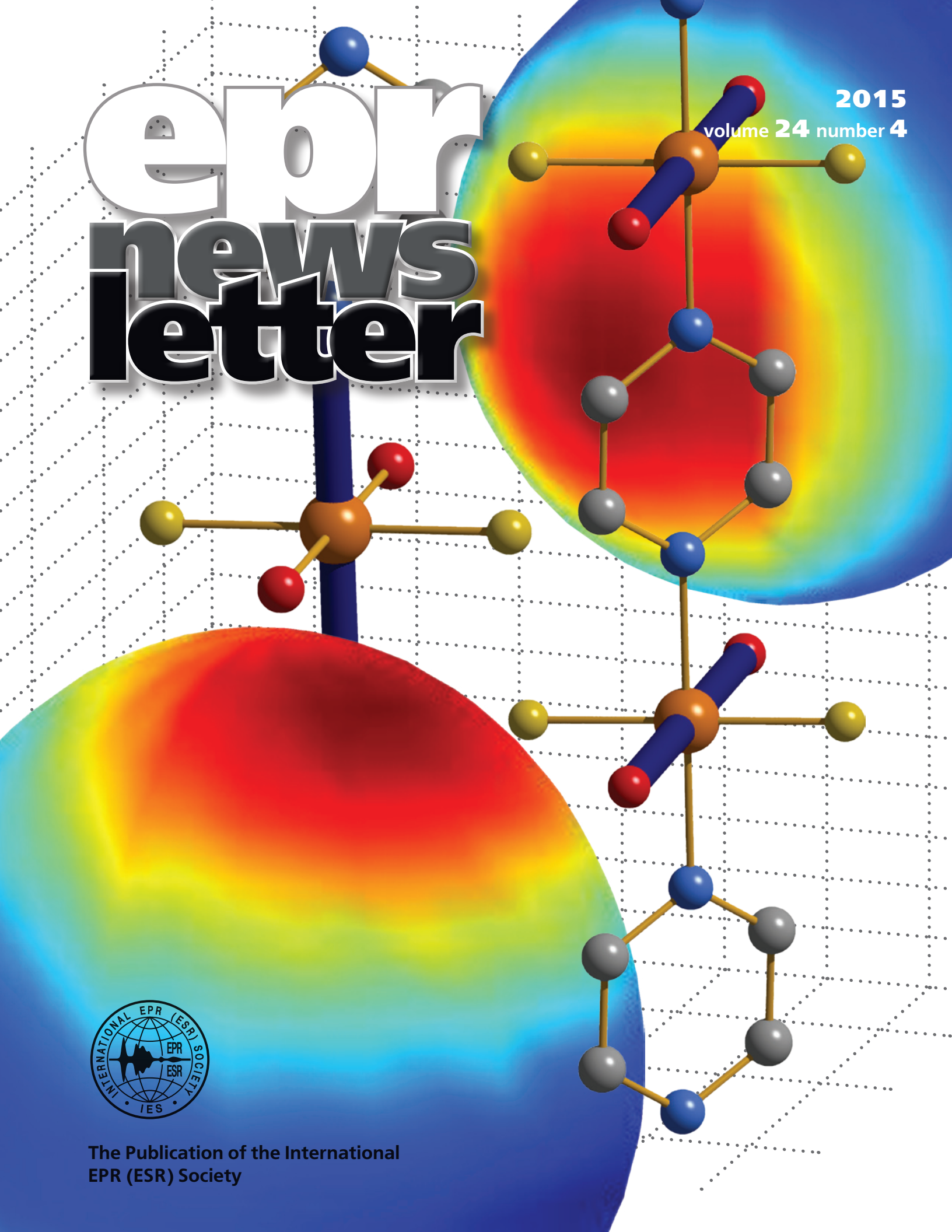
epr newsletter

2015
volume 24 number 4



The Publication of the International
EPR (ESR) Society

Officers of the International EPR (ESR) Society

Fellows of the International EPR (ESR) Society

Anatole Abragam (1914–2011)
John Michael Baker
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
Wayne Hubbell
Clyde A. Hutchison, Jr. (1913–2005)
James S. Hyde
Lowell Kispert
Daniel Kivelson (1929–2003)
Melvin P. Klein (1921–2000)
Harry Kurreck
August H. Maki (1930–2008)
Harden McConnell (1927–2014)
Bruce R. McGarvey
Keith A. McLauchlan
Klaus Möbius
Yuriy N. Molin
James R. Norris
John R. Pilbrow
Charles P. Poole, Jr.
Aleksandr M. Prokhorov (1916–2002)
Kev M. Salikhov
Tengiz I. Sanadze (1930–2011)
Arthur Schweiger (1946–2006)
Charles P. Slichter
Leslie H. Sutcliffe
Harold M. Swartz
Martyn C. R. Symons (1925–2002)
Wolfgang E. Trommer
Yuri D. Tsvetkov
Joan H. van der Waals
George D. Watkins
John A. Weil (1929–2010)
Samuel I. Weissman (1912–2007)
David Whiffen (1922–2002)
Hans C. Wolf

epr newsletter

www.epr-newsletter.ethz.ch

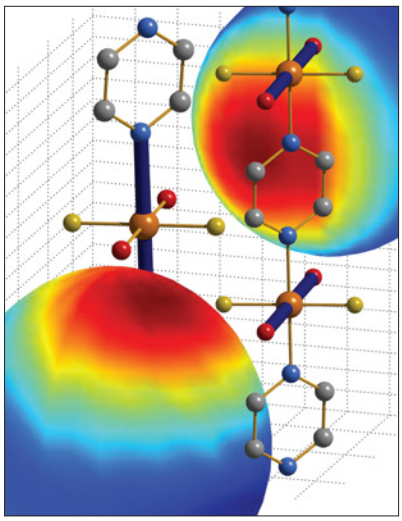
The official publication of the International EPR (ESR) Society is supported by the Society, by corporate and other donors, the Zavoisky Physical-Technical Institute of the Russian Academy of Sciences, Kazan, Russian Federation, and the Swiss Federal Institute of Technology, Zürich, Switzerland.

