epr newsletter

2010
volume 20 number 2-3

The Publication of the International
EPR (ESR) Society

Officers of the International EPR (ESR) Society

Fellows of the International EPR (ESR) Society

Anatole Abragam
Brebis Bleaney (1915–2006)
James R. Bolton
Harvey A. Buckmaster
Anders Ehrenberg
Gareth R. Eaton
Sandra S. Eaton
George Feher
George Fraenkel
Erwin Hahn
Karl Hausser (1919–2001)
Noboru Hirota
Clyde A. Hutchison, Jr. (1913–2005)
James S. Hyde
Daniel Kivelson (1929–2003)
Melvin P. Klein (1921–2000)
Harry Kurreck
August H. Maki (1930–2008)
Bruce R. McGarvey
Keith A. McLauchlan
Yuriy N. Molin
James R. Norris
John R. Pilbrow
Charles P. Poole, Jr.
Aleksandr M. Prokhorov (1916–2002)
Tengiz I. Sanadze
Charles P. Slichter
Leslie H. Sutcliffe
Harold M. Swartz
Martyn C. R. Symons (1925–2002)
Yuri D. Tsvetkov
Joan H. van der Waals
George D. Watkins
John A. Weil
Samuel I. Weissman (1912–2007)
David Whiffen (1922–2002)
Hans C. Wolf

epr newsletter

www.epr-newsletter.ethz.ch

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Please feel free to contact us with items (news, notices, technical notes, and comments) or ideas for the *EPR newsletter*.

The *EPR newsletter* is published quarterly by the International EPR (ESR) Society and is available in electronic and printed form to all members of the Society. The deadlines for submission of news for upcoming issues: Spring March, 15; Summer June, 15; Fall September, 15; Winter December, 15.

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The cover picture shows a piece of pottery made by Daniella Goldfarb, recipient of the 2009 Zavoisky Award.

"... When I work with the clay, I feel that I am creating something from nothing without using my head but with my soul and my heart. I may argue that science is our soul and heart – but this requires a considerably well organized intellectual effort which is something I refuse to apply to my pottery work ..."

Please find a complete article "Pottery – A Love Story" in the 'Another passion' column, p. 8 of this issue.

epr newsletter

The Publication of the International EPR (ESR) Society

volume 20 number 2-3 2010

continued on page 2

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Editorial

Dear colleagues,

How many of you had any idea of what relevance the terrific cover picture has to EPR before you read the cover legend? Probably a very limited number of people know about this 'another passion' of Daniella Goldfarb, recipient of the 2007 Bruker Prize (a more EPR-like cover of vol. 18/2-3) and recipient of the 2009 Zavoisky Award. I was charmed by the beauty of her pieces of pottery which I saw at her place in Rehovot when visiting the Weizmann Institute of Science this January and I am completely happy that she told us her love story (p. 8). I agree with Candice Klug that the article is fantastic and Daniella is a wonderful writer.

This article is a bright decoration of the following EPR-in-Israel-oriented *EPR newsletter* Anecdotes column (pp. 14–22). Zeev Luz, Daniella Goldfarb, Lev Weiner (Weizmann Institute of Science), Haim Levanon (Hebrew University of Jerusalem), Gertz Likhtenshtein, Boris Tsukerblat and Alexander Shames (Ben-Gurion University of the Negev), Moisey Belinsky (Tel-Aviv University) and Aharon Blank (Technion) present a comprehensive story of the breath-taking history and impressive development of EPR in Israel. It was a special pleasure for me to meet with old friends and make new ones during my visit to Israel and I take this opportunity to heartily thank all of them for their warm hospitality. Toda raba!

The minutes of the Annual General Meeting of the IES held in May 2010 are included in this issue (pp. 3–5) and provide detailed information about the current condition of the IES affairs. The main emphasis of the IES activities is to promote the EPR research around the world and to this end we need the support of our members and sponsors. Speaking of sponsors, this year Bruker BioSpin, our Patron, celebrates its 50th anniversary and the relevant events that took place during numerous magnetic resonance conferences all over the world. To pay tribute to the great contribution of Bruker BioSpin to the IES, the forthcoming issue of the *EPR newsletter* 20/4 is devoted to its 50 years and everybody is welcome to share with us his/her relevant experience. Also, LaPlume and Sons Printing, our printer, starting from this issue, prints the 2nd and 3rd cover pages in color at no extra cost in appreciation of the contribution Bruker BioSpin has made to the IES and the *EPR newsletter*. Thanks a lot, Scott!

As usual, it is good to introduce to the EPR community young scientists awarded by the APES and SEST Awards. Nick Cox and Mika Tada (APES2010), and Katsuichi Kanemoto and Eiji Ohmichi (SEST) made nice presentations of their research (pp. 6–7). We will keep an eye on your progress in science, guys!

In a recent conversation with Alex Müller, he emphasized that EPR as an analytical tool made substantial contributions to condensed matter physics. This is addressed in the eleven chapters of the book edited by K. Alex Müller and Tom Kool ranging from the properties of high-valence paramagnetic ions to the properties of Fermi glasses and superconductivity (p. 25).

Who could believe that Dante Gatteschi is 65 this year? Not me! We all join Andrea Dei in congratulating this outstanding scientist on his birthday. Tanti auguri a te, caro Dante! Hal Swartz, Founder President of the IES, generously gives an interview in the Five Years After column. It really is like a fascinating story of his way in science.

Joy and grief come together. We say farewell to the late John Weil, Fellow of the IES (p. 24). He contributed a lot to the *EPR newsletter* [see his article "Memories of the Hutchison Jr. Group" (with co-authors Arthur Heiss and Ralph Weber, *EPR newsletter* 13/3, p. 16), and others (vol. 13/3, p. 16; vol. 19/3, p. 16). It is a kind of consolation to know that John could read the article by James Bolton on the occasion of his 80th birthday (vol. 19/1-2, p. 23). Rest in peace, dear John!

Laila Mosina

IES BUSINESS

Annual General Meeting 2010

Held at the Joint Conference of the 14th In Vivo EPR Spectroscopy & Imaging and 11th International EPR Spin Trapping/Spin Labeling Meeting in San Juan, Puerto Rico on 2nd May 2010. The meeting was opened and chaired by Jack Freed, the President of the Society, and opened at 17:00.

The agenda of the meeting and minutes of the AGM 2009 were distributed to those present, along with the attendance sheet and membership forms. (Everyone was invited to attend the meeting even if he/she was not a member of IES).

1. Attendance and Apologies

Attendance (35): Stephany Natasha Arellano Ahumada, Aharon Blank, Michael Davies, Ruhong Dong, Gareth R. Eaton, Sandra S. Eaton, Robert T. Foster II, Yves Frapart, Jack H. Freed, Ruth Goldschmidt, Oleg Grinberg, Howard Halpern, Graeme Hanson, Xiaoming He, Hiroshi Hirata, Huagang Hou, Kazuhiro Ichikawa, Nadeem Khan, B. Kalyanaraman, Murali Krishna, Ajay Kumar, Periannan Kuppusamy, Fabian Leinisch, Ken-ichiro Matsumoto, Yuji Matsuzoe, Thomas Matthews, Barry Potter, Dario C. Ramirez, Kalina Ranguelova, Daniel Ramirez Rosales, Steven Swarts, Hal Swartz, Hideo Utsumi, Benjamin Williams, Keiji Yasukawa.

Apologies: The Secretary, Treasurer, Newsletter Editor, and Vice Presidents send their apologies for not being able to attend.

Their reports were included in the Powerpoint presentation by the President.

2. 2009 Minutes

The minutes of the General Meeting held on the 22nd July 2009 were presented and accepted as a true record of the previous meeting.

3. President's Report

Dear Colleagues,

On behalf of the IES Executive Committee, I wish to welcome all participants to the 2010 General Meeting of the IES and the Joint Conference of the 14th In Vivo EPR Spectroscopy & Imaging and the 11th International EPR Spin Trapping/Spin Labeling Meeting.

I would like to express my gratitude to the organizers of this meeting, especially Conference Co-chairs Antonio Alegria & Balaraman Kalyanaraman and Conference Coordinator, Jane Thelaner, for allowing our General Meeting to take place during this Conference.

This General Meeting marks the 21st year of the IES. The previous two meetings were in Cairns (Australia) and Snowmass (Colorado, USA). Puerto Rico is a new venue for the IES meeting.

Last year we celebrated the 20th anniversary of the IES. I include some excerpts from last year's meeting. For details, see the EPR newsletter 19/3, pp. 3–7 (2009).

Over these past 21 years the ESR/EPR field has witnessed a real renaissance. These include new instrumental & theoretical technologies which realize its potentials of:

- High Spin Sensitivity
- Excellent Spectral Resolution
- High Sensitivity to Molecular Motion
- Ability to Measure Short & Long Distances Within & Between Molecules
- Medical Imaging & Microscopy Down to Micron Dimensions
- Limited Degree to which the Measurement Disrupts the Host
- Availability of Spin Labels for a Wide Range of Applications
- Convenience of Measurement

Applications of these capabilities include both chemical and biological applications including the study of free radicals, metalloenzymes and organo-metallic compounds, polymers, protein and membrane structure and dynamics, molecular dynamics in complex fluids, electron transfer reactions, and spin-trapping.

In the physics/materials field, new applications such as superparamagnetism, quantum dots, and quantum computing have emerged and add to studies of ferromagnetism, semiconductors, and defect centers.

Surely, the audience will be able to add to this extensive list.

Over the last 21 years, the IES has provided encouragement to these and other EPR developments worldwide in all scientific fields and aided in the dissemination of new ideas and methods in EPR spectroscopy throughout the scientific community.

The IES will continue to actively support and participate in the numerous national and international conferences and workshops and encourage new.

The IES will support established EPR groups and centers, to maintain, and to re-establish where needed, ties amongst these EPR activities in a true international spirit.

The IES will continue to foster its accessibility to its members, providing them with the latest information on the many activities in the field of EPR.

A major function of the IES is to honor distinguished contributors to the EPR/ESR field.

These awards were initiated in 1992 with the Gold Medal and extended in 1994 to include the Silver Medals in various specialized areas of EPR. They are Silver Medals in Chemistry, Biology/Medicine, Physics/Materials Science, Instrumentation, and the Young Investigator Award.

- IES Award 2010
  Silver Medal (Physics)

Professor Naresh Dalal
Dirac Professor of Chemistry & Biochemistry, Florida State University, Faculty Associate at the National High Magnetic Field Laboratory
in recognition of three decades of pioneering research in EPR & its novel application to a wide range of problems from studies of free radicals in coal and diesel soot, toxicology, and carcinogenesis to ferroelectric and magnetic phase transitions in quantum solids and high-temperature superconductivity.

The selection of Fellows of the Society was initiated in 1995 for honoring distinguished senior scientists for their extensive contributions to EPR.

- Fellows of IES Award 2010

Professor James Norris
University of Chicago, USA
in recognition of his innovative contributions to the elucidation of the molecular structure of paramagnetic species in photosynthetic reaction centers.

Professor Yuri Tsvetkov
Institute of Chemical Kinetics and Combustion, Novosibirsk, Russia
in recognition of his long and distinguished career in EPR/ESR, & in particular for his ground-breaking work in electron spin echo (ESE) spectroscopy & pulse electron-electron double resonance (PELDOR).

I want to thank all the members of the Silver Medal Committee for Physics/Materials Science for their excellent work for the Society.

• Meetings and conferences in 2010–2011

May 25–28, 2010. Multi-frequency EPR in the Biosciences, Lorenz Center, Leiden University, The Netherlands
http://www.lorentzcenter.nl

July 4–9, 2010. Joint EUROMAR 2010 and 17th ISMAR Conference, (WWMR2010), Florence, Italy
http://www.cerm.unifi.it/wwmr2010

August 1–5, 2010. 52nd Annual Rocky Mountain Conference on Analytical Chemistry, Snowmass, Colorado
http://www.rockychem.com

August 22–27, 2010. XXIV ICMRBS International Conference on MR in Biological Systems, Cairns, Australia
http://www.icmrbs2010.org

September 5–12, 2010. 5th EF-EPR Summer School on Advanced EPR Spectroscopy, University of Constance, Germany
http://cms.uni-konstanz.de/en/intra/epr-summerschool/home

September 12–16, 2010. 10th Bologna meeting on Magnetic Resonance in Porous media (MRPM 10), University of Leipzig, Leipzig, Germany
http://ingo.exphysik.uni-leipzig.de/mrpm10

October 10–14, 2010. Asia-Pacific EPR/ESR Symposium 2010, Jeju, Korea
http://www.apes2010.org

October 10–14, 2010. EPRBioDose 2010 International Conference, Mandelieu-La Napoule, France
http://www.iss.infn.it/eprbiodose

October 17–21, 2010. 37th Annual Conference of the Fed. of Analytical Chem. & Spectroscopy Societies, Raleigh, NC, USA
http://facss.org/facss/index.php

December 15–20, 2010. Nitroxide Radicals: Synthesis and Advanced Bio- and Nano-materials Applications International Chemical Congress of Pacific Basin Societies (Pacifichem), Honolulu, Hawaii, USA
http://www.pacifichem.org

January 13–14, 2011. Intensive 2-day Workshop in NMR, The University of Manchester, UK
http://www.chemistry.manchester.ac.uk/aboutus/events/nmr

January 16–18, 2011. 2011 ACERT Workshop "ESR Microscopy and Its Applications in Biomedical ESR Imaging", Cornell University, Ithaca, New York, USA
http://www.acert.cornell.edu

April 18–23, 2011. 51st ENC Experimental Nuclear Magnetic Resonance Conference, Daytona Beach, Florida USA
http://www.enc-conference.org

May 15–20, 2011. 12th International Symposium on Spin & Magnetic Field Effects in Chemistry, Hotel Witte Raaf, Noordwijk, The Netherlands
http://scm2011.leidenuniv.nl

August 14–18, 2011. ICMRM 2011 International Conference on Magnetic Resonance Microscopy, Changping, Beijing , China

August 21–25, 2011. EUROMAR 2011, 33rd GDCh Fachgruppentagung Magnetische Resonanz & the 8th Meeting of European Federation of EPR Groups, Frankfurt, Germany

4. Secretary's Report

• IES Awards 2010

The silver medal for Physics/Materials Science will be presented to Prof. Naresh Dalal at the Euromar conference in Florence, Italy in July 2010. The new Fellows have not yet decided where they would like to receive their certificates.

• IES Awards 2011

Nominations are invited for the following awards:
Gold Medal
Silver Medal for Instrumentation
Young Investigator Award
Fellows of the Society

Please visit http://ieprs.org for full constitution and by-laws.

Send nominations to the IES President.
Closing date: 15th November 2010

• IES Activities

The Secretary is responsible for day-to-day operations of the Society, and ensures efficient functioning of the Society, e.g.

– Sending out invoices to the sponsors;
– Informing members of the various items of interest to them, e.g. announcements of conferences and workshops;
– Organization of awards given by the IES: certificates and citations;
– Overlooking financial status and membership of the Society;
– Website (revamping);
– Updating IES letterhead;
– Answering any enquiries;
– Organizing the AGM;
– Liaison with the Editor of the EPR newsletter.

I sincerely thank Shirley Fairhurst, my predecessor, for her enthusiastic cooperation on all matters of secretarial advice whenever required by me.

IES Web Site (www.ieprs.org) has been recently revamped. Some representative pages were demonstrated.

5. Treasurer's Report

2009 Financial Report ($) (unaudited)

Balance January 1, 2009	9,930.09
Income:	
Membership	7,435.53
Sponsors	5,710.00
Total Income	13,145.53
Expenses:	
Bank & credit card fees	1,079.53
Web design & fees	856.65
Newsletter	9,965.00
Awards + RMCAC	1,673.50
State of Illinois	13.00
Total Expences	13587.68
Balance December 31, 2009	9,487.94

2010 (January-March) Financial Report ($)

Balance January 1, 2010	9,487.94
Income:	
Membership	959.14
Sponsors	2,970.00
Total Income	3,929.14
Expenses:	
Bank & credit card fees	224.70
Newsletter	2,168.00
Total Expences	2,392.70
Balance March 30, 2010	11,024.38

In 2009 we have gained sponsorship from JEOL JAPAN as Major Sponsor.

We more than ever need support of the members and our sponsors.

