

From the President

By Liesl Folks, President of the Magnetics Society

Over the summer I had the great pleasure of participating in the Magnetics Society Summer School (MSSS) 2014, held in Rio de Janeiro, Brazil. It was hosted by the team that is putting together a new Brazilian Chapter of the IEEE Magnetics Society (for which the petition is under evaluation at the IEEE headquarters). The event was held on the premises of the Centro Brasileiro de Pesquisas Físicas - CBPF (the Brazilian Center for Physics Research), and ably led by Prof. Rubem Luis Sommer, who holds the titles of Head of the Experimental Condensed Matter Physics Division and Director of the LABNANO/CBPF Nanocenter at CBPF. The MSSS was, once again, a marvellous event for the graduate student attendees, who came together from all around the world for a week of in-depth tutorials on topics in magnetism by some of the finest lecturers we have in the Society. The Brazil team



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2014 IEEE Magnetics Society Summer School

By Mingzhong Wu, Education Committee Chair

The 7th IEEE Magnetics Society Summer School was successfully held in Rio de Janeiro, Brazil during August 10-15, 2014. 82 graduate students from 25 different countries and areas around the world attended the school.

Each student presented their work at poster presentation sessions, and six of them received the Best Poster Awards. Those students are Maria Brollo (Brazil), Afshin Houshang (Sweden), Charles-Henri Lambert (France), Claribel Dominguez Ordonez (Colombia), Mary Luz Mojica Pisciotti (Argentina), and Seonghoon Woo (USA). Congratulations to those students!

The school program included lectures on eight different subjects. The lecture subjects and lecturers were:

- Fundamentals - Albrecht Jander
- Magnets for Energy Applications - Stan Trout
- Nano-Magnetism - Olivier Fruchart
- Spintronics - Daniel Bürgler
- Magnetization Dynamics – Burkard Hillebrands
- Magnetic Recording - Stella Wu
- Modelling and Simulations - Robert Stamps
- Magnetic Measurements - Rudolf Schaefer.

The school program also included Distinguished Lecturer talks by Hans-Benjamin Braun, Jonathan Coker, and Tim St Pierre. The Local Organizing Committee, chaired by Rubem Luis Sommer, made exceptional efforts in hosting the summer school and making it a very productive, sensational, and memorable experience for all the participants.

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deserves enormous credit for putting together a wonderful program in a terrific location, as does the Education Committee of the Magnetics Society, led by Prof. Mingzong Wu of Colorado State University, for its continued work on growing this activity into a flagship activity for the Magnetics Society.

I am delighted to let you know that the next Summer School will be held June 14-19, 2015, at the University of Minnesota in Minneapolis, USA. See the article elsewhere in the Newsletter for further details. Please encourage graduate students to attend this marvellous annual event, if they have not already.

As I wrote in the last newsletter, the Magnetics Society is dedicated to building the strongest possible international

community for those working in magnetism and magnetic materials. Accordingly, I am delighted that we now have a new chapter in Japan, to be known as the IEEE Shin-Etsu Section Magnetics Society Chapter, thanks to the effort of Dr. Akimitsu Morisako and his regional colleagues.

Finally, I very much hope to see a great many of you at the upcoming MMM Conference, to be held in Honolulu, November 3-7, 2014. The MMM meeting is jointly sponsored by American Institute of Physics Publishing, in accordance with a long-standing agreement that we greatly value.

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MOMAG 2014 Conference Review

By Luiz Lebensztajn, President of the Brazilian Society of Electromagnetism

MOMAG is a biennial conference, combining the Brazilian Symposium on Microwave and Optoelectronics and the Brazilian Congress of Electromagnetism. It is run jointly by the Brazilian Society of Microwave and Optoelectronics and the Brazilian Society of Electromagnetism. Previous conferences were held in São Paulo (2004), Belo Horizonte (2006), Florianópolis (2008), Vitória (2010) and João Pessoa (2012).

This year the conference was held in Curitiba and was chaired by Prof. José Luís Fabris from Federal Technological University of Parana and Prof. Jean Vianei Leite from Federal University of Santa Catarina. The Program Committee Chairs were Professor Murilo Araujo Romero and Professor Luiz Lebensztajn, both from University of São Paulo.

