C.S. Fadley described the new technique of Spin Polarized Photoelectron Diffraction. The spin splitting of S electrons in magnetic ions provides a source of photoelectrons polarized relative to their source atoms. The angular distribution of the emitted electrons relative to lattice directions gives information about local spin correlations in the surface region. Studies of KMn F_3 and MnO show an abrupt change of behavior at several times the bulk Neel temperature, suggesting a sudden loss of short range order at this point.

Session DD, R-Fe Alloying and Proc.
Chairperson: F.E. Pinkerton

This session emphasized improvements to the properties of Nd-Fe-B permanent magnets by substitutions or changes in processing. In the arena of melt-spun magnets, Matsumoto et al. reported producing Si and Al substituted ribbons with a remanence of about 9 kG in three orthogonal directions, in excess of the 8 kG expected for an isotropic Nd-Fe-B magnet. This result is similar to a paper presented at the '86 MMM conference by Energy Conversion Devices. Welker and Guthrie demonstrated that powders of crushed MAGNEQUENCH ribbons are inherently stable against long-term aging when stored under ambient conditions. Electron microscopy of uniaxially hot deformed magnets by Mishra et al. concluded that significant grain orientation during die-upsetting can be achieved only in small-grained materials such as melt-spun ribbons. Yang and Ray densified ribbons by hot extrusion and presented evidence that some preferred orientation was obtained in the plane perpendicular to the extrusion direction.

Several papers on sintered magnets addressed ways to mitigate the decrease in magnetic properties at elevated temperatures by increasing the room temperature coercivity and/or increasing the Curie temperature. Xiao et al. studied the effects of a number of additives, particularly Nb, on the elevated temperature properties. Kim studied simultaneous Dy and Al substitutions. In other papers, Tokunaga et al. discussed the fields required to magnetize sintered magnets with various substituents, Gong and Hadjipanayis magnetically hardened misch-metal-Fe-B in both sintered and melt-spun forms, and Brown and Cost, with an eye toward possible applications in accelerators, reported that Nd-Fe-B sintered magnets lose remanence much faster than Sm-Co magnets when irradiated with neutrons. Finally, two papers use x-ray pole figure techniques to measure the degree of crystallographic alignment in sintered magnets. Chang et al. focussed on variations in alignment as a function of excess Nd content, while Zhou et al., using a less rigorous x-ray technique to

make more general correlations between orientation and magnetic properties, observed that, contrary to expectations, some magnets they studied lacked cylindrical symmetry along the pre-sintering magnetic alignment direction.

Session DE, Low-Dimensional Magnets
Chairperson: T.A. Kaplan

The paper by Renard, Verdaguer, Regnault, Erkelens, Rossat-Mignod, and Ribas presented important evidence, from magnetic susceptibility and inelastic neutron scattering, for the Haldane gap in two quasi-one-dimensional spin-1 antiferromagnets, $Ni(C_2H_8N_2\ NO_2(ClO_4)$ and $Ni(C_3H_{10}N_2)_2NO_2(CO_4)$. A marked improvement over previous efforts was achieved because of very weak interchain interaction (no long range magnetic order was observed down to 1.2K).

The papers of Bonner, Muller, Parkinson, and by Bonner and Parkinson were also concerned in some way with the predictions of Haldane. The former studied, numerically, the excited states of spin-1 XXZ chains at the point where the Haldane gap vanishes. They found the low-lying states predicted by Haldane; they also found a new set of excitations in this region.

Drillon, Coronado, and Carlin described experimental quasi-one-dimensional ferrimagnets. An antiferromagnet with, e.g., S=1/2 and S =1 ions would be interesting, in my opinion, in regard to the Haldane gap.

The paper of Wiesler and Zabel reported a neutron diffraction study of the quasi-two-dimensional magnetic system, stage-2 $CoCl_2$-graphite intercalation compound. The difficulties in this attempt to see the expected Kosterlitz-Thouless phase were presented.

Both one- and two-dimensional behavior of the specific heat was found in each of two compunds, α-$XC_2O_4.2H_2O$, X=Fe, Mn, by Simizu and Friedberg. X=Fe,Mn are anisotropic, Heisenberg-like, respectively. They found weak coupling between chains lying in a given plane, and much weaker inter-plane coupling. Partial theoretical understanding was presented.

The post deadline paper of Arovas, Auerbach and Haldane was exceptionally interesting. They discovered a striking analogy between grouped states of a variety of spin models due to Affleck et al. and the Laughlin wave function for the fractional quantum Hall effect. They exploited this relation to find properties of the spin models.

Session DQ, Magnetic Compounds and Alloys
Chairperson: Stanley J. Pickart

The first ten papers of Session DQ, which dealt with magnetic compounds and alloys, can be divided conveniently into three groups: magnetic structures, high coercive force compounds, and actinides.

In the first group, Gotaas et al. reported on the field dependence of the spiral structure in an alloy of 3% Dy in Y. They found that the helical state was suppressed at 3 tesla with a hysteresis effect attributed to cystal field anisotropy. Galera et al. and Ali both dealt with the as-yet unknown magnetic phases in GdB_6. The paper by Galera et al. shows two phases that are incommensurate; it is interesting as an application of the novel technique of magnetic x-ray scattering. Ali's work on magnetic and transport properties shows anisotropy and hysteresis. The final paper in this group was a magnetization study of two $RCo_{12}B_6$ hexagonal intermetallics with R=Y and Gd. The first compound is a simple ferromagnet, but the replacement with Gd results in ferrimagnetism and a compensation point. In both compounds the Co moment is low, about 0.4 Bohr magnetons.