Membership fees are unchanged at:	
Full	$30
Emeritus/retired	$10
Postdoctoral (3 years max)	$10
Student	$5
Fellows (Complementary)	

Membership forms are included in the handouts or join via the web site: www.ieprs.org.

Are you interested to become a member of the International EPR (ESR) Society? Please find the registration/information form for new/continuing members of the IES and non-credit-card payment instructions for individual members on this Web site: www.epr-newsletter.ethz.ch/contact.html

6. Newsletter Editor's Report

Since the previous Annual Meeting of the IES in 2009 in Snowmass we published two single issues, 19/3 and 19/4, and a double issue 19/1-2. We hope all of you had a look at them on the newsletter website and got copies as well.

A preview of the latest issue 19/4 was presented. By now it is already on the newsletter website as well.

On behalf of the Editorial Board, I thank most heartily all contributors to the EPR newsletter with special thanks going to the CEOs of the IES and editors of the columns in the EPR newsletter: John Pilbrow, Candice Klug, Thomas Prisner, Stefan Stoll, Keith Earle and David Budil, and also to Yevhen Polyhach and Veronica Heinz, our web-masters, and Sergei Akhmin, our Technical Editor. I highly estimate Shirley Fairhurst's continuing support of the EPR newsletter.

I gratefully acknowledge collaboration with Associate Editors Candice Klug, Hitoshi Ohta and Thomas Prisner.

7. Thanks

The IES thanks the following Corporate Sponsors for their contributions in 2009–2010:
• Bruker BioSpin • JEOL USA • Elsevier • Research Specialties • Wilmad-LabGlass • Scientific Software Services • L&M EPR Supplies • Norell • Molecular Specialties • GMW • Resonance Instruments

Thanks to all paid up members

Newsletter Editor: Laila Mosina

Technical Editor: Sergei Akhmin

Associate Editors: Thomas Prisner, Candice Klug and Hitoshi Ohta

Special thanks to ETH Zurich for hosting the Newsletter website and the Zavoisky Physical-Technical Institute, Kazan for supporting the Newsletter.

The meeting was closed at 18:00.

From left to right: Jack Freed and Naresh Dalal.

Highlights of the Annual General Meeting 2010 at WWMR2010

The highlights of the Annual General Meeting 2010 were also presented at the Joint EUROMAR 2010 and 17th ISMAR Conference (WWMR2010) in Florence, Italy, July 4–9, 2010, on July 15, 2010 (1:00–1:45 PM). Jack H. Freed, the President of the Society, Sushil K. Misra, the Secretary of the Society, and Tatyana Smirnova, the Treasurer of the Society, presented their reports. The award of 2010 Silver medal for Physics and Materials Science was made to Naresh Dalal (please see the relevant photo). One of the main topics of discussion was how the IES can promote the EPR research around the world. The participants of the WWMR2010 attended this presentation. Among them were Aharon Blank, Marina Bennati, Robert Bittl, Vice President Michael Bowman, Marina Brustolon, Alberto Collanto, Klaus-Peter Dinse, Betty Gaffney, Graeme Hanson, Pär Håkasson, Past President Wolfgang Lubitz, Hitoshi Ohta, Hans Wolfgang Spiess, Heinz-Jürgen Steinhoff, Christian Teutloff, to name a few.

Sushil Misra,
Secretary of the IES

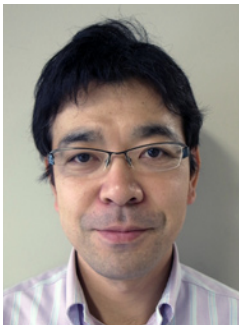
SEST Young Investigator Awards

Katsuichi Kanemoto:

I am very honored to receive the SEST Young Investigator Award for my study of "Study on the electron spin dynamics of carriers in conducting polymers". This study was performed with the help of my many collaborators and I particularly thank Emeritus Professor J. Yamauchi at Kyoto University for his helpful advice.

The aim of my research is to elucidate the electrons spin dynamics of π-conjugated conducting polymers. I am using several ESR techniques to explore the dynamics of polaron carriers with a 1/2 electron spin. The first attempt was an approach focusing on spin relaxation times determined by pulsed ESR techniques. I demonstrated that the temperature dependence of spin relaxation rates in lightly doped polymers follows the motional narrowing mechanism (Phys. Rev. B 2000) and that the mechanism of spin relaxation varies from the motional narrowing to the Elliott mechanism with increasing the doping level (Synth. Met. 2000). In addition, I attempted to establish how to derive the information of the spin dynamics from the lineshape and the linewidth of cw-ESR spectra. In particularly I have shown that the polaron carriers hop between grains consisting of polymer chains and the hopping motion affects electrical conduction of the polymer film (Phys. Rev. B 2003, *ibid* 2007, J. Phys. Chem. B 2008).

I believe that these studies on the spin dynamics should be useful for the investigation of spin properties of polymer semiconducting devices. To that end, I am currently attempting to build a system to evaluate device properties via spin dynamics derived from ESR. I hope to report this work in the near future.



Eiji Ohmichi:

I was honored to receive the SEST Young Investigator Award for the development of a high-frequency and high-field electron spin resonance (ESR) technique using a microcantilever. This study involved many collaborators since I moved to Kobe in 2006. I especially thank Prof. H. Ohta at Kobe University and my graduate students for their invaluable contributions.

I have developed a new method of high-frequency ESR using a microcantilever. In this method, the ESR signal is detected via the change in the sample magnetization associated with ESR absorption. Since the size of the cantilever is on the order of 100 μm, our method can be applied to very small sample volumes, on the order of 1 μg. Using this new method I succeeded measuring a microcrystal of Co Tutton salt in the millimeter wavelength region (up to 315 GHz) and achieved a spin sensitivity of ~109 spins/gauss at 4.2 K.

I am currently working to extend the frequency region available to beyond 1 THz, in combination with a backward wave traveling oscillator. For this purpose, further development of new detection system and customized cantilever fabrication are in progress. I hope that our method will open up high-frequency ESR to new applications to research fields as diverse as nanomaterials and biomolecule systems.

The Zavoisky Award
Call for nominations 2011

The Zavoisky Award 2011 will be presented at the Annual Symposium "Modern Development Magnetic Resonance" to take place in September 2011 in Kazan.

It was there that academician E. K. Zavoisky discovered EPR in 1944. The Zavoisky Award consists of a Diploma, a Medal and 1500 Euro.

This prestigious award is given in recognition of an outstanding contribution to the development of electron paramagnetic resonance. It is presented by the Kazan Zavoisky Physical-Technical Institute of the Russian Academy of Sciences, Kazan State University, the Government of the Republic of Tatarstan, and Springer-Verlag Wien New York. The lecture of the award-winner will be published in the journal *Applied Magnetic Resonance*.

Previous winners of the Zavoisky Award were: William B. Mims (1991), Brebis Bleaney (1992), Arthur Schweiger (1993), James R. Norris, Yakov S. Lebedev and Klaus Möbius (1994), James S. Hyde (1995), George Feher (1996), Kamil A. Valiev (1997), Jack H. Freed (1998), Joan H. van der Waals (1999), Harden M. McConnell and Bruker Analytik GmbH (2000), Keith A. McLauchlan (2001), Wolfgang Lubitz (2002), Wayne L. Hubbell (2003), Kev M. Salikhov and Dietmar Stehlik (2004), Harold M. Swartz (2005), Jan Schmidt (2006), Brian M. Hoffman (2007), Michael Mehring (2008), Daniella Goldfarb (2009), and Hans Wolfgang Spiess (2010).

Nominations are being sought from the EPR community worldwide. A brief presentation of the applicant covering 1–2 pages is expected. The final decision is made by the Award Selection Committee which comprises George Feher (La Jolla), Dante Gatteschi (Florence), Harden M. McConnell (Stanford), Keith A. McLauchlan (Oxford), Klaus Möbius (Berlin), and the chairman, Kev M. Salikhov (Kazan). The selection of the Awardee is made after consultations with the Advisory Award Committee which comprises Yuriy N. Molin (Novosibirsk), and Yuri D. Tsvetkov (Novosibirsk).

Nominations should be submitted to Dr. Laila V. Mosina, Executive Secretary of the Zavoisky Award Committee, Zavoisky Physical-Technical Institute, Sibirsky trakt, 10/7, Kazan, 420029, Russian Federation

e-mail: mosina@kfti.knc.ru

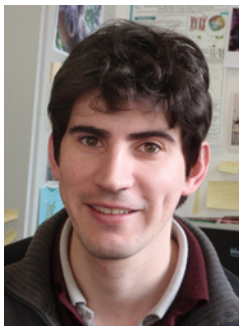
fax: 7-843-2725075

The deadline for submission of nominations is April 1, 2011.

The Ulderico Segre Prize
Call for nominations 2011

Ulderico Segre (1946–2008) was an Italian scientist whose research activity greatly contributed to the advancement of theoretical and computational modelling applied to mag-

APES Young Scientist's Awards



Nicholas (Nick) Cox:

I am very grateful to the organizing committee of APES 2010, including Profs. Sa-Ouk Kang and Hong-In Lee, for selecting me for the APES Young Scientist Award and for the opportunity to present some of my current research in the field of metalloenzymes. I thoroughly enjoyed my week on Jeju Island, the arcadia of the East and our excursions to volcanic formations and nature parks. This was my first visit to Korea and I hope to return again soon. The weather was certainly a significant improvement on that of Germany. After a week of gloriously sunny days of 25°C, I returned home to rain and an average October temperature of 10°C.

I am currently completing my first Postdoc in the research group of Prof. Wolfgang Lubitz at the Max-Planck-Institute for Bioinorganic Chemistry located in Mülheim an der Ruhr. My research over the last two years has been primarily devoted to the study of metalloproteins. EPR is ideally suited for these systems and the extensive facilities available at Mülheim allow these complicated systems to be untangled. Currently I am involved with the Photosystem II/Ribonucleotide Reductase subgroup. We comprise four members: Dr. Simon Drew, Leonid Rapatskiy, Thomas Lohmiller and myself. We have close collaborative ties with Prof. Frank Neese, who is a fellow of the Institute, and his group members: Dr. William Ames and Dr. Dimitrios Pantazis. They provide the theoretical detail needed to analyze these complicated systems. I plan to continue to my stay at MPI Bioinorganic Chemistry for the next couple of years, as a senior researcher.

The research I presented in Jeju comprised two topics: (i) spectroscopic characterization of the di-manganese ribonucleotide reductase (Mn-RNR) and; (ii) a refinement of the electronic structural model of the oxygen evolving complex (OEC) of Photosystem II (PS II). Our multi-frequency study (9 GHz, 34 GHz and 244 GHz) on the Mn-RNR, together with the work of Joanne Stubbe (MIT) has allowed the mechanism of metallo-cofactor assembly to be resolved. Similarly, our work on the OEC (multi-frequency EPR/55Mn ENDOR) has further limited the number of possible structural motifs of the tetra-manganese cluster and provided new information with regard to the mechanism of water splitting catalysis.

I look forward to attending APES2012 in Beijing.

Mika Tada:

I was honored to receive the APES2010 Young Scientist Award for our recent study entitled 'Scavenging or Quenching Effect of Melanin on Superoxide Anion and Singlet Oxygen'. This study confirmed that the scavenging or quenching activity of melanin against superoxide anions ($O_2^{\bullet -}$) and singlet oxygen ($^1O_2$) is an important photoprotection mechanism of melanin in skin. This study was supported by many collaborators. I especially thank Prof. M. Kohno and Prof. Y. Niwano at New Industry Creation Hatchery Center in Tohoku University. They taught me the basics EPR. I also thank Prof. S. Kasai at Center of general education, Tohoku Institute of Technology, where I have worked for the last eight months.

My background is in the biomedical and biochemical fields. Here I have used X-band or L-band EPR under wet conditions such as in vivo, ex vivo, or in situ, to elucidate structure and function.

This was my first attendance of the APES meeting. The APES meeting had many topics related to biochemical studies, which were carried out by using CW-EPR and pulsed EPR spectroscopy and at high microwave frequencies. I found the many of the topics and presentations really exciting. I made many new friends and contacts and enjoyed the hot poster session discussions. APES2010 was an important event for me. I hope to keep in touch with everyone.

Finally, I am grateful to the organizers of Yukawa Memorial Foundation for the financial support.

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netic spectroscopies. To honour his memory, and on behalf of the Segre family, GIRSE is proud to advertise the second edition of the Ulderico Segre Prize.

The Prize will be awarded for an outstanding doctoral thesis. Eligible theses must discuss theoretical and computational models and advanced methodologies for magnetic resonance spectroscopies.

The winner will be selected before the VIII EFEPR Meeting (Frankfurt, Germany, 21–25 August 2011) and the Prize will be awarded during that Meeting. The doctoral theses will have been formally approved by the nominee's thesis committee between May 1, 2009 and April 30, 2011. The degree need not have been formally awarded during this period.

Nominations must be made by e-mail to the Secretary of GIRSE. The nominator must be the supervisor of the nominee's doctoral work or a member of the nominee's thesis committee. The applications should consist of pdf files of the following material:

- a letter of nomination;
- the nominee's thesis;
- a separate summary of the contributions contained in the thesis, written by the nominee (no more than 2000 characters);
- a brief biographical sketch of the nominee;
- a brief documentation showing when the thesis was approved.

Nominations and the accompanying documentation must be written in English. The winner will receive an award of € 3,600.00. The winner will be notified by the June 17, 2011 and she/he is expected to attend the VIII EFEPR Meeting where the Prize will be received.

The Ulderico Segre Prize Committee consists of Marina Brustolon, Angelo Alberti and the GIRSE Executive Board at the time of the deadline for nominations (Paola Fattibene, Elio Giamello, Marco Lucarini, Maria Francesca Ottaviani, Pierluigi Stipa). Further details will be available soon (January 2011).

The deadline for nominations is May 20, 2011.

Gian Franco Pedulli
President of GIRSE

Another Passion

Pottery – A Love Story

Daniella Goldfarb

It all started about ten years ago when Gali, a former student of mine, mentioned with much enthusiasm a new hobby of hers – pottery. This brought back old memories of pottery classes I loved that I took as a kid but stopped because I also wanted to play tennis and my parents told me that I could not do both and, therefore, had to choose between the two. I chose tennis and forgot about the pottery. Thirty odd years later I finally found myself in a situation where I could actually do what I wanted – my daughters were out of the house so time had stopped being as expensive as it used to be. I told Gali that I would give it a try and decided to join her pottery classes – this turned out to be the beginning of a love story – orthogonal to my scientific work, though I did find a few things in common. I discovered that I could still surprise myself and what a great feeling that is.

From the start I wanted to work with the wheel rather than do hand work which I found too slow and requiring a great deal of patience. The wheel on the other hand seemed fast and technically challenging (at the beginning), just right for a physical chemist – albeit the technology involved is at the level of prehistory. Initially it was not as easy as I thought. I got this pack of soft clay that I needed to control on the fast turning wheel and shape into something recognizable. That chunk of clay danced on the wheel, refused to obey me and collapsed when I thought I had almost made a small ugly ash tray (although I do not smoke and nobody around me does). Was I going to declare myself beaten? Certainly not! I continued to fight this poor chunk of clay for several classes, while many of my more patient classmates were taking their breaks and making nice handmade dishes – and not having to face continuous failures. The teacher following my desperate struggle at the wheel was rather amazed that I was not discouraged by failure. I told her that as a scientist I was used to, and trained to, face things that are not always working, and if they do, it is often not as we planned or wished, but in the long run things happen and some new and interesting findings emerge. So I hoped that with pottery it would be the same. It was! And finally I managed to control the clay, love its touch and eventually make forms that satisfied me.

I have filled my house in Rehovot with my creations – anything you can think of – bowls, coffee mugs, plates, vases, lamps, tables (painting the tiles), decorative plates hanging on the walls and some other abstract decorations – all the cupboards are full, there is no room left for anything. A few years ago we bought a second house in northern Israel and my husband is sure that my secret motivation for buying this house was that I needed space for my pottery. So now there is another house full of plates, mugs, lamps... etc. and even a studio waiting for my retirement in a million years. And now with the second house filled – what next? I was lucky that my daughters got married – lots of dishes to make. First Yael, who as a wedding gift was presented with a full set of dishes for eight and four years later Sivanne's surprise wedding present was another full set. However, you can imagine that as I got better at my craft, the second set looked finer than the first, so now I have to make another one for Yael that will match the performance of Sivanne's set and this can keep me busy for many more years until my very young granddaughters reach the right age.

