

GMAG NEWSLETTER

A Focused Group within The American Physical Society

N^o 2, October 1997, Edited by R Bruce van Dover

GMAG — the first year

The Topical Group on Magnetism and its Applications (GMAG) has now been in existence for a year. Like any new organization we have had to feel our way forward rather carefully, but for such a new unit we have a lot to be proud of. Here are a few highlights from the first year.

We now have an elected executive committee who will provide guidance for the group. Carl Patton is Chair-elect, Bernie Argyle is vice chair and Bruce van Dover is secretary/treasurer. As the positions roll over each year Carl and Bernie will assume the chair of the group in successive years. New elections will be held this Fall. Membership continues to grow, we were over 360 in August of this year. Hopefully we will soon grow beyond 400, but that depends on our collective efforts to recruit friends and colleagues to the group. So let's get those friends signed up!

We made our first appearance at the March Meeting this year. I was pleased to see that GMAG was responsible for organizing some outstanding sessions (see the conference report in this issue by Marty Sablik). Our invited sessions on magnetoresistive sensors and on characterization of magnetic nanostructures together with focus sessions on magnetic modelling and coercivity in rare earth magnets, drew large attendances. Our regular contributed sessions were very well attended too. The GMAG approach to organizing these sessions has been to coordinate our efforts wherever possible with other units within the APS, most notably DCMP, DMP, GIMS and FIAP. We provide ideas, assistance and direction that will ensure the hottest topics in magnetism get attention at the meeting. Some of these ideas resulted in strongly applications oriented sessions and we were pleased to have some of our engineering colleagues come to make invited presentations. This helps give us a more rounded view of where our subject is headed. Some of these sessions would perhaps not have been otherwise considered for the March Meeting. Yet there is a strong need for all of us involved in magnetism (not just physicists) to communicate our results and developments, so that we can appreciate where progress is being made and where effort is needed. Our topical group can help this process of integration of the magnetism community along.

At the next March Meeting we have four cosponsored invited sessions on magnetism and its applications. These are in collaboration with our colleagues in DCMP (spin dependent phenomena in magnetic semiconductors, and magnetism at the nanoscale), GIMS (torque measurements) and FIAP (magnetic refrigeration), and one focus session of our own on magnetic measurements techniques with two invited papers.

We have also requested APS sponsorship of the International Conference on Magnetism, one of the major magnetism conferences that is held every third year at different locations around the world. This will be of mutual benefit of course, we will be advertising the conference and ICM will hopefully help us to recruit new

members. However we were disappointed to see such a low attendance from the US at this year's ICM in Cairns, Australia (see the report in this issue). One of our objectives is to ensure that the US magnetism community is strongly represented at the next ICM in Brazil in the year 2000. We are also considering how GMAG should be involved with the annual magnetism and magnetic materials (MMM) conference.

As we look forward to the future for our topical group I think we can expect to see its influence and numbers grow. Our subject is basic and applied, while magneticians can be physicists, materials scientists or engineers (and frequently have to be all three at once!). We should be looking to attract more industrial physicists to our group. The magnetics industries amount to an annual market at the 125-150 billion dollars a year level, and that means there is a huge demand for magnetism at both the basic and applied ends of the spectrum. Magnetism is big and is here to stay. Our group should provide an important focus for physicists on developments in this important area of technology.

-David Jiles
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Following is some information relating to the upcoming

APS March Meeting

March 16-20, 1998

Los Angeles, CA

Remember—The deadline for receipt of abstracts is 3 December 1997!

Invited symposia cosponsored by GMAG

7 Magnetocaloric effect/magnetic refrigeration. (cosponsored with FIAP)

Co-chairs: Karl A. Gschneidner, Jr. and Fred Pinkerton

–John Barclay (U. Victoria, BC), *Liquefaction of natural gas (methane) by Magnetic Refrigeration (MR)*.

–Carl Zimm (Astronautics Corp. of Amer.), *Sub-room temperature MR*.

–Vitalij Pecharsky (Ames Lab), *The giant magnetocaloric effect*

–Robert Shull (NIST), *Nanocrystalline materials for magnetic refrigeration*.

–R. Chahine (U. du Quebec a Trois-Rivieres), *Modeling*.