MOMAG 2014 attracted several presentations from around the world. There were 270 submissions from 11 different countries,

and 212 were selected for presentation. Scientific and technical contributions were arranged into 21 oral sessions and 3 poster sessions, covering new developments in microwaves, optoelectronics and electromagnetism. Three plenary lectures were also organized. Patrick Dular (University of Liege, Belgium), Yvonnick Le Ménach (Université Lille1, France) and Rogério N Nogueira (Instituto de Telecomunicacoes, Portugal) were the invited speakers for the plenary lectures.

Overall, this conference was successful thanks to the great efforts of the 39-person Technical Program Committee, the Local Organizing Committee, and the Session Chairs.

MOMAG 2016 will be held in Gramado, Brazil, in May, 2016, with Prof. Aly Ferreira Flores Filho as the Conference Chair.

2015 IEEE Magnetics Society Summer School

By Mingzhong Wu, Education Committee Chair

The 8th IEEE Magnetics Society Summer School will be held in the University of Minnesota, Minneapolis, USA during June 14-19, 2015. As in the previous summer schools, this school will consist of lectures by international experts and will include poster presentations by participating students. The program will cover both fundamentals and advanced topics in magnetism.

Financial support will be awarded to approximately 100 students from around the world. Awardees will be provided free

accommodation for the duration of the school and will be reimbursed for most of their travel cost. The summer school is open to current M.S. and Ph.D. students who are members of the IEEE Magnetics Society (at the time of attendance) and have not attended previous summer schools. For more information about the school and applications, please visit: <http://summerschool.ieemagnetics.org/>.

The student application deadline is November 15, 2014.

2015 Distinguished Lecturers

The IEEE Magnetics Society selected four Distinguished Lecturers (DLs) for 2015. They are:

- ▶ Russell Cowburn (University of Cambridge, UK);
- ▶ Ivan K. Schuller (University of California - San Diego, USA);

- ▶ Ludwig Schultz (Leibniz Institute of Solid State and Materials Research, Dresden, Germany);
- ▶ Bethany Stadler (University of Minnesota, USA).

Each DL makes his or her own schedule, so contact them early via their respective institutions.

IEEE Magnetics Society 2015 Distinguished Lecturer

Perpendicular Magnetic Anisotropy: From Ultralow Power Spintronics to Cancer Therapy

Russell Cowburn, Cavendish Laboratory, University of Cambridge, Cambridge, UK

Most thin magnetic films have their magnetization in the plane of the film because of shape anisotropy. In recent years there has been a resurgence of interest in thin magnetic films that exhibit a magnetization easy axis along the surface normal due to so-called perpendicular magnetic anisotropy (PMA). PMA has its origins in the symmetry breaking that occurs at surfaces and interfaces and can be strong enough to dominate the magnetic properties of some material systems. In this talk I explain the physics of such materials and show how the magnetic properties associated with PMA are often very well suited to applications. I show three different examples of real and potential applications of PMA materials: ultralow power spin-transfer-torque magnetic random-access memory (STT-MRAM) devices for low energy computing, three-dimensional magnetic logic structures, and a novel form of cancer therapy.

[1] R.Lavrijsen, J.-H. Lee, A. Fernández-Pacheco, D. Petit, R. Mansell, and R. P. Cowburn, "Magnetic ratchet for three-dimensional spintronic memory and logic," *Nature*, vol. 493, pp. 647-650 (2013).

[2] L. O'Brien, E. R. Lewis, A. Fernández-Pacheco, D. Petit, R. P. Cowburn, J. Sampaio, and D. E. Read, "Dynamic oscillations of coupled domain walls," *Phys. Rev. Lett.*, vol. 108, 187202 (2012).

[3] L. O'Brien, D. Petit, E. R. Lewis, R. P. Cowburn, D. E. Read, J. Sampaio, H. T. Zeng, and A.-V. Jausovec, "Tunable remote pinning of domain walls in magnetic nanowires," *Phys. Rev. Lett.*, vol. 106, 087204 (2011).