I work in a studio that is run by the municipality of Rehovot. I go there once a week from 5 to 9 pm. I try to get there earlier but somehow there are too many strong strings that tie me to the lab, preventing me from leaving really early (4 pm...). In any case I try never to miss a session, unless I am abroad and every one at Weizmann knows that any meeting on Sunday (my pottery day) has to end by 4:30 pm. I referred to the pottery class as a session and not as a class because it is not a class anymore, we are a group of 5-6 girls (ladies.. no men around for some reason) that have been working together for a long time. Some of them have a studio at home but they still come for the company and the inspiring atmosphere. For me it also has a social value, connecting me to the real world away from the ivory tower of academia where I spend most of my time.

So why do I like it so much? I often arrive at the studio stressed, sometimes nervous and in a bad mood, but when I leave, I am always relaxed with a pleasant feeling that the session was too short and I am already looking forward to next week. It is never enough. My husband loves to come and pick me up – he says that then I am always nice and smiling when I come out. When I work with the clay, I feel that I am creating something from nothing without using my head but with my soul and my heart. I may argue that science is our soul and heart – but this requires a considerably well organized intellectual effort which is something I refuse to apply to my pottery work. With the pottery I just flow. I have to concentrate on the clay and on the shape I want to create for if I don't, it collapses. So there is no more space in my head for thoughts related to the stress of work. It cleans my mind – a feeling like discharging a capacitor. So you may even call it occupational therapy, a way to dissipate stress and unlike a visit to a psychologist – cheaper, and you get to bring something home.

Recently I was introduced to the concept of "mandala" which is a Sanskrit word that means "circle". The mandalas are concentric diagrams that have spiritual and ritual significance in both Buddhism and Hinduism. However, I am interested only in their esthetic aspect. The mandalas start from the center outwards and lead to beautiful intuitive forms and colors that are great decorations for round shapes, bowl and plates. With patience I never knew I had I start at the center of the round dish and develop outwards without any plan, just flowing with my feelings and at the end – even without knowing how to draw – something beautiful emerges. So now I am into large plates decorated with mandalas. Next year I will have to think about something else.

65th Birthday of Dante Gatteschi

It is not easy to assess and to describe the figure of a friend, even if he is an outstanding scientist like Dante Gatteschi. Dante is turning 65 this year and more than forty years of a deep reciprocal friendship may induce distortion and prejudice. But it is always a pleasure and I sincerely thank Laila Mosina, Editor of this newsletter, for this grateful task. Dante Gatteschi was born in Florence on the 27th of October 1945. He got his degree in Chemistry in 1969 in the Laboratory directed by Luigi Sacconi and actively participated in the birth of the Inorganic Chemistry School of Florence, which was at that time mainly devoted to the development of coordination chemistry. In my personal view, it is however important to stress that, since the very beginning of his scientific career, Gatteschi moved away from the traditional research themes of the Florence School. In that period Dante was attracted by any kind of spectroscopy, and EPR, with its inherent power of providing well defined information about the electronic properties of metal complexes, was for sure the preferred one. Since this period he has been known in the chemistry community as one of the most outstanding EPR spectroscopists for metal-ion-containing systems. The work he performed in that period, coupled with the achievement of a relevant theoretical background in quantum chemistry, would have then provided the basis of the approach he established in developing the investigation of many issues relevant to molecular magnetism. The characterization of both homo- and hetero-dinuclear metal complexes, followed by the study of the EPR and magnetic properties of polynuclear entities, constitutes the basic prelude of his subsequent fruitful activity. Indeed, the analysis of the energy terms characterizing dinuclear and polynuclear paramagnetic systems and his ability in manipulating spin Hamiltonians allowed him to address his attention to the investigation of magnetic materials. I want to stress here that his book with Alessandro Bencini, "EPR of Exchange Coupled Systems", constitutes to date the reference source of this chemical topic. At the end of the 1980s, visiting the laboratory of Louis-Claude Brunel in Grenoble, he suggested the design of an HF EPR spectrometer, showing how this technique could provide a breakthrough in the analysis of the electronic properties of paramagnetic clusters. Since this period Anne-Laure Barra, researcher at

LNCMI in Grenoble, developed with Dante and his Florence group an active and highly fruitful research program in this field.

This culture and sensitivity led him and his coworkers (I would like to stress here the contribution of Roberta Sessoli) to the discovery of single-molecule magnet behavior, i.e., the discovery that some molecules, with high-spin ground state and large easy axis anisotropy, behave at low temperatures as tiny magnets with a remnant magnetization of purely molecular origin. These studies led to the unequivocal observation, for the first time, of mesoscopic quantum tunneling of the magnetization by revealing transitions between magnetic states that were not driven by thermal fluctuations. This achievement, which has been recently selected as a milestone in the research on spin chemistry of the 20th century, as stated by the publication on Nature Milestones (Milestones in Spins, www.nature.com/milestones/milespin/index.html), can be compared with the discovery of macroscopic quantum effects in physics, like the Josephson effect. In a less restricted scenario this discovery opened the researchers' minds to the investigation of systems in a mesoscopic dimension. This has been shown to provide a new physical regime, where quantum and classical effects coexist and where new physical properties of the matter may allow an improvement of humankind knowledge and new technological opportunities. Dante proved in this period that HF EPR could be a tool of fundamental importance for the investigation of these systems, and can provide very detailed information about the spin-Hamiltonian terms driving the exotic behavior of these systems at low temperature. He received several awards for his scientific activity. In the present context I would like to mention the Bruker Prize for EPR Spectroscopy (2000) and the Agilent Technologies Europhysics Prize (2002 with R. Sessoli).

Since 1980 he has been a full professor in Inorganic Chemistry at the University of Florence. His activity has focused on several subjects in Inorganic Chemistry. According to the depersonalized and arid locutions currently used in chemical literature, his main scientific interests are: Theoretical Inorganic Chemistry, Magnetic Interactions, Electronic Structure of Metal Complexes, Interactions of Metal Ions, Organic Radicals, Electron Paramagnetic Resonance (EPR) Spectroscopy, and Molecular-Based Magnetic Materials. In the mainstream thought many significant aspects of his work have been stressed. However, beyond diversifying the laudatory appreciations and opinions, it should be emphasized that his highest merit comes from the key role he has played in developing a research area, i.e., magnetic materials, whose extension and perspective were largely unforeseen and unexpected.

It is important to mention that Gatteschi did not formulate any revolutionary theory, but he was the author of many significant scientific discoveries. Although in determining the relevance of a scientist the feature would often be underestimated, it is worth mentioning his particular and personal approach towards the deductive-nomological model in the relationship between the experimental data and the scientific explanations to be proposed. His approach does not fall in the rigidity of the Descartes mathematical model, which constitutes the basis of Western scientific revolution, or in the theology of the Newtonian approach.

Sometimes during his scientific discussion, he reminds me of Diderot and his egg. This means that simplifications are allowed if one is aware of the remaining difficulties dictated by the complex nature of the investigated systems. His message is a synthesis of interpretation, criticism, communication and educational perspective and there is no doubt these features have characterized the achievements and the developments of molecular magnetism in Florence. In that context he has strongly promoted the birth of a scientific group in Florence by gathering around him several young talented co-workers: Bencini, who ceased to be two years ago, Caneschi, Sessoli, Cornia, Sangregorio and Sorace who are now very well established scientists. The research philosophy and activity of the Florence group are actually considered a reference excellence target in the international context. For this reason in the scientific community he is considered one of the pioneers of molecular magnetism and an excellent scientist in the chemistry world. The results of his activity are collected in more than six hundred articles and in very famous text books, the latest one being "Molecular Nanomagnets", (Roberta Sessoli and Jacques Villain co-authors).

His scientific activity, however, cannot be reductively analyzed in terms of relationships between explanandum and explanans, i.e., nomic expectability in the regular account of causation. Gatteschi, in addition to the Florence Laboratory LAMM, was so clever to foresee thirty years ago the intrinsic limits of the scientific activity of a culturally isolated laboratory in the modern scientific world. This view led him to promote the foundation of a national endowed institution like the National Institute of Science and Technology of Materials (INSTM), which constitutes a very efficient network between all the Italian universities and research centers. Since its foundation, Gatteschi has been the director of this Institution. Along the same line, he successfully attempted the federation of all the European Laboratories with the aim of building a European research culture in the field of molecular magnetism with the same philosophy moving towards European integration.

I sign this presentation, but I am aware that I am doing it because the first co-worker of Dante, Alessandro Bencini, who unfortunately disappeared, cannot do it. I hope, Sandro, I might receive your approval.

Andrea Dei
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Hal Swartz:
an interview to the *EPR newsletter*

EPR newsletter: *Dear Professor Swartz, on behalf of the readers of the EPR newsletter we congratulate you on your 75th birthday. We are most appreciative that you agreed to answer the questions of this interview. Why did you start towards your career in science and why was it EPR?*

I did not start my career in science in EPR, but came to it only by accident. I was fascinated by research when I was in college and participated in several different research projects, ranging from fruit flies to parasites. I really did not have a particular focus in any area of science but enjoyed all fields that I encountered. So when it became time to decide on the next steps in my education, I took the easy way out and did something that at least superficially appeared to involve science but did not require making any choice of field—I went to medical school!

When I was in medical school I started to get involved in research more seriously. In the summer after my first year of medical training, I carried out a research project to try to determine the origin of "factor 3", a potential new vitamin. I designed a dietary experiment with rats to determine the effects of a diet deficient in factor 3 by feeding them a synthetic diet reported to be complete except for factor 3, with two subgroups that received stratins of yeast expected to differ only by the presence of factor

3 in one of them. My research was sponsored by my father-in-law whose business was to extract vitamins from yeast left over after brewing beer! I had no real external guidance as to what to do, so I did it myself and in the process learned a lot about designing and carrying out research. This turned out to be a theme of much of the development of my scientific career: learning things on my own without a real mentor. Not very efficient but perhaps a good way to learn more thoroughly, experiencing problems, and then needing to work out the solutions through reading, thinking, and trials.

My next research project, also in medical school, was a bit more structured, but it again involved a high degree of independence: I studied the effects of dietary cholesterol on the development of atherosclerosis. While this research wound up convincing me of the personal importance of cholesterol on health and influenced my advice for patients and family about dietary cholesterol and prevention of heart disease, it did not have a major influence on my life-long direction of research. Instead, my clinical years in medical school were simply too full to do much research. Nevertheless, I did start during my clinical training to learn about the effects of ionizing radiation on humans, which fascinated me as a clinical problem as well as being a potentially fruitful area for future research.

After my internship, like all young doctors in the USA at that time, I was obligated to serve in the military. During my military orientation for entering physicians, they showed us some results of radiation on human subjects and some of the research that the military was undertaking in that field. I was fascinated and a little skeptical about these 'facts' and immediately asked where they had obtained their data and what kinds of studies were being done. I was informed that the military had a special set of specialists, termed "nuclear medical officers' (very different from the specialty that is now termed Nuclear Medicine), and that interested physicians who qualified could undergo a specific educational program to become one of these specialists.

I applied to this special program in nuclear medicine and, after spending a year doing general medical care in the army, I was accepted to the MSPH program at the University of North Carolina, Chapel Hill for an intensive year of training in radiation physics and biological effects of radiation. After this program,

we (there were about 10 military trainees in the group) then spent several weeks learning what was going on at sites such as Los Alamos and Nevada Test Site, followed by an intense short course in military radiation biology.

Based on this training and experience, I decided I wanted to do my initial research on the mechanisms of the action of drugs designed to protect against ionizing radiation. I was assigned to the Walter Reed Army Institute of Research (in the fall of 1962) to further my research career in this area. Although already knowing the general area in which I wanted to conduct research, it was not clear in which laboratory and with which team of collaborators I would work. The initial plan was for me to rotate through several laboratories and determine which would be the best fit to carry out my research.

The first laboratory on my 'rotation' at Walter Reed carried out research using two instruments that I knew very little about: Varian NMR (A-160) and EPR (V-4500) spectrometers. While the NMR instrument was already being used by an excellent scientist, no research was ongoing using the EPR instrument. The chief operator of the instrument was a private (who had achieved that rank, starting from an initial level of Captain, through diligent drinking) who explained to me how to use the instrument. I immediately saw a great fit to my interests and decided to do a crash self-study to learn about the principles and research areas in EPR and began to apply it to a study of the role of free radicals in the mechanism of action of the radioprotective drugs (structural analogs based on β-mercaptoethylamine ("MEA").

As it turned out, I never bothered to rotate beyond this lab and EPR. I wound up spending eight years there, gradually extending my research to include the effects of oxygen on cellular damage. I used an offshoot of my research, which seemed like a nice compact and solvable problem, as my thesis topic, earning a PhD at Georgetown University during the period 1968–1970. My research was again pretty much a "do it yourself" project, where a professor in Biochemistry agreed to serve as my thesis advisor even though he had no real background in ESR. However, he did insist on my obtaining a high degree of academic rigor in my data analysis. I was fortunate to have an excellent EPR expert, Heinz Schleyer, on my thesis committee who also helped make sure my data and conclusions were correct.

In spite of strong advice to the contrary from many researchers and advisors along the way, I have continued to focus my research career around a technique, EPR. I have not regretted that at all. EPR is such a powerful and versatile technique that I have been able to pursue a wide range of problems of interest, utilizing a technique for which I have developed some considerable familiarity. It has also afforded me the exciting opportunity to combine my M.D. and Ph.D. training and perspectives and pursue my lifelong interests in improving clinical care for several major diseases through applications of EPR oximetry and improving the delivery of public health care for disaster situations through using EPR dosimetry.

What do you think about the young generation of the EPR researchers and what is your message to them?

For many years, the field had seemed to be attracting relatively few new researchers, but amongst these were very competent and enthusiastic scientists . I have been especially lucky in regard to attracting exceptionally talented young investigators, with many of my present highly regarded colleagues having started their research using EPR as my students, post-docs, and research associates. I am very proud of these associations and the accomplishments of these very talented individuals. I am encouraged that there now appears to be a growing number of individuals entering the field and that so many of these seem to be exceptionally competent. I think that this growth has occurred because of the exciting recent developments in both the technical capabilities of EPR and the very interesting problems to which it is being applied, especially in the life sciences.

I have thought a lot about what advice those of the more "mature" cohort should give to our younger colleagues, and I believe that we have much to impart to them that might really be useful.

First and foremost, it seems that the most important ingredient for success is to have a willingness to work hard. Bright ideas will not lead to desirable results without a willingness to work hard at them and to persevere in the face of potential barriers. Hard work will overcome logistical problems and even what sometimes seems to be a scarcity of good ideas and good problems. Hard work, combined with thoughtful consideration of the results and what they may mean ultimately will lead to excellent insights and generate exciting and productive ideas to pursue.

Second, it is essential that scientists be very demanding of themselves about the quality of the work that they do. While it always is desirable to be able to convince the reviewers and readers of your work as to its quality, the most demanding person that one should need to satisfy is yourself. It is not too hard to fool somebody less familiar about your work by strongly asserting that your data and conclusions are well founded, so you must be sure first that you do not fool yourself in this way, let alone attempt to fool others. You are often the only person who has indepth and critical knowledge about possible defects or shortcomings in the data that you have produced, and therefore you must be intensively self-critical as to the full validity of your data and conclusions.

Third, I strongly advocate that success in this competitive world is much more likely if you find a niche where you have particular expertise and then continue to build on it. There are lots in interesting problems in the world, but also ▶

lots of very competent people out there who are capable of pursuing them. However, if you establish areas of special expertise and indepth understanding, you then are in the best position to compete successfully.

Fourth, do not be afraid to reach out to work with others and to share fully your ideas. Good colleagues—young and 'mature', directly in the same field and in related areas of research— are an invaluable asset. And you should never hesitate to share fully your ideas and your techniques—if you cannot do better with them than anyone else, then you are indeed in trouble, because you have had a very significant head start on them.

Fifth, always be respectful and considerate of all other scientists. This does not mean that you should not criticize, but this must be done in a constructive manner. This is not only good human behavior, but it also has practical implications, because those same individuals are likely to be in a position someday that could affect your career. Make sure that they do not have reasons, external to the quality of your science, to make harsh judgments.

Finally, remember that you have a continuing obligation to teach your colleagues, especially your younger colleagues. You have gotten to where you are due to the efforts of others and you, in turn, need to continue this tradition for the future of science and EPR in particular.