7 Magnetic measurements using force and torque methods (cosponsored with GIMS)

Co-chairs: Larry Rubin and Bruce Brandt

–Terry Wood (Oxford Instruments, Oxford, UK), *Magnetic measurements using classical force methods including Faraday and Gouy balances*.

–M. Chaparala (Univ. of Virginia), *Micromachined Silicon Cantilever Magnetometry*.

–Lance DeLong (Univ. of Kentucky), *Vibrating Reed Measurements of the Nonlinear, Anisotropic Susceptibility of Superconducting and Magnetic Materials*.

–J. R. Lindemuth (Lake Shore Cryotronics), *Anisotropy Constants and Magnetic Torque Derived from*

Vector Vibrating Sample Magnetometry.

7 Spin dependent phenomena in magnetic semiconductor quantum structures (cosponsored with DCMP)

Chair: David Awschalom

–Nitin Samarth, *Spin Transport and localization in Magnetic Two Dimensional Electron Gases.*

–Jim Allen, *Magnetization controlled quantum transport in ErAs/ III-V heterostructures.*

–Hideo Ohno, *Spin Dependent Transport in Ferromagnetic (Ga,Mn)As.*

–Gary Prinz, *Applications of Magnetic Nanostructures for Magnetoelectronics.*

–J. Moodera (MIT), *Spin Polarized Transport and Tunneling.*

7 Recent developments in magnetism at the nanoscale (cosponsored with DCMP)

Chair: Puru Jena

–S. Umemura (NTT Research Laboratories), *Magnetic Thin Films of Cobalt Nanocrystals encapsulated in Graphite-like Carbon.*

–B. Hjorvarsson (Univ. of Uppsala, Sweden) *Reversible Tuning of Magnetic Coupling in Fe/N/Fe Superlattices using Hydrogen.*

–S. K. Nayak (Virginia Commonwealth University), *Colossal Magnetism in small Mn and MnO Clusters.*

–J. Tejada (University of Barcelona, Spain), *Quantum Tunnelling in High Spin Molecules*

–F. Borsa (Ames Lab), *NMR of mesoscopic molecular magnetic clusters*

Focus Session Announcement and Call for Papers

GMAG is sponsoring a focus session on **New developments in magnetic measurement techniques** at the next March Meeting. We have two invited speakers identified, and so we are now soliciting contributed papers in the same general area. If you intend to submit a paper which would be suitable for inclusion in this session please let David Jiles or Larry Bennett know. We can then look out for it at the sorters' meeting and make sure your paper gets included in this special session.

–David E. Farrell, Case Western Reserve University *Torque studies of high Tc superconductors*

–Stephen R. Julian, University of Cambridge, UK *Quantum oscillations studied via torque methods*

Sorting Categories—1998 March Meeting

For your convenience, here are the sorting categories that contain the word "magnetism".

1. Applications

(f) Magnetoresistive Sensors for Applications

2. Biophysics: Focused Session

(i) Magnetic Field Effects on Biological Systems

8. Instrument & Measurements: Focused Session

(g) Spectroscopy at High Magnetic Fields

14. Magnetism: General

(a) Electromagnetism and Magnetic Fields

(b) Modeling and Simulations

- (c) Magnetic Materials
- (d) Theory
- (e) Magnetic Devices and Sensors
- (f) Magnetic Recording Technology
- (g) Magneto Optics
- (h) Spin Polarized Transport
- (i) Miscellaneous Phenomena

15. Materials Physics: Focused Sessions

- (j) Microscopic Origins and Applications of "Colossal" Magnetoresistance Materials
- (k) Magnetic Nanostructures and Heterostructures

26. Semiconductors: Bulk

- (d) Dilute Magnetism

36. Surfaces: Metallic

- (f) Surface Magnetism

Conference Reports

In this section Marty Sablik and David Jiles report on the 1997 March meeting (sessions sponsored by GMAG) and the 1997 ICM Conference, respectively.