Russell Cowburn has research interests in nanotechnology and its application to magnetism, electronics, and optics. Before returning to Cambridge in 2010 he held positions at the CNRS (Paris), University of Durham, and Imperial College (London). Prof. Cowburn is the founder of two start-up companies and the inventor of the anti-counterfeiting technology, "Laser Surface Authentication." He has been granted over 60 patents and is a frequent invited speaker at international conferences. Prof. Cowburn is the winner of the GlaxoSmithKline Westminster Medal and Prize, the Degussa Science to Business Award, the Hermes International Technology Award, and the Institute of Physics Paterson Medal and Prize. He is a Fellow of the Royal Society. Contact: rpc12@cam.ac.uk



Thirty-Five Years of Magnetic Heterostructures

Ivan K. Schuller, Department of Physics and Center for Advanced Nanoscience,
University of California - San Diego, San Diego, California, USA

Hybrid, heterostructured materials allow the development of new material properties by creative uses of proximity effects. When two dissimilar materials are in close physical proximity, the properties of each may be radically modified and occasionally a completely new material emerges. In the area of magnetism, controlling the magnetic properties of ferromagnetic thin films without magnetic fields is an on-going challenge with multiple technological implications for low-energy memory and logic devices. All of these are based on basic discoveries, which provide the scientific foundation for important applications. Of course, like with all basic research discoveries, it is difficult to predict where and when these will make it into applications.

Roughly 35 years ago the development of metallic (magnetic, in particular) superlattices started a quest to engineer novel properties unlike those existing in naturally occurring materials. This has led to a many studies related to metallic superlattices and eventually to the development of the whole new field of spintronics. After a brief motivation and historic background, I will describe some of the most recent developments in the field. Interesting magnetic proximity effects arise when ferromagnets (FM) are in contact with antiferromagnets (AFM), such as the shift of the hysteresis loop along the field axis. In this "exchange biased" configuration, a variety of unusual phenomena arise unlike in any other magnetic systems: 1) the reversal of the FM becomes asymmetric; 2) large exchange bias appears in

nominally fully compensated surfaces; 3) positive exchange bias emerges for certain classes of bilayers; 4) at fast time scales (< 300 ps) the reversal is anomalous; and 5) the phenomenon is affected by the bulk magnetic structure of the AFM. Another interesting possibility arises when ferromagnets are in proximity to materials that undergo metal-insulator and structural phase transitions. In this case, the coercivities and magnetizations of the ferromagnetic films grown on different oxides are strongly affected by the phase transition in the oxide. Both of these phenomena have presently existing and future potential applications in the areas of spintronics, sensors, magnetic recording, and transformers.

Work supported by the U.S. Department of Energy and the U.S. Air Force Office of Scientific Research.

[1] A. Porat, S. Bar-Ad, and I. K. Schuller, "Novel laser-induced dynamics in exchange-biased systems," *Euro. Phys. Lett.*, vol. 87, 67001 (2009).

[2] A. C. Basaran, T. Saerbeck, J. de la Venta, H. Huckfeldt, A. Ehresmann, and I. K. Schuller, "Exchange bias: The antiferromagnetic bulk matters," *Appl. Phys. Lett.*, vol. 105, 072403 (2014).

[3] J. de la Venta, S. Wang, T. Saerbeck, J. G. Ramirez, I. Valmianski, and I. K. Schuller, "Coercivity enhancement in V2O3/Ni bilayers driven by nanoscale phase coexistence," *Appl. Phys. Lett.*, vol. 104, 062410 (2014).

Ivan Schuller received his undergraduate degree from the University of Chile, the Ph.D. from Northwestern University, and the Honoris Causa Doctorate from the Universidad Complutense in Spain. He is the director of the Center for Advanced Nanoscience (CAN) at the University of California-San Diego.

Prof. Schuller has received the Ernest Orlando Lawrence Award from the U.S. Department of Energy, the John Wheatley Award and the David Adler Lectureship Award from the American Physical Society, the MRS Medal from the Materials Research Society, and the Somiya Award from the International Union of Materials Research Societies. His work was mentioned as a precursor for giant magnetoresistance in the justification of the 2007 Noble Prize for physics. He has won

several regional Emmy Awards and other television awards for his science-related movies.