What would you have done if given a different opportunity?

I am not sure that there is any thing very different than I wish I had done or missed opportunities. I have been very fortunate in having environments where I could succeed if I worked hard, in having people in authority who supported my efforts and gave me the flexibility to be inventive, and in finding colleagues whose collaborations have made my contributions to the work appear to be substantial, even though that often builds importantly on their originality, competence and hard work. Finally, I have been especially fortunate in finding, in my wife Ann, a real partner who has made it all possible and enjoyable.

So I would not have wished for any "make-over", I wish only to continue to pursue my research with continued opportunities and the good health, good colleagues, and my partner to help me carry it out. At this time, in spite of the calendar, I feel that I am at the most vigorous and productive stage of my life, and I anticipate continuing to experience the excitement and challenges of new developments and improvements in all aspects of my career as a scientist, clinician, mentor and partner.

Notices of Meetings

2011 ACERT Workshop on "ESR Microscopy and Its Applications in Biomedical ESR Imaging"

Cornell University, Ithaca, New York, USA, January 16–18, 2011

www.acert.cornell.edu

The objective of the workshop is to raise awareness in the biomedical community to the potential of ESR Microscopy, especially in relation to ESR Imaging. Topics will include a cross-section of up-to-date ESR Microscopy and ESR Imaging techniques. We envision that a typical attendee will include those interested in the potential of ESR microscopy and those who want to learn its operation and applications. This workshop is suited for graduate students and postdocs who would benefit from learning what advantages ESR microscopy can offer for biomedical and related studies.

To register for the workshop, please print the Registration Form from our website www.acert.cornell.edu and mail with payment to:

ESR Microscopy Workshop,
ACERT Cornell University
B28 Baker Laboratory
Ithaca, New York 14853, USA

Key lectures, given by leading specialists include the following:

ESR microscopy – current capabilities and future directions, Dr. Aharon Blank, of the Technion – Israel Institute of Technology

Image formation and reconstruction approaches using pulsed ESR spectroscopy to obtain spectroscopic images of a paramagnetic tracer (Tent.), Dr. Murali Krishna Cherukuri of the National Cancer Institute (NIH)

ESR microscopy of molecular probes in cells and polymeric materials (Tent.), Dr. Periannan Kuppusamy of the Ohio State University Medical School

In vivo distribution of trityl spin probe with EPR microscopy (Tent.), Dr. Howard Halpern of the University of Chicago Medical School

Oxygen concentration and redox metrabolism with trityl probes in cardiac myocytes (Tent.), Dr. Jay L. Zweier of the Ohio State University Medical School

ESR microscopy for biological and biomedical applications (Tent.) Chang Seok Shin, Lawrence Berkeley National Laboratory

Advances in time-domain EPR imaging: towards slice-selected, globally phase-encoded echo-based FT-EPR imaging and quantitative in vivo oximetry, Dr. Sankaran Subramanian of the National Cancer Institute (NIH)

Climbing to Bio-Med: an historical overview, Dr. Oleg Grinberg of the University of Dartmouth Medical School

ESR microscopy at ACERT, Dr. Jack H. Freed, ACERT, Cornell University

Instrumentation for ESR Microscopy, Mr. Curt Dunnam ACERT, Cornell University

Please contact us directly at acert@cornell.edu for more information.
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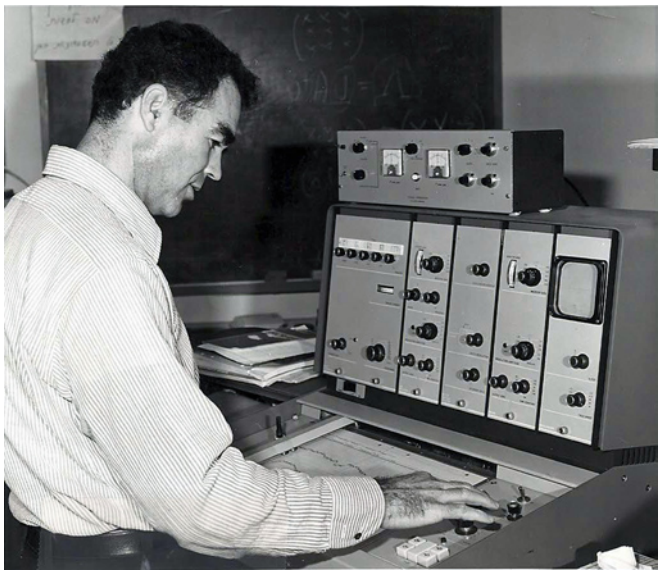
EPR in Israel



The Early Days of Chemical Application of Electron Spin Resonance in Israel

Zeev Luz
Chemical Physics Department, Weizmann Institute of Science, Rehovot, Israel

Application of Electron Spin Resonance (ESR or EPR) spectroscopy started in Israel when the method was still in its infancy. It was first introduced in the country in the mid 1950's, by Professor William Low (Zeev Lev) of the Hebrew University (HU) in Jerusalem. After completing his Ph.D. with C. H. Townes at Columbia University, Low joined the Physics Department of the HU and set up a microwave spectroscopy laboratory. Around 1955, following a short visit with Bleaney in Oxford he extended it to include EPR. In certain aspects this laboratory is still operational under his then student, now Professor Emeritus, David Shaltiel. Shaltiel graduated from the Technion (Israel Institute of Technology, Haifa) in Electrical Engineering and then did an M.Sc. degree with A.M. Portis in Philadelphia, where he learned the trade of building EPR spectrometers. He returned to the Technion in 1955 and simultaneously constructed two EPR spectrometers: one, in the laboratory of Jan Genosar at the Technion and the other in Low's laboratory at the HU. Shaltiel did his Ph.D. under Low's supervision in the Technion and eventually joined the Physics Department of the HU. The emphasis in Low's laboratory centered on studying paramagnetic sites in solids and characterizing their spin Hamiltonians. Much of the early work in Low's laboratory is described in his book, "Paramagnetic Resonance in Solids" (Academic Press 1960). In 1962, Low received the prestigious "Israel Prize in Exact Sciences" for his pioneering contribution to this field. Research in EPR continued in the HU by several of Low's students. Others established EPR centers outside the HU as, for example, Yehuda Suss, who set up such a laboratory in the Soreq Nuclear Center.

The late 1950's and early 1960's mark an increasing interest in radiation chemistry and the chemistry of free radicals and, with it, an interest in chemical applications of ESR. Low's laboratory appeared at the time too physically oriented and remained, sort of, out of bound for the chemistry community. At about that time the Varian Company started to market reliable and easy-to-operate ESR spectrometers for experiments on both solids and liquids. Accessories for in-situ irradiation, in-situ electrolysis, premixing of reagents, variable temperature measurements and measurements of aqueous samples were also provided. All this made the Varian spectrometer very much chemistry friendly and within less than a decade several ESR centers popped up in Israeli Scientific Institutions. In this article I will briefly mention the ESR-Chemistry centers that were established in the country up to the mid 1970's. In the following decades a younger generation of ESR spectroscopists, mostly students of the older generation scientists set up new and modern laboratories, which turned Israel into a major world center of ESR. In subsequent articles some of them tell their own adventures in the field.

The first of these chemistry-oriented EPR centers was the initiative of the late Professor Gabor Stein of the Physical Chemistry Department in the HU. In 1963 he acquired an X-band Varian spectrometer and nominated the late Dr. Chia Eden to be in charge of it. EPR was not the main interest of Eden, and so the laboratory remained dormant for some time, until, in 1965, Haim Levanon, then an M.Sc. student of Stein, decided to do his Ph.D. in the field of EPR and took charge of the laboratory. Stein asked me to be a co-adviser for Levanon's thesis. As its main topic, we chose spin relaxation of paramagnetic ions in solutions. The work included quantitative interpretation of the spectral lineshapes in terms of the relaxation theory. It also provided structural information on paramagnetic complexes, often not otherwise obtainable. This EPR laboratory became the core around which Haim Levanon, after returning from his postdoctoral training, built his time-resolved ESR center, as described in his own article.

In 1964 I returned to the Weizmann Institute (WI) from my Postdoctoral training in the USA, to start my own research in the field of Magnetic Resonance (MR). Brian Silver returned at about the same time and we started to collaborate on application of ^{17}O NMR to study dynamics in chemical systems. We had an essentially free supply of water enriched with heavy oxygen isotopes, which we used to prepare ^{17}O labeled materials for NMR studies. This "heavy water" was obtained from the isotope separation plant set up by Professor Israel Dostrovsky, more than a decade earlier. It occurred to us that we could likewise prepare heavy oxygen enriched material for the production of labeled free radicals and use EPR to study their ^{17}O hyperfine interactions. As in those days the WI did not own an ESR spectrometer, we used the HU one, until we acquired our own in 1969. The results provided improved spin density maps for radicals with "blind" sites in the absence of ^{17}O labeling. The solution spectra often exhibited pronounced linewidth variation of the ^{17}O hyperfine satellites which we analyzed in terms of the then popular Freed & Fraenkel relaxation theory. The ^{17}O project continued for nearly a decade, also after Silver left for the Technion in 1968. Starting with Moti Broze in 1966 (at WI) several graduate students made their Ph.D.'s on this project in both institutions.

In the early 1970's Eva Meirovitch (now professor at Bar Ilan University) started her Ph.D. in the MR group at the WI, analyzing the manganese EPR spectrum of single crystals of concanavalin A (co-advisor, J. Gilboa). As part of her Ph.D. she also used EPR to study mesomorphic properties of smectic liquid crystals (co-advisor, S. Alexander). Upon returning from her postdoctoral training (1980) as an independent researcher, she used the WI EPR spectrometer to study dynamics of spin probes in membrane systems, before moving on to other projects.

A special topic related to our research at the WI in those years concerns the theory of dynamic lineshape and spin relaxation, which started with the study of the ^{17}O labeled radicals in solution. The activity was stimulated by a visit of Jack Freed during 1971, about the time that Asher Baram (now at the Soreq Nuclear Center) started his Ph.D. in this field. This project continued at the WI for an extended period by other graduate students and researchers, including, in particular, Eva Meirovitch and Raphy Poupko. Throughout this activity Shlomo Alexander (HU and WI) provided continuous inspiration and guidance until his premature death in 1998.

Daniella Goldfarb did her Ph.D. (1980–1985) in the same MR laboratory, using NMR to study discotic liquid crystalline systems. The project required extensive material preparation and isotopic labeling, which were carried out by Herbert Zimmermann (MPI, Heidelberg). It, thus, also marks the beginning of the long-term collaboration between him and our MR group at the WI, which still continues. After completing her Ph.D., Daniella went to post-doc with Larry Kevan and returned to the WI as an accomplished EPR spectroscopist. The WI EPR spectrometer became the seed for her present day laboratory. Shortly thereafter Lev Weiner, an experienced EPR spectroscopist from the Novosibirsk school, joined the WI and set up an EPR laboratory in its Chemical Research Support unit. Both he and Daniella tell their story in the pages below.

The chemistry faculty at the Technion established an EPR laboratory in 1966. Aharon Loewenstein with his then student, Raphy Poupko, used it to study free radicals produced by oxidation of alcohols and amino acids in solution. Poupko then moved to the WI, in time to accept the newly arrived spectrometer mentioned above. When Silver joined the Technion in 1968, he adopted its EPR spectrometer as his main research tool. He first used it for the ^{17}O project and other physically oriented topics, but subsequently moved to more biologically minded problems, until his premature death in 1997. ESR activity in the Technion was revived along quite different lines with the arrival of Aharon Blank in 2005, as described by him below.

Two other spectrometers which belong to those early days need to be mentioned. The first was acquired in 1966 by Kedma Bar-Eli at the Chemistry Department of Tel-Aviv University, who just returned from a postdoctoral training period with Tom Tuttle at Boston University. He used it for several years to study the properties of solvated alkali ions in methyl amines. It was also used by Gil Navon to study paramagnetic centers in single crystals, but eventually the spectrometer changed hands and moved to Levanon's laboratory in the HU.

The last spectrometer from those early days was acquired by Alexander Wolberg at around 1971 to be used at Kamag in southern Israel. Wolberg fell in the Yom Kipur war. I have no knowledge of any application of this spectrometer.

EPR at the Weizmann Institute of Science

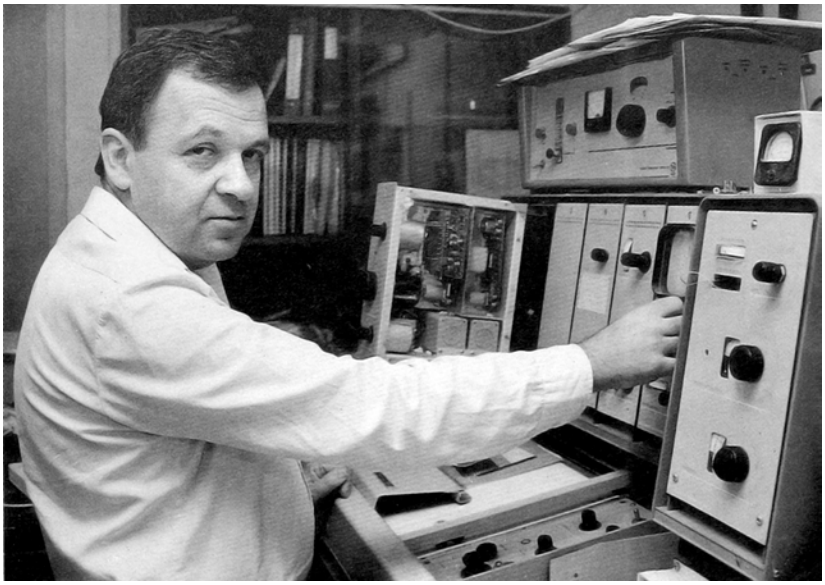
Lev Weiner and **Daniella Goldfarb**
Faculty of Chemistry, Weizmann Institute of Science, Rehovot, Israel

The Weizmann Institute of Science (WIS) is a research Institute established some 75 years ago and is focused on the promotion of curiosity driven science. It is situated in a beautiful green campus in Rehovot, a town south east of Tel-Aviv. The Institute counts some 250 research groups and some 2600 staff in total. There are five faculties on campus, Mathematics and Computer Science, Physics, Chemistry, Biochemistry and Biology. The Weizmann Institute has a graduate school with some 1000 M.Sc. and Ph.D. students and 150 post-docs. The Faculty of Chemistry includes about 55 tenured and tenure-track academic members, distributed throughout five research-oriented departments. There are two EPR labs in the faculty of Chemistry, one is a central facility part of the Chemical Research Support unit, headed by Dr. Lev Weiner, and the other is the specialized laboratory of Prof. Daniella Goldfarb at the Department of Chemical Physics.

Chemical Research Support Lab

I (Lev Weiner) have established the ESR central facility when I joined the WIS in the early 90's after I immigrated to Israel from Novosibirsk, the former Soviet Union. We have two Bruker EPR spectrometers: a "new" ELEXSYS 500, purchased in 2002, and an "old" ER 200D-SRC, purchased in 1993. The ELEXSYS 500 has X- (3.2 cm) and Q- (8 mm) bands, and is equipped with low-temperature cooling, e.g., down to liquid helium temperature. For routine measurements at room and liquid nitrogen temperatures, we use the ER 200D-SRC. Photochemical experiments are carried out on both spectrometers. The lab is being used by researchers from the Chemistry and Life Science departments from the Weizmann Institute and from Tel-Aviv University.

The research interests of the lab focus on biochemical and biological applications of cutting-edge methods in ESR spectroscopy, including spin labeling and spin trapping



techniques, and characterization of stable nitroxide radicals, in biophysical studies. Some examples are: (a) development of nitroxide probes possessing pH-dependent ESR spectra for ESR imaging both in cell cultures and in vivo; (b) use of EPR for determination of the thiol status in individual proteins and in living cells. Recently topography of SH groups in pyridoxal dependent enzyme, alliinase from garlic, was determined using this approach. Note that ESR data (at physiological conditions) were in good agreement with the X-ray structure done for this enzyme (Prot. Sci., 18, 196–205 (2009)); (c) molecular mechanisms of generation of reactive oxygen species by redox-active compounds, including antitumor drugs using spin-trapping technique; (d) design and synthesis of novel redox-active quinones, covalently conjugated with either polypeptide hormones or antibodies, to produce targeted damage of cancer cells; (e) studies of the folding and unfolding of the synaptic enzyme, acetylcholinesterase, stabilization of partially unfolded states of the enzyme by chemical and pharmacological chaperons; (f) resolving the molecular mechanisms underlying the therapeutic activity of the natural thiosulfinate, allicin, which is found in garlic; and, finally, a novel time-resolved ESR method, utilizing photo oxidation of nitroxyl radicals by Ru^{3+} complexes for quantitative measurement of electron transfer in chemical and biological systems, was recently developed and implemented. Site-directed spin-labelled bacteriorhodopsin was used as a model for the method.

