epr newsletter

2008
volume 18 number 1

The Publication of the International
EPR (ESR) Society

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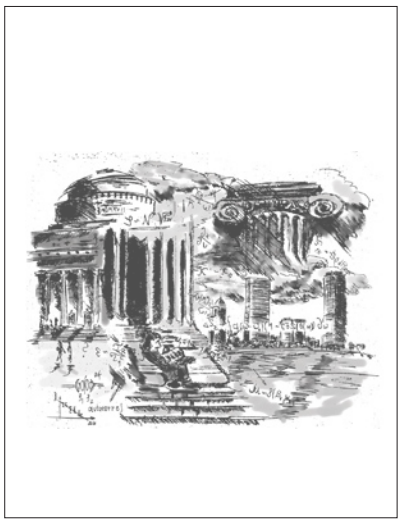
The official publication of the International EPR (ESR) Society is supported by the Society, by corporate and other donors, the Zavoisky Physical-Technical Institute of the Russian Academy of Sciences, Kazan, Russian Federation, and the Swiss Federal Institute of Technology, Zürich, Switzerland.

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.

ISSN 1094-5571

PRINTING: LaPlume and Sons Printing, Inc.
One Farley Street, Lawrence MA 01843 USA
phone: (978) 683-1009, fax: (978) 683-4594



The cover picture shows an etching by Thomas F. Prisner, recipient of the 2007 IES Silver Medal for Physics/Materials Science. This etching dates back to 1990 when he worked as a postdoc in the laboratory of Robert Griffin after finishing his PhD thesis with Klaus-Peter Dinse at Dortmund University. It was his first encounter with high-field EPR and DNP. The etching is a collage of impressions from MIT, Charles River skyline and figures and calculations out of his notebook.

epr newsletter

The Publication of the International EPR (ESR) Society

volume 18 number 1 2008

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Editorial

Dear colleagues,

I understand you are greatly impressed by the cover picture. I still remember my own sensations when I first saw Thomas Prisner's etchings while visiting his lab on Christmas Eve, 2004. Yes, a talented man is talented in many things. I hope that in one of the forthcoming issues of the *EPR newsletter* Thomas will kindly let us have a look into the depth of his personality by writing an article for the Another Passion column. Now he tells us about a special issue of *Applied Magnetic Resonance* on dynamic nuclear polarization to be printed very soon (p. 18). To quote his article, "It covers the state-of-the-art in recent developments and achievements in the field of DNP and may serve not only as a reference basis and data collection for specialists in the field but also as a good introduction and overview for newcomers in this vastly expanding field. It collects for the first time a broad range of theoretical and experimental developments as well as their first applications in a broad range of areas". Please check the list of contents and maybe you will be interested in ordering it while it is still available.

Interestingly, in this issue, two articles meet: one by Jan Schmidt, the Zavoisky Award 2006 and the IES Gold Medal 2008 (p. 7), and another by Eli Shkrob, the IES Young Investigator Award 1999 (p. 6). Both demonstrate the great potential of EPR in diverse fields of science.

I have good news to share: Gunnar Jeschke moved to ETH to take the position of a Professor in EPR and he kindly agreed to keep the *EPR newsletter* website in his laboratory. I am glad that our collaboration with EPR@ETH continues. I would like to thank our former webmasters from the Schweiger group: Moritz Kälin, Stefan Stoll, and Patrick Lèger. Besnik Kasumaj was very helpful as well, thank you, Besnik! It is my pleasure to welcome a new webmaster, Veronika Schlupp.

Last but not least, in this issue you find the registration/information form for new/continuing members of the IES (p. 17). Please fill out this form and send with your dues, you may also use this form to update or correct the information in the IES database. Here is a special request for current IES members: please have a look around and if you find an EPR researcher not involved in the IES activities yet, attract his/her attention to this form and to the IES website (www.ieprs.org) and the EPR newsletter website (www.epr-newsletter.ethz.ch). If you have copies of the EPR newsletter at hand, show them so that they can see how good it is! I hope that next time we will have to print many more copies than we do now!

Laila Mosina

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

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Fellowship of the IES to...

Professor Gareth Eaton

FELLOW OF THE SOCIETY 2008

Professor Gareth Eaton, University of Denver John Evans Professor since 1997, is a pioneer of electron magnetic resonance. Gareth studied at Harvard for a BA in Chemistry and received a PhD in Inorganic Chemistry at MIT where he met and married Sandra. Together, they formed a remarkable scientific partnership that has flourished for about 30 years. They have developed imaging techniques using CW, pulsed and rapid-scan methodologies for in vivo applications, have applied pulse techniques to measure weak interactions between transition metal centers and nuclear spins in close proximity to the metal and applied the method to examine binding sites in metalloenzymes, and have made significant advances in measuring inter-spin distances and applied these to spin-labeled metmyoglobin, spin-labeled carbonic anhydrase, and other biomolecules possessing two unpaired electrons. Gareth has authored over 250 publications, several books on EPR and has contributed to numerous multi-author monographs.

In addition to his researches, Gareth has also provided great services to the EPR community. In particular, the founding and running of the EPR Symposium at the Rocky Mountain Conference (now in its 31st year), and he is noted for encouraging talks on innovations and its pre-Symposium workshops. Gareth has also served as founding Secretary (1989–1993) of the International EPR/ESR Society.

Gareth Eaton's achievements have been recognized in the past with a Special Award of the International EPR/ESR Society in 1996, a Special IES medal commemorating 25 years of the EPR Symposium in 2002 and in 2002 the Bruker Prize awarded by the ESR Group of the Royal Society of Chemistry.

The title of Fellow of the Society is conferred on those who have made truly outstanding contributions to EPR theory and/or practice. It is very appropriate that Gareth Eaton should be honored with a Fellowship of the International EPR/ESR Society.

2008 IES Gold Medal to Jan Schmidt

The Gold Medal 2008 of the International EPR/ESR Society honours Prof. Dr. Jan Schmidt for his remarkable achievements in EPR research. Jan Schmidt started his career in Paris in 1964 by studying EPR of phosphor impurities in silicon via changes in the photoconductivity. During his Ph.D. and postdoctoral work at the University of Leiden he was the first to observe the zero-field ODMR signals and electron-spin-echo signals of photo-excited triplet state molecules. After his post-doctoral period at IBM in San Jose, where he performed photon echo experiments, he started in 1974 a long career as Lector and later Professor at the University of Leiden, pursuing research in the fields of EPR and of laser spectroscopy.

His achievements in EPR include the realization of pulse high-field/high frequency EPR/ENDOR spectrometers working at 95 and 275 GHz, the first observation of the microwave transition of a single molecular spin and the observation of single-molecule EPR and the hyperfine splitting owing to a single nucleus, the study of the spatial distribution of the wavefunction of shallow centres in semiconductors and the use of photoexcited triplet states to produce high nuclear polarization. He is the author of more than 200 scientific papers and previous awards include the IES Silver Medal for Instrumentation (1995), Bruker Prize (1999), Ampère Prize (2000), Jacob Kistemaker Prize (2001) and Zavoisky Award (2006).

Members Notice

Paid up members, who have added their email address to their 'members profile', should be receiving email notification of the download password and that the latest issue of the *EPR Newsletter* is ready to download from the newsletter website (www.epr-newsletter.ethz.ch). If you do not receive this notice please go to the members pages on the IES site (www.ieprs.org) to check your email address is correct. The problem may be your email service provider is blocking our emails to you. Please contact the IES Secretary or Treasurer if you need a reminder of your username or any further help.

Fellowship of the IES to...

Professor Sandra Eaton

FELLOW OF THE SOCIETY 2008

Professor Sandra Eaton, University of Denver John Evans Professor since 1997, is a pioneer of electron magnetic resonance. She obtained her BA in Chemistry at Wellesley College and then went on to obtain a PhD in Inorganic Chemistry at MIT. It was at MIT that she was introduced to magnetic resonance while studying metal complexes. It was also at this time that she met Gareth Eaton and they formed a remarkable scientific partnership that has flourished for about 30 years. Together, they developed imaging techniques using CW, pulsed and rapid-scan methodologies for in vivo applications, have applied pulse techniques to measure weak interactions between transition metal centers and nuclear spins in close proximity to the metal and applied the method to examine binding sites in metalloenzymes, and have made significant advances in measuring interspin distances and applied these to spin-labeled metmyoglobin, spin-labeled carbonic anhydrase, and other biomolecules possessing two unpaired electrons. Sandra has authored over 260 publications, several books on EPR and has contributed to numerous multi-author monographs.