Prof. Schuller is a member of the Chilean, Spanish, Belgian, and Colombian Academies of Science and a frequent visitor in Europe, Latin America, and the Far East. His more than 500 papers and 20 patents have been dedicated to many aspects of nano- and meso-structured solids in the fields of magnetism, superconductivity, and organics. Contact:

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Interaction of Ferromagnetic and Superconducting Permanent Magnets: Superconducting Levitation

Ludwig Schultz, Institute of Metallic Materials,
Leibniz Institute of Solid State and Materials Research, Dresden, Germany

New means of urban transportation and logistics will become realistic with superconducting magnetic bearings using bulk high-temperature superconductors. The advantage of superconducting magnetic levitation is that it is passively stable without any electronic control, but with attracting and repelling forces to suspend a vehicle pendant or standing upright from zero to high speed. These are perfect conditions for a rail-bound, individual transport with cabins for 4 to 5 passengers, requested call by call. They will levitate noiselessly over a track made of rare-earth permanent magnets, saving energy and travel time.

A big step forward in this vision has been made in Dresden. The world largest research and test facility for transport systems

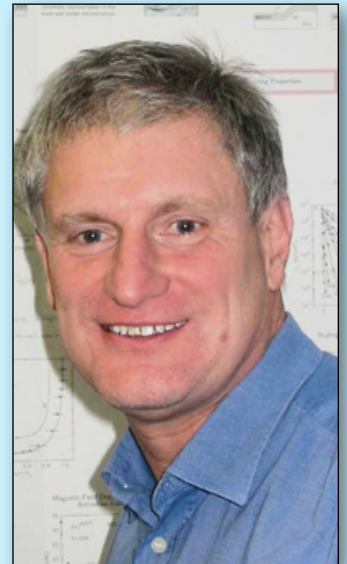
using bulk high-temperature superconducting material in the levitation and guidance system, in combination with a permanent magnet track, was put into operation. A vehicle for two passengers, equipped with linear-drive propulsion, a non-contact energy supply, a second braking system, and various test and measurement systems is running on an 80 m long, oval driveway. In the presentation, the principle of superconducting levitation by flux pinning in high-temperature superconductors will be described. Based on this, an overview of the SupraTrans II research facility and future directions of superconductivity-based magnetic levitation and bearing for automation technology, transportation, and medical treatment under enhanced gravity will be given.

Ludwig Schultz received the Ph.D. in physics from the University of Goettingen in 1976. In 1978 he was a postdoctoral fellow at IBM's Thomas J. Watson Research Center in Yorktown Heights, New York. From 1980 to 1993 he was a staff scientist and then head of the High Temperature Superconductors and Magnetic Materials Department at the Siemens Research Laboratories, Erlangen. In 1993 Prof. Schultz became a full professor of Metallic Materials and Metal Physics at the Technische Universität Dresden and Director of the Institute of Metallic Materials at the Leibniz Institute of Solid State and Materials Research (IFW) Dresden. From 2008 to 2013 he was the Scientific Director of IFW Dresden.

Prof. Schultz is also a Fellow Professor of the University of Ulsan (South Korea) and is affiliated to the International Laboratory of High Fields and Low Temperatures at Wroclaw (Poland). He has served on many Executive Boards and committees such as the German Physical Society (DPG). In 2011/12 he was the President of the "German Association for the Advancement of Science and Medicine (GDNAE)". In

addition to chairing many conferences, he served as co-chair of the 2014 Intermag Conference in Dresden.

Prof. Schultz is the Editor-in-Chief of the Journal of Alloys and Compounds. He has been awarded many honors and prizes, including the Ehrennadel (Medal of Honor) of the German Physical Society. His research programs have included superconducting materials, magnetic materials, amorphous and nanocrystalline materials, and electrochemical and mechanical properties of alloy.



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Magnetic Nanowires: Revolutionizing Hard Disk Drives, Random-Access Memory, and Cancer Treatment

Bethanie Stadler, Department of Electrical and Computer Engineering,
University of Minnesota, Minneapolis, Minnesota, USA

Magnetic nanowires can have many names: bits, sensors, heads, artificial cilia, sensors, and nano-bots. These applications require nanometer control of dimensions, while incorporating various metals and alloys. To realize this control, 7 to 200 nm diameter nanowires are synthesized within insulating matrices by direct electrochemistry. Our nanowires can easily have lengths 10,000 times their diameters, and they are often layered with magnetic and non-magnetic metals as required by each application.