We have strong long-term collaborations with the groups of Georg Gescheidt (Technische Universität, Graz, Austria), Marina Brustolon (University of Padova, Italy), Valery Shnyrov (University of Salamanca, Spain).

Daniella's group:
Bottom right to left: Erez Matalon, Daniella Goldfarb, Ilia Kaminker, Akiva Feintuch
Top right to left : Nurit Kuszpet, Debamalya Banerjee, Marina Radoul, Anastasiya Sushanko, Marc Florent, Michal Gordon-Grossmann

Department of Chemical Physics Lab

The second EPR lab of the Weizmann Institute is in the Chemical Physics Department, which includes three experimental groups highly engaged in basic Magnetic Resonance Research (Frydman, Vega and myself (Daniella Goldfarb)). Of these three, my laboratory is dedicated to modern EPR spectroscopy and the other two to NMR. The lab was established at 1987, when I joined the Weizmann Institute as a young scientist and built the first pulse EPR (X-band) spectrometer in Israel, using the magnet of the Varian E12 available in lab of Prof. Zeev Luz (see pictures). At that time, the spectrometer was used for both CW and pulse experiments. The lab has grown and the homebuilt pulse spectrometer that served us extremely well for 15 years has been replaced by a commercial spectrometer, the Bruker Elexsys 580. During this time we built a pulse W-band EPR spectrometer, based on a Russian microwave bridge – the so-called "Krymov" bridge. This spectrometer again was extensively used for about 10 years until it required a serious upgrade. Three years ago this original, first prototype "Krymov" microwave bridge was replaced with a new in-house designed and built microwave bridge. We have lots of fun with this new high-power bridge. The old microwave bridge functions as a CW bridge and we are still using the Varian E12 spectrometer for CW X-band EPR measurements on samples that do not require high sensitivity. Many of its original parts have been replaced including the magnet, but the console is still there and it has the same look. When we need high sensitivity measurements, we go the lab of Lev Weiner.

Currently my group consists of wonderful young co-workers from Israel, France and India – five Ph.D students, one post-doc, one part time undergraduate student and one M.Sc. student. In addition, we are lucky to have the technical support of an electronic technician and of an absolutely superb, retired part time microwave engineer and a research associate, shared with the NMR groups. In terms of software development we use the great "SpecMan" and we are well looked after by Dr. Boris Epel, once a post-doc in my lab and now at the University of Chicago. The lab is situated at what has been referred to for many years as the "Perlmann second floor", a synonym for the magnetic resonance group that includes the groups of Profs. Frydman, Vega, us – and Prof. Zeev Luz that is still active and always

ready to discuss magnetic resonance and teach it. It is this very special concentration of hard core magnetic resonance activities – NMR (solids, liquids and imaging), EPR and their combination (DNP – dynamic nuclear polarization) that makes us all resonate so well. It is a most inspiring atmosphere with a bi-weekly magnetic resonance seminar (other groups from other departments engaged in magnetic resonance research join as well) that has been running for more than 40 years! In addition we have our own weekly EPR group meetings where we study together new papers (and old ones) and discuss our recent results. The spectrometers are working hard, particularly the W-band spectrometer that runs around the clock. Recently, together with Shimon Vega and Akiva Feintuch, we have completed the design and construction of a 95 GHz/144 MHz DNP spectrometer that is both an NMR and a pulse EPR spectrometer. It is dedicated for the investigation of the spin physics underlying high-field solid-state DNP.

What science do we do? We develop pulse EPR methodology, aiming at improving resolution and sensitivity, designing new experimental techniques and improving instrumentation. We apply all possible techniques at both X- and W-band, single resonance experiments, electron-nuclear double resonance and electron-electron double resonance in one or more dimensions and recently we have also started to jump the magnetic field as well (sounds like a circus!). We apply these sophisticated methods as well as conventional EPR to decipher the mechanism of enzymes, to understand peptide-membrane interactions and resolve the formation mechanism of templated mesoprous materials, always, emphasizing new insights that can be obtained by modern EPR spectroscopy.

The Best Years of My Scientific Life

Haim Levanon
The Hebrew University of Jerusalem

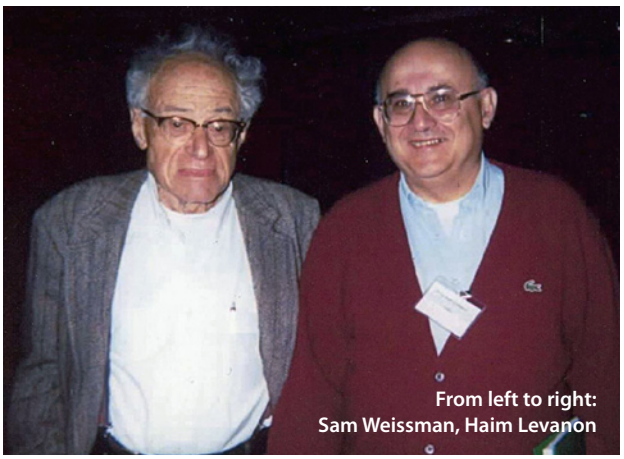
The start of my scientific activities at The Hebrew University goes back to the early 70's. As described by my colleague and mentor Professor Zeev Luz, the main efforts were focused on studying physical systems employing ground state EPR. In those days, a distinguished committee to check my credentials was set up and their decision was vital to my career. I remember that one of the prominent chemists on the committee asked me to describe the "architecture of the biology lecture hall", where I was interviewed. I didn't know what he was talking about. The reason for his question was the structure of a huge banana that was implanted in the facade of the building, which was a fingerprint of biology and biochemistry. Since I was in charge of the banana plantation in the kibbutz, the committee decided that I would fit perfectly into the biology program.

Professor Treinin, who was my teacher in high school, "saved me" from being a biologist. He invited me to his office, letting me know that I was accepted into chemistry. As you read this outline you will realize I finished my studies in chemistry. "Hurrah, Hurrah", I am a chemist.

Any appointment of a new faculty member started with an interview between the candidate and the head of the Chemistry Department, who asked me: "Dr. Levanon, with whom did you accomplish your postdoc studies?" On my response "with Sam Weissman, at Washington University" he said "I have never met with this Professor before", and he asked his secretary to find Sam Weissman in the Directory of Graduate Research. Then he added "your mentor in America does not publish much and I want you to know that you have 10% chance to get tenure ship". Nevertheless, "Hurrah," his evaluation was very wrong.

My accomplishments in time-resolved EPR (TREPR) started with a Xenon flash lamp generating detectable paramagnetic species. It was clear to me that the new technique should have been applied and that novel experiments

From left to right:
Haim Levanon, Lady Margaret Thatcher, Denis Thatcher



From left to right:
Sam Weissman, Haim Levanon

could not be performed without adopting pulsed EPR. Thus, my efforts were focused on this approach. This part in my research was inspired by Weissman who introduced me to the fascinating field of TREPR.

In the 1980's, work in Jerusalem was being carried out by employing a faithful Varian EPR spectrometer. However, I had no doubts that the next generation of TREPR should be enhanced by entering the new era of pulsed EPR. Unfortunately, at this stage of the "game" I couldn't purchase the pulsed Bruker EPR spectrometer because of the lack of funds. Rescue came from an unexpected source by the name Lady Margaret Thatcher, when she and her spouse, while visiting the Hebrew University, attended my lab. Friends of the Hebrew University in England offered the distinguished guest with two alternatives: either to inaugurate English literature or Chemistry. It was not surprising that Lady Thatcher, being a Chemist, chose Chemistry. With this financial support I was able to place an order for a new machine in 1998.

The new modern set up allowed us to study the dynamics of the photoexcited triplet state of fullerenes C_{60}. Unfortunately, I lost my chance to be the first one in analyzing this phenomenon because of the First Gulf War, when the Post Office didn't function and couldn't send my paper to J. Phys. Chem.

In parallel with the work on fullerenes and photosynthetic model systems, I was involved in optical and magnetic resonance studies of spin dynamics in alkali metals in non aqueous solutions. This brings us to the early studies pioneered by Sam Weissman.

In the 1990's and early 2000 I was heavily involved in utilizing light-induced electron spin polarization for designing novel electro-optical devices such as phase shifters and masers.

During the past several years my research activities have been focused on revealing structure-function relationships in new porphyrinoids, namely, corroles bearing various central metal ions and axial ligands. Meanwhile, we were studying light-driven processes in such exotic supramolecules as rotaxanes and catenanes, where the molecular entities are linked together, not via chemical bonds, but are mechanically connected. These studies are still in progress.

It goes without saying that part of my research was carried out in collaboration with many colleagues. I'll mention a few of them, namely, Möbius, Stehlik, Kurreck (Free University Berlin), Kothe (Freiburg University), Wasielewski (Northwestern University), Schuster, Gonen (New York University), Sessler (University of Texas), Norris (University of Chicago), Bowman (University of Alabama), Gross, Blank (Israel Institute of Technology).

I acknowledge Dr. Alexander Berg for his contribution to this article.

EPR at the Ben-Gurion University of the Negev, Beer-Sheva, Israel

Gertz Likhtenshtein:

In April 1992 I made the hardest decision to leave a comfortable life in my Alma Mater, Institute of Chemical Physics of the Russian Academy of Sciences, laboratory which I headed for 27 years. I left behind talented, qualified, highly motivated and devoted colleagues, including three professors and five PhDs, all my former students. At that time, it became impossible for my family to live in the ugly atmosphere in Russia when the rise of Russian Nazis has not been halted by anyone in power. Though I was in fact invited and warmly welcomed by the authorities of the Ben-Gurion University of the Negev, the first period of my stay in Israel was shocking. My status was described during a friendly lunch by a local Professor, who said: "We know that you are good scientist, but, frankly, I don't understand what you are going to do here. You have no laboratory, no equipment, no students, no friendly relations with people of influence. You don't know Hebrew and, therefore, cannot teach properly". It was absolutely true. But I had something more. In the Soviet Union I used to do without modern expensive equipment and reagents. In such a situation the only way to compete with the Western laboratories was to find one's own paths in science. This experience happened to be useful.

Since 1992 the basic idea underlying our approach to solving a number of tasks in chemical biophysics and biomedicine is combining the classic ESR spin labeling method with NMR and fluorescence techniques. Such an approach allows us to markedly expand the potential for investigation in comparison with the each individual method on its own. Using the phenomena of intramolecular fluorescence quenching with nitroxides and dynamic spin-spin exchange dipole-dipole interactions, the following results were obtained.

Following picosecond kinetics of electron transfer (ET) in the donor-acceptor dual-nitroxide supermolecules incorporated into a protein, and measuring quantitative parameters of micropolarity and mobility of media in the vicinity of the donor (fluorescence) and acceptor (ESR) fragments, the factors affecting ET have been established.

Analysis of the dynamic spin-spin exchange interaction between hemeproteins and nitroxide probes of different charges, allowed us to measure local electrostatic fields (EF) in the region of the protein-active center. Similar approaches based on the analysis of spin-spin dipole-dipole interactions was employed for establishing the distribution of EF around such biologically important molecules as aminoacids and charged succharides.

On the basis of the theory of dynamic spin-spin exchange interactions (K. M. Salikhov) a method for estimating the depth of immersion of a radical in a molecular object has been developed.

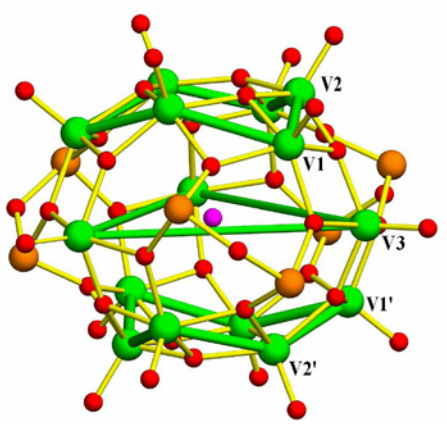
A cascade spin-triplet-photochrome method of studying the dynamic properties of biological and model membranes has been proposed and implemented. The method allowed us to measure the lateral encounter rate constant over a range of eight orders of magnitude in good agreement with the corresponding theory of Razi-Naqvi.

Using unique properties of dual nitroxide-fluorohore compounds, in which the nitrioxide fragment reduction is accompanied by the decrease in the ESR signal and, in parallel, drastic increase in fluorescence, a real time analysis of ascorbic acids and other antioxidants, nitric oxide, superoxide, reactive radicals in the nanomole concentration range has been developed.

The aforementioned results have been the subject of 20 publications in international journals and were included in two recent books. Eight Ph.D. and two Master students have been successful under my supervision. All in all, since April 1992 I published five books and about 45 articles. A new book, invited by Wiley-VCH, has been prepared for a submission.

Boris Tsukerblat:

The Molecular Magnetism Group in the Chemistry Department of the Ben-Gurion University of the Negev was founded in 2002. The studies in this area were mainly focused on the molecule-based magnetic materials containing metal clusters as structural units,



Ball-and-stick representations of the cluster anion $[V^{IV}_{15}As_6O_{42}(H_2O)]^{6-} = \{V_{15}As_6\}$. The central equilateral V_3 triangle (green) is sandwiched between two warped V_6 groups (indicated by orange lines). Each central V center couples to two adjacent V positions of each of the two V_6 groups via μ_3-oxo groups (indicated by grey bonds for one equatorial V site).

and on the physics of nanoscopic objects including nanotechnological applications: single-molecule magnets as storage units, quantum bits (qubits).

Recently the long-lived coherent quantum oscillations in a molecular magnet have been discovered using pulsed EPR. The article, "Quantum oscillations in a molecular magnet" (Nature, 2008), describes unprecedented results on the basis of a magnetic molecule containing vanadium and oxygen atoms which can act as a carrier of quantum information. The research was carried out through the interdisciplinary collaboration of three groups: Bielefeld University (Ahim Müller), Germany; Institut Nèel (Bernard Barbara), France; and Ben-Gurion University of the Negev (Boris Tsukerblat), Israel.

The problem of the exchange interaction in magnetic clusters containing metal ions with unquenched angular orbital momenta was considered. In this case the traditional theories of the exchange (based on the Heisenberg Hamiltonian) are inapplicable. A new theoretical approach was developed and the concept of orbitally dependent exchange was introduced. The orbitally dependent exchange was shown to lead to an anomalously strong magnetic anisotropy that can be considered as the main physical manifestation of the unquenched orbital angular momentum in metal clusters containing degenerate ions. This opens up a new trend in the controlled design of the so-called single-molecule magnets that can be used as memory storage systems at molecular scales and whose action is based on a high barrier for the reorientation of magnetization. A series of single-molecule magnets based on the cyanometalates has been studied, and single-molecule properties have been revealed and modeled with the help of the theoretical approach based on the irreducible tensor operator technique.

The many-body multi-electronic problem of mixed valency has been solved and new efficient software (MVPACK) has been designed that allows one to find the energy levels and thermodynamic characteristics of high-nuclearity, mixed-valence systems in which an arbitrary number of the itinerant electrons move over the network of spin sites (double exchange).

Alex Shames:

The Laboratory of Magnetic Resonance of the Department of Physics at the Ben Gurion University (BGU) was established in 1995. The Laboratory focuses its interest on combined EMR (EPR/ESR/FMR/AFMR) and solid-state NMR/NQR studies of novel materials, especially giant magnetoresistance (GMR) manganites and nanocarbons.

We applied temperature-dependent EMR within the range from 3.8 K to 650 K for detailed study of crystalline, polycrystalline, thin film and nanocrystalline manganites belonging to various manganite families (both electron-doped and hole-doped). Careful studies of EMR signals in the vicinity of charge and magnetic ordering phase transitions (usually there are several) as well as temperature dependence of EMR signal parameters above phase transitions (i.e., in the high-temperature paramagnetic region) supply us with unique information on samples' homogeneity, the origin of charge end magnetic ordering and relaxation processes etc. The experimental data were successfully explained using a theory developed in collaboration with our colleagues from the Departments of Physics and Electrical Engineering.