In addition to her researches, Sandra has also provided great services to the EPR community. In particular, the founding and running of the EPR Symposium at the Rocky Mountain Conference (now in its 31st year) and she is noted for encouraging talks on innovations and its pre-Symposium workshops. Sandra has also served as founding Treasurer (1989–1993) and Vice President (1999–2002) of the International EPR/ESR Society.

Sandra Eaton's achievements have been recognized in the past with a Special Award of the International EPR/ESR Society in 1996, a Special IES medal commemorating 25 years of the EPR Symposium in 2002 and in 2002 the Bruker Prize awarded by the ESR Group of the Royal Society of Chemistry.

The title of Fellow of the Society is conferred on those who have made truly outstanding contributions to EPR theory and/or practice. It is very appropriate that Sandra Eaton should be honored with a Fellowship of the International EPR/ESR Society.

2008 IES Silver Medal to Hitoshi Ohta

for Instrumentation

Hitoshi Ohta (Professor of Physics, Kobe University, Japan) is a pioneer in the area of high frequency/high field EPR using pulsed magnetic fields and has contributed immensely to the subject and its application in Physics and Material Science.

He has developed high field EPR systems up to 55 T using pulsed magnetic fields and is currently a leader in this field. He has also opened up new fields of research by developing high frequency / high field EPR at pressures up to 1.1 GPa and high sensitivity detection under pulsed fields using a cantilever EPR system. These developments have a great potential for future applications in Physics and Materials Science.

Professor Ohta has published more than 250 papers in scientific journals, and is currently an Associate Editor of IES. He is also a founding member of the Asia-Pacific EPR Society (APES) and the Society of Electron Spin Science and Technology (SEST) and is currently President of APES (2004–2008) and a Vice-President of SEST (2008–2009).

In recognition of his many contributions to advanced high frequency/high field EPR Professor Hitoshi Ohta richly deserves the Silver Medal of the International EPR (ESR) Society.

International EPR(ESR) Society Awards 2009

Call for Nominations

Nominations are invited for: Silver Medal for Biology/Medicine, Silver Medal for Chemistry, Young Investigator Medal and Fellowship of the Society. (see extract from by-laws below or visit ieprs.org for full constitution and by-laws)

All nominations must be accompanied by a 100-150 word citation in support of the nomination. **No nomination can be considered without a citation**. Additional supporting material may be included.

Nominations are to be sent, by e-mail in word or pdf format, to the IES President.

The closing date for nominations for Awards in 2009 is 15th November 2008.

By-laws

- A Silver Medal shall be awarded for significant contributions to EPR (ESR) Spectroscopy in the area of Biology/Medicine or Chemistry.
- A Young Investigator Award shall be made for outstanding contributions to EPR (ESR) Spectroscopy by a young scientist. Nominees should be under the age of 35 years on the 1st July of the year of the award. The date of birth of the nominee must be included in the nomination. The nominee will ordinarily be at the post-doctoral level. Only in exceptional circumstances will either doctoral candidates or junior faculty members be considered for this Award. In the case of the Young Investigator Award, please provide copies of two recently published papers which, in the nominator's judgement, represents the nominees best work.
- A Fellowship of the Society may be conferred on individuals who have made influential and distinguished contributions to the practice of EPR (ESR) Spectroscopy and its welfare over a long period.

Notice of Annual Meeting 2008

The Annual Meeting of the Society will take place on Thursday July 18th 2008 during the Asia Pacific EPR Society – EPR Symposium 2008, at the Cairns Convention Centre, Cairns, Queensland, Australia..

Honorary Doctor for Wolfgang Lubitz

An Honorary Doctor has been bestowed on Wolfgang Lubitz by the Technical and Natural Sciences Faculty of Uppsala University "for his very important studies of how energy and electrons are controlled when solar energy is converted to chemical energy".

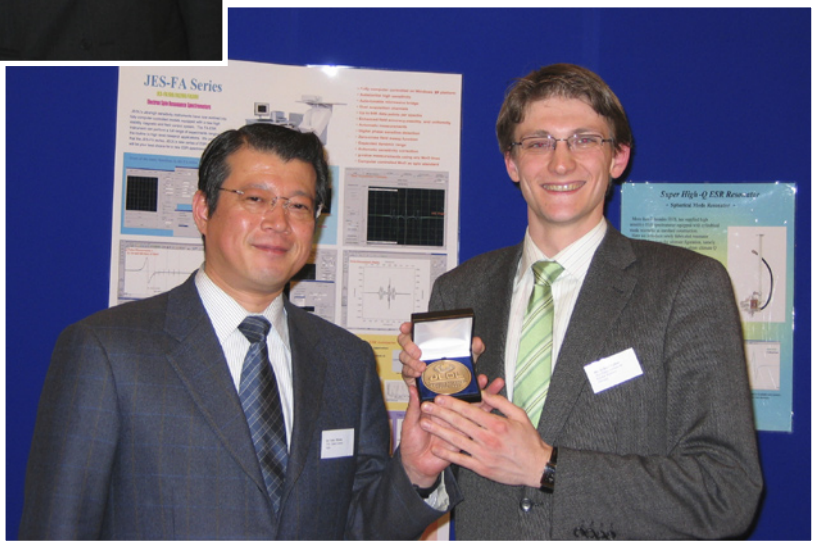
As current President of the International EPR Society and Director at the Max Planck Institute for Bioinorganic Chemistry, Wolfgang Lubitz does not need any introduction to the readers of the EPR newsletter, but the event certainly points again to his high standing in the scientific community. At the presentation with laurel, ring and certificate a cannon shot was fired for each honorary doctor, who received the appropriate cartridge afterwards. Speaker and also recipient of a honorary doctor at the 25 January 2008 ceremony was the writer Umberto Eco (The Name of the Rose). News and pictures of the event can be found on the website of the Max Planck Institute under www.mpibac.mpg.de.

Wolfgang Lubitz gets the certificate from Professor Börje Johansson, Uppsala University, and member of the Nobel Committee for Physics of the Royal Swedish Academy of Sciences.

The Bruker Prize 2008 to Edgar Groenen

From left to right: Dieter Schmalbein (Bruker BioSpin), Edgar Groenen and David Collison (UK ESR Group Chair).

For details, see this newsletter, p. 16



The Jeol Student Talk Prize to Aleksei Volkov

Aleksei Volkov (right) with Dr Mizuta (JEOL).

For details, see this newsletter, p. 16

IES Young Investigator Award Revisited

This column features former recipients of the IES Young Investigator Award.

Spinning the Yarn

I was introduced to EPR almost twenty years ago, by the combined efforts of Anatole Buchachenko, Keith McLauchlan, Jeffrey Wan, and Alex Trifunac. They wasted no time explaining to me that I knew next to nothing about EPR and I had a lot to learn. It was only after I received the IES Young Investigator Award in 1999 that I realized that I might be an EPR spectroscopist of sorts. I told that to Alex; he had a good laugh at me. He was right, I have a commitment problem. I've been drifting towards ultrafast pump-probe and X-ray spectroscopy, radiation and astro-chemistry, photocatalysis, supercritical fluids and ionic liquids, device physics, and whatnot. That, however, does not mean that I gave up on the technique; EPR continued to be the tool of choice for structural studies. I discovered that unfaithfulness pays off, it gives one the perspective of an outsider - for a price, of course. Recently, I spent considerable time trying to understand one of the commonest species in chemistry - the solvated electron. I took a heterodox position, first propounded by the late Martyn Symons, a born contrarian and one of the best EPR spectroscopists of all times, that such a species does not exist. Our heresy is that the "solvated electron" is a solvent stabilized multimer radical anion in which the negative charge is shared between the cavity and the antibonding orbitals of heteroatoms in the solvent molecules making the cavity. This goes against 60 years of picturing this species as a particle in a box. In a series of studies, we showed that Symons was correct: the "solvated electron" is a figment of physico-chemical imagination. Here the knowledge of EPR was indispensable, because part of the argument hinged on an unusual pattern of hyperfine coupling constants for the 'solvated electron'.

I am returning to EPR once more, as I have a hard problem on my hands. The US Department of Energy wants to know the potential of room temperature ionic liquids to replace conventional solvents for advanced nuclear fuel processing. This kind of innovation is required for clean nuclear energy to replace coal plants. We need to learn how radiation resistant these new solvents are and what can be done to increase their resistance. Understanding damage in these chemically complex liquids required the observation of primary radicals, which are many and fairly complex. This task was accomplished using – what else – EPR. It turned out that the fragmentation pattern is predicated on the decay path, the charge vs. the proton transfer, taken by an exotic species – organic radical dication - that is generated by the ionization of cations comprising these ionic liquids.