Of the high-coercive force materials, Liu et al. described the crystal structure of $R(Ti,Fe)_{12}$ compounds with R=Nd and Sm. Preparation methods are an interesting feature of this work, since the materials were prepared by sputtering and were subsequently annealed with in-plane applied fields. Takahashi et al. have calculated the

anisotropy constants for RCo_5 and R_2Co_7 compounds on the basis of a band model for the d electrons and d-f hydridization. Lin et al. were able to stabilize the $CuCa_5$ structure in the Sm-Fe system by substituting 25% of the Sm with Zr. The final paper in this group was a neutron diffraction study by Giorgi et al. on uranium-copper-silicon alloys with manganese substitution. A simple ferro-magnetic structure was found, with no evidence for site ordering between Cu and Mn.

The final two papers dealt with neutron measurements of different aspects of the light actinides Pu and Nd. Kern et al. searched using inelastic neutron scattering for crystal field levels in NpO_2, but no sharp peak was observed, contrary to expectations using previously determined parameters in UO_2. The magnetization density surrounding trivalent Pu in a series of compounds was studied by Lander et al. using polarized neutron scattering. An unusual form factor peaking at non-zero scattering vector was observed in $PuFe_2$, and was attributed to strong hybridization of the 5f and 3d electrons reducing the Pu orbital moment.

Session DQ, Magnetic Compounds and Alloys
Chairperson: Allan H. Morrish

The last eight papers in session DQ are concerned with transition metal alloys and compounds. One is an antiferromagnetic insulator, Cr_2O_3, one is an intermetallic, and the other six are alloys. Magnetic structure, anisotropy, and phase changes are central to most of the papers.

Tasset et al have developed a new neutron-polarization technique utilizing the Meissner effect to provide magnetic isolation. They are then able to determine all three components of polarization in the incident and in the scattered beam. The method has great potential for the determination of fine details in magnetic structure. For $Cr_{12}O_3$ they conclude that the chromium moments point towards the smaller of two oxygen equilateral triangles.

In a Monte Carlo calculation, Parra and Lopex find that the sharp forward peaks observed in the neutron scattering from dilute PtCo alloys have an inelastic origin; they thus account for differences inferred from magnetization measurements. Smit and Alberts have also studied dilute alloys, viz CrGa and CrGe, but with the view to determining whether or not magnetic anomalies exist at the incommensurate to commensurate transition. By resistivity and electron-microprobe measurements they conclude that the homogeneity of the sample is the factor that determines whether an anomaly will occur.

Yamauchi et al induce a unidirectional anisotropy in Ni_3Mn by field cooling that is a function of temperature. Displaced hystersis loops are observed. Takahashi et al calculate the energies for γ-FeMn using the method of Deegan; they deduce that the large anisotropy is mainly the result of th eexchange interaction. The [111]-direction is the easy axis for the spins and the multi-spin-density wave is then realized.

Oliver et al. are concerned with the $MNNi_{4.15}Fe_{0.85}$ (MN is misch-metal) and its hydride. The hydrogen was introduced at high pressure; some cracking is observed by SEM. The susceptibility and magnetization increase substantially at low temperatures. The Mossbauer hyperfine parameters are insensitive to the particular rare-earth element, but depend instead mainly on the crystal structure and on the iron environment. Atzmony et al observed time effects in the ac susceptibility of $Cu_{72}Ni_{28}$ alloy prepared by melt spinning. Hysteresis observed in as-quenched and in annealed ribbons.

Session EC, Valence Fluctuations & Heavy Fermions
Chairperson: G.H. Lander

This session on valence fluctuations and heavy fermions consisted of two invited and six contributed talks. Both invited talks were on theory and both speakers came from the same institution, MPI, Stuttgart. P. Fulde discussed density fluctuations in heavy electrons systems and showed that because of

quasi-particles a new mode should exist in the hydrodynamic regime. He also reported experiment evidence for such a mode. O. Gunnarson discussed how one could start from the Anderson model and develop parameters from the valence spectra that can be used to understand the photoemission and BIS spectra of Ce compounds; it proves to be more difficult for actinides. This question of the photoemission interpretation was also addressed by Riseborough (Brooklyn Polytech) and experimental evidence for the localized-delocalized transition as seen in photoemission was presented by Arko (Argonne). Cooper (West Virginia University) discussed how the differences between CeSb and CeTe could be understood on the basis of 4f hybridization, and Edelstein (NRL) presented new data on $(CeGd)Al_3$ alloys showing the existence of spin-glass state. Baum (U. of Wisconsin) discussed ultrasonic attenuation in UPt_3 and Lu (Rutgers) discussed how implantation techniques could extend the range of available valence-fluctuation compounds.