This talk will reveal synthesis secrets for nanometer control of layer thicknesses, even for difficult alloys, which has enabled studies of magnetization reversal, magneto-elasticity, giant magnetoresistance, and spin-transfer torque switching. These nanowires will mitigate the ITRS Roadmap's "Size Effect" grand challenge, which identifies the high resistivities in small

interconnects as a barrier to continued progress along Moore's Law (or better).

High magnetoresistance is also possible in other multilayered nanowires that exhibit excellent properties for multi-level, non-volatile, random-access memory. If the insulating growth matrix is etched away, the nanowires resemble a magnetic bed of nano-seaweed, which enables microfluidic flow sensors and vibration sensors.

Finally, we have incubated various nanowires with several healthy and cancerous cell lines, and find that they are readily internalized. Careful magnetic design of these "nano-bots" enables external steering, nano-barcode identification, and several modes of therapy

Bethanie Stadler received the B.S. degree from Case Western Reserve University in 1990 and the Ph.D. degree from Massachusetts Institute of Technology in 1994. She held a National Research Council post-doctoral fellowship at the Air Force Rome Research Laboratory before joining the Electrical and Computer Engineering Department at the University of Minnesota. Her research there has been awarded the National Science Foundation Faculty Early Career Development award and a McKnight Presidential Fellowship.

Prof. Stadler works on the integration of magnetic nanowires for magneto-electronics (including hard-disk-drive heads), microfluidic flow sensors and actuators, acoustic/vibration sensor applications, and cellular biomarkers. In photonics, she works on the integration of magnets, magneto-optical garnet

waveguides, and nanostructures for magnetophotonic crystals with semiconductor platforms for isolator and sensor applications.

Prof. Stadler has served as director and secretary of the Materials Research Society.

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Singapore Chapter Magnetics Symposium 2014

By S. N. (Prem) Piramanayagam, General Conference Chair



The Singapore Chapter of IEEE Magnetics Society organizes a Magnetics Symposium annually. This year, being the 50th anniversary of the Society, the Singapore Chapter decided to organize it in a grander manner, and to arrange at least 50 talks to emphasize the celebration theme of the Symposium. Plenary, keynote and invited speakers were identified; contributed talks were solicited from budding researchers and students.

In total, the final program comprised 52 talks, 50 of which were presented by members of the Singapore Chapter. The event took place during September 22-23, 2014, at the National Research Foundation (NRF) Auditorium in Singapore.

Prof. Low Teck Seng, IEEE Fellow, Chief of the NRF and member of the Singapore Chapter, delivered the opening speech. Prof. Mitsuteru Inoue (Toyohashi, Japan) delivered a plenary lecture on “Artificial Magnetic Lattices and Magneto-optic Three-dimensional devices”. The other talks covered the two major areas, of magnetic recording and spintronics and other areas such as energy, fundamental magnetism and so on.

The competition round of the Symposium had the participation of 20 students and covered various aspects of magnetism. They represented the National University of Singapore (NUS) and Nanyang Technological University (NTU). Kulothungasagaran Narayanapillai (NUS) and Siddharth Rao (NUS) emerged as winners and Yupu Wang (NUS), Li Ming Loong (NUS), Anansa Ahmed (NTU) and Shreya Kundu (NUS) emerged as runners-up. Gan Weiliang (NTU), who is currently doing his undergraduate study, won a commendation prize for his excellent presentation.

The two-day event served as a good platform to exchange ideas between researchers in Singapore and as an event to celebrate the 50th anniversary of IEEE Magnetics Society. Selected papers will be published in *IEEE Magnetics Letters*.

New Senior Members

The following members of the IEEE Magnetics Society were recently elevated to the grade of Senior Member.

July 2014: Rosa Ana Salas Merino and Mariusz Stepień.

August 2014: Manuel C Blanco.