Another one of my EPR forays is admittedly esoteric: I just obtained funding from NASA to solve the problem of Martian soil. This goes back to the largest disappointment of my boyhood: the 1976 discovery that there were no green men on Mars. Not only did the Viking probes find no biomolecules, no organic molecules were found at all! This is odd, because over the last two billion years, Mars has been steadily bombarded by comets and (micro-)meteorites containing organic C, and the question is, what happened to this carbon? It has to be there, but it is not. Observe that the surface of Mars is red. That's because it is paved by nano- and micro-particles of Fe(III) oxide. Where does it comes from? There is almost no water and no oxygen on Mars. Why is iron present in the oxidized form under the reducing conditions? These and other puzzles suggest that the soil contains an oxidizer. It was originally thought to be hydrogen peroxide. The latest satellite data suggest otherwise, as there is too little of it in the atmosphere. To deepen the mystery, methane has been found in the atmosphere, but its source remains unknown. All of these puzzles are presently coming into play because if the soil rapidly oxidizes everything into carbon dioxide, it would be futile to search for biomarkers by scratching the surface. What is this mysterious oxidizer? No reasonable candidate has emerged so far. Here is my theory: there is, actually, no oxidizer. The oxidation is carried out photocatalytically by the Fe(III) oxide particles themselves. An interesting feature of the hypothetical photocatalytic cycle is that it ends in a photo-Kolbe reaction releasing the methane. Another feature is that the cycle erodes the particles, thereby explaining the origin of the fine oxide dust. The surface of Mars could be a humongous photosynthesis operation that is assisted by its thin, phototransparent atmosphere. From our standpoint, this type of photosynthesis – converting organics to CO_2 – is a tremendous waste of a good thing, and it should be the other way around, but the Martians prefer inorganic chemistry. This summer, we will start exploring this scenario, and we will be using EPR as one of the main tools for identification of radicals and spin centers generated during the photocatalytic cycle. I have no idea how it will turn out.

I often run into people saying that EPR is old news, that there are better and fancier spectroscopies, and so forth. The best argument I can furnish to prove these people wrong is to find new, imaginative ways in which EPR can be used to solve outstanding problems in physics, chemistry, and biology. I thank Providence for my chancy encounter with EPR spectroscopy and the remarkable people who developed, advanced, and applied it in novel ways. They are my kind of people, and I am still struggling to step into their shoes.

And so I promise to be more faithful in the future...

Eli Shkrob

The Zavoisky Award 2008

Michael Mehring

University of Stuttgart, Stuttgart, Germany

Forty Years in the Footsteps of the Pioneers in EPR Spectroscopy

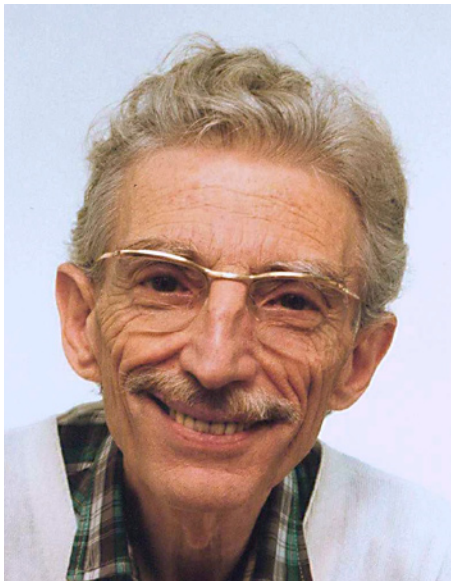
Jan Schmidt

Leiden University, Leiden,
The Netherlands

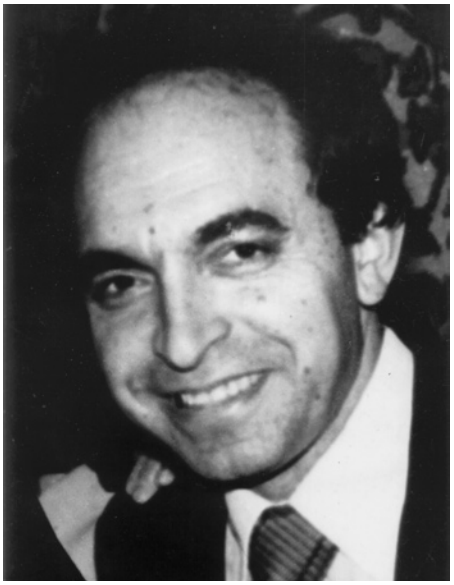
At the occasion of the Zavoisky Award, which was awarded to me in Kazan in 2006, I was asked to give a short overview of my scientific life. This stimulated me to think about the question of why I decided to dedicate so much effort to the understanding, application and development of EPR spectroscopy. I realized that I owed a lot to the inspiration, insight and guidance of a number of outstanding scientists with whom I had the privilege to work. It is for this reason that the title of my lecture was "Forty years in the footsteps of the pioneers in EPR spectroscopy". It was Laila Mosina who convinced me to put this overview in writing for the *EPR newsletter*. I do hope that the readers may find this story interesting and perhaps some of you will recognize some of their own experiences.

I finished my masters degree at the University of Amsterdam in 1961 in the field of the magnetism of thin metal layers, a subject that attracted a great interest at that time in view of the application in memory devices. Immediately after my graduation I had to go into military service for almost two years. First I went through a training that made me an officer in the infantry. Fortunately for me, the generals at that time realized that there were many young men with a university degree who were wasting their time as a 'sand hare'. They decided that these guys might be used as cheap labour in their technical services and I was so lucky to be placed in a laboratory to work on radar problems for the navy. During this time I learned a lot about microwave technology.

After this military period I applied for a job and I quickly got offers from both Philips Research Laboratories in Eindhoven and the Shell Laboratory in Amsterdam. In particular the research at this Shell laboratory attracted me. This laboratory had acquired the first commercial Varian NMR spectrometers in The Netherlands, operating at 60 MHz, and I considered these machines miracles of technological development. Not only was the equipment outstanding, compared to the outdated instruments in the universities, but also the science. I was particularly intrigued by the way quantum mechanics was used in magnetic resonance. During my time as a student, quantum mechanics was my favourite subject and I realized that I had forgotten most of it during my military service. Joan van der Waals was director of the basic research group at the Shell Laboratory and to my delight he not only offered me a position but he also arranged for me to spend two years abroad to be trained in magnetic resonance. Since I had a great preference to go to France, it was decided that I would spend two years in the laboratory of Ionel Solomon at the École Polytechnique in Paris. Ionel Solomon had just been appointed as professor after working many years with Anatole Abragam in Saclay. These two years, from 1964 till 1966, were not easy because I had to improve my knowledge of the French language considerably and I had to learn a lot about magnetic resonance, theoretically as well as experimentally. In particular I had the study the 'bible' of magnetic resonance "The Principles of Nuclear Magnetism" by Anatole Abragam. This book was expected to lie visibly on the desk of every student in this laboratory and ready to be opened



Jonel Solomon



Yakov S. Lebedev

Joan van der Waals

at any moment that you could not proceed with the experiment.

During this period in Paris I succeeded in observing the EPR in DPPH via thermal detection, i.e., by measuring the heating of the sample upon the saturation of the EPR transition. Further in silicon I observed the EPR transitions of the shallow phosphor donor via the changes in the photoconductivity. These two small successes owed a lot to Ionel Solomon who had been my teacher during the two years that I spent in his laboratory. Thanks to his brilliance, drive and personality I had the feeling that I understood the essentials of magnetic resonance. Moreover I had seen how efficiently he managed his research group.

When I returned to the Shell Laboratory in Amsterdam in 1966 the tides had changed. Basic research at Shell was disappearing and was redirected to very practical problems that were considered to be of interest for the oil business. Joan van der Waals and Menno de Groot however managed during that time to continue their beautiful EPR research on the triplet state of simple aromatic molecules. I shared an office with Menno de Groot and I became involved in the discussions of whether or not it would be possible to detect the EPR signals via the intensity of the emitted phosphorescence. This was a hot subject at the time and we studied thoroughly the papers of Brossel and Kastler from 1949 and Brossel and Bitter from 1952 about the optical detection of the transitions between the sublevels of the $^3P_1$ state of Hg atoms, and of Geschwind, Collins and Schawlow who in 1961 observed the EPR transitions in the $\bar{E}(^2E)$ excited state of Cr^{3+} ions in Al_2O_3. My suspicion was that the failure to observe ODMR signals in the triplet state might be related to a slow SLR rate between the sublevels. With my knowledge of magnetic resonance acquired in Ionel Solomon's laboratory I proposed to apply magnetic field modulation instead of amplitude modulation of the microwave power and to my surprise this led to immediate success. Unfortunately we were just too late because a few weeks after our experiments, in 1967, publications appeared by Sharnoff and Kwiram with the first ODMR results on the triplet state of naphthalene and phenanthrene. Our results on quinoxaline were interesting enough to be published but our feeling was that we had only won a bronze medal.