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 illustrates aspects of research carried out by Stephen Hill, recipient of the IES Silver Medal for Instrumentation 2014. It shows false color maps of the g-tensor of a Cu(II) coordination complex that undergoes a pressure-driven orbital reorientation and coordination sphere reconstruction. The single-crystal EPR data were collected at pressures of 0.1 and 2.5 GPa.

epr newsletter

The Publication of the International EPR (ESR) Society

volume 24 number 4 2015

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Editorial

Dear colleagues,

This issue introduces to you the team of CEOs of the International EPR Society 2015–2017 (pp. 3–5) though perhaps the term "introduces" is hardly the correct one in the context because Hitoshi Ohta-san, President, Stephen Hill, Vice President (Americas), Elena Bagryanskaya, Vice President (Asia-Pacific), Graham Smith, Vice President (Europe), Aharon Blank, Secretary, and Tatyana Smirnova, Treasurer, Lawrence Berliner and Klaus Möbius, Immediate Past Presidents, hardly need any introduction being researchers well known to the international magnetic resonance community.

Letter of the President by Hitoshi Ohta-san (p. 3) highlights the main challenges and problems to be solved by the IES in order to increase the visibility of the society and the membership. Concerning the development of the *EPR newsletter*, the idea is to increase the number of contributions from researchers of the younger generation of the EPR community. Our Editorial team aims at finding a good balance between the different columns of our newsletter to make it both instructive and entertaining, and continue to involve more and more young researchers in the sphere of our interests. The current issue is not an exception: the success story by Stephen Hill, the IES Silver Medal for Instrumentation 2014 is nicely complemented by stories of Tomoaki Miura (IES Young Investigator Award 2014) (see also 23/4, p. 4), and Daniel Klose (JEOL Prize 2014) (see also 24/3, p. 3). The report of the IES Annual General Meeting 2014 (Nara, Japan) specifies all details of the IES activities (pp. 6–8). The report of the joint APES-IES-SEST2014 conference (Nara, Japan) itself will be published in the forthcoming issue of the *EPR newsletter*.

I was very generous with promises in my previous editorial (24/3, p. 2) telling you about prospects for the future issues of the *EPR newsletter* in 2015. A promise is a promise and by comparing my editorial and the list of contents of the current issue you can judge for yourself what promises are fulfilled and what are shifted to the forthcoming issue. I would like to underline the contributions by four IES Presidents, Larry Berliner, Hitoshi Ohta-san, Klaus Möbius, and Wolfgang Lubitz (pp. 14–16). Diverse as these contributions are, they are very optimistic about the EPR state-of-the-art and its future.

By now many of you know, sad news, about the passing away of Graeme Hanson, who served a short term as Vice President (Asia-Pacific) from January 1st to February 25th, 2015. The In Memoriam column in the forthcoming issue of the *EPR newsletter* features contributions from his colleagues and friends and pays tribute to his multiple talents and activities. I will mention here only one of facets of his versatile personality – editing the EPR-Hot Topics column in the *EPR newsletter* (see 23/2, pp. 14, 15; 23/3, pp. 14, 15; 24/1-2, pp. 24, 25). I was delighted when Graeme contacted me with a proposal that he opens a new column describing cutting edge EPR (spectroscopy and imaging) and its applications in the broad areas of medicine, structural biology, chemistry, earth science, physics, quantum computing, solid state-, bio- and nano-materials science. Starting from the very beginning, his column was a great success and the international magnetic resonance community benefited a lot from it and greatly appreciated it. Graeme was very enthusiastic about his column and we discussed Graeme's ideas concerning his column for the current issue just several days before his untimely demise. It was a delight to know Graeme in person. We all will miss him tremendously. Our grateful memory will keep him alive for the years to come.

Laila Mosina

Letter of the President

Dear Colleagues:

I am very happy to announce that new IES Executives for the 2015–2017 term have been elected following the IES Constitution. I am Hitoshi Ohta (Kobe University) and it is my great privilege to serve as President. Three Vice Presidents representing the America, Europe, and the Asia-Pacific region are Stephen Hill (NHMFL, Florida State University), Graham Smith (University of St Andrews), and Graeme Hanson (University of Queensland), respectively. They are well known and well experienced scientists in the community, and I am sure that they will support me and the society with full of ideas. Aharon Blank (Technion - Israel Institute of Technology), who became the Secretary after the resignation of Sushil K. Misra last September, continues as the Secretary. Tatyana Smirnova (North Carolina State University) also continues as the Treasurer. We are very happy to have their continued supports. Lawrence Berliner and Klaus Moebius will serve as the Immediate Past President for the first half and the second half of the term, respectively, because they served as the Acting President equally after the sudden passing of the former President Seigo Yamauchi on September, 2012. Laila Mosina also continues her important role as the Editor-in-Chief of the *EPR newsletter*. We rely on her and her team very much because the EPR newsletter is the important link between the IES members and the society.