Session EC, Valence Fluctuations & Heavy Fermions
Chairperson: S.H. Liu

The level of activity in the field of heavy fermion systems has declined in the past year, perhaps because of the recent mass defection of workers into the field of high T_c superconductivity. Although new materials with heavy fermion behavior continue to be synthesized, some by new methods, no unexpected experimental finding was reported in this session. On the theoretical side, the major issues remain unsettled, for instance: 1. Are the quasi-particles itinerant f electrons or excitations in the Kondo condensate? 2. Are first principles calculations capable of determining the theoretical model paramaters? A breadth of fresh air was provided by P. Fulde (EC1) who reported a thorough investigation of the effects of charge density fluctuations. New phenomena have been predicted, and they are subject to direct verification. The predictions are also model independent in the sense that the effects are calculable from the results of other experiments. This work deserves special attention.

Session ED, R-Fe New Phases and Intrinsic Properties
Chairperson: J.F. Herbst

Several papers in the session dealt with two new classes of hard magnetic materials, the R-Fe-Ti and $CeCo_4B$-type systems. In studies of Nd-Ti-Fe and Sm-Ti-Fe films, Kamprath et al. observed magnetically soft, tetragonal $ThMn_{12}$ structure components as well as a yet unidentified Sm-Ti-Fe phase featuring 31 kOe room temperature coercivity. Zhao and co-workers investigated rapidly quenched alloys having the nominal $RTiFe_{10}$ composition with $R=Nd_xDy_{1-x}$ or Sm; a heat-treated, melt-spun Sm-Ti-Fe sample exhibited $H_{ci} \simeq 2.5$ kOe and tetragonal lattice symmetry. A room temperature anisotropy constant approaching that of $Nd_2Fe_{14}B$ and magnetization implying a theoretical maximum energy product of 38 MGOe were measured by Yang et al. on an arc-melted $SmTiFe_8$ sample which formed the $ThMn_{12}$ structure. Aly and co-workers reported the magnetic properties of rapidly solidified $RFe_{4-x}Co_xB$ alloys; a crystallized $SmFe_2Co_2B$ sample principally comprised of a phase having the hexagonal $CeCo_4B$ structure exhibited a room temperature coercivity of ~ 17 kOe. Enchanced magnetics in annealed, cold-rolled Fe-Cr-Co-Mo alloys were reported by Sugimoto, Okada, and Homma.

$R_2Fe_{14}B$ materials received considerable attention in the session. The research described included magnetization measurements on single crystals of the heavy rare earth compounds (Givord et al.), the effects of Ga substitution in the Pr and Nd phases (Pedziwiatr, Sankar, and Wallace), the electronic structure of $Gd_2Fe_{14}B$ (Ching and Gu), an NMR study of Co-substituted $Nd_2Fe_{14}B$ (Zhang et al.), a Mossbauer investigation of $Nd_2(Fe_{1-x}Ni_x)_{14}B$ (Dai et al.), and a Nd-145 Mossbauer study on single-crystal $Nd_2Fe_{14}B$ (Muraleedharan et al.). Magnetic order and site preferences in $Er_2(Co_xFe_{1-x})_{17}$ were reported by Kumar, Yelon, and Fuerst.

Session EP, Ferrites
Chairperson: G.F. Dionne

This session featured several contributions related to the seldom discussed subject of microwave absorption, which generally involves the coating of a metal with ferrite or iron carbonyl particles dispersed in a medium of low dielectric constant. Among these were a theory paper that examined the validity of various mixture equations for predicting the properties of composites by H.M. Musal, H.T. Hahn, and G.G. Bush, additional theoretical work on this topic by Bush utilizing an MIE series calculation, a description of low-temperature preparation technique for ultrafine NiZn ferrite powder by C.J. Chen, K. Bridger, S.R. Winzer, and V. Pai Verneker, and measurements of microwave susceptibility and effective FMR linewidth of iron carbonyl powders by A. Naziripour, C.E. Patton, and M.V. Kogekar.

The remainder of the session included papers that covered the entire spectrum of ferrite-related work. M. Abe, T. Itoh, Y. Tamura and M. Gomi reported that "spray-spincoating" of NiZn ferrite on GaAs substrates produced films of 4.5 to 6.5 μm thick. Other papers on the synthesis of ferrite powders for high density materials were presented by T.T. Srinivasan et al., and S. Joshi, S.M. Kanetkar, and S.B. Ogale. In the general category of fundamental ferrite properties, G.F. Dionne described his thermomagnetization modelling of the Mn and Ni spinel ferrite families and concluded that $4\pi M$ values much greater than 5000 G are unlikely in either system because of octahedral sublattice canting effects. In a continuation of Dionne's recent work on exchange isolation effects of Co in LiTi ferrites, B.K. Kuanr et al. reported additional microwave magnetic and dieletric measurements. On the subject of charge transport in ferrimagnetic oxides, P.V. Reddy described the hopping electron conduction data in LiNi ferrite.

Topics of a miscellaneous nature included the Kerr effect in ferrites by P.K. Singh et al., external magnetic field influence on Snoek's Law by G.G. Bush, and narrow x-ray linewidth with Fe^{57}-YIG epitaxial films on GGG by D.M. Gaultieri, W. Lavender, and S. Ruby.