APS March Meeting

Kansas City, 1997

The Topical Group on Magnetism sponsored or cosponsored the following sessions:

- C19** Antiferromagnetism and Spin Dynamics
- F19** Magnetism of Clusters and Nanoparticles
- G19** Coercivity in Rare-Earth Magnets: Theory and Practice
- I4** Invited Symposium on Magnetoresistive Sensors and Applications
- J19** Magnetic Modeling I.
- K19** Magnetic Modeling II.
- M19** Magnetic Properties of Materials
- N19** Magnetic Measurements
- O5** Advanced Characterization of Magnetic Nanostructures
- R19** Spin Glasses

C19 This session primarily was concerned with one-dimensional and two-dimensional antiferromagnets. Four papers dealt with three-dimensional antiferromagnets—from the point of view of Monte Carlo simulation, cluster modeling, linked cluster expansion modeling, and low-energy magnon spectra.

F19 This session featured two invited papers—one by B. Reddy on the magnetism of transition metal clusters and the other by R.H. Kodama on the numerical modeling of small antiferromagnetic nanoparticles. Other

papers were on similar topics.

G19 This session featured an invited paper by George Hadjipanayis who talked about the properties of nanocrystalline rare earth permanent magnets, including recent developments on nanocomposite spring magnets featuring mixed hard and soft magnetic particles. Experimental contributed papers dealt with $(\text{Ce}(\text{Pr}))_3\text{Co}_8\text{Si}$ compounds, 2-17 magnets, and neodymium iron boride magnets. Modeling presented had to do with bond order potential theory of chemical bonding in rare earth intermetallics.

I4 This was an invited session featuring papers by Jim Daughton on GMR memory and GMR sensors, by James Brug on colossal magnetoresistance and spin tunneling potential applications in advanced memories, by Neil Smith on a high sensitivity GMR spin-valve magnetometer, and by Bruce Gurney on GMR spin valves for magnetic recording.

J19 This session featured two invited talks—one by J.Fidler on micromagnetic modeling of the magnetic changes in hard magnets with granular microstructure, and the other by G.Bertotti on general aspects of hysteresis in which he related return point memory and congruence properties to Barkhausen noise and magnetic relaxation. Other modeling papers dealt with random anisotropy, hysteresis in anisotropic materials, domain wall behavior in magnetic stripe films, modeling of a pinned spin valve memory cell, Monte Carlo modeling which exhibits orthogonal ordering in multilayers, soliton solutions for 2D domain patterns, modeling of GMR hysteresis, and magnetic hysteresis modeling under high frequency pulsed excitation.

K19 This session dealt with a variety of topics—mean field modeling of the Curie temperature in yttrium intermetallics, noncollinear magnetic structure in FeNi alloys, velocity change of a moving magnet when it enters or leaves a strong electric field, a discussion of the Ehrenberg- Siday-Aharonov-Bohm (ESAB) effect, optically induced magnetism, multipole simulation of magnetic colloids, Monte Carlo modeling of magnetization switching in uniaxial ferromagnets, phase separation in the 2D Hubbard model, modeling involving the 2D XXZ model, modeling of canted interlayer coupling in Fe/Cr multilayers, modeling of tunneling GMR hysteresis, and micromagnetic modeling of GMR in spin valves and multilayers.

M19 This session started off with two papers on magnetostrictive composites--an experimental paper describing magnetostrictive composites of SmFe_2 with Fe or Al, and a theoretical paper estimating the magnetostriction of such a composite. Other papers included topics like magnetomechanical damping, magnetoelastic coupling in a spin-Peierls system, relationship between yield stress and magnetic properties complicated multilayer systems, titanomagnetites, aerogel ferrite fine powders, TbNi_2Ge_2 , $\text{La}_5\text{Pb}_3\text{Mn}$, temperature and grain size effects in iron-cobalt alloys, accommodation and aftereffect behavior in magnetic materials, and a discussion of Barkhausen noise in a ferromagnetic amorphous alloy.

N19 This magnetic measurements session included papers on "SH-MOKE" (second harmonic magneto-optic Kerr effect) being used to study spin valves, "MOKEE" (magneto-optical Kerr effect ellipsometry), ultrafast magneto-optic sampling, calibration of a polar Kerr spectrometer, the noise limit of a fluxgate magnetometer, magnetometry using micromechanical cantilevers, magnetic resonance force microscopy, magnetic measurements on cobalt-doped CuGeO_3 , hot electron current measurements in a magnetic multilayer, a Tesla low mass magnetic sweep assembly, and FMR in AgCo granular films.