EPR/ESR spectroscopy in basic science and applications is advancing and increasing its importance in a wide range of fields, from physics and chemistry to geology, biology and medicine. Therefore, the importance of IES to play certain roles in the science community is becoming stronger and stronger. On the other hand, IES is facing several issues nowadays, and the IES Executives have to seek the way to solve them with the supports of members.

First we would like to put some efforts to increase the visibility of IES, which has been discussed for last few years. IES has already started IES poster awards at several EPR/ESR related conferences for this purpose since 2013. IES poster awards have been given to students and post doctors at Rocky Mountain Conference (USA) in 2013 and 2014, at Symposium "Catalytic Systems for Chemical Energy Conversion" (Germany), the EF-EPR 2014 meeting of the European Federation of EPR Groups in (France), and Joint Conference of Asia-Pacific EPR/ESR Symposium, IES Symposium and the Annual Meeting of The Society of Electron Spin Science and Technology (APES-IES-SEST2014, Japan) in 2014. At the moment the awardee receives the certificate, some cash award and one year free IES membership which can be used next year. The IES poster awards seem to be effective for increasing the visibility of IES, and they will be continued. However, on top of that, we would like to propose to have Joint IES Symposium. The weak part of IES is that it does not have its own symposium. On the other hand, as there already exist many conferences related to EPR/ESR in various fields, some EPR/ESR scientists may not be happy to have another new IES Symposium because someone has to put new efforts to organize a conference and too many conferences cannot attract many participants. Therefore, having a Joint IES Symposium together with the existing EPR/ESR related conference is the easiest and the most effective way to increase the visibility of IES. Moreover, Joint IES Symposium benefits not only IES but also the conference organizers. It will help to increase the international attraction of the existing conference and increase the number of participants and sponsors. APES-IES-SEST2014 was the first Joint IES Symposium, and it gained about 60 participants from outside Asia-Pacific area within total 279 participants, which was a record for APES Symposium. APES-IES-SEST2014 also attracted 33 sponsors and it helped a lot to come up with a large surplus in the balance of symposium. Therefore, we hope the conference organizers will consider about the Joint IES Symposium, and the President and the IES Executives will be happy to talk with you about it.

Second item is to increase the number of IES membership because it correlates with the strength of society. Moreover, as the society's income is mainly coming from the sponsors and not the membership fee, keeping the large number of membership is very important to keep IES attractive to the sponsors. On the other hand, the number of IES membership is gradually decreasing in past several years, and the previous IES Executives have

Hitoshi Ohta,
IES President

Hitoshi Ohta was awarded his B.Sc. from University of Tokyo, Japan, in 1982. He was accepted to the graduate program at Science University of Tokyo and earned M.Sc. degree in 1985. During his graduate program he was appointed as an Assistant Professor at Kobe University in 1987, and received the Doctor degree in Physics from Science University of Tokyo in 1989.

In Kobe he started his career in high field ESR using pulsed magnetic field, and became an Associate Professor in 1994. Since 2001 he holds a Full Professor position in the Molecular Photoscience Research Center, Kobe University. He has published more than 350 papers in scientific journals, and his research interest is focused on the development of multi-extreme high field ESR in THz region and its applications to the quantum spin systems. Currently he serves as advisory board member of the *Applied Magnetic Resonance*, associate editor of *EPR newsletter*, council member of Asia-Pacific EPR Society (APES), representative member of the Physical Society of Japan, council member of the Japan Society of Infrared Science and Technology. He is also a founding member of APES and the Society of Electron Spin Science and Technology (SEST), and he also served as President (2004–2008) and Vice-President (2012–2014) of APES, and President (2010–2011) and Vice-President (2008–2009) of SEST. In 2008 he received the IES Silver Medal for Instrumentation.

encouraged the scientists personally to join IES, which affected in some extent but not so effective. In order to increase the number, we have to show some benefits to join IES. One attempt was done during APES-IES-SEST2014 where the registration fee (40,000 JPY) was reduced 7,000 JPY for regular participants and 3,500 JPY for students if you join IES. They are big deals because it costs $36/year for regular IES member and only $6/year for student IES member. As a result IES membership for Japanese increased to about 75, which is three times the number to the former year. We can apply the similar idea to other EPR/ESR related conferences. New Executives will continue the discussion and we appreciate your other ideas.

Third item is the continuity to balance the budget of IES. It was balanced since 2012. Thanks to Laila Mosina and Tatyana Smirnova for their extreme efforts to gain sponsors, which balanced the budget. Now we have some surplus and we can afford some cash awards for the IES Poster Awardee and the Young Investigator Awardee, which make the IES award more attractive to young people. As the amount of money for each award may change depending on the budget situation, we have to continue the efforts to keep the budget in good shape.

Fourth item is about the EPR newsletter. Although it is already in a great shape and working as the effective media to connect the society and members, we may increase the articles for young scientists, which were discussed among previous IES executives. We already have articles from young scientists who received IES Young Investigator Award, IES Poster Award, APES Young Scientist Award, SEST Young Investigator Award. However, we would like to increase some more. We will continue the discussion with the Editor-in-Chief, Laila Mosina and Associate Editors (C. S. Klug, H. Ohta and S. Van Doorslaer), and your input is also highly appreciated.