Session EQ, Spin Waves
Chairperson: J.F. Cochran

Twelve papers were presented at this session. Seven experimental papers and five papers of a theoretical nature. Five of the experimental papers reported the results of FMR and/or standing spin wave resonances in thin film structures: Ni-Fe multi layers, (EQ-01); Fe on GaAs (EQ-02) and Fe and Co films on ZnSe/GaAs substrates (EQ-03); amorphous films of $Fe_xNi_{1-x}B_{15}Si_5$ (EQ-04); and bilayers of NiFe/FeMn (EQ-05). Papers EQ-02 and EQ-03 were noteworthy for the use of a broadband strip-line (0.1 to 20 GHz) to measure ferromagnetic resonance absorption over a broad frequency range. Paper EQ-07 reported preliminary measurements of the temperature dependence of the Landau-Lifshitz damping parameter for iron using the technique of ferromagnetic antiresonance transmission at 736Hz.

One of the most interesting papers in the session was the report of the observation of a new evenescent surface magnon in an Yttrium Iron Garnet film in the presence of a gound plane (EQ-09). This disturbance is difficult to detect using conventional absorption techniques: CE Patton and co-workers detected the evanescent wave using Brillouin scattering of laser light.

The theoretical papers covered a very wide range of problems: the calculation of spin-wave stiffness in ferromagnetic metallic alloys (EQ-06); the effect of an overlayer and substrate on the magnon modes in a thin metallic film (EQ-08); the dynamics of longitudinal spin fluctuations in a ferromagnet (EQ-13); the effect of zero-point fluctuations and magnetic fields on the ground state of a rhombohedral Heinsenberg anti-ferromagnet (EQ-14); and the dynamic susceptibility and damping rate of magnetic excitations in hybridizing cerium systems (EQ-15).

Session FA, Thermo-Magneto-Optic Recording
Chairperson: B. Shula

This session was a change of pace from the previous magneto-optic sessions at MMM conferences in the past. The emphasis was not on deposition parameters or compositions but on the characteristics of the media and recording techniques. A true sign that the field is maturing.

The major topics addressed were domain shapes, switching behavior and direct overwrite techniques. All of these topics are interrelated and therefore not easily dealt with individually. The emphasis was on observed differences in the switching and nucleation of domains in TM-rich and RE-rich materials and how to deal with these differences through modelling. The modelling techniques discussed included simulating the nucleation process and domain wall dynamics and solving thermal gradient equations.

Articles of particular interest from this session are the pictures of the magnetization reversals shown by Lin et al. and the domain shapes formed by field modulation reported by Okamine et al. Greidanus, et al., discussed an experimental method for measuring the switching behavior in bulk materials which was very interesting.

Session FP, Hard Magnets & Applications
Chairperson: E.B. Boltich

The papers presented in this session fall into three categories, dealing with: 1) fundamental properties, 2) technical properties and 3) permanent magnet devices.

All of the papers in the first category dealt with the phenomenon of spin reorientation. From a subjective point of view, the most interesting paper was that of Boltich et al., in which the magnetic phase diagram of several mixed rare earth 2:14:B systems were predicted on the basis of 2nd order crystal field theory. Their major prediction was that Tm and Pr should become increasingly dominant in determining the magnetic anisotropy as the temperature is lowered. Objectively, the most significant result was that of Chen et al., where it was observed that 20% Sm is sufficient to shift the spin reorientation below room temperature in $Nd_{2-x}Sm_xCo_{13}Fe_4$ systems.

In the second category there were papers dealing with all cases of rare earth permanent magnets: 1:5, 2:17 and 2:14:B. The most significant work presented was that of the Dayton group (Mildrum et al.), in which they reported on extensive study of the thermal stability of sintered rare earth-cobalt magnets. This paper contained a large amount of empirical information concerning both reversible and irreversible losses and is recommended to anyone interested in the long-term stability of rare earth permanent magnets. The authors observed the system $Sm_{.5}Ce_{.5}(Co,Cu,Mn)_7$ to possess the best long term stability of all materials reported.

Two of the three papers in the final group were presented by the Fort Monmouth group. The first of these dealt with simplification of permanent anti-mirrors (soft ferromagnets). The second discussed the use of tapered pole pieces to reduce the size and weight of TWT's. In the final paper, N. Ida and L.E. Roemer presented a magnetostrictive "motor", capable of precise bidirectional linear motion.

Session GA, Magnetic Recording Heads
Chairperson: C.H. Tsang

This session includes three papers on magnetic measurements using or on inductive heads; two on the use of amorphous materials in inductive and magnetoresistive heads, one on the device modeling of the MR head; and two on the domain effects in inductive heads.

Walker and Arrott, in their invited work, demonstrates that by positioning an inductive head precisely against another head or against a current carrying wire-grid, the efficiency of the head can be measured, and the effects of closure domais on the stability of the head can be observed. Brug et al. presented a

variation on the micro-loop technique of head field measurement where the vertical field from an inductive head is first measured directly, and the horizontal field is then obtained by Hilbert transforming the vertical field. Koeppe et al. measured the side fringing-field of an inductive head by placing a thin magnetic film beneath the gap and observed the local Kerr-effect response across the film. Results show that rather significant broadening of the written track can result from modest misalignments of the pole-tips.