September 2014: Yiming Deng, Jon Lewis, Alireza Safaee and Lijian Wu

For further information, visit the IEEE Web site at:

www.ieee.org/membership_services/membership/grade_elevation.html

16th Louis Néel Colloquium

By Vincent Baltz, Organizing Committee Chair

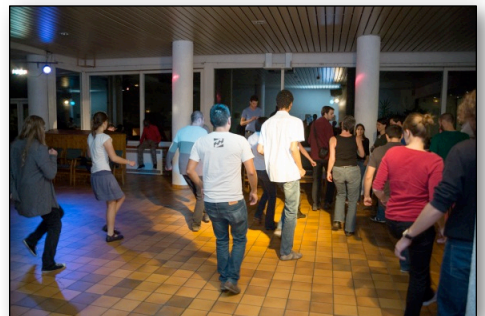
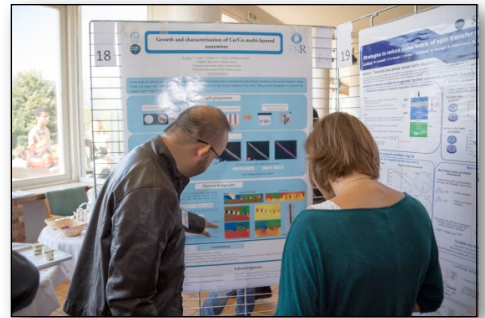
Since the 1990s, the Louis Néel Colloquium on magnetic thin films and nanostructures has taken place in France every 18 months. It gathers researchers, mainly from France, working in the field of nanomagnetism and spintronics. The Colloquium attracts both young and senior researchers, with the talks given mainly by PhD students and post-doctoral fellows. This event is often the first opportunity for PhD students to present their work in front of the nanomagnetism community. In addition, the Colloquium offers the community a unique opportunity to discuss new ideas and set the foundations of new collaborative projects.

The Colloquium is alternatively organized by the major French researchers in nanomagnetism and spintronics. This year it was led by the SPINTEC laboratory, the NM laboratory and the Néel Institute, all three based in Grenoble. The Colloquium took place during September 23-26 in Austrans, in the Vercors Mountains. The 200 participants listened to 38 scientific

presentations, including an invited talk from the company CROCUS Technology, and reviewed of over 100 scientific posters. The sessions included topics on spin dynamics, nanostructures, spintronics, theory and applications.

Convivial interludes also gave the participants opportunities for more discussions in a more relaxed atmosphere, in order to draw the community closer together. These interludes included an acoustic concert from the De La Mancha local band, a team-building orienteering event in the mountains, and a festive meal, giving an opportunity to reward the six poster competition winners.

The organizing committee warmly thanks the IEEE Magnetics Society and in particular its French Chapter for its valuable financial support that definitely contributed to the success of this 16th edition of our Louis Néel Colloquium.



Conference Calendar

November 3-7, 2014 59th Conference on Magnetism & Magnetic Materials (MMM 2014)
Honolulu, Hawaii, USA
www.magnetism.org

January 21-22, 2015 Magnetics 2015
Orlando, Florida, USA
<http://www.magneticsmagazine.com/conferences/>

January 31 - 2015 Conference on Magnetism and its Applications (MIA2015)
February 2, 2015 Shanghai, China
<http://www.scirp.org/Conference/Home.aspx?ConferenceID=79>

May 11-15, 2015 INTERMAG
Beijing, China
www.intermagconference.com

June 1-4, 2015 9th International Conference on Power Electronics ECCE Asia (ICPE 2015)
Seoul, Korea
www.icpe2015.org

June 5-6, 2015 PELS Workshop on Emerging Technologies: Wireless Power (2015 WOW)
Seoul, Korea

July 5-10, 2015 20th International Conference on Magnetism (ICM2015)
Barcelona, Spain
<http://www.icm2015.org>

January 11-15, 2016 Joint MMM-INTERMAG Conference
San Diego, California, USA
www.magnetism.org

To list your conference in the Newsletter Conference Calendar, please contact the Editor

About the Newsletter

The purpose of the IEEE Magnetics Society Newsletter is to publicize activities, conferences, workshops and other information of interest to the Society's members and other technical people in the general area of applied magnetics. Manuscripts are solicited from Magnetics Society members, conference organizers, Society Officers & other volunteers, local chapters, and other individuals with relevant material.

The Newsletter is published in January, April, July and October electronically on the Magnetics Society webpage at www.ieeemagnetics.org. Submission deadlines are January 1, April 1, July 1, and October 1 respectively.

Please send articles, letters & other contributions to the Newsletter Editor:

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