Finally honoring the distinguished scientists in EPR/ESR research is the most important mission of the society. The Gold medal and the Silver medals in the areas of Biology/Medicine, Chemistry, Physics/Material Science, and Instrumentation will continue in the present form. Many nominations from IES members will be appreciated. Recently we are putting much effort on the Young Investigator Award because encouraging young scientists to join IES is very important for the future of IES. Previous IES Executives decided to award Young Investigator Awardees not only with the certificate and medal but also with some cash awards, which will support their activities. I would like to point out that it became possible, thanks to the well balanced situation of the budget. Therefore, we would like to encourage senior scientists to nominate many good young scientists for the Young Investigator Award.

From the experiences as previous Vice-President I hope I understand some of current issues of IES, and I would like to solve above issues step by step together with the new IES Executives and IES members. Moreover, in order to contact with various IES members I am also thinking of having AGM of IES at different area, such as America, Europe and Asia-Pacific, year by year, which was originally an idea of former IES President Wolfgang Lubitz. Finally I would like to do my best as the President and looking forward to your supports and inputs.

Hitoshi Ohta

Stephen Hill, IES Vice-President Americas

Stephen Hill received his BA and D. Phil. degrees in Physics from the University of Oxford in 1991 and 1994, respectively. From 1995 to 1997, he held postdoctoral positions at Boston University and the US National High Magnetic Field Laboratory (NHMFL) in Tallahassee, Florida. He then took up faculty positions at Montana State University and the University of Florida before moving to Florida State University (FSU) in 2008. Hill currently holds the titles of Professor of Physics at FSU and Director of the Electron Magnetic Resonance program at the NHMFL.

Hill has more than 20 years of experience performing microwave and far-infrared magneto-optical spectroscopy in high magnetic fields, spanning the range from 0.3 to 200 cm^{-1} (9 GHz to 6 THz), using a wide array of measurement techniques (conductivity and Electron Paramagnetic Resonance (EPR), etc.). Current research interests include: fundamental studies of quantum phenomena in molecular magnets and correlated electron systems (quantum magnets and superconductors); structure property relationships in a wide variety of polynuclear transition metal complexes; and the development of high-field EPR and Dynamic Nuclear Polarization methods. Hill is a fellow of the American Physical Society and received the International EPR Society Silver Medal for Instrumentation in 2014.

Graham Smith, IES Vice-President Europe

Graham Smith is currently Head of the MM-Wave and EPR Group, and Reader at the School of Physics and Astronomy at the University of St Andrews in Scotland. Born in 1963, he has a BSc in Theoretical Physics from University of York, an MSc in Lasers in Optoelectronics from St Andrews and did his PhD under Dr Jim Lesurf on MM-wave Physics, also at St Andrews. After a short spell at the UK National Physics laboratory, and working on projects relating to mm-wave metrology, he was appointed to Faculty at the University of St Andrews and soon after was awarded a UK EPSRC Advanced fellowship to work on EPR instrumentation. He developed and ran the UK High Field EPR instrumentation facility

for many years. He was Deputy Chair of the COST Action on Advanced EPR Methods for Molecular BioPhysics (2005–2009) and was President of the European Federation of EPR groups (2010–2014). He was also one of the main organizers of the 2008 EU Summer School at St Andrews. In 2011, he was awarded the IES Silver Medal for Instrumentation for his work on developing a new type of high field EPR spectrometer offering very high concentration sensitivity and low deadtime. He is currently Chair of the UK Royal Society of Chemistry EPR Groups.

Elena Bagryanskaya, IES Vice-President Asia-Pacific

Elena Bagryanskaya is currently Head of the Laboratory of Physical Methods, and Director at Novosibirsk Institute of Organic Chemistry, Siberian Branch of the Russian Academy of Sciences (SB RAS). Born in 1958, she has her diploma with honors at Physical Department of Novosibirsk State University. She did her PhD degree in the Institute of Chemical Kinetics and Combustion SB RAS in Novosibirsk. Her thesis was titled "Stimulated Nuclear Polarization and new methods of registration of short-lived radical intermediates". From 1985 till 1992 she continued in the Institute of Chemical Kinetics and Combustion SB RAS as researcher and then as senior researcher. In 1993 the International Tomography Center was founded and she became the head of the Spin Polarization group in the Laboratory of Magnetic and Spin Phenomenon. In 1996 she worked as a Fellow in Oxford University Merton College and as JSPS professor in Tohoku University. In 1998 she defended her Habilitation (Russian title: Doctor of physical and mathematical sciences). The dissertation was titled: "The development and creation of new highly sensitive time-resolved methods of detection of short-lived radical intermediates", and in 2002 she was awarded the title of Full Professor of Chemical Physics of RAS.

From 2003 till 2013 she was Member of the International Spin Chemistry Committee.

From 2004 she is a member of consulting committee of Asia-Pacific EPR society and in 2014 she became vice president of APES.

From 2004 she is President of Russian EPR Society. From 2004 she became a Head of Laboratory of Magnetic Resonance, ITC SB RAS. In 2014 she was elected as Member of ISMAR Committee.

She was involved in development of several new highly sensitive techniques to study short-lived radical intermediates – Stimulated Nuclear Polarization, Dynamic Nuclear Polarization, CIDNP with Switched External Magnetics Fields, and has applied them to study the mechanisms of radical reaction as well as to study electron spin polarization and electron spin relaxation in low and zero magnetic fields. During the last decade her interests are in development of spin traps, spin probes and spin labels based on nitroxides and trityl radicals and their application to materials science and biomolecules using pulse EPR and EPR tomography.