In the area of amorphous films investigation, Su et al. compared the recording performance of a laminated CoZr head with a plated permalloy head, and showed that the CoZr head had better writeability due to the higher $4\pi M$ of the CoZr material, but smaller signal amplitude and worse instability problems, due to a lower permeability and a non-zero magnetostriction coefficient respectively. Yamada et al. studied the properties of CoZrMo as a biasing layer in MR sensors, and showed that high permeability, hish resistivity and low magnetostriction can be obtained, but primarily only for films thicker than ~ 500Å.

In MR head modeling, Heim computed the bias profile of a shunt-biased MR sensor along the trackwidth direction, and showed the rather unexpected result that the amount of tail region in the offtrack area directly depended on the bias level at tract center. The implications of this result for optimum bias designs and narrow track situations were also discussed.

Finally, in inductive head domain studies, Argyle et al. showed that application of high speed current pulses to inductive heads can move both the domain walls in the head, as well as the Bloch lines in the walls. Also, Herman et al. showed the typical domain patterns in a laminated single pole-tip structure, and studied the conditions under which these patterns converted into each other.

Session GA, Magnetic Recording Heads
Chairperson: G.A. Prinz

The session contained papers which fell into three distinct categories: Theoretical calculations of the electronic structure of non-equilibrium phases of the transition metals; Experimental studies of the magnetic properties of the ultrathin epitaxial films of magnetic metals; The properties of icosahedral quasicrystal alloys. Of particular note were the two invited talks. The first, was a report on the latest results from IBM Watson by the team of P.M. Marcus and V.L. Moruzzi. They have extended their calculational technique of obtaining the total energy with fixed-spin-moment to exam the stability limit of particular phases. This is a very useful guide for experimental efforts to realize these strained phases by epitaxial growth techniques. The second invited talk by J.A.C. Bland and R.F. Willis of Cavendish Laboratory described the technique of polarized neutron scattering from thin magnetic films to study the magnetic properties. Specifically they discussed fcc Fe and fcc Co growth up to several atomic layers. Many questions from the floor provoked discussion of the problems associated with obtaining well-defined composition of the magnetic films with this substrate.

Session GD
Chairperson: R.D. Taylor

This session concerned recent work using various resonance techniques to study local fields and structure. Most of the papers utilized either the Mossbauer Effect (ME) or NMR or microscopic probes. Walker presented an invited paper on the ME of stabilized 150 to 400-Å Fe particles. They find a rather profound effect on the room temperature recoil-free fraction depending on whether the particles are loosely or tightly packed, suggesting macroscopic motion is important. Tang presented ME data on Zn-substituted Fe_3O_4 magnetite particles. The hyperfine fields were analyzed in terms of the binomial distribution of Zn neighbors. Taylor used a diamond anvil cell to obtain pressures to 310 kbar for a ME study of EuO. The Curier

temperature was determined from the onset of the hyperfine field and was found to rise with pressure but to peak out in the 200-310 kbar range. Mauger concluded that the low temperature behavior of $LaNi_{5-x}Fe_x$ compounds implied magnetic clusters coexisting with long-range magnetic ordering; ME, resistivity, and magnetic susceptibility data were given. McCally presented ME data on crystalline and amorphous alloys of Fe_xP_{1-x} demonstrating their contrasting hyperfine field, isomer shift, and electric field gradient behavior. The unusual resistivity of UNiSn led to a ^{119}Sn-Me annealing study that Bykovetz presented as evidence for an unusual order-disorder lattice transition. In a post-deadline paper, Evans presented ME hyperfine data on $Mn_{1.7}Fe_{1.3}O_4$, a naturally occurring manganese ferrite. The clustering of Mn found in synthetic materials was absent. Rosenberg reported on NMR study of weakly magnetic ^{59}Co in $YCo_{12}B_6$ and $GdCo_{12}B_6$ from which they extract the Co electronic moment in the domains and in the domain walls. He also presented a study of a rare earth-transition metal-boron serires in which the transferred hyperfine fields at the boron sites were analyzed in terms of dipolar fields. In a ^{63}Cu and ^{55}Mn spin echo study of sputtered Heusler alloys, LeDang reported a signal maximum for the ordered phase formed at a substrate temperature of 167°C. This ordering temperature confirms magnetization results. Ebert discussed the role of the local environment as an explanation of the spin-lattice relaxation rate of Pt in disordered Cu_xPt_{1-x} alloys. A study of time-dependent EPR study of cupric and vanadyl ions in polymeric gels was reported by Suryanarayana.