The successful ODMR results convinced me that my future was in academic science and not in the Shell Laboratory. In 1968 I decided to follow Joan van der Waals to Leiden University, where he had just been appointed a professor in the Department of Physics with the task of setting up a collaborative effort between the Departments of Physics and Chemistry. At Leiden University I began the construction of a spectrometer that would allow us to observe ODMR signals on photo-excited triplet-state molecules in zero-magnetic field. I was convinced that this experiment should work but simultaneously had the feeling that the results would not be very interesting. The reason was that in zero field the hyperfine interactions reduce to a second-order effect and consequently the hyperfine splittings disappear. I was convinced that after the observation of the zero-field transitions we would move quickly to ENDOR spectroscopy in a magnetic field to study hyperfine interactions of photo-excited triplet state molecules.

The first observation of zero-field ODMR signals took place on September 8, 1968 and I still remember our excitement. This time we had beaten our competitors and this gave a feeling of great satisfaction. It marked the start of a considerable effort in our laboratory in Leiden. First we confirmed that the line shape of the zero-field transitions did not provide a great deal of information because first-order hyperfine splittings are indeed absent in zero field. The unexpected finding was that in the temperature range between 1 and 2 K the spin-lattice relaxation times between the sublevels of the triplet state become so slow that the sublevels become 'isolated', i.e., the populating and decay rates of the sublevels occur independently. By applying pulsed, resonant, microwave fields during the decay of the phosphorescence it proved very straightforward to unravel the decay rates and relative populating rates of the sublevels. This MIDP or Microwave Induced Delayed Phosphorescence method became very popular and led to a large number of publications. The result of this research was a complete understanding of the selection rules that govern the populating and depopulating rates of the triplet sublevels of aromatic molecules and the role played by the spin-orbit coupling in these processes. In retrospect, zero-field ODMR was simple and very rewarding and this may have been the reason why so many other groups became engaged in this type of spectroscopy.

Inspired by the MIDP experiments I became interested in time-resolved electron-spin-echo (ESE) experiments as pioneered at that time by William B. Mims, then at the Bell Telephone Laboratories, and the recipient of the first Zavoisky Award in 1991. With relatively simple means we converted a Varian X-band EPR spectrometer into an ESE spectrometer that we gradually built up, following the example of Bill Mims.

In 1983 David Singel, then a postdoctoral fellow in our laboratory in Leiden, showed me a publication of Yakov Lebedev that had just been translated into English and that described experimental results of a 140 GHz

EPR spectrometer constructed by him and his collaborators in Moscow. I was extremely impressed by this technical performance and in particular by the resolution that could be obtained in the magnetic field of almost 6 Tesla. I realized that the anisotropy of the g-tensor at this high magnetic field allows the selection of molecules in a given orientation in randomly oriented materials. Inspired by this publication and with our experience in pulsed EPR, we decided in 1985 to make the great leap forward and to construct a 95 GHz pulsed EPR spectrometer. To my surprise and relief we got permission to buy the necessary microwave equipment from Hughes Aircraft Company in the USA. Remember, we were still in the Cold War and this microwave equipment was used for all kinds of advanced military applications. Probably because The Netherlands was considered to be a reliable NATO partner we obtained the export license. In the course of the following seven years we completed step by step the pulsed EPR and ENDOR spectrometer at 95 GHz. Oleg Poluektov, from Yakov Lebedev's laboratory, joined our group in 1990 and played an essential role, after the efforts of Ralph Weber and Jürgen Allgeier, in the completion of this spectrometer. Many results were obtained. I mention here the ENDOR spectrum of ^{107}Ag and ^{109}Ag nuclear spins in the EPR signal of the shallow donor in AgCl. This spectrum demonstrated the beautiful resolution that can be obtained at high fields not only in the EPR but also in the ENDOR spectra. The research on AgCl was followed by many studies on semiconductors that were inspired by Pavel Baranov from the Ioffe Institute in St. Petersburg in Russia, with whom we have collaborated during for almost two decades. The recent results on the nanoparticles of ZnO demonstrated convincingly the attraction of high-frequency EPR and ENDOR spectroscopy for studying semiconductor nanoparticles. For the first time, the atomic structure of donors and acceptors in nanoparticles was ascertained; a result that cannot be obtained with optical spectroscopy.

Very stimulating for us was that Bruker BioSpin became interested in our spectrometer and decided to develop a pulsed and cw EPR spectrometer operating at 95 GHz. The overwhelming observation during the European EPR meeting in Madrid in 2006 was that many EPR scientists in the world now have access to high frequency EPR, in particular 95 GHz.

Stimulated by the success of the 95 GHz EPR spectrometer we embarked in 2000 on the construction of a 275 GHz cw and pulsed system that was completed in 2006. Here I owed a lot to my two technicians, Jos Disselhorst and Harmen van der Meer. Together with Huib Blok, and Serguei Orlinskii from Kazan State University in Russia, they succeeded in constructing this advanced system. Here again we stumbled over an unexpected result. When studying the EPR signal of the shallow H donor in ZnO we discovered a spectacular shift of the EPR line caused by the dynamic nuclear polarization of the ^{67}Zn nuclear spins via an Overhauser effect induced by the zero-point vibrations of the empty phonon system in the crystal. It again demonstrates that, when introducing new spectroscopic tools, one discovers new and unexpected effects.

This overview is not exhaustive, and in particular I did not mention all of the colleagues with whom I have collaborated. I do hope that I have convinced you that during my 40 years of activity in EPR, many outstanding scientists have inspired me. Some of them have been my teachers; many have stimulated me during discussions in their laboratories or during conferences. In particular, at the occasion of the Zavoisky Award and my visit to Kazan, I would like to thank my Russian friends and colleagues with whom I had such good relations over many years.

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   Instruments for CW-EPR, FT-EPR, EPR imaging, high-frequency EPR, electron-electron and electron-nuclear multi-resonance EPR - we supply them all - and in the highest of specifications.

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EPR Solutions

Samuel Isaac Weissman (1912–2007)

Samuel Isaac Weissman, Ph.D., Professor Emeritus of Chemistry in Arts & Sciences who worked on the Manhattan Project, died June 12, 2007, at the age of 94.

Born in South Bend, Indiana, USA in 1912 on June 25, he was educated in Chicago's public schools. Weissman attended the University of Chicago and earned a bachelor's degree (1933) and doctorate (1938) in physical chemistry. He went to the University of California, Berkeley, and worked as a National Research Council fellow with physical chemist Gilbert Newton Lewis. During this time, he worked on optical properties of rare earths, laying the foundation for certain lasers and some resonant energy transfer methods.

Dr. Weissman's work at Berkeley was cut short by World War II. He was one of the first to arrive at Los Alamos, N.M., where he was assigned to work on the Manhattan Project – the development of the first atomic bomb. He was among a group who asked unsuccessfully that the bomb not be dropped on civilian targets. According to his son, Michael Weissman, Ph.D., professor of physics at the University of Illinois at Urbana-Champaign, despite his father's intimate knowledge of how to build an atomic bomb, in the Sen. Joseph McCarthy years, he was denied security clearance to do summer work on essentially non-military magnetic resonance projects at Brookhaven National Laboratory. The most serious charge was that his mother had given money to a collection for the Spanish Republican government. The security clearance was restored by 1954.

Dr. Weissman came to the Washington University in St. Louis (WUSTL) in 1946 and became a full professor in 1955. The group of six who came to St. Louis from Los Alamos – Lindsay Helmholz, Joseph Kennedy, David Lipkin, Herbert Potratz, Arthur Wahl and Samuel Weissman – founded the modern Department of Chemistry at WUSTL. At the University, Dr. Weissman, in collaboration with other scientists, pioneered the use of electron spin resonance in chemistry. This developed into his primary work. Although he became an emeritus professor in 1980, until recently, he was an almost daily presence in the department, discussing research and planning experiments with colleagues and students.