Aharon Blank, IES Secretary

Aharon Blank is an associate Prof. at the Schiluch Faculty of Chemistry, Technion – Israel Institute of Technology. Born in 1972, graduated from the Hebrew University of Jerusalem in 1992 with degrees in Mathematics, Physics and Chemistry; Completed his Master degree at Tel Aviv University in 1997 in electrical engineering – Physical electronics under the supervision of Prof. Raphael Kastner and finished his PhD in 2002 at the Hebrew University of Jerusalem in Physical Chemistry - Electron Spin Resonance (ESR), under the supervision of the late Prof. Haim Levanon. During this time he served 9 years in the IAF as a Scientific Officer and also as a CTO in a medical device company, developing miniature intravascular MRI. Following his PhD he spent 3 years at Cornell University as a Post Doc at the group of Prof. Jack Freed (on a Rothschild post-doctoral fellowship), developing the subject of ESR microscopy, and since 2005 he is a Faculty member at the Technion. Aharon main interests today are development and applications of new methodologies in the field of magnetic resonance. His group works on miniature sensitive ESR resonators; small, self contained NMR and ESR medical tools; and ESR probes for micro and nano imaging.

Tatyana Smirnova, IES Treasurer

Tatyana Smirnova received undergraduate Chemistry/Chemical Engendering Honors degree from the Lomonosov Institute of Fine Chemical Technology, Moscow, Russia in 1986. She was accepted to the graduate program at the University of Illinois at Urbana-Champaign in 1991 and earned a PhD in Chemistry under Prof. R. Linn Belford in 1997. She was awarded a NIH Postdoctoral Fellowship in 1997 and completed postdoctoral studies with Robert B. Clarkson at University of Illinois at Urbana-Champaign. Tatyana now is an Associate Professor at the North Carolina State University. Her research interests include the use and development of EPR spectroscopy, especially at high field/high frequency, as a tool to study fundamental roles of intermolecular interactions in biological self-assembly and structure-function relationship in multi component protein systems.

ANNUAL GENERAL MEETING 2014

Minutes of the Annual General Meeting of the International EPR/ESR Society for 2014, held during the APES-IES-SEST meeting on November 15, 2014, in Nara, Japan.

AGENDA

1. Introductory notes by Prof. Klaus Möbius
2. President's Report
3. Secretary's Report
4. Treasurer's Report (Financial Report 2013–14)
5. *EPR newsletter* Editor's Report
6. Thanks
7. IES Awards Ceremony

1. Introductory notes by Prof. Klaus Möbius

Dear Colleagues,

On behalf of the IES Executive Board I wish to welcome all participants to the 25th General Meeting of the IES at the APES-IES-SEST 2014 meeting in Nara. I would like to express my gratitude to the conference organizers of this meeting, especially to Prof. Hitoshi Ohta, Chairperson of APES 2014 and IES, and Prof. Atsushi Kajiwara, Chairperson of SEST 2014, for allowing our General Meeting to take place during this Conference.

As Hitoshi Ohta had reported at last AGM 2013 in Crete, Prof. Seigo Yamauchi passed away suddenly on Sept. 26, 2012. It was only 9 months after he started as the President of IES. It was a great loss for our Society. However, his will to expand and strengthen the Society remains as driving force for the Executive Members of IES.

The Society had to decide on a new President. After the discussion among the IES Executives, it was decided that the three Vice-Presidents will become Acting Presidents, equally sharing the remaining 27 months of the IES Executives term as follows:

Hitoshi Ohta 01.10.2012–30.06.2013
Lawrence Berliner 01.07.2013–31.03.2014
Klaus Möbius 01.04.2014–31.12.2014

2. President's Report

2.1 Brief Report of the Previous AGM – Crete, August 2013
Main topics discussed:
Budget – how to stabilize it, how to enable savings, how to increase the income (membership dues, sponsors)?
Visibility – how to increase it?
Poster Awards IES presentation at joint EPR meetings in USA, Europe and Asia.

2.2 The importance of IES and its activities. For basic science and applied research, EPR/ESR spectroscopy is continuing to become an increasingly important tool in a wide range of fields, from physics and chemistry to geology, biology, and medicine. The International EPR (ESR) Society will continue working to promote EPR and to foster scientific collaboration within the wide magnetic resonance community.

We'll be making a renewed effort to expand our membership. We believe that the IES has a lot more room to grow in terms of due-paying members. To achieve this, we need to increase the visibility and attractiveness of the Society.

New functions to increase the visibility of the Society were discussed among the Executives. One of the ideas was to have joint IES symposia with other related EPR (ESR) conferences. First example of IES participation in this International EPR conference: APES-IES-SEST 2014 in Nara, This was an initiative of Prof. Hitoshi Ohta. Thank you!

Attracting present and new members will be one of central focus of IES, and we welcome ideas from current members. We look forward to hearing from you and working together to help the Society to grow and flourish. We need to communicate and collaborate with scientists both inside and outside of the EPR field. The *EPR newsletter* is intended to help mediate the exchange of information about excellent laboratories and scientific meetings (see below).

A major function of the IES is to honor distinguished contributors to EPR/ESR. The awards were initiated in 1992 with the Gold Medal and extended to Silver Medals in various specialized areas of EPR, Young Investigator Awards and IES Fellowships. Please visit www.ieprs.org for full details on IES constitution and by-laws relating to Awards.