Session HA, Recent Dev. in High Tc Superconductivity
Chairperson: Jerry B. Torrance

The session on Recent Developments in High T_c Superconductivity was highlighted by five such developments: (1) On single crystals of the ~90K superconductor $YBa_2Cu_3O_{7-y}$, contact-free measurements of critical fields and critical currents were reported in an invited talks by Bill Gallagher of IBM Yorktown Heights. He showed that the compound is a uniaxial three-dimensional superconductor, with the uniaxial direction perpendicular to the CuO planes and with an anistropy of 5:1 in the upper critical field H_{c2} near T_c. Critical supercurrent densities in single crystals reached $3x10^6$Å/cm^2 in low fields at 4.5K and remain above 10^6Å/cm^2 to beyond 4T. (2) A hexagonally ordered lattice of flux quanta was observed in $YBa_2Cu_3O_7$ by D.J. Bishop, et al. of AT&T Bell Labs. (3) Preliminary neutron evidence was presented by C. Peters from M.I.T. for the observation of spin wave excitations in La_2CuO_4. (4) New measurements on three copper oxide compounds showed that they were not superconducting. Jerry Torrance of IBM Almaden concluded that they have many chemical and structural features in common with the two High T_c systems, but no unique feature to account for their lack of superconductivity. (5) T.A. Kaplan of Michigan State proposed using a Hubbard model with first and second neighbor hopping as a model to illustrate the physics of the resonating valence band approach and of the properties of High T_c systems.

Session HB, Fine Particles
Chairperson: A. Berkowitz

Defranzo, Klik, Gunther, Swanson and Brooks presented a preliminary description of a macroscopic quantum tunneling mechanism to account for anomalous magnetization decay at very low temperatures. Using nano-lithographic techniques, Smythe, Schultz, Kern, Schmid and Yee have produced arrays of identical particles inthe < 0.1 μm range. They have described initial measurements showing H_c increases with decreasing dimension and decreasing interactions (particle spacing). Liou and Chien presented two papers on the properties of sputtered films composed of Fe grains in an SiO_2 matrix. A remarkable result was the high H_c(2500 Oe) for films in which the Fe particles appeared to be too well separated for exchange or substantial magnetostatic interactions. Ohnuma, Kunimoto, and Masumoto reported additional data on the arrays of acicular fine Fe particles prepared by sputtering onto sputter-etched polyimide substrates. These arrays

have longitudinal axes normal to the film. Arrays of acicular amorophous particles prepared in the same manner were described by Ohnuma, Mitera, and Masumoto. These elongated amorphous particles showed anisotropies consistent with their shape. The use of highly magnetostrictive amorphous particles for fiber optic interferometric magnetometers was reported by Brugel, Gibbs and Squire. Haneda and Morrish found Mossbauer evidence for a non-collinear magnetic structure in small $CoFe_2O_4$ particles. They proposed that the non-collinear spins were in the grain boundaries of crystallites composing the particles. Granular films of Fe-oxide in Ag were investigated by Shull, Atzmony, Shapiro, Swartzendruber, Bennett, Green and Moorjani. The films showed a behavior consistent with a superparamagnetic fraction at higher temperatures. Takacs described the preparation and the similar properties of Fe-Hg ferrofluids prepared both by electroplating into Hg and by using sodium amalgam for reduction. Freezing and melting of ferrofluids was monitored by magnetization measurements in a paper by Miyajima, Inaba, Taketomi, Sakura and Chikazumi. The interesting possibility of following a variety of changes of state were discussed.

Session HE, Spin Glass Experiment
Chairperson: J.S. Kouvel

The session began with an invited paper by J.A. Mydosh (Leiden), who asserted the importance of "short-range" spin density waves in spin-glass (SG) alloys such as CuMn and compared them to the "long-range" SDW found in YGd. Dynamical SG properties were the main subject of four experimental paeprs: Ph. Refreigier et al. (Saclay) on susceptibility noise measurements, C. Giovannella et al. (Orsay) on torque relaxation, R.L. Lichti et al. (Texas Tech and San Jose State Univ's) on ESR linewidths and muon depolarization, and S.B. Liao et al. (Maryland and John Hopkins Univ's) also on ESR studies. Regarding low-dimensional SG's, C. Dekker et al. (Utrecht) reported on the 2-d Ising system $Rb_2(Cu,Co)F_4$, while G.V. Rubenacker et al. (Montana State) reported on hydrated $(CH\text{-}3)_3NH(Co,Ni)Cl_3$, a pseudo 1-d system. Susceptibility and Mossbauer evidence for SG transitions in rutile-structured oxides was presented by A. Labarta et al. (Barcelona & Birmingham Univ's). Asymmetric field-cycling as a magnetization probe of local fields in metallic SG's was described by L.P. Levy & H. Bouchiat (AT&T Bell Labs). Finally, there were two papers by the session chairman and coworkers: M.R. Said et al. (Univ. Ill.-Chicago & Argonne) on the coexistence of SG and long-range antiferromagnetic order in (Tb,Y)Ag and Kh. Ziq and J.S. Kouvel (UIC) on isothermal field-induced rotations of the anisotropy in Au-Fe.

FOURTH JOINT MAGNETISM AND MAGNETIC MATERIALS - INTERMAG CONFERENCE VANCOUVER, CANADA July 12-15, 1988

The Fourth Joint Magnetism and Magnetic Materials - INTERMAG Conference ($4M^3I$) will be held at the Hyatt Regency Vancouver Hotel and the Hotel Vancouver in Vancouver, Canada on July 12-15, 1988. This meeting combines the Annual Conference on Magnetism and Magnetic Materials and the INTERMAG Conferences; **it will be the only meeting of either of these two major conferences in 1988.** The Conference is jointly sponsored by the American Institute of Physics and the Magnetics Society of the IEEE, in cooperation with the American Physical Society for Testing and Materials, and the American Ceramic Society.