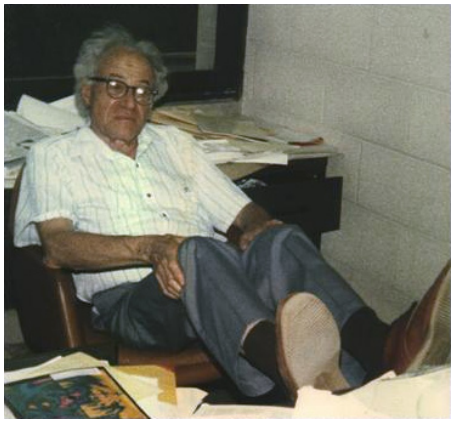
Dr. Weissman was elected a fellow of the American Academy of Arts and Sciences in 1963 and was elected to the United States National Academy of Sciences in 1966. He was appointed a Fellow of the International EPR/ESR Society in 1995.

Reminiscences by Gerd Kothe and Jim Norris

To summarize adequately and fairly the life of a mensch like Sam Weissman is not possible. Ask anyone who knew Sam well. This is our biased and personal attempt to provide a brief glimpse into Sam's genius. Sam's own version of "The Way It Was" can be found in the Annual Reviews of Physical Chemistry, volume 41, pages 1–13, 1990.

While working on isotope separation in 1942 at Berkeley, Sam Weissman and Dave Lipkin performed an experiment on the fundamental nature of the phosphorescent state. Speculation then existed that long-lived phosphorescence proceeded not by an electric dipole mechanism, but by a higher order multipole. They determined the mechanism of the beta phosphorescence of fluorescein, one of G. N. Lewis' favorite phosphorescent molecules. The experiment was finished in one week; the answer, pure electric dipole [1].

In 1952, Sam Weissman and his colleagues G.E. Pake and J. Townsend reported the first observation of hyperfine structure in the EPR spectra of radicals in solution [2]. Four years later he and Harden McConnell independently gave a quantum mechanical



Sam in his rocking chair.

interpretation of the isotropic hyperfine coupling constants of π-radicals [3, 4]. This fundamental result proved to be of great importance for the development and examination of π-electron theories. Moreover, Weissman and McConnell demonstrated how EPR could be utilized to gain information about details of molecular structure.

Beginning in 1957, Sam Weissman showed that line broadening phenomena could yield information about the mechanism and rates of a variety of fast chemical reactions, including electron and atom transfer between molecules in solution [5]. Later on these studies were extended to ketyl radicals and their paramagnetic dimers in which the spin-spin interactions were probed by dynamic EPR [6]. In 1958, Sam made another classical contribution by recognizing the significance of the electron dipolar interaction for the observation of triplet EPR spectra [7], first reported by C. A. Hutchison and B. W. Mangum [8]. Since that time the number of studies of photo-excited triplet states has increased enormously. In 1969, Sam Weissman's insight resulted in a density matrix approach for calculating dynamic triplet lineshapes [9]. It turned out that this method is fairly general and equivalent to the stochastic Liouville approach, independently developed by R. Kubo and J. H. Freed [10].

In the early to mid 70s, Sam Weissman published a series of papers on transient and quantum effects in photoexcited triplets in the presence of a magnetic field [11, 12]. Beginning about 1975, he pioneered the development and application of transient nutation EPR. Combination of this technique with pulsed laser excitation provided valuable information about short-lived photo-induced intermediates including a phosphorescent quartet state [13, 14]. Recent successful applications of this method involve the detection of quantum oscillations in the radical-pair intermediates of photosynthesis [15].

Since 1995, Sam Weissman and his colleagues at Washington University/St. Louis pioneered the development of pulsed zero-field EPR combined with fast-field switching to study the structure and dynamics of photo-excited triplet states [16]. It appears that this new technique finally enables the detection of the quantum interference effects which he predicted more than 30 years ago [17].

Many other examples of Sam's influence can be found, especially in the acknowledgement sections of other landmark journal publications, one example found in Clyde Hutchison's classic paper on the first EPR detection of triplet excited states of naphthalene.

Sam was much more than just a great scientist. Sam was known to possess an irreverent sense of humor. He was especially fond of telling about his experiences during World War II at Los Alamos while on the Manhattan project. His sense of humor was revealed numerous times through his colorful descriptions of this critical period in history. True to the end, his sense of humor never left him.

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Helmut Beinert (1913–2007)

Helmut Beinert, Professor Emeritus, University of Wisconsin-Madison, died on December 21, 2007, at the age of 94. He was born November 17, 1913, in Lahr, Germany. He received an undergraduate education in the classical traditions of Latin, Mathematics, Greek and French, along with some Chemistry and Physics. He then studied acting at the State Theater and became a professional actor prior to being drafted into the army. Helmut asked for and was granted a leave to pursue graduate studies in Chemistry at the Universities of Leipzig and Heidelberg. His thesis work, completed in 1943, was carried out at Kaiser-Wilhelm Institute for Medical Research in Heidelberg. Dr. Beinert was careful to avoid research that would stimulate any interest from the military, and surviving the turmoil of the war years was something that he attributed to the good fortune of simply being born in 1913 instead of 1914.

After the war, the Control Commission of the Allied Forces moved a group of medical doctors and chemists to Randolf Field in Texas, where Dr. Beinert carried out studies on the fate of exogenously administered cytochrome c in tissues. In 1950, Dr. Beinert came to the Institute for Enzyme Research in Madison to carry out postdoctoral work. One of his early projects was to develop a new method for the isolation of coenzyme A. Dr. Beinert was promoted to professorial rank in 1952 and became a full professor in 1962. He retired from the University of Wisconsin in 1984 and took a professorship at the Medical College of Wisconsin in Milwaukee where he remained until returning to Madison in 1994. He remained actively engaged in research and scholarly activities, and his passion for science continued until his death.

Dr. Beinert leaves a remarkable record of contributions and accomplishments in biochemistry and biophysics. His name is always associated with the field of iron-sulfur proteins, although he was adamant in pointing out that he was not the original discoverer of this class of proteins. Rather, he was the leading figure in characterizing the electronic structures and functions of many members of this large family of metalloproteins. Dr. Beinert was an early proponent of the use of EPR spectroscopy to study paramagnetic intermediates in flavoproteins and well as metalloproteins such as the iron-sulfur proteins. His research articles and scholarly reviews did much to introduce EPR to the biochemical community. His collaborative EPR experiments in the 1960's wherein ^{57}Fe and ^{33}S and subsequently ^{77}Se were incorporated into iron-sulfur proteins revealed the covalent nature of the iron-chalcogen core were classic achievements. Dr. Beinert's work on fatty acid oxidation and tissue respiration led to many important discoveries including an abundance of iron-sulfur centers in proteins of the respiratory chain of mitochondria. The discovery of an iron sulfur cluster in the tricarboxylic acid cycle enzyme, aconitase, expanded the repertoire of iron-sulfur clusters beyond electron carriers to catalysts. This discovery rekindled Dr. Beinert's interest in iron-sulfur enzymes. Subsequently, Dr. Beinert participated in revealing the roles of iron-sulfur clusters in transcriptional and in translational regulation. Dr. Beinert's scientific contributions span a period of more than 60 years.

Dr. Beinert's accomplishments were recognized internationally. He was respected as a pioneer in the areas of bioinorganic chemistry and biophysical spectroscopy. He was a recipient of a lifetime NIH Career Development Award. He was elected a member of the US National Academy of Sciences in 1980. Dr. Beinert's numerous awards included the Keilin Medal of the British Biochemical Society, the Sir Hans Krebs Medal of the European Biochemical Societies, the Fritz Lipmann Award from the American Society of Biochemistry and Molecular Biology, the Otto Warburg Medal of the German Society for Biochemistry, and Honorary Doctorates of Science from the University of Wisconsin-Milwaukee and the University of Konstanz.

For the last several years Dr. Beinert maintained a quiet presence at seminars and symposia around the Madison campus. His early morning trips to the Steenbock Library equipped with his briefcase, dark glasses, and flat cap were a familiar and comforting sight. Dr. Beinert was popular with students and postdoctoral fellows who benefited from his encyclopedic knowledge of biochemistry and his willingness to share his perspective on science. Dr. Beinert had many collaborators at the University of Wisconsin and around the world. Many of these projects established new areas of investigation that provide a continuing legacy for Dr. Beinert. His sharp wit, remarkable intellect, exceptional standards, and indomitable spirit will be sorely missed.