In 2014, IES awards the following distinctions: Gold Medal, Silver Medal for Instrumentation, Young Investigator Award (John-Weil), Young Investigator Award (IES), IES Fellowships. Poster Awards (eight in 2014!)

2.3 IES Awards for 2014
These are the Awardees for 2014: 2014 Gold Medal: David Britt (USA); 2014 Silver Medal for Instrumentation: Hans van Tol / Stephen Hill (USA); 2014 Young Investigator Award (John Weil): Nicholas Cox (Germany); 2014 Young Investigator Award (IES): Tomoaki Miura (Japan); 2014 IES Fellowships: Arthur Schweiger (posthumous, Switzerland), Harden McConnell (USA), Wayne Hubbell (USA), Kev Salikhov (Russia).

We want to thank all the members of the Awards and Fellowship Committees for their excellent work for the Society.

Hitoshi Ohta, Lawrence Berliner, Klaus Möbius

Call for IES Award Nominations – 2015: Nominations are invited for: Silver Medal Biology/Medicine; Silver Medal Chemistry; IES Young Investigator Award; Fellowship of the Society.

Nominations, accompanied by a curriculum vitae, were due by 1 November 2014. For more information, see our www.ieprs.org at the "Awards" page

3. Secretary's Report: Sushil Misra (up to August 31, 2014), Aharon Blank (from October 1, 2014)

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

a. The Secretary shall maintain all the records of the Society shall keep the minutes of Society meetings, and be responsible for the distribution of all essential information to members.

b. Sending out invoices to the sponsors (in consultation with the Treasurer).

c. Informing members (and sponsors) of the various items of interest, e.g. announcements of conferences, workshops, publication of new issues of EPR newsletter.

d. Organization of material for awards given by the IES: medals, certificates and citations.

e. Overlooking financial status and membership of the Society (in consultation with the Treasurer).

f. Website (revamping). Please, visit web site www.ieprs.org

g. Answering any enquiries;

h. Organizing AGM;

i. Liaisons with the President, Treasurer, Editor of the *EPR newsletter*, and the members of the IES Executive.

We want to thank Sushil Misra and Aharon Blank for their excellent work as Secretaries of the Society.

Hitoshi Ohta, Lawrence Berliner, Klaus Möbius

4. Treasurer's Report: Tatyana Smirnova (Financial Report 2013–2014)

2013 Financial Report ($) (self-audited)	
Balance January 1, 2013	11,192.25
Deposits:	
Membership	7,612.06
Sponsors	10,535.00
Bruker contribution to printing	2,226.00
Total Income	20,373.06
Expenses:	
Credit card fees, internet commerce and merchant services	737.25
Web design / maintenance & fees	352.32
Newsletter printing (including 2,226.00 paid by Bruker)	9,376.00
Newsletter Editorial	3,242.00
State of Illinois+misc	201.00
Awards and medals	1,296.16
Total Expences	15,204.73
Balance December 31, 2013	16,360.58

2014 (January-September) Financial Report ($) (self-audited)	
Balance January 1, 2014	16,360.58
Income:	
Membership	5,211.65
Sponsors	5,481.00
Bruker contribution to printing	2,226.00
Total Income	12,918.65
Expenses:	
Credit card fees, internet commerce and merchant services	474.07
Web design / maintenance & fees	1,133.82
Newsletter printing	4,785.10
Newsletter Editorial	3,242.00
State of Illinois+misc	18.80
Awards and medals	616.93
Total Expences	10,270.72
Balance September 30, 2014	19,008.51

Comments from the Treasurer:

We have balanced the budget in 2013!!!!

In 2013 the Society gained the sponsorships of:

Virginia Diodes, Inc. – Sponsor
Active Spectrum – Sponsor
Magnettech – Major Supporter

Thank you, members and sponsors, for your support!

Tatyana Smirnova (Treasurer)

Status of membership as of November 1, 2014	
Complementary/sponsored	51
Membership: paid for 2012 or 2013	306
Membership: paid for 2014	237
Full members	154
Emeritus	15
Students	54
Postdoctoral members	14

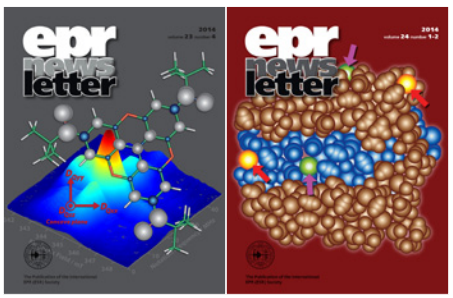
Members represent 30 countries:
Japan 83 Germany 17 Russia 20 USA 59

We want to thank Tatyana Smirnova for her excellent work as Treasurer of the Society.

Hitoshi Ohta, Lawrence Berliner, Klaus Möbius

5. *EPR newsletter* Editor's Report: Laila Mosina

Since the previous Annual Meeting of the IES in 2013 in Crete (Greece) we published three single issues, 23/2, 23/3, 23/4 and a double issue 24/1-2 . We hope all of you had a look at these issues on the newsletter website and got copies of 23/2, 23/3 and 23/4.



Now we start with the preparation of the forthcoming issue 24/3. To remind you, we present the columns of the newsletter:

Columns of the *EPR newsletter* 24/3 (2014)
Editorial
IES business
Awards
IES Young Investigator Award Revisited
Another Passion
Anniversaries
EPR newsletter Anecdotes
In Memoriam
Pro & Contra
Software
Tips and Techniques
Notices of Meetings
Conference Reports
New EPR Faculty
New Books and Journals
Market Place
Reader's Corner
Guest of the Issue

Please feel free to submit YOUR material, dear colleagues!!!