Members of the domestic and international science and engineering communities interested in recent developments in magnetism and its associated technologies are invited to attend the Conference and to contribute to the technical sessions. The scope of the Joint Conference embraces all areas of basic science, applied science and engineering in magnetism. These include experimental and theoretical research in magnetism, the properties and synthesis of new magnetic materials (including superconductors), new developments in applied magnetics (dc to microwave),

information storage technology, magnetic separation, and applied superconductivity. The program will consist of invited and contributed papers. Selection of contributed papers is based on abstracts whose submission deadline is 12 February 1988.

The General Chairman of the Conference is Ken Lee and the Local Chairman is John Cochran. Persons or organizations who desire further information on the Conference or who wish to make additions to the Conference mailing list should contact Ms. Diane Suiters, $4M^3I$ Conference Coordinator, 655 15th Street, N.W., Suite 300, Washington, D.C. 20005, Tel. (202) 639-5088; Telex 440487 COURTESY.

IEEE MAGNETICS SOCIETY ANNOUNCES GRADUATE STUDENT TRAVEL AWARDS

The Awards Department of the Magnetics Society of the IEEE will sponsor several graduate students working in magnetics to attend the 4th Joint MMM-Intermag Conference to be held July 12-15, 1988, in Vancouver, British Columbia, Canada.

Nominations will be accepted up to May 15, 1988 from faculty advisors of the interested students. The nominator must be a member of the Magnetics Society. Please include your budget requirements along with the nomination. It is expected that some portion of the cost will be borne by the student or his/her institution. The awards will be announced June 1, 1988. Nominations for students working in Canada and the United States should be sent to:

Prof. D. D. Stancil
Department of Elec. and Comp. Eng.
Carnegie Mellon University
Pittsburgh, PA 15213-3890

Nominations for students in all other countries should be sent to:

Prof. P. P. Birninger, Chair
Dept. of Elec. Engineering
University of Toronto
Toronto, Canada M5S 1A4

BOOK REVIEW

"The Foundations of Magnetic Recording"
by John C. Mallinson, Academic Press Inc.: San Diego, 1987, 175 pages.

This is probably the first textbook on magnetic recording that has been written explicitly for classroom use. It is a clear introduction to the subject, and includes all the necessary background that a beginner needs. As an aid to the teacher, each of the ten chapters has a series of exercises that can be assigned for homework.

The first two chapters introduce the relevant dimensions, units and measuring techniques. The next two chapters discuss the magnetic materials used in media and heads. The read/write processes, and the effect of noise are then discussed. The book concludes with three chapters on practical devices. Such topics as equalization, slant track recording and error rates are also briefly presented.

The presentation is admittedly simplified, but references are included which amplify the material. Although this book will never replace the few books on aspects of magnetic recording which have recently finally started to appear, it does serve as an excellent introduction to them.

PROCEEDINGS AVAILABLE

Proceedings books for the "9th International Workshop on Rare Earth Permanent Magnets and their Applications" (soft cover, 756 pages) and for the "5th International Symposium on Magnetic Anisotropy and Coercivity in Rare Earth-Transition Metal Alloys" (471 pages) are available in North America through the University of Dayton, Magnetics Laboratory KL-365, 300 College Park, Dayton, Ohio 45469, telephone (513) 229-3535. The price of the Workshop Proceedings (Vol. I) is $65.00 and the symposium proceedings (Vol. II) is $35. Each volume has a $5 handling/shipping charge for anywhere, or a $12 charge for airmail outside of North America. Requests

from elsewhere should be addressed directly to the publisher: Deutsche Physikalische Gesellschaft, Attn: Dr. R. Poerschke, Hauptstrasse 5, D-5340 Bad Honnef 1, West Germany. The price there is DM 120 for Vol. I and DM 60 for Vol. II, plus shipping costs.

7th ANNUAL CONFERENCE ON PROPERTIES AND APPLICATIONS OF MAGNETIC MATERIALS

The Seventh Annual Conference on Properties and Applications of Magnetic Materials will be held at the Illinois Institute of Technology, from 1:00 pm on May 24, 1988 to noon on May 26, 1988. The conference is sponsored by the Illinois Institute of Technology and cosponsored by the IEEE Magnetics Society.

For additional information please contact Prof. H.P. Messinger, Dept. of Electrical Engineering, Illinois Institute of Technology, 3301 South Dearborn Street, Chicago, IL 60616.

ICEC 12

The Twelfth Internatinal Cryogenic Engineering Conference and Exhibition (ICEC 12) will be held at the Boldrewood Conference Centre, University of Southampton, England, in July 1988. The program consists of invited talks, and submitted papers in oral and poster sessions.