R19 This session featured an invited talk by F. Pazmandi on quantum spin glasses in the strong glass regime. The session included papers on organic spin glasses, two papers applying the "hierarchical model" to spin

glasses, two papers discussing numerical simulations of spin glasses, a paper on thermal remanent magnetization in spin glasses, and a paper on a quasi one-dimensional realization of a spin glass.

On Wednesday after the business meeting, 15 magneticians adjourned to dinner at the Savoy Grill, where excellent food was served including fabulous flaming desserts. A private dining room was provided and good company was enjoyed by all. It is hoped that next year a larger group will assemble.

-Marty Sablik

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International Conference on Magnetism

(ICM '97)

Cairns, Australia, July 28 - August 1, 1997

The International Conference on Magnetism (ICM), which is held every third year under the auspices of the Magnetism Commission of the International Union of Pure and Applied Physics (IUPAP), took place this year in Cairns, Australia. The meeting was a great success, due largely to the leadership of the conference organizers Bob Street (University of Western Australia), Fred Smith (La Trobe University) and Trevor Hicks (Monash University) who found an excellent location at the Cairns Convention Centre and generally ensured that everyone was well looked after.

The attendance was over eight hundred persons, including 146 students which was a large turn out once again for the meeting, despite the distant location. This comprised over 43% from Japan, 21% from Western Europe (excluding UK), 6% from UK, 6% from the USA and Canada, and 6% from Eastern Europe. The remaining 18% were mostly from Australia and Asia. One notable feature was the rather low attendance from the US. We hope to increase this for the next ICM which is nearer to home in Recife, Brazil.

During the conference the magnetism prize was presented to Prof. R. Birgeneau of MIT for his work on random fields and random anisotropies in magnetic systems. There were also four plenary sessions: H. Von Lohneysen of the Technical University of Karlsruhe (TH) spoke on "Heavy fermion systems at the magnetic/non-magnetic quantum phase transition", M. B. Maple of the University of California, San Diego spoke on "High temperature superconductivity", T. Shinjo of Kyoto University spoke on "Nanostructured magnetism", and E. Chudnovsky of City University of New York, spoke on "Macroscopic Quantum Tunneling in magnetic systems".

The main part of the conference consisted of 27 oral sessions run in parallel sessions of three, and 12 large poster sessions. Sometimes each poster sessions contained up to 80 papers, so there was a vast amount of information on display. A total of 1418 papers were presented, 5 plenary, 26 invited, 148 other oral presentations and 1239 poster presentations. A great advantage of the Cairns Convention Centre was that it afforded plenty of room for the poster sessions, which at some recent ICM's have posed a problem due to the sheer numbers of presentations. This time it was possible to get to see the posters in which you were interested! In addition there were two special evening sessions: a Workshop on Magnetic Force Microscopy and a panel discussion on The Future of Magnetic Recording. As usual the ICM conference focuses more on the basic physics of magnetism than on the technological applications. In that respect it has more similarities

to the MMM conference than the InterMag Conference. Nevertheless there were more sessions this year on applications of magnetism, including magnetic recording, ferrites & garnets and domain walls & hysteresis, in addition to the more traditional "condensed matter physics" topics such as strongly correlated electrons systems, spin glasses and low dimensional systems.

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International Conference On Magnetism

(ICM 2000)

August 6-11, 2000

Recife, Brazil

The International Conference on Magnetism -ICM- in the year 2000 will be held at the State Convention

Center in Recife, on the Northeastern Coast of Brazil. ICM belongs to a series of triennial conferences held under the auspices of the International Union for Pure and Applied Physics - IUPAP. It is designed to bring together the international community of scientists and engineers interested in recent developments in all branches of fundamental and applied in magnetism and to provide a forum for the presentation and discussion of new concepts, properties and developments in materials research and magnetic applications. The most recent conferences were held in Cairns, Australia (1997), Warsaw (1994), Edinburgh (1991), Paris (1988), San Francisco (1985) and Kyoto (1982). The next ICM will be held in Brazil in August 2000. The main conference will take place in Recife, while satellite conferences and workshops are scheduled for Porto Alegre, Campinas, Rio de Janeiro and Belo Horizonte.