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, Wolfgang Lubitz, Graeme Smith, Keith Earle and David Budil, and also to Yevhen Polyhach, our web-master, and Sergei Akhmin, our Technical Editor. I gratefully acknowledge collaboration with Associate Editors Candice Klug, Hitoshi Ohta and Thomas Prisner.

We heartily thank Thomas Prisner for his long-term service as Associate Editor Europe and welcome Sabine Van Doorslaer, his successor.

6. Thanks

The IES thanks the following Corporate Sponsors for their contributions in 2012–2014:

Active Spectrum
Adani Systems
Bruker BioSpin
Cryogenic Ltd
GMW
JEOL Japan & USA
Keycom
L&M EPR Supplies
Magnettech GmbH
Molecular Specialties
Norell
Research Specialties
Scientific Software Services
Wilmad-LabGlass

Special thanks go to ETH Zurich for hosting the newsletter website and the Zavoisky Physical-Technical Institute, Kazan for supporting the newsletter, and to all paid up members;

Newsletter Editor: Laila Mosina
Technical Editor: Sergei Akhmin
Associate Editors: Thomas Prisner, Candice Klug, Hitoshi Ohta, and Sabine Van Doorslaer

List of IES executives

International EPR (ESR) Society Executive:
Vice President Asia Pacific: Hitoshi Ohta (Acting President: September 1, 2012–June 30, 2013)
Vice President Americas: Lawrence Berliner (Acting President: July 1, 2013–March 31, 2014)
Vice President Europe: Klaus Möbius (Acting President: April 1, 2014–December 31, 2014)
Secretary: Sushil Misra / Aharon Blank (since October 1, 2014)
Treasurer: Tatyana Smirnova
Immediate Past President: Jack Freed
Founder President: Harold Swartz

From right to left: Hitoshi Ohta, Klaus Möbius, Aharon Blank, Tatyana Smirnova, Lawrence Berliner, and Laila Mosina

Attendance list

Akaishi Satomi, Akimoto Ikuko, Ambe Christopher, Arata Toshiaki, Bagryanskaya Elena, Berliner Lawrence, Bhat S.V., Blank Aharon, Britt David,Carl Pat, Flood Ann, Freed Jack, Han Songi, Han Hidayuki, Hassan Gmal, Hirata Hiroshi, Höfer Peter, Ikoma Tadaaki, Ishii Tatsuya, Kay Chris, Kobori Yasuhiro, Lubitz Wolfgang, Matsuoka Hideto, McKay Johannes, Meinke Martina, Mino Hiroyuki, Miura Tomoaki, Miurai Hisao, Möbius Klaus, Morimoto Kazuya, Mosina Laila, Nakamura Toshikazu, Ohta Hiroshi, Ohta Hitoshi, Okubo Susuma, Prisner Thomas, Rakvin Boris, Sakai Toru, Sato Kazunobu, Smirnova Tatiana, Smith Graham, Sukhanov Andrey, Swartz Harold, Takui Takeji, Trommer Wolfgang, Van Tol Hans, Wasielewski Michael, Yamamato Satoro, Zaripov Ruslan.

IES Silver Medal for Instrumentation 2014

Stephen Hill:

High-field EPR, or far-infrared spectroscopy at high magnetic fields

Dedicated to James Brooks who sadly passed away in September, 2014

My experiences performing far-infrared magnetooptical measurements in some of the world's strongest magnets date back nearly 25 years to the early days of my graduate studies with John Singleton at the University of Oxford. I had only been in the group a matter of weeks when another student and I drove overnight from Oxford to the High Field Magnet Lab at the University of Nijmegen in the Netherlands in an attempt to observe electron cyclotron resonance in a family of organic charge transfer salts, some of which were superconductors at low temperatures. We succeeded! Very high magnetic fields (up to 20 Tesla) and high frequencies were needed to overcome the much faster relaxation associated with the orbital motion of electrons in solids compared to typical spin relaxation rates. The measurements were conducted overnight when electricity was cheaper because the magnets were resistive, drawing on the order of ten megawatts of power from the local grid.

My PhD focused almost exclusively on cyclotron resonance studies of electron correlations in metals and semiconductors, including the quantum and fractional quantum Hall states that were extremely popular in the condensed matter physics community around that time. Most of the work was performed using very temperamental molecular gas lasers to generate far-infrared radiation spanning the range from 10 to 200 cm^{-1} or 300 GHz to 6 THz. We would often lock ourselves in the lab overnight in order to avoid any kind of temperature fluctuation (e.g. someone opening the door) that would cause the laser to stop emitting. About a year of my PhD was spent modifying a dilution refrigerator so that we could carry out these measurements below 100 mK; it worked! I did most of the machining and vacuum soldering myself, experiences that have served me well throughout my career. By the end of my PhD, I also worked with several types of fourier-transform far-infrared interferometer, and had the chance to perform experiments with backward-wave oscillators at the General Physics Institute in Moscow. Most importantly, I was introduced to the 8–350 GHz Millimeter-wave Vector Network Analyzer (MVNA, also known as the French radio) made by Philippe Goy in Paris (See Terahertz Pioneers, IEEE Trans. THz Sci. & Technol. 3, 347, 2013).