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Helmut Beinert – Reminiscences

About 1964, when I was an undergraduate, a forward-thinking lecturer told us about the mysterious 'g = 1.94 EPR signal' observed by Helmut Beinert in some important respiratory enzymes. Beinert's analyses had shown that in mitochondria there was more iron than could be accounted for by the cytochromes. With Dick Sands, he investigated this anomaly using EPR spectroscopy, which opened a new window on the radicals and transition metals in biological systems (Beinert and Sands 1960). Nowadays the iron-sulfur proteins, as they soon became known, are well established in the text-books, but at the time the EPR method was not widely appreciated. In 1965 Beinert wrote a review describing the basic properties of the iron-sulfur proteins, in which he noted: "Finally it is worth emphasizing that all of the work reported in this paper points out the virtues of the, at least in biological applications, much-criticized and condemned low-temperature EPR technique." (Beinert 1966). But EPR was soon taken seriously, as there followed a wealth of discoveries of iron-sulfur proteins in laboratories around the world. What had first appeared to be horrendously complex EPR spectra were an indication of the vital role of the iron-sulfur

proteins in cellular respiration and photosynthesis. With Bill and Nan Orme-Johnson, Beinert set about dissecting the EPR spectra of the mitochondrial electron-transport chain, and by 1974 they had identified most of the major species that are now recognized (Orme-Johnson et al. 1974). Until the protein structures were discovered nearly 30 years later, EPR was practically the only method to study them.

Beinert was a consummate experimentalist, carefully verifying his measurements so they could be trusted when they led to unexpected conclusions. An example was the observation of a 'HiPIP-type' signal from mitochondria, first thought by others to be yet another electron-transfer component, which he and Frank Ruzicka showed to be an oxidized form of the citric-acid cycle enzyme aconitase. At that time, the number of iron atoms of large and unstable proteins was very difficult to estimate with certainty; values in the literature for the number of iron atoms in nitrogenase, for example, fluctuated between fourteen and nearly forty! With oxidized aconitase, Beinert found that the protein contained three atoms of iron and four of sulfur. Up till then, all Fe-S clusters known had contained either 2 Fe or 4 Fe atoms, and equal numbers of sulfurs. It was a tribute to Helmut's reputation as a precise and critical experimentalist, that his result was accepted almost immediately. With Mary Claire Kennedy, he showed that a fourth iron atom of the cluster, which plays a central role in catalysis, was easily lost by oxidation. In another twist to the story, it was shown that after removal of iron, the protein takes up a completely different role as the iron responsive protein, which controls iron homeostasis in the body (Beinert et al. 1996).

Several times in the 1970's I visited his laboratory in Madison, WI, where he generously gave me his time and access to his facilities to make rapid-freeze and liquid-helium temperature Q-band measurements. It was an education to watch Helmut at work. Analytical precision was not so much a matter of sophisticated equipment, but of painstaking experiments, often using improvised apparatus. I first saw him in the lab, preparing tiny sealed glass bubbles filled with measured quantities of sodium dithionite for stoichiometric reduction of proteins, using an ancient-looking but, in his hands, reliable torsion balance.

Despite his rather forbidding reputation, I found Helmut to be welcoming and generous to a (relatively) young researcher. He was a man of simple tastes, and his approach to the study of biochemical systems and EPR spectroscopic techniques was to make them clear and as simple as possible. He continued to carry out research and write highly-cited reviews on iron-sulfur proteins into his 80's (Beinert 2000). A meeting of the Biochemical Society was held in his honour in Leeds in 1985, which included contributions from Helmut and some of the foremost exponents of biochemical EPR spectroscopy. That year, he was awarded the Keilin medal. It was fitting that his name should be associated with that of David Keilin, the explorer of the other great class of mitochondrial iron proteins, the cytochromes (Keilin 1966).

Richard Cammack
King's College London, UK

The specter of Helmut Beinert has been hard to avoid. My graduate work on xanthine oxidase in the late Bob Bray's lab began 25 years after Bob, Helmut and Graham Palmer's rapid-freeze EPR studies of the enzyme (J. Biol. Chem., 239, 2667 [1964]). I stepped from one of Helmut's domains into another when I embarked on postdoctoral work on aconitase with Andrew Thomson; ten years earlier, Andrew and Helmut had been working together to unveil the secrets of the three-iron cluster of aconitase (PNAS USA, 80, 393 [1983]) and Helmut would continue ground-breaking work on this protein. When I eventually arrived at the EPR Center in Milwaukee, it was the laboratory of Helmut's long-time colleague Mary Claire Kennedy that I found myself occupying and to this day we use rapid-freeze equipment that once belonged to Helmut.

It was at the EPR Center that I first met Helmut, there in his capacity as chair of our Advisory Committee. Upon being introduced, I was enormously flattered that Helmut had not only heard of me, but was familiar with my work, even that well outside of the xanthine oxidase and aconitase fields; metallohydrolases, molybdenum-containing reductases, FNR. I was to learn that Helmut's knowledge of my work bespoke no personal compliment; Helmut's knowledge of the literature, of science, and of the practitioners of science was encyclopedic. He also had a sense of humor. He would be first in line at the library for the new issues of the journals and would make a discrete pencil mark on the front page of the articles that he read. When excited graduate students or colleagues arrived from the library with a photocopy of the 'latest' hot paper, Helmut, upon a quick scan for the tell-tale mark, would confidently announce that he had already read it. Although appearing frail in later years, Helmut could never be underestimated. He would sit, mainly silent and sometimes appearing barely awake, through the long Advisory Council meetings at the EPR Center. The most detailed and insightful reports on the meetings, however, came from Helmut Beinert.

The biggest impression that Helmut made on me was when I persuaded him, on behalf of the organizers at Utah State University where I had once worked, to give a keynote lecture at an ACS meeting in Logan, Utah, in 2004. Everything had to be organized meticulously and well in advance, from Helmut being picked up at home, put on the flight, setting up a ride from Salt Lake City to Logan, booking special accommodation, special meals, transport to and from USU etc. However, we did ultimately manage to get Helmut there. And how it was worth it. With only six slides, Helmut enchanted the audience with a spellbinding story of the development of what we now call inorganic biochemistry spanning more than a century of discovery and discoverers. It was a masterclass in communication and revealed the depth of Helmut's passion for his chosen path in life.

His love for science and for the people who perform science was indeed great. That is how I will remember Helmut Beinert.

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The 41st Annual ESR Conference

University College London, United Kingdom, April 6–10, 2008

The 41st Annual ESR Conference took place at University College London in the Wilkins Building, with lectures in the Gustav Tuck Lecture Theatre and posters in the South Cloisters.

The 2008 Bruker Prize Lecture by Professor Edgar Groenen (Leiden University, The Netherlands) spoke under the title: "$\Psi^{(EPR)}_{ENDOR}$".

Professor Klaus Möbius introduced the lecture, and in a fascinating talk from Professor Groenen we learned about the complementary use of EPR and modern electronic structural theory applied to a wide range of problems.

There were over 125 attendees representing19 different countries, and over a quarter of the participants were graduate students, which suggests a healthy future for ESR spectroscopy.

The scientific programme was supported by social evenings and receptions sponsored by the ESR Group of the RSC, JEOL and Bruker. The free Tuesday afternoon and evening allowed delegates the chance to explore London, with the British Museum and the British Library nearby.

Keynote lectures were presented by: Jim Norris (University of Chicago), *Exploring spin chemistry in melanin and retinal pigment epithelial eye cells using time-resolved EPR and static magnetic fields*; Gunnar Jeschke (University of Konstanz), *Structural models of proteins from pulsed EPR distance measurements*; Andrew Thomson (University of East Anglia), *Spin mapping of membrane proteins*; and Chris Kay (UCL), *Towards using electron spins as sensors*.

As well as the Keynote lectures we had a series of excellent invited and offered short talks, a poster session and the Bruker Lecture and the JEOL student talk session.

This year there were 50 posters and one was selected to win the poster prize with the traditional bottle of whisky going to Aliaksandr Marchanka (MPI, Mülheim) for his poster *Low-temperature pulsed EPR study of the triplet state of the primary electron donor and the carotenoid in bacterial; reaction centres of Rhodobacter sphaeroides*.

The poster prize winner and two runners-up, Bela Bode and Christopher Smith each received a copy of the recently published *Electron Spin Resonance: Analysis and Interpretation*, by the late Phil Rieger, the copies being generously donated by the publishers, the Royal Society of Chemistry. The JEOL prize medal attracted a number of excellent applications from which three were selected to present their talks. The JEOL prize medal for the best oral presentation by a young scientist was awarded to Aleksei Volkov (MPI, Mainz) for his talk: *Pulse EPR studies of membrane protein structure and folding on example of LHCIIb*. Joint runners-up were Sofie Cambré (Antwerp) and Michał Kużdżał (Wroclaw). All the student talks were of a very high calibre. The three students were also presented with cash prizes by Dr. Yukio Mizuta (JEOL).