The Conference will be sponsored by Sociedade Brasileira de Física - SBF (Brazilian Physical Society), the Universidade Federal de Pernambuco -UFPE (Federal University of Pernambuco) and the International Union for Pure and Applied Physics - IUPAP. Further information can be obtained on World Wide Web at the site www.df.ufpe.br/icm2000/

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Note: Phil Wigen has agreed to act as our APS/GMAG liason with ICM 2000 as he is on the ICM organizing committee.

WWW page

(<http://www.aps.org/units/gmag>)

The GMAG Home Page is continuing to be constructed. I added a huge number of hyperlinks copied from Alison Chaikin's page (<http://www.wsrcc.com/alison/magrec.html>), focussed on magnetic recording. Check it out! I still hope for suggestions from our members, especially on other aspect of magnetism. If you come across any appropriate Web sites please send me a short note with the URL. I'll get it on the list. Furthermore, if you have any suggestions or comments regarding the design and layout of our Home Page, please forward them.

Bruce van Dover
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1997 Business Meeting

While the minutes of the 1997 Business meeting have not been formally approved, here is an unofficial precis of what went on.

The meeting was held on Wednesday, 19 March, and 23 Members were present at the start of the meeting. David Jiles presided. The results of the 1997 elections were announced, and Larry Rubin was thanked for his role as Chair of the Nominating Committee. After some discussion as to the precise wording of the Bylaws, the Bylaws were approved.

The GMAG Chair was asked to initiate contact with the organizing committee of the MMM conference, to explore the possibility of interaction, possibly including coordination of the technical programs of MMM, InterMag, and the APS March Meeting.

The Secretary-Treasurer reported that the newsletter mailed 15 Feb 97 comprised most of the expense incurred by GMAG so far (~\$2.00/member). Ideas on how to reduce this expense are being explored.

Committee chairs (see the list of officers in this newsletter) were nominated and elected.

A vote of appreciation to Marty Sablik for serving as Interim Treasurer was passed unanimously.

Bruce van Dover
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Calendar of Upcoming Magnetism Meetings

1997

| <i>date</i> | <i>organization, venue</i> | <i>primary contact</i> |
|----------------|---|---|
| October 20-24 | American Vacuum Society '97, San Jose, California | AVS, 120 Wall Street 32nd Floor, New York, NY 10005 Phone: (212) 248-0200 Fax: (212) 248-0245 |
| October 20-24 | 15th International Conference on Magnet Technology (MT-15) Beijing, China | Lan Luguang or Yu Yunjia Inst. of Electrical Engineering Chinese Academy of Sciences PO BOX 2703, Beijing, China |
| November 3-6 | Computational Magnetism (CompuMag) Conference Rio de Janeiro, Brazil | Jose Roberto Cardoso Fax: +55 (11) 818-5719 compumag@pea.usp.br |
| December 17-19 | Condensed Matter and Materials Physics Conference - CMMP'97 University of Exeter, Exeter UK | The Institute of Physics 76 Portland Place London W1N 4AA Tel: +44 (0) 171 470 4800 Fax: +44 (0) 171 470 4848 E-mail: cmmp@iop.org |

1998

| <i>date</i> | <i>organization, venue</i> | <i>primary contact</i> |
|---------------------------|---|---|
| January 6-9 | Joint Magnetism and Magnetic Materials/INTERMAG Conference San Francisco, California | Diane Suiters Courtesy Associates, Washington DC Fax: (202) 347-6109 magnetism@mcimail.com |
| August 30- September 3 | Fifteenth International Workshop on Rare-Earth Magnets and Their Applications (REM XV) Dresden, Germany. | Anja Mangold Fax: +49 (69) 7917733 or: Dr. Dietrich Hinz IFW Dresden Fax: + 49 (351) 4659541 |
| September 4 | Tenth International Symposium on Magnetic Anisotropy and Coercivity in Rare-Earth Transition Metal Alloys Dresden, Germany | |
| September 9-12 | European Magnetic Materials and Applications (EMMA) Conference Zaragoza, Spain | Conference Secretariat Physics Department University of Zaragoza Fax: +34 (7) 676-1229 emma98@posta.unizar.es |
| November 9-12 | Magnetism and Magnetic Materials Conference, Miami, Florida | Diane Suiters Courtesy Associates Washington DC Fax: (202) 347-6109 magnetism@mcimail.com |