Other important objects of our EMR study are various nanosized carbon materials. In the late nineties we started from fullerenes and fullerene films where photo- and oxygen-induced cation paramagnetic centers were revealed. Then we concentrated our attention on new very promising (from both scientific and technological points of view) materials – ultra-nanocrystalline detonation diamonds, nanocrystalline diamond films and various detonation nanodiamond derivatives: nanodiamonds with surfaces intentionally modified by paramagnetic ions, fluorine, and hydrogen etc. as well as nanocarbon anions and multi-shell polyhedra. Using EMR, new types of paramagnetic defects in nanodiamonds, e.g., exchange-coupled dangling bonds, have been found. Just such unusual EMR results revealed intriguing magnetic and electronic properties of newly discovered large multi-shell polyhedral nanoparticles called astralens.

The results of our work have been published in more than 100 peer-reviewed articles and chapters in books. Several Master and Ph.D. students completed their work in our Lab.

Moisey I. Belinsky

Studies of Magnetism, Exchange Coupling and Spectroscopy of Polynuclear Metal Centers in Biology, Chemistry and Physics at the School of Chemistry, Sackler Faculty of Exact Sciences, Tel-Aviv University, Israel

Research interests: 1) spectroscopy and magnetism of active metal centers of biological systems, 2) theory of magnetism, 3) nanomagnets, molecular magnetism, 4) polynuclear cluster compounds in coordination and bioinorganic chemistry.

Theoretical approaches to magnetism and spectroscopy of polynuclear active centers of biologically important native systems such as iron-sulfur proteins, enzymes and Photosystem II have been developed. The exchange models, which include the Heisenberg exchange, double exchange coupling, zero-field splittings (ZFS), cluster distortions and the mixing of the spin states, describe the correlations between molecular and local g-factors and ZFS parameters, as well as the hyperfine and superhyperfine interactions in iron-sulfur centers. The theory explains the data of EPR, Mössbauer, ENDOR, and NMR spectroscopy and magnetic properties of the mixed-valence [4Fe4S], [3Fe4S], {[4Fe-4S]2+-Fe} active centers of the iron-sulfur proteins, enzymes and their synthetic models. The exchange model of manganese [4Mn] clusters explains the EPR spectra, the hyperfine structure, and magnetism of the [4Mn] active center of Photosystem II in the S2 state. The results provide important information concerning the electronic structure, energy spectrum, ground state, distortions and the individual characteristics of the metal ions of the active centers of different native iron-sulfur proteins, enzymes and Photosystem II.

Theory of antisymmetric and anisotropic double exchange coupling, and theory of double exchange in polynuclear clusters have been developed. In the classical Anderson-

EPR (ESR) at the Technion

Aharon Blank

Recently I have been asked by Laila Mosina to provide a short overview of the ESR activity at the Technion, focusing mainly on my present projects and problems of interest.

First I would like to say a few words about the Technion, for those readers who are not familiar with this institution: The Technion – Israel Institute of Technology – has been Israel's primary Technological University for more than eight decades and is the country's largest center for applied research. It is ranked among the leading technological universities in the world. Many innovations in all fields of Science, Technology, Engineering and Life Sciences have their origins in research conducted at the Technion. Recently, two Technion scientists, distinguished Professors Avram Hershko and Aaron Ciechanover received the Nobel Prize in Chemistry, for their pioneering research on the degradation of intracellular proteins.

ESR has a long history at the Technion. The first ESR instrument (X-band) was built by Prof. David Shaltiel and Prof. Jan Genossar in the mid 1950's. It was used by David and Jan at the Physics Department. A paper in Physical Review entitled "Electron-spin resonance in irradiated alkali halides" from 1955 describes some of their work. Later on, Prof. Shaltiel continued to work on ESR of dopants and defects in other solid oxides such as barium titanate and thorium oxide. The next chapter of ESR at the Technion was by Prof. Aharon Loewenstein and Prof. Brian Silver. Aharon bought a Varian E-4 system and together with his PhD student, Rafi Poupko, performed studies on proton exchange in radicals derived from simple alcohols and radicals derived from amines and amino acids. Brian took over the system and later upgraded it. With this system he performed many studies on the electronic structure and spin relaxation of inorganic free radicals and transition metal complexes, until his premature death in 1997. In 2004 a new EMX system from Bruker was purchased (X-band CW). It is currently used primarily for analytical purposes by several organic chemistry groups, looking at stable radicals in Si compounds and radicals of high oxidative states.

In late 2005 I came to the Technion to build a new lab focusing on ESR and NMR. My background includes Physics, Chemistry and Engineering, with an extended period in ▶

Hasegawa double exchange theory, the double exchange coupling (spin-dependent electron transfer) in mixed-valence systems results in an isotropic delocalized ground state with maximal total spin *S*. Taking into account spin-orbit coupling leads to antisymmetric and anisotropic double exchange coupling (anisotropy of electron transfer), which are the analogues of antisymmetric and anisotropic exchange, respectively, in the localized systems. The antisymmetric double exchange interaction is stronger than the Dzialoshinsky-Moriya exchange coupling. Antisymmetric and anisotropic double exchange interactions strongly contribute to the fine splittings and anisotropy of the spectroscopic characteristics of the valence-delocalized clusters.

In the spin-frustrated V3 and Cu3 nanomagnets with the Dzialoshinsky-Moriya (DM) exchange interaction, a microscopic theory of in-plane and out-of-plane DM exchange, theory of spin canting, spin chirality, tunneling gaps, polarization, toroidal moments, induced by the DM exchange, and the theory of the inelastic neutron scattering and EPR transitions have been successfully developed. The theory can explain the magnetism, polarization and spectroscopy of these nanomagnets, which are the nanoscale analogues of multiferroics, and also predict applications of the nanomagnets as molecular devices.

Other activities include my activity from 1994 to the present time as a Chairman of the Council of the Association of Scientists-Repatriates of Israeli universities. The Association, founded in 1994, is a public organization, which unites scientists-repatriates, working at Israeli academic institutions, with the aim of finding a solution for their permanent employment. During this period, the Association struggled for the integration of the scientists-repatriates into Israeli science. As a result of the active struggle and united efforts of the Association and supporting forces, the KAMEA Project was adopted for implementation by the Israeli Government in 1997. Starting 1998, 500 scientists-repatriates have worked in the KAMEA project at academic institutions. The successful KAMEA Project plays important role in the absorption of scientists-repatriates and their integration in the Israeli society. KAMEA scientists strongly contribute to Israeli science, technology and education. ●

the Israeli Air Force, working on microwave technology. I did my PhD with Prof. Haim Levanon at the Hebrew University, working on light-induced ESR systems, and post-doc with Prof. Jack Freed at Cornell, in the field of ESR microscopy. The current research projects in my lab focus on the development of new methodological tools for high sensitivity and high image resolution ESR. The tools we develop are being applied to high resolution spectral and spatial mapping of free radicals and paramagnetic species in many types of samples for applications ranging from semiconductors physics to processes in live cells. For example, we are measuring the oxygen concentration near live cells at micron scale resolution by mapping the relaxation time, T_2, of an exogenous spin probe (which is inversely proportional to the oxygen concentration). This work is in collaboration with Prof. Kuppusamy from the Ohio State University and Prof. Tormyshev from Novosibirsk Institute of Organic Chemistry. In another recent project we mapped defects in SiO_2 substrates and observed their micron scale diffusion as a consequence of heating, to obtain directly their diffusion constant. This diffusion is very slow (hours) and therefore can be captured by several "snapshots" of high-resolution ESR images. Our ESR systems, which are very sensitive and equipped with powerful gradient sources, can also be used to measure much faster diffusion processes occurring in the microsecond time scale by means of pulsed gradient spin echo methods. This is carried out in the same way as diffusion is measured using NMR, with the exception that the short ESR time scale requires having much more powerful and much shorter gradient pulses.

The current experimental "arsenal" in our lab includes four electromagnets, two "homebuilt" pulsed ESR imaging systems operating at 6–18 and 35 GHz and two CW ESR systems, one "homebuilt" operating at 6–18 GHz and one is a classical Varian E-12 X-band system. The photo shows one of our latest pulsed micro-imaging systems at work. Most of our current experiments are carried out at room temperature, but in some recent work we have employed new "homemade" probes which were operated at liquid He temperatures. This greatly improves our sensitivity and resolution capabilities; however, it is still "work in progress". The future focus of our lab will be on further improving the sensitivity and resolution of our induction-detection-based probes, hopefully down to the single electron spin level, and the resolution to less than 100 nm.

John A. Weil (1929–2010)

It is my sad duty to inform you that my friend Professor John Weil, passed away on 17 November 2010.

Fortunately, I had the opportunity to write a tribute in 2009 in the International EPR Newsletter on the occasion of his 80th birthday. I am happy that he had the chance to read that tribute before he left us. I will only include parts of that tribute here. I refer the reader to the EPR newsletter vol. 19/1-2, p. 23 for the full tribute.

I'll start by quoting parts of the obituary published in the Saskatoon Star Phoenix:

"Dr. John Ashley Weil was born 15 March 1929 near Hamburg, Germany. He, his mother, and his brother Claude Weil, fled Europe during the Nazi regime and arrived in the United States in 1940. John did his early education in a one-room schoolhouse in the Catskill region of New York State, and then moved to Chicago, Illinois, where he completed high school in 1945. That same year, John met Andrea (Andy) Moellenhoff, who in 1947 became his loving wife of almost 60 years. Their son, Stephen, was born in Chicago. John completed his doctorate in Chemical Physics at the University of Chicago in 1955, and then did a post-doctoral fellowship and taught at Princeton University, where daughter Elika was born. John was lured away to Argonne National Laboratory, near Chicago, where he worked on research for a dozen years, achieving the level of Senior Scientist. In 1971, he moved to the University of Saskatchewan to take up a tenured Professorship in Chemistry. In 1996, John formally retired from the University of Saskatchewan; but as Professor Emeritus, continued active research throughout the remainder of his life."

Professor John Weil's research and personal interests were certainly eclectic. His 158 publications in peer-reviewed journals, plus 5 submitted or in press (and many more 'planned to be submitted') cover a wide range of topics (mostly involving EPR) including gas adsorption on charcoals, defect centers in quartz (probably the application for which he is most famous), the effects of crystal symmetry on magnetic resonance spectra, the effect of crystalline environments on the wave functions of the hydrogen atom, frontier EPR techniques, such as pulsed microwave and optical detection, and large-scale Hartree-Fock cluster modeling.

Prof. Weil was the senior author (with J. R. Bolton and J. E. Wertz) of the widely accepted introductory text to the field of "Electron Paramagnetic Resonance", which was first published in 1994 by John Wiley & Sons as a totally revised 2nd edition of the 1972 book co-authored by J. E. Wertz and J. R. Bolton. Since demand materialized, a new much-updated edition, under the authorship of J. A. Weil and J. R. Bolton, appeared in 2007.

Prof. Weil also was involved in various extra-scientific activities. One notable one was his interest in the cultural aspects of crystalline quartz, ranging from anthropological/archaeological aspects to visual aesthetic ones. A bibliography (2500+ references) has been copyrighted. A venture in Northern New Mexico led to the discovery and characterization of a buried shamanic kit, containing a quartz-crystal fetish of the Largo-Gallina culture.

More details of all recent publications can be found on Prof. Weil's Website: http://homepage.usask.ca/~jaw519/, which is still active.

Personally, I will remember John as a kind and faithful friend. He was a stickler for accuracy and thoroughness in his publications. He will be remembered best by his students and associates as one who loved teaching and discussions on many topics, not always scientific. He will be remembered by his colleagues throughout the world as one who has advanced the subject of EPR in many significant ways and who was open to collaboration with many in the EPR community.

I'll end with a final quote from the Star Phoenix obituary:

"Dr. Weil was a dynamic, fascinating man, who will be much missed by family and friends throughout the world. In lieu of flowers, charitable donations to directly support the research of budding young scientists may be made to the "University of Saskatchewan, Department of Chemistry" (www.usask.ca/chemistry; contact person: Ronda Duke (306) 966-4655), with a notation that it is in memory of Dr. John A. Weil. The family has organized a memorial reception to honor John's life, on Wednesday Dec. 29, 2010, 3-6 pm, at the Edwards Family Centre (333 4th Avenue North) in Saskatoon. Courtesy parking at Saskatoon Funeral Home. Memorial tributes will start at 4pm. All who knew John are invited to attend. Condolences may be sent to mail@saskatoonfuneralhome.com Arrangements entrusted to Saskatoon Funeral Home, (306) 244-5577.

James R. Bolton
Adjunct Professor
Department of Civil and Environmental Engineering, University of Alberta,
Edmonton, AB, Canada

Electron Paramagnetic Resonance: Elementary Theory and Practical Applications

by J. A. Weil and J. R. Bolton

revision

Wiley, 2007

The passing of Prof. John Weil (see separate obituary) means that unless someone steps up to write a revision of the Weil/Bolton EPR text, there will be no further edition, since I am now not involved in the EPR field. To my knowledge, John did not specify a future collaborator in a new edition.

I have all of the computer files used to generate the most recent (2007) edition, so if anyone is interested in writing a new edition, I would be happy to provide the files. Send me an e-mail at jbolton@boltonuv.com.

Jim Bolton

New
Books & Journals

Quantitative EPR

by

G. R. Eaton, University of Denver, CO, USA
S. S. Eaton, University of Denver, CO, USA
D. P. Barr, Bruker BioSpin
R. T. Weber, Bruker BioSpin

Publisher: Springer Wien
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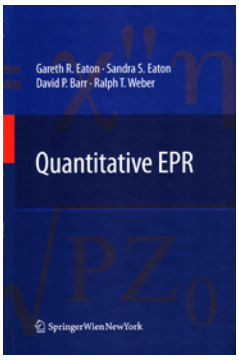

This is the first comprehensive practical guide for people who perform EPR measurements, or supervise the use of EPR spectroscopy, and want to obtain quantitative results.

No existing book provides this level of practical guidance to ensure successful use of EPR. This meets the growing need in both industrial and academic research to provide meaningful and accurate quantitative results from EPR experiments. Discussed are the various sample-related, instrument-related and software-related aspects for obtaining useful quantitative results from EPR experiments. Some specific items discussed include: choosing a reference standard, resonator considerations (Q, B_1, B_m), power saturation characteristics, sample positioning, and finally, putting all the factors together to provide a calculation model for obtaining an accurate spin concentration of a sample. Both relative intensity quantification and the absolute spin concentration of EPR samples are covered as well. Numerous pictures of the effect of instrument parameters on EPR spectra are included and careful attention to the guidance given in this book will ensure quantitatively accurate EPR spectra... more on

http://springer.com/978-3-211-92947-6

Properties of Perovskites and Other Oxides

Editors: K. Alex Müller and Tom W. Kool

Publisher: World Scientific Publishing Co. Pte. Ltd., Singapore
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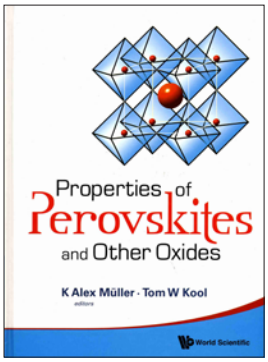
Brief content



Synopsis

This book encompasses the most important writings of K. Alex Müller and his coworkers for the period of 50 years up until 2009 and chosen from more than 400 original publications relevant to the areas addressed. Perovskites and related oxides doped by additional ions have a remarkable variety of magnetic, electric and structural properties: from static paramagnetism to unusual spin dynamics and long-range ordering; from para-, ferro-, antiferro-electricity to conventional and high-temperature superconductivity; from the local static and dynamic Jahn-Teller effect to itinerant polarons and structural phase transitions. This list is by far not complete. The main tool used by Alex Müller to investigate all of these properties at an atomic level was electron paramagnetic resonance (EPR) spectroscopy. The publications are grouped into eleven chapters in the book according to specific area of investigation. Therefore it will be easy for the reader to find a paper of interest. Each chapter starts with a very useful introduction clarifying the main points of the studies on each topic.

There are at least two features of the book that make it interesting to a very large community of condensed matter researchers. First, the presented works are devoted to important aspects of condensed matter physics, as mentioned above, but at the same time instructive. They contain a combination of fresh ideas with highly professional measurements and a deep insight into interpretation. As an example we can mention the EPR study of the excited Jahn-Teller (JT) state, which gave the JT stabilization energy. The latter became important in later efforts leading to the discovery of copper-oxide superconductivity.