The program consists of :

1)Cyrogenics - Present and Future,
by Dr. J. Hulm, Westinghouse (USA)
Industrial Liquefaction and Separation of Gases, A Review,
by Professor G.G. Haselden,
University of Leeds (UK)

followed by sessions on:

- large and small scale refrigeration and liquefaction technology
- industrial applications of cryogenic technology
- aero-space applications of cryogenics
- instrumentation and design of cryogenic systems

2)The European Transonic Wind Tunnel,
by ETW Project Group, Cologne (West Germany)
Cryogenics of Joint European Torus (JET) and Next European Torus (NET),
by Hm Dr. W. Obert, JET Culham (UK)

followed by sessions on:

- properties of materials and fluids
- applications of cryogenics to medicine and biology, including MRI and MR spectroscopy
- non-superconducting cryo-electronics

3)An Update on Superconductivity Above 20K,
by Dr. A. Clark, NBS, Boulder (USA)
Implications of High T_c Superconductors,
by Hm Prof. Dr. P. Komarek,
Institute of Technical Physics,
Karlsruhe, (W. Germany)

followed by sessions on:

- production, investigations and applications of new high T_c materials
- superconducting magnet technology and applications to magnetic separation, magnetic levitation, motors, generators, energy storage, fusion and high energy physics

4) Cryogenics in Japan,
by Prof. T. Otuka, Tohoku University (Japan)

Mendelssohn Award Presentation and Lecture

to be followed by sessions on:

- further papers on T_c superconductors
- superconducting cryo-electronics

For further information contact:

ICEC 12 Secretariat
Sales Plus, 4 Hubbard Road,
Houndmills, Basingstoke
Hants RG21 2UH England

12th ICMFS
1 - 5 August 1988

The 12th International Colloquium on Magnetic Films and Surfaces will be held August 1-5, 1988 at Chateau de la Verrerie, Le Creusot, Burgundy, France. The 12th ICMFS is a satellite meeting of the International Conference on Magnetism to be held in Paris on July 25-29, 1988.

The aim of the Colluquium is to bring together scientists actively involved in fundamental and applied research related to magnetic films and surfaces. Beside presentations of invited and contributed papers, informal discussions on subjects currently under investigation will be organized.

Scope of the conference includes:

1) Surfaces, very thin films, and multilayers
2) Physics of magnetic and magnetooptical recording of other applications of magnetic films
3) Micromagnetism and magnetic domains in thin films
4) High temperature superconducting films (Invited papers and panel discussion only)

Since it is not intended to publish proceedings of the Conference, it is essential that Abstracts contain as complete information as possible. The inclusion of figures, tables and numerical results is therefore strongly recommended. The Abstract Booklet will be distributed to all participants upon arrival in Le Creusot.

Contributed papers accepted by the Scientific Committee will normally be presented as posters. Some selected contributions will, however, be proposed for oral presentation.

Abstracts must not exceed two pages, including figures. They should be neatly typed on two single-sided sheets of paper, with a centered title and 2 cm margins off top, bottom, left and right of standard 21 x 29.7 cm paper sheets. The Abstracts category (see above) as well as the full address for further correspondence must be indicated separately. All abstracts must be received before April 1, 1988 at the address below:

Dr. J. Miltat
Laboratoire de Physique des Solides
Bat. 510 , Universite Paris-Sud
91405 Orsay, France
Tel (33) 1-69-41-53-74
Telex: Facors 692166 F
Bitnet id: Miltat at FRSOL 11

4th INTERNATIONAL CONFERENCE ON PHYSICS OF MAGNETIC MATERIALS TO BE HELD

The 4th International Conference on Physics of Magnetic Materials, organized jointly by the Institute of Physics of the Polish Academy of Sciences and the Research Laboratory "Polfer" - Plant of Magnetic Materials is to be held in Szczyrk-Bila (Poland) on September 4-10, 1988.

For further details please contact the Secretary of the Conference:

Dr. Marek Gutowski
Institute of Physics
Polish Academy of Sciences
Al. Lotnikow 32/46
PL-02-668 WARSAW
POLAND

CONFERENCE CALENDAR

Joint INTERMAG/3M Conference, July 11-15, 1988, Vancouver, BC, contact R.M. Josephs, Naval Air Development Center, Code 5023, Warminster, PA, 18974.

ICM88, July 25-29, 1988, Paris, France

ICMFS-12, 12th Int'l Colloq. on Magnetic Films and Surfaces, August 1-5, 1988, Chateau de la Verrerie, Le Creusot, France, For information and contact see page 25.

4th International Conference on Physics of Magnetic Materials, September 4-10, 1988, Szczyrk-Bila, Poland. See information and contact on page 25.

3rd Biennial Conference on Electromagnetic Field Computation, December 13-14, 1988, Washington, D.C. Contact: W. Wasylkiwskyj, Dept. of EE & CS, George Washington University, Washington, DC 20052.

INTERMAG Conference, March 27-31, 1989, Mayflower Hotel, Washington, D.C. Contact: J.A. Nyenhuis, EE Dept., Purdue University, W. Lafayette, IN 47907.

34th Conference on Magnetism and Magnetic Materials, December 4-7, 1989, Sheraton Hotel, Boston, MA.

INTERMAG Conference, April 16-20, 1990, Metropole Hotel, Brighton, UK.

35th Magnetism and Magnetic Materials Conference, October 29-November 2, 1990, Town and Country Hotel, San Diego, CA.

7th Annual Conference on Properties and Applications of Magnetic Materials, Illinois Institute of Technology, May 24-May 26, 1988. For information and contact see page 24.

ICEC 12 - Twelfth International Cryogenic Engineering Conference and Exhibition, Boldrewood Conference Centre, Southampton, UK, July 1988. For information and contact see page 24.

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