The next ESR conference will take place in Norwich in the period April 19–23, 2009 (www.esr-group.org.uk).

David Collison

41st RSC ESR Group Conference, UCL 2008

Fields of Interest Abbreviations

BIOMED ..... Biomedicine
CA ..... Contrast Agents
COAL ..... Coal, Fossil Fuels, and other Carbonaceous Materials
COMP ..... Computation / Theory
CRYST ..... Single Crystals / Crystalline Materials
DMR ..... Double / Multiple MR Techniques
EPRI ..... Electron Paramagnetic Resonance Imaging
FERR ..... Ferromagnetic / Antiferromagnetic Materials
FREE ..... Free Radicals
GEOL ..... Geology
HFEPR ..... High Field / High Frequency EPR
INSTR ..... Instrumentation
ION ..... Metal Ions
KINETICS ..... Kinetics
LIQ ..... Liquid Crystals
MEMBR ..... Membranes
METALP ..... Metalloproteins
OXY ..... Oximetry
PERP ..... Pulsed EPR/ Time Domain EPR
PHOTO ..... Photochemistry/Photobiology/Photosynthesis
POL ..... Polymers
POLAR ..... Chemically-Induced Dynamic Polarization
..... Dynamic Nuclear Polarization
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SOLID ..... Solid State, Materials
SUPERC ..... Superconductors
SURFACE ..... Surface Studies
TRAP ..... Spin Trapping
VIVO ..... In Vivo EPR

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New Books & Journals

Dynamic Nuclear Polarization: New Experimental and Methodology Approaches and Applications in Physics, Chemistry, Biology and Medicine

A special issue of *Applied Magnetic Resonance*
edited by Walter Köckenberger and Thomas F. Prisner

Dynamic Nuclear Polarization (DNP) is a long known method in NMR spectroscopy to enhance signal intensity by coupling the nuclear spin system to a paramagnetic spin system and transferring the much larger electron spin polarization by microwave irradiation onto the nucleus. Despite the very large signal enhancements obtainable by this method it has only recently been used in modern high field NMR applications such as structure determinations, metabolomic screening, microscopy and imaging. The reasons for this hesitation were twofold: on the one hand there was a strong belief that the method cannot work at high magnetic field strength, on the other hand microwave equipment in the frequency range above 100 GHz, which is necessary to excite electron spins at high magnetic fields, was not readily available.

Only after the successful demonstration of DNP at high magnetic fields for SS MAS NMR applications by Griffin and coworkers and more recently by Golman and coworkers for liquid samples obtained by fast dissolution after polarization at very low temperatures, the interest in DNP fanned out rapidly to a larger community.

This renewed scientific interest in DNP is documented by a number of scientific initiatives as well as by in the impressive number of participants at the 1st DNP symposium organized by Walter Köckenberger 2007 in Nottingham: more than 150 participants attended this joint meeting of the British Radiofrequency Group and the EU Design Study Bio-DNP. The talks at the symposium ranged from hardware development, new polarization transfer methods and DNP agents to applicatations in material science, structural biology and medicine.

This interdisciplinary mix of high-frequency microwave technology and DNP hardware developments, new concepts in advanced polarization transfer methods and their application potentials in new areas of NMR spectroscopy and imaging fascinated all scientists attending the symposium and built the basis of this special issue. It covers the state-of-the-art in recent developments and achievements in the field of DNP and may serve not only as a reference basis and data collection for specialists in the field but also as a good introduction and overview for newcomers in this vastly expanding field. It collects for the first time a broad range of theoretical and experimental developments as well as their first applications in a broad range of areas. This unique collection of papers contains short and introductory articles into the basic concepts of DNP with a good data basis of relevant and important citations, reviews of the new methodology achievements of the leading groups in this field over the past years and a series of first experimental results obtained by new approaches to this topic by a number of research groups. This issue documents the current status of the fast-paced developments in the field of DNP and leads to extensive relevant literature from the past and should therefore be very valuable to many researchers.

A copy of this double issue (*Applied Magnetic Resonance* vol. 34, nr. 3-4) can be obtained as part of a subscription to the volumes of 2008, 34 and 35 (four issues each), which is offered at a special rate of EUR 199.- (excl. VAT and shipping charges) to members of the IES ordering directly from Springer-Verlag in Vienna, Austria (journals@springer.at; see also 17/4, p. 19).

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Notices of Meetings

4th EF EPR Summer School, COST P15 Training School and SUSSP 64

St. Andrews, Scotland,
August 22 – September 1 2008

The 4th EPR Summer School of the European Federation of EPR Groups, will be held in St. Andrews, Scotland from the 22nd of August to the 1st of September 2008 and is orgnanised by both St.Andrews University and Dundee University.

The European Federation of EPR Groups, now part of the Ampere group, initiated the idea of European EPR Summer Schools on a triennial schedule and it is an event that has always been strongly supported by senior members of the ESR community for the benefit of its younger members.

The first summer school was held in Caorle, Italy in 1999, the second in Retie, Belgium in 2002 and the third in Wiesbaden Germany in 2005. This year the school will also be the 64th Scottish Universities Summer School in Physics, a major training school for the EU COST P15 Action on Advanced Paramagnetic Resonance Methods in Molecular Biophysics and will also be the associated with the annual UK EPSRC ESR School.

The objective of the school is to disseminate modern EPR methodology to the scientific community through its young researchers and is primarily aimed at PhD students and early Postdoctoral Researchers using EPR spectroscopy. The aim is to have students from a wide range of disciplines, laboratories and countries. The nine day school will start off with two days of introductory lectures in EPR spectroscopy, which are then followed by more advanced lectures on EPR methods, theory and applications, with a focus on pulse ESR techniques. The school will also provide computer courses on spectral simulations and DFT calculations as well as blackboard courses on spectral interpretation. The students will have the opportunity to present posters during the school.

St. Andrews is the ancient capital of Scotland and is the third oldest University in the English speaking world and is situated next to long sandy beaches and some of the most famous golf courses in the world. Accommodation and Conference facilities are less than 100 meters from the Old Course (the oldest golf course in the world) and the West Sands beach. In the tradition of previous ESR and Scottish Summer Schools there will also be a social program that will seek to highlight Scottish hospitality and will include Whisky tasting, a Scottish Cehlidh and opportunities for sporting events as well as a trip to the Scottish Highlands. The cost for the school and all accommodation, food and events is £200 and restricted to 80 students.

The deadline for application to the School is June 15th 2008.

Further details can be found at www.st-andrews.ac.uk/~eprschool.

Market Place

POSITIONS

Magnetic resonance facility manager at Miami University

Applications are invited for a full-time EPR facility manager in the Department of Chemistry and Biochemistry at Miami University, Oxford, OH. Job Description: manage, administer, instruct, train, and maintain an instrumentation facility for EPR/NMR researchers. The department has 2 CW-EPR spectrometers, a new pulsed EPR (ESEEM, ENDOR, and DEER) instrument, and several NMR spectrometers. Requirements: Ph.D. in Chemistry or a related field, with expertise in the area of EPR and/or NMR spectroscopy. The applicant will work under the supervision of the chair of the department. Preference will be given to those with previous instrumentation facility experience. Please send your CV and three letters of recommendation to: Professor Gary A. Lorigan, Dept. of Chemistry and Biochemistry, Miami University, Oxford, OH, 45056. Review of complete applications will begin June 6, 2008. The search will continue until the position is filled. Miami is an EOE/AA employer. Campus Crime and Safety Report is available at www.muohio.edu/righttoknow. A hard copy is available upon request.

The University of New Hampshire invites

The Department of Chemistry at the University of New Hampshire welcomes inquiries from PhD scientists at any rank regarding research, and graduate and undergraduate teaching opportunities, in the area of Experimental Physical or Biophysical Chemistry. Candidates with research interests in electron resonance are particularly encouraged. Facilities include Bruker ELEXSYS E500/E560 with X-band CW-ENDOR, and Varian X- and Q-band CW-EPR/ENDOR spectrometers with dispersion and absorption mode detection and temperature capability from 2 to 300 K. The electron resonance lab has a variety of microwave components, bridges, cavities and electronic measuring equipment for instrument construction as well as facilities for biochemical research. Inquiries should include a cover letter explaining the type of research and teaching opportunities desired, a CV, research plans and teaching goals, and

Reader's Corner

Keeping the Flame Burning – Using Magnetic Resonance To Keep Kids Interested in Science (Part One)

by
Dr. Reef Morse
Professor of Chemistry, Illinois State University (Retired)
Member, Board of Trustees, Steppingstone School

The United State of America has recognized the need for more scientists. One approach has been to create standards for classroom education and for teacher training; see, for example:

http://www.nap.edu/openbook.php?isbn=0309053269

These are important and necessary actions for improving science education. There are also additional means to provide science opportunities for kids. This article discusses one of those additional opportunities – providing a kid-oriented research environment using EPR instrumentation. Because I have the good fortune to be on the Board of Trustees of Steppingstone, an independent school for gifted children (www.steppingstoneschool.org), the school has dedicated a portion of its physical facility to house this project. It has been named the SMART Center (for Steppingstone MAgnetic Resonance Training Center).