The second feature is connected in some sense with the first one. Many careful investigations of different properties of perovskites and related oxides look like a whole chain of steps toward the discovery of high-temperature superconductivity. This aspect of the book should encourage young researchers (and not only them) in their everyday work to do it carefully, thoughtfully and hopefully. Who knows, maybe you are working toward the Nobel Prize?

It is worth mentioning that the book concludes with the results on superconductivity obtained through 1987. One can hope that the field of high temperature superconductivity, where Alex Müller is still actively participating, will be the content of a future book.

Boris Kochelaev

Multi-Frequency Electron Paramagnetic Resonance, a Perspective in the Biosciences

Lorentz Center at Leiden University, Leiden, The Netherlands,
May 25–28, 2010

In the context of a co-operation between several Dutch and German research groups, a workshop on multi-frequency EPR took place in the Lorentz Center at Leiden University in the last week of May. The workshop focused on instrumental and methodological developments toward sensitive and widely applicable high-frequency EPR, spin-label and transition-metal multi-frequency EPR and the study of the dynamics of spin systems at different time scales, all in view of applications in the biosciences. It was organized by Klaus Möbius (MPI Mülheim a.d. Ruhr), Heinz-Jürgen Steinhoff (University Osnabrück), Martin Engelhard (MPI Dortmund), Maurice van Gastel (University Bonn), and Edgar Groenen (Leiden University).

In the professional and stimulating environment of the Lorentz Center about 45 scientists came together. A limited number of talks and posters were presented to allow ample time for discussion. Recent developments were reported, for example with respect to instrumentation (Graham Smith, Peter Höfer), the use of (novel) spin labels for structure determination and probing of local environment (Heinz-Jürgen Steinhoff, Daniella Goldfarb, Olav Schiemann), the elucidation of the electronic structure of transition-metal sites in proteins (Sabine van Doorslaer, Wolfgang Lubitz), the (electronic) structure of transient species in relation to photosynthesis (Klaus Möbius, Alexander Marchanka), the modeling of large-scale structural changes of proteins based on EPR-derived restraints (Gunnar Jeschke), and the multi-frequency approach to the study of molecular dynamics at largely different time scales (Jack Freed). These presentations initiated extensive and lively discussions in the lecture room, in the common room and in the corridor. Besides contributions from the EPR perspective, some contributions were given from the perspective of the biosciences leading to discussions concerning the expectations of the biochemist as regards EPR and the convictions of the spectroscopist as regards the potential of modern EPR for the biosciences. In more general terms, the question was addressed what goals the EPR bio-community should set for the near future.

The workshop was completed by a (too) short visit of the Boerhaave Museum, the renowned Dutch national museum for the history of science and medicine, and a dinner in the center of the old town. All participants enthusiastically put in a lot of energy to make the workshop into a success. Hopefully they have been inspired, which will become clear when we meet again.

Edgar Groenen

The 33rd EPR Symposium at the Rocky Mountain Conference

Snowmass, Colorado, USA,
August 1–5, 2010

The 52nd Rocky Mountain Conference on Analytical chemistry (RMCAC) took place at the Snowmass Conference Center in Snowmass, Colorado. The RMCAC features symposia on electron paramagnetic resonance (co-chaired by Glenn Millhauser and Alex Angerhofer) and solid-state NMR (chaired by Mei Hong). Snowmass Village at 8200 feet is a world-class ski resort in winter and in summer the beauty of the pine forests is open for hiking and mountain-bike riding. On arrival, we were greeted with a majestic view of Bush Creek Valley and Burnt Mountain Ridge.

The Sunday featured an evening workshop given by Bruker celebrating its bicentennial. Dieter Schmalbein gave an informative and entertaining talk about the history of Bruker EPR detailing the various instrumental developments. This was followed by a presentation about frequently asked questions with an accompanying booklet. Finally, most recent developments were outlined. The session was highly informative.

The first full day started with a session on Pulse Techniques (chaired by Gary Gerfen) and began by a talk entitled, "Applications of Pulse Dipolar ESR to Solving Structures of Large Proteins Complexes" by Jack Freed. This was followed by four other excellent presentations (Daniella Goldfarb, Gunnar Jeschke, Keith A. Earle and Kurt Warncke). The afternoon session focused on proteins. It

will be of no surprise that PELDER/DEER measurements featured heavily in the work and discussions. In particular, the benefits of measurements at 35 GHz (Q-band) were highlighted.

The biological theme was continued into the second day with the joint EPR/NMR session on Metalloproteins (chaired by Dave Tierney), including work on pyranopterin molybdenum enzymes (Martin L. Kirk) and magic angle spinning of diamagnetic proteins with paramagnetic labels (Christopher P. Jaroniec). In the afternoon there was a Transient Radicals session (chaired by Malcolm Forbes). There were four stimulating presentations including topics such as avian magnetoreception (Peter J. Hore) and spin teleportation using triradicals (Michael R. Wasielewski). The annual Lawrence Piette Memorial Lecture was given by Gary Gerfen from Albert Einstein College of Medicine, New York.

The third day featured a morning session on materials (chaired by Christoph Boehme), which included work on thermoresponsive dendronized polymers (Hans W. Spiess) and metal oxide semiconductor systems (Patrick Lenahan). The following session was devoted to young researchers (Glen Millhauser, chairing). The opportunity was taken by eight people, who gave well-received fifteen minute presentations.

The conference concluded with a session on In Vivo EPR (chaired by Howard Halpern) highlighting the increased success of oximetry and outlook.

The conference had two evening poster sessions, and the rooms were filled with people discussing and rotating on to the next poster. We also gathered to celebrate Harold Swartz's 75th birthday and had cake!

The programme also offered the opportunity to visit the 35th Snowmass rodeo. About twenty of us saw the show and feasted at the western barbeque. Although, we were not allowed to take part in the activities we were treated to watching a unique American entertainment!

The next meeting will be EPR only with Alex Angerhofer, Christoph Boehme and Gail Fanucci as organizers.

Alistair J. Fielding

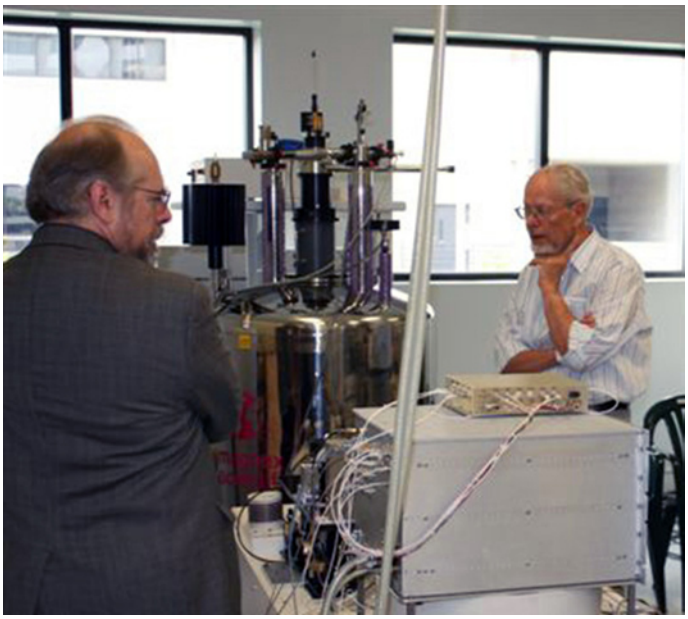
EPR Workshop 2010: Cutting-Edge Biomedical EPR Methods

The National Biomedical EPR Center at the Medical College of Wisconsin, Milwaukee, USA, August 20–21, 2010

The National Biomedical EPR Center at the Medical College of Wisconsin in Milwaukee sponsors a workshop every five years that focuses on advances in EPR technology. EPR Workshop 2010: Cutting-Edge Biomedical EPR Methods was held on August 20–21, 2010, at the Milwaukee Public Museum. When not wandering through the museum's unique historical exhibits, students and faculty from across the world were given the rare opportunity to listen and learn what the next 20 years of EPR have in store. The program was divided into five mini-symposia: high-pressure EPR (Wayne Hubbell), distance determination (Klaus Möbius, Christian Altenbach, Eric Hustedt, and Aaron Kittell), saturation recovery (W. Karol Subczynski and Michael Bridges), high and low frequency EPR (Robert Strangeway and Jason Kowalski), and pure absorption rapid-scan EPR (Gareth Eaton and James Hyde), with the main focus geared toward technological and methodological advances. Particular importance was placed on how some of these developments are connected to the earliest years of EPR, reminding everyone that advances in computing power and microwave technology can breathe new life into old ideas like global analysis, direct detection EPR, and use of helical resonators. The enthusiasm of young investigators Kittell, Bridges, and Kowalski was notable.

The workshop concluded the following morning at the Medical College of Wisconsin where participants were able to tour the EPR Center's various facilities, discuss posters, and observe demonstrations on DEER, in vivo EPR, instrumentation control software, pure absorption rapid-scan EPR, resonator design, saturation recovery EPR, W-band EPR, and multi-component fitting of CW spectra. About 100 persons participated in the workshop. The National Institute for Biomedical Imaging and Bioengineering (NIBIB) of the National Institutes of Health provided financial support.

Jim Hyde



Art Heiss (Bruker) and Klaus Möbius (Free University of Berlin) at the EPR Center's multi-arm W-band spectrometer.

7th Asia-Pacific EPR/ESR Symposium (APES2010)

Jeju, Republic of Korea, October 10–14, 2010

Since the first Asia-Pacific EPR/ESR Symposium held in 1997, organized by Prof. Czeslaw Rudowicz, the founding President of the Society, the countries in the Asia-Pacific region have hosted the meeting every two or three years. The Symposium was established to stimulate EPR/ESR researches in the Asia-Pacific region. This year's APES follows previous meetings held in Hong Kong (1997), Hangzhou, China (1999), Kobe, Japan (2001), Bangalore, India (2004), Novosibirsk, Russia (2006), and Cairns, Australia (2008). The efforts made by the hosting countries and the participants from the Asia-Pacific region as well as other parts of the world have now placed the APES meeting among the major international EPR gatherings.

During the 6th Asia-Pacific EPR/ESR Symposium held in Cairns, Prof. Sa-Ouk Kang, Chair of APES2010, announced that Korea would host the next APES on Jeju Island, located in the Pacific Ocean, just off the southern tip of the Korean Peninsula. The island was formed from a volcanic eruption approximately one million years ago. It is relatively isolated from the rest of the world, which has ensured that its natural beauty has been preserved. The venue, the international convention center Jeju, is reflects Jeju's natural beauty and has become one of the most attractive conference facilities in Asia.

The preparation for the meeting was started one year before the meeting with the signing of an agreement with the convention center. The official conference website (www.apes2010.org) was opened December 2009 to attract the attention of EPR scientists. All information has subsequently been posted in the website and the site is still available to all.

The meeting began on the 10th (Sunday) October. Registration followed by a welcome reception. A cultural ambassador was on hand throughout the week. During the reception she gave a short presentation on Tripitaka Koreana. The depository of the Tripitaka has been listed as a UNESCO world heritage site. The official scientific program started on the 11th October with welcoming addresses given by Prof. Sa-Ouk Kang and Prof. Sergei A. Dzuba, the president of Asia-Pacific EPR/ESR Society. The first plenary lecture that kicked off the scientific sessions was given by Prof. Brian M. Hoffman (USA). Subsequently, six other plenary lectures were presented, in the following order: Prof. Subray V. Bhat (India), Prof. Takeji Takui (Japan), Prof. Yeon-Kyun Shin (Korea), Prof. Sergei A. Dzuba (Russia), Prof. Gunnar Jeschke (Switzerland), and Prof. Hitoshi Ohta (Japan). In addition, there were 36 invited lectures and 25 oral presentations covering many EPR research fields including: metalloenzymes, conductivity, nano/inorganic compounds, magnetism, solution, quantum computing, distance measurements, theory/calculations, light-sensitive systems, biological/biomedical applications, and others. Dr. Dieter Schmalbein and Dr. Peter Höfer from Bruker BioSpin were on hand to describe the most recent instrumental developments in EPR on Monday afternoon. Monday and Tuesday sessions were concluded with the 47 poster presentations.

At APES2008 in Cairns, the APES Young Scientist's Awards were established to provide support for young scientists at the beginning of their careers. As a continuation, two young scientists, Dr. Mika Tada (Japan) and Dr. Nicholas Cox (Germany, born in Australia), were selected as the APES2010 Young Scientist's Awardees for their work on: scavenging superoxide radicals and metalloenzymes, respectively. On Wednesday morning, each awardee received KRW 1,000,000 and a certificate, and presented her/his work, for which the award was made. Please see the APES Young Scientist's Awardees' articles in this edition ▶

for further details. On Wednesday afternoon, all participants were invited to join the local tour of Jeju Island. This included: Hanlim park and Mt. Songak, where the attendees could be refreshed by sightseeing through lava caves and from walks along the coastline, the mountains, and the folk villages.

On the final day, the scientific presentations were followed by the closing ceremony where Prof. Sergei A. Dzuba and Prof. Sa-Ouk Kang gave closing remarks and the APES2010 Poster Awards (Certificate and KRW 200,000 per person) were presented. The six awardees were: Ayaka Tanaka (Japan), Victoria N. Syryamina (Russia), Simon C. Drew (Germany, born in Australia), Risa Mutoh (Japan), and Andrey V. Pivtsov (Russia). At the General Meeting of the Asia-Pacific EPR/ESR Society, held after the closing ceremony, Beijing (China) was nominated as the site for the next APES. APES2010 concluded with a conference banquet in which several Korean traditional performances entertained the participants. Everyone joined together to enjoy dancing, singing and games.

APES2010 travel bursaries (KRW 500,000 per person) were provided to nine students and postdocs to support their attendance of the meeting. Bruker BioSpin, Jeol, Seoul National University, Kyungpook National University, Korea Tourism Organization, Jeju Convention and Visitors Bureau, and Microbiology Society of Korea generously sponsored APES2010, providing funds for the awards, travel bursaries, and other financial expenses. Their contribution was critical for the success of the meeting in which more than 100 scientists from 14 countries (Australia, Canada, China including Hong Kong, Germany, India, Japan, Pakistan, Poland, Russia, Slovenia, Switzerland, UK, USA, and Korea) exchanged scientific ideas and built social friendships.

The final item of the scientific program of each APES is traditionally a special issue of "Applied Magnetic Resonance" with contributions from the APES conference attendees. This special issue, dedicated to APES2010, will be published early 2011.

It was our great pleasure to host APES2010 and to meet many EPR scientists from all over the world. I hope to see all again in Beijing 2012.

Hong-In Lee
Secretary General of APES2010

VIIth International Workshop on EPR (ESR) in Biology and Medicine
Krakow, Poland, October 4–7, 2010

The VIIth International Workshop on EPR in Biology and Medicine was held at the Polish Academy of Arts and Sciences in beautiful and historic Krakow, Poland. The workshop, which has taken place every three years since 1989, was organized by Tadeusz Sarna (Jagiellonian University) and Balaraman Kalyanaraman (Medical College of Wisconsin). World specialists in the biomedical applications of EPR spectroscopy gathered to share the latest research advances and to discuss new ideas. This year, the following sessions were presented with one plenary and five lecturers communicating new data for each topic: Instrumentation, DEER Measurements, Spin-label Oximetry, In vivo Imaging, Radiation Dosimetry, Spin Trapping, Biological Applications of Novel Probes. Poster sessions and selected abstract presentations were also included, along with a welcome reception and banquet dinner showcasing Polish food and hospitality. Generous sponsors helped make this workshop possible: Bruker Poland, Department of Biophysics at the Medical College of Wisconsin, Department of Biophysics at the Jagiellonian University, Poland Ministry of Science and Higher Education, and Thadikonda Research Foundation. In total, the meeting drew approximately 100 researchers, including faculty, postdocs and students from Poland, USA, Russia, France, Germany, Slovenia, Croatia, Ukraine, and the Czech Republic. See you in Krakow in 2013!

Candice Klug

Wojciech Froncisz and James Hyde engaged in conversation at the conference banquet in Krakow, Poland.

Professor's Garden at the Jagiellonian University.