The SMART Center grew out of conversations between myself and Dr. Arthur Heiss of Bruker Instruments. We were discussing how exciting the field of EPR has become and the technological advances available in Bruker's EPR product line, and the relatively flat growth of EPR itself (one indicator is that attendance at the EPR sessions of the Rocky Mountain Conference in Colorado has been roughly constant for several years). We talked about the ages at which kids begin to think of science as a career and concluded that it occurred most often between the ages of 12 and 18 (in the US, this corresponds to middle and high school). Almost no one of that age is exposed to EPR as a scientific tool; most of us did our first EPR experiment at college or graduate school. I suggested that Steppingstone would be a place where young, gifted kids could use EPR as a scientific tool in a real research environment asking and answering real scientific questions. Dr. Heiss responded by offering an ESP300 spectrometer console and bridge in support of this project. We have obtained a magnet and power supply from another source and will have the instrumentation in place to open this facility.

Although not yet in operation, we have had some unexpected positive responses to the announcement of the SMART Center. I will report on those, as well as some suggestions for topics appropriate for young students in a magnetic resonance research lab.

should identify three people as references. Send to: Christopher F. Bauer, Chair, Department of Chemistry, University of New Hampshire, Durham, NH 03824 (603) 862-1550 (fax 4278), cfb@cisunix.unh.edu. Inquiries will be reviewed as they are received. UNH supports diversity and strongly encourages women and minority candidates to send an inquiry.

Research Positions - Advanced EPR of Bioinorganic Systems

Several research positions (PhD and Postdoc level) are presently available in the EPR department of the Max Planck Institute of Bioinorganic Chemistry in Mülheim/Ruhr, Germany.

We are looking for highly motivated young scientists in the field of Electron Paramagnetic Resonance who are interested in studying metallo-enzymes and related model systems. The main focus is on the investigation of photosynthetic systems (reaction centers, water oxidation), hydrogenase (biohydrogen production), radical enzymes and protein maquettes.

Our EPR lab is equipped with the full range of modern Bruker EPR spectrometers including E500 CW X-band, E580 CW/pulse X-band, E700 CW/pulse Q-band, and E680 CW/pulse W-band. In addition a high field CW/pulse spectrometer operating at 122 and 244 GHz (fields up to 12 T) is available next to several other CW EPR systems at S-, C-, X- and Q-band. We are using the complete repertoire of pulse and CW EPR techniques (ENDOR/TRIPLE, ELDOR, ESEEM) in combination with laser excitation and freeze quench techniques. More details can be found on our website: www.mpibac.mpg.de/lubitz.html.

The selected persons should have relevant training in Magnetic Resonance Spectroscopy, preferably in EPR. Candidates with an interest in EPR instrumental development and microwave engineering are specifically encouraged to respond.

Please send your application to Prof. Dr. Wolfgang Lubitz, Max Planck-Institute for Bioinorganic Chemistry, Stiftstrasse 34-36, 45470 Mülheim an der Ruhr, Germany

E-mail: lubitz@mpi-muelheim.mpg.de

Postdoctoral or Research Associate position

A position on pulse EPR at the postdoctoral or research associate level depending on qualifications is available at the CNR-INFM MDM National Laboratory, in Agrate Brianza (Milano, Italy). The research activity is related to the pulse EPR/ENDOR investigation of impurities in semiconductors for quantum information processing. The successful candidate must have experience on the pulse EPR/ENDOR techniques possibly connected with the study of semiconductors or insulators, excellent knowledge of solid state physics and quantum mechanics, and good experimental skills. The position is initially for one year, but can be renewed up to five years. For additional information **please contact:** Prof. Marco Fanciulli, marco.fanciulli@mdm.infm.it, tel. +390396036253 (direct), +390396037489 (secretary).

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 in-

formation 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.

Postdoctoral position at the University of Illinois at Urbana-Champaign

A postdoctoral position for research supported by US NIH and DOE funding is available at the University of Illinois at Urbana-Champaign. A significant component of the work would include multifrequency ESEEM and ENDOR characterization of the iron-sulfur clusters and semiquinone radicals in membrane proteins. An expertise in the area of biochemistry for work with proteins, and familiarity with freeze-quench techniques for protein sample preparations would also be desirable.

Interested individuals should contact: Prof. Antony Crofts (a-crofts@life.uiuc.edu) or Prof. Sergei Dikanov (dikanov@uiuc.edu).

Applicants should send a compete CV, and ask for two letters of recommendation to be sent by e-mail independently.

The National Biomedical Research Center for AdvanCed ESR Technology (ACERT) at Cornell University invites applications for two Postdoctoral positions

Applications are encouraged from individuals who can contribute strongly to areas of:
(1) ESR Microscopy. This position is for the further development of ESR-Microscopy to provide true micron resolution at very high spin sensitivity, and for its application to the study of small biological samples such as single cells. **(2) Pulsed ESR and Molecular Dynamics.** This position is for the study of molecular motions of membranes and proteins by multi-frequency 2D-FT-ESR techniques at 9, 17, 35, and 95 GHz. Experience in pulsed ESR techniques and/or ESR spectral simulation is highly desirable.

Interested qualified candidates should direct their inquires to acert@cornell.edu. Applicants should provide a cover letter and most recent CV. Two or three letters of recommendation are also required. Additional information about the ACERT may be found at www.acert.cornell.edu.

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

Available: EPR accessories and supplies

We have some excess EPR accessories and supplies that might be of use to other labs. For example, we have a lot of chart paper, pens and ink for older recorders, and some spare parts and accessories such as VT Dewars for older spectrometers. If you need something for an older-style Varian or Bruker spectrometer, ask us – we might be able to help. Most items are available for shipping costs.

Gareth R. Eaton geaton@du.edu

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

Design, upgrade and repair of EPR equipment

St.Petersburg Instruments (Russia) has available: (1) Compact high performance X-band EPR Spectrometer. (2) Microwave X-band low-noise Gunn oscillators. (3) Small low-weight magnet systems based on electromagnets or permanent magnets. (4) PC control electronic units. (5) Specialized EPR software. **Please contact:** Valeri Drapkin, St. Petersburg Instruments, P.O.Box 123, St.-Petersburg, 194156, Russia.
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site: www.spin-inc.ru
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The Conradi group at Washington University in Saint Louis MO USA has a 12-inch Varian magnet with a 3-inch gap (full-diameter, cylindrical Pole caps). It is a V-3900 and is of the low impedance design (1/4 ohm), so It energizes at 200 A and 50 V. The max field is about 11000 G, or a bit more. The magnet rotates about a vertical axis for single-crystal studies, with a fixed 45 degree lean-back of the yoke. The magnet weighs about 5300 pounds; its base has metal wheels to allow it to move between two experimental stations on a rail. The power supply was a V-2803, but it is not available. A closed-loop water system is also available. This uses de-ionized water to circulate through the magnet, and dumps the heat to either raw water or the building's chilled water loop. The water system is homebuilt.

Our group used the magnet now and then at 10000 G, cooling with raw water. The system worked fine as of December 2007.

There is also a 9-inch diameter Varian magnet with a gap of about 1.75 inches. This 'little brother' weighs 1800 pounds. It too is a 1/4 ohm design, but the maximum current is 160 A.

Please contact: Mark Conradi at msc@wuphys.wustl.edu or by phone at 314-935-6418 (office + voicemail) or 314-935-6292 (lab).

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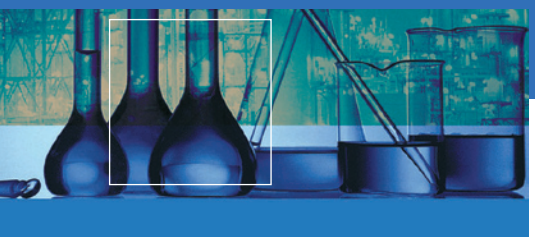

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ISSN: 1090-7807

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