Reader's Corner

EPR DOSIMETRY COMES OF AGE
(*and you can participate!*)

Hal M. Swartz

Director, EPR Center for Viable Systems, Dartmouth Medical School
Hanover, NH, USA

With new funding at Dartmouth of one and probably two major initiatives in the field of EPR dosimetry, there now is official recognition at the highest level (i.e., the people who control the purse strings!) that EPR dosimetry can be a major contributor to meeting the need for a means to measure radiation dose in individuals after a large-scale potential exposure to life-threatening levels of ionizing radiation, such as the radiation events in Japan in 1945 and at Chernobyl in 1986.

The advanced state of the research and development that made this funding possible was carried out over the last 40+ years in a number of laboratories throughout the world. Initially the measurements were made in isolated teeth where the radiation-induced changes in the enamel (more specifically, the stabilized carbonate anion radicals in the hydroxyapatite matrix) provided a permanent signature reflecting the total dose of ionizing radiation received. But even at the early stages (J. M. Brady, N. O. Aarestad, and H. M. Swartz, "In Vivo Dosimetry by Electron Spin Resonance Spectroscopy," Health Physics, 15: 43–47 (1968) it was suggested that the method could eventually be utilized in vivo, thereby expanding its practicality and desirability for measuring a large population of potentially exposed individuals. Similarly based on a direct EPR measurement of fingernails it was hypothesized that fingernails (and toenails) also would be suitable for EPR dosimetry (based on long-lived radicals in the keratin).

Recent developments at Dartmouth, in collaboration with several laboratories from around the world, have now led to funding of the research with the ultimate and now practical goal of providing EPR-based devices and procedures to rapidly and accurately identify whether individuals, in the aftermath of a massive radiation event, received an exposure that requires they be entered into the medical system for further diagnosis and clinical care.

One project is a five-year U-19 grant (H. Swartz, PI; A. Flood, B. Williams Assoc. PIs) from NIAID with the NIH to form a Center for Medical Countermeasures Against Radiation (CMCR) in EPR Biodosimetry at Dartmouth (which we call the Dart-Dose CMCR). The Dart-Dose CMCR is charged with developing improved physical biodosimetry with the definitive goal of producing fully functional prototypes and procedures for rapid estimates of radiation dose, using three types of EPR spectroscopy, i.e., based on teeth in vivo (B. Williams, PI), nails in vivo (H. Swartz, PI), and clipped nails (S. Swarts, PI). Participating groups from other universities include: the Medical College of Wisconsin (J. Hyde, PI) which will be especially involved in developing sensitive resonators that can be used to measure the radiation induced signals in nails in vivo at X-Band; and the University of Florida (S. Swarts, PI), which will be especially involved in the in vitro (clipped) nail studies. Other participating EPR centers include: the U. of Chicago (H. Halpern), U. of Denver (G. Eaton), and the Jagiellonian University (W. Froncisz).

The amount of funding for this research is the highest funding of a single grant that the PI (H. Swartz) has ever had and also is the largest single initial biomedical grant in the history of Dartmouth! The funding level is $3,300,000/year for five years. The funding includes not only very adequate support for all three projects, but also provides the new center with the explicit responsibility to identify and fund other research related to EPR dosimetry through competitive pilot project grants administered by the Dart-Dose CMCR.

The second initiative, currently under negotiation with a projected start date of December 15, 2010, is a contract from the Biomedical Advanced Research and Development Authority (BARDA) in the US Department of Health & Human Services Department, for the rapid development and then the complete production of a manufacturable prototype for EPR dosimetry of teeth in vivo. Starting with the currently existing instrument at Dartmouth, this initiative is being carried out in extensive collaboration with General Electric (GE). It has the potential to be funded at up to $8,000,000 per year for up to 5 years. The ▶

RELAXATION TIMES REVIEW

Extensive reviews of electron spin relaxation times are in:

- K. J. Standley and R. A. Vaughan: Electron Spin Relaxation Phenomena in Solids. Plenum Press 1969.
- I. Bertini, G. Martini, and C. Luchinat: Relaxation data Tabulation, chapt. IV in Handbook of Electron Spin Resonance (C. P. Poole, Jr. and H. A. Farach, eds.) AIP Press 1994.
- S. S. Eaton and G. R. Eaton: Relaxation Times of Organic Radicals and Transition Metal Ions. Biol. Magn. Reson. **19**, 29–154 (2000)

We are gathering relaxation times to update these prior reviews. Many electron spin relaxation times are buried in papers deeply enough that they are not found by computer searches. Sometimes we find them only serendipitously. Some papers contain information that suggest to us that the lab might have measured relaxation times but did not actually put a numerical result in the published paper. We will appreciate having relaxation time values brought to our attention, so that our review can be more complete than in the past.

Gareth R. Eaton
geaton@du.edu

ultimate aim is to provide an FDA-approved prototype, fully compliant with the required manufacturing processes for medical devices, which can immediately be manufactured in sufficient numbers to be deployed throughout the USA, and potentially throughout the world, for immediate response to a catastrophic event involving ionizing radiation. The goal for this prototype is that it be a fully automated instrument and system, which can be operated by persons with no prior training in EPR or indeed training in any type of instrumentation. The challenges for accomplishing this goal are considerable but appear to be fully achievable. As a by-product of the collaboration with GE, the entire EPR community may have access to very dependable, sensitive, and fully automated EPR spectrometers that can be used for any purpose.

Collaborative opportunities:
There are 3 interrelated opportunities for other EPR centers and researchers to help advance EPR dosimetry:

First, as part of the NIH grant (as noted above) the Dart-Dose CMCR has funds available for up to ten pilot projects each year, to support the purposes of the CMCRs overall, with special emphasis on supporting EPR dosimetry. The procedure for applying and more information about the pilot projects is posted on the website for the EPR Center (www.dartmouth.edu/~eprctr/pilot), but the essence is that we will be able to support projects that strengthen our current developments (e.g., making better resonators) or provide critical data for considering alternative approaches to the current ones (e.g., tooth or nail dosimetry at other frequencies or in the time domain).

Second, there are also opportunities for direct cooperative collaborations with the ongoing research efforts in this field through complementary research, fabrication of essential components, etc. These collaborations can be initiated through direct discussions with senior investigators at the EPR Center for the Study of Viable Systems at Dartmouth.

Third, there are immediate and future openings at Dartmouth for several individuals for the instrumental development aspects of both the new initiatives described above. We are especially focused on advancing sensitivity, reliability, automation, and field deployability of our instrumental systems. To those ends, we have special needs for individuals who can help us make advancements in the resonators and device automation, but opportunities exist in many other aspects of our work. Engineering, especially microwave, and other instrumental development skills are essential; EPR experience is desirable but not absolutely essential. Successful applicants will be given regular positions at Dartmouth with full benefits and competitive salaries, etc.

Please contact Hal Swartz via e-mail (harold.swartz@dartmouth.edu) for further information about any of these opportunities to collaborate and/or to make specific proposals or to make inquiries about employment.

In a future issue of the *EPR newsletter* we will provide a resume of the principal scientific issues and accomplishments in this new and exciting field. Meanwhile, we look forward to working with many of you to take full advantage of the 'coming of age' of EPR dosimetry!

Market Place

POSITIONS

Positions available immediately at Dartmouth

Job description: The Electron Paramagnetic Resonance (EPR) Center for the Study of Viable Systems at the Dartmouth Medical School is developing instrumentation and methodology to enable after-the-fact characterization of individual personal radiation exposures following a large-scale radiation accident or attack. This research is supported by several major grants from federal agencies. Our approach focuses on the use of EPR spectroscopy to detect radiation induced radical species in tooth enamel and keratin in nails.

Requirements for the instrumentation include high sensitivity to radicals present in the tissues, full automation of measurement procedures, compatibility for use with human subjects, ease of transport, and reliability and robustness under field conditions.

Activities within our engineering lab include the development of surface-loop and other novel resonators for detection of in vivo EPR signals, the design and fabrication of RF bridges, and the incorporation of these components into optimized systems capable of automatic tuning, coupling, and phase adjustment.

We are seeking several well-prepared, highly motivated individuals to join our international team pursuing this research. The persons hired for this position will assist in the design and construction of the instrumentation for EPR spectroscopy and will service the prototype instruments being evaluated within clinical studies. More specifically, they will be working with a team of local RF engineers, as well as national and international collaborators, to design, fabricate, and optimize RF bridges and resonators and to incorporate them into fully functional and automated instrumentation, to enable EPR techniques to address an important national security concern.

The candidate should have experience in the design and manufacture of RF systems for frequency conversion and signal demodulation. The candidate should have practical knowledge in digital electronics systems and proficiency in Matlab based analyses. Familiarity with simulation software such as HFSS, ADS, and/or Pspice is desirable. Prior experience with EPR is desirable but not essential. An advanced degree in engineering is desirable. A strong work ethic and willingness to work hard and learn new areas is essential.

Qualifications: BS or more advanced degree in RF engineering or Physics. Experience with at least one and preferably several of the following: (1) EPR experience, (2) microwave circuit and/or system design experience, (3) modeling experience with either HFSS, ADS, Pspice or other circuit software design packages, (4) knowledge of Matlab, (5) digital electronics experience.

Contact:

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Dartmouth Medical School
704 Vail, HB7785
phone: (603) 650-1784
fax: (603) 650-1717
e-mail: epr@dartmouth.edu

Multiple positions available – will consider varying degrees of expertise.

Positions available in the Eaton lab (University of Denver EPR Center)

Positions are available in the Eaton lab (University of Denver EPR Center) for graduate and postdoctoral students and engineers with a strong interest in EPR instrumentation.

Gareth R. Eaton geaton@du.edu

Postdoctoral position at Physics Department, National Dong Hwa University, Taiwan

A postdoctoral position is available in the laboratory of Prof. Shyue-Chu Ke at the Physics Department, National Dong Hwa University, Taiwan.

The research will involve the application of EPR and pulsed EPR spectroscopy to understand the fundamental questions related to adenosylcobalamin-dependent enzymatic reactions.

Additional information about the laboratory is available at:
www.phys.ndhu.edu.tw/teachers/ke/ke.htm.

Applicants should have experience in analytical techniques and continuous or pulsed EPR methods and data analysis. Experimental physical chemists with experience in cell culture or synthesis would be beneficial, but is not essential.

The position is available this summer and appointments are for up to 3 years.

If interested, please send a CV and summary of previous research experience to ke@mail.ndhu.edu.tw.

EQUIPMENT

Design and construction of EPR electronics

The University of Denver can supply electronic design and construction services for EPR applications. Low-noise pulse amplifiers, low-noise 100 kHz preamplifiers, boxcar integrators, and pulse timing systems are available. We also supply a conversion kit to convert Varian field-control units to voltage-controlled scan operation. A 6-digit 1-ppm frequency counter is available in X-, C-, S-, L-band, or MHz versions. Complete microwave/RF bridges from 150 MHz to L-, S-, or C-band are available from designs previously built and tested at the University of Denver.

Please contact: Richard W. Quine,
e-mail: rquine@du.edu,
phone: 1-303-871-2419

For sale: Varian and ESR equipment

Resonance Instruments has available: (1) Replacement klystrons for Varian EPR bridges and some Bruker bridges (at reduced prices) and other klystrons; (2) Resonance Instrument's Model 8320A is a general purpose Hall-effect based magnetic field controller that provides direct control and precise regulation of the magnetic field between the pole pieces of an electromatnet. Its high resolution permits precise adjustment of the magnet's field either though the front panel keyboard or though an RS232 serial interface with your PC.

Please contact: Clarence Arnow, President, e-mail: 8400sales@resonanceinstruments.com, phone: 1-847-583-1000, fax: 1-847-583-1021.

Available: Used Varian EPR equipment

(1) Varian E-104 EPR spectrometer with vertical style bridge and e-line fieldial. (2) Varian E-9 EPR spectrometer. Both available with warranty and continued service support. (3) Varian TM cavity with flat cell holders and flat cells. (4) Varian E-257 variable temperature controller with heater sensor and insert holder. (5) Varian E-272B field/frequency lock accessory.

Please contact: James Anderson, Research Specialties, 1030 S. Main St., Cedar Grove, WI 53013, USA.

phone/fax: 1-920-668-9905
e-mail: janderson36@wi.rr.com

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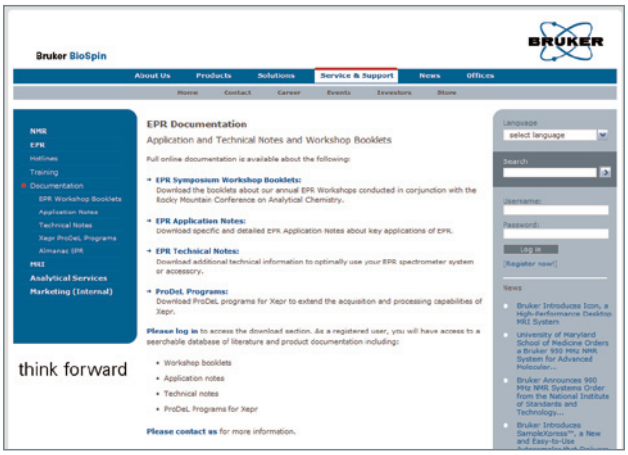

Leading performance from the company synonymous with EPR
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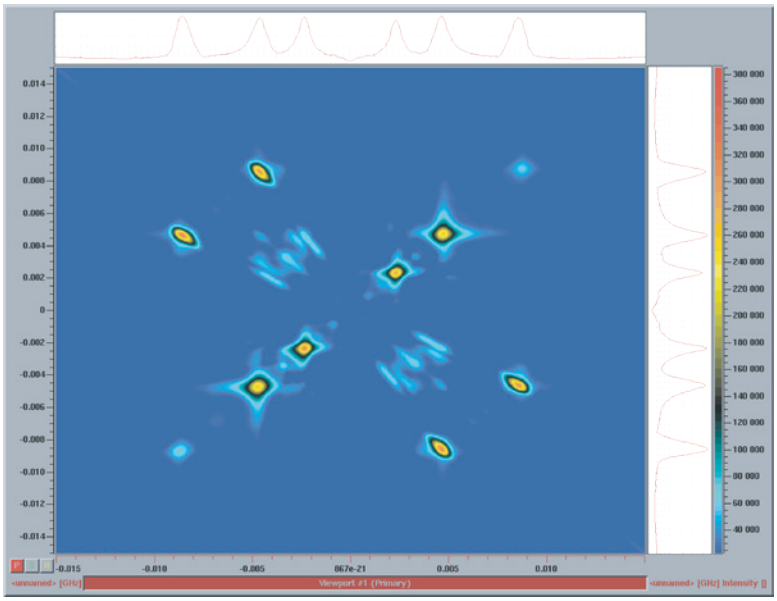
E 580 Evolution

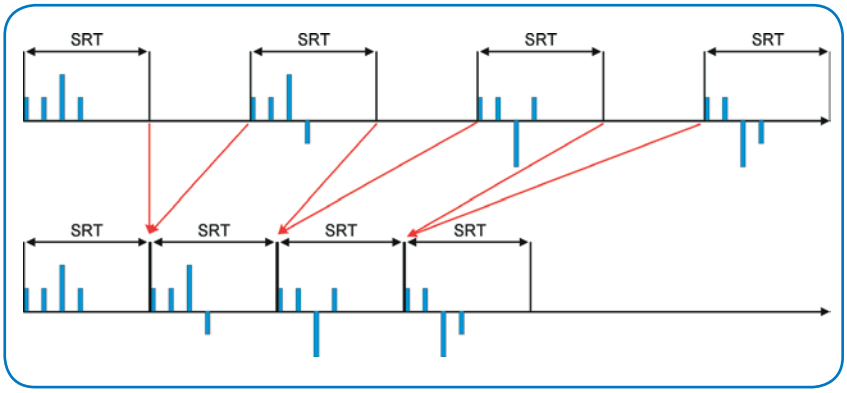
Reducing re-programming overhead by high-speed Direct Phase Cycling (DPC)



Measuring time for a 2D-HYSCORE with 128*128 points,
5 shots/point and 102 usec SRT with 4 step phase cycle:

- Previous: 346 sec
- Now: 70 sec

The unique features of the PatternJet-II and SpecJet-II are now used to perform high speed phase cycling without reprogramming overhead for 1D and 2D experiments. The full time evolution, including all phase cycles of a HYSCORE experiment, for example, are preloaded into the PatternJet-II memory and executed with no interrupts.



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