I was offered a postdoctoral position with Jim Brooks at the new magnet lab in Tallahassee in 1995. Louis-Claude Brunel, Brooks and I managed to convince then lab Director, Jack Crow, to purchase two MVNAs together with all of the bells and whistles. These two instruments, which I still use to this day along with two others, helped shape my postdoctoral research and my career. Everything at the new Tallahassee MagLab was bigger and better than I had experienced before, e.g., 33 Tesla (eventually 35 T and 45 T and a 56 MW power supply!) instead of 20 T, and two MVNAs! Moreover, the user community was not yet well established in those dayss, so we could run in the high-field magnets virtually every week, whereas 3 weeks per year is now very hard to come by. I published about 20 papers resulting from my 2.5 year postdoc with Brooks, mostly on cyclotron resonance and microwave conductivity studies of molecular metals. These measurements employed both fundamental mode and over-sized cavities working anywhere from 40 to 150 GHz (later up to nearly 400 GHz). We even setup our own machine shop to fabricate cavities and waveguide probes that were compatible with the high-field magnets. These capabilities proved to be quite unique. Little did I know at the time that they would be of interest to an entirely different research community.

It was in 1997 that Brooks and I started a collaboration with Naresh Dalal on the now famous Mn_{12} molecular nanomagnet (or single-molecule magnet, SMM). That same year, I moved to Montana State University and established an independent career. Over the following four to six years my research made a rapid transition from studies of optical conductivity and cyclotron resonance towards utilizing the methods that I had developed for those purposes to instead carry out high-frequency EPR studies of molecular nanomagnets. I was very fortunate to team up with two of the pioneering chemists in the field – George Christou and David Hendrickson. By coincidence, George and I both moved to the University of Florida in 2001, where we established a remarkable collaboration that continues to this day. SMMs are of interest because of their potential future use as molecular memory elements in both classical and quantum logic devices. From a fundamental point-of-view, they form high-quality crystals in which every molecule has the same spin, orientation, magnetic anisotropy, etc., enabling detailed spectroscopic studies of ensembles of nominally independent nanomagnets that have been lacking for other types of magnetic nanostructures. Our high-field EPR studies have thus provided crucial insights into the quantum nature of magnetization dynamics at the nanoscale.

I came full circle in 2008, moving back to Tallahassee to take up my dream job as Professor of Physics at Florida State University and Director of the National High Magnetic Field Laboratory Electron Magnetic Resonance (EMR) users program. My current team (Hans van Tol, Jurek Krzystek, Likai Song and my own group of students and postdocs) is constantly looking for ways to push the envelope in terms of what our users, potential new users, and collaborators might need. Instrument development is always at the forefront of our thinking. Current efforts here are focused on high-field EPR at high pressures (up to 3 GPa), and Dynamic Nuclear Polarization at 14 T/395 GHz/600 MHz. Although my career and reputation have undoubtedly been defined by the development of unique microwave and far-infrared techniques at the very highest magnetic fields (up to 45 T), I nevertheless feel that my success owes a lot to the application of these methods to a wide range of cutting-edge scientific problems spanning quite distinct research fields. That is, the technique development has always been driven by the science, although I have experienced my fair share of good fortune as well. For example, the unexpected switch to molecular magnetism brought me closer to the field of my father, who is a chemist. Meanwhile, my role as EMR Director brings regular interactions with engineers, biophysicists and biochemists (even

geochemists). I therefore learn something new most days. This is probably the thing that I like the most about EPR. It is a truly interdisciplinary tool, with seemingly endless scientific possibilities. Indeed, I still feel today like the green graduate student of nearly 25 years ago as I explore new scientific directions, both through my own research and as part of the MagLab users programs.

IES Young Investigator Award 2014

Tomoaki Miura:

I was honored to receive the International EPR/ESR Society Young Investigator Award for 2014. The award was presented by the President of the International EPR/ESR Society, Prof. Klaus Möbius at the Joint Conference of APES2014/IES/SEST 2014 held in Nara. I thank him and award committee for giving me such a prestigious award.

I started my research on spin science under the supervision by Prof. Tatsuo Arai and Prof. Kiminori Maeda at University of Tsukuba in 2002. My main project was to detect the effect of nanosecond-pulsed magnetic fields on the reaction yield of photochemically generated radical pairs. By that time, pulsed-field effects on the nuclear polarization had been reported, but that on the reaction yield or kinetics had not been reported. We developed a fast current pulser equipped with small coils and installed it to a nanosecond transient optical spectrometer. We first tried experiments with a widely known system, methylnaphthoquinone in SDS micelle dispersed in water, which gives a long-lived radical pair from the excited triplet state. By using the pulsed magnetic field, we succeeded in observing field dependence (<12 mT) of the spin-state mixing at very early times (~50 ns), which cannot be observed by conventional static magnetic field effect. The result indicates the effect of dephasing processes having a timescale of ~10 ns, which is considered to be due to diffusional fluctuation of the spin-spin interactions.

After getting a master's degree from Tsukuba, I moved to Shizuoka University and started my PhD study under the supervision by Prof. Hisao Murai. We applied the pulsed-magnetic-field effect to tetraphenyl hydrazine in SDS micelle, which immediately gives a singlet radical pair upon photo-irradiation. By a newly developed pulse scheme, we succeeded in real-time observation of the singlet-triplet spin-state mixing with a time resolution of ~10 ns. The observed time trace is obviously incoherent, which demonstrates the effect of the dephasing processes on the mixing process in the low magnetic fields. The results can be simulated with dephasing terms (S-T and T-T dephasing), but we developed a novel simulation method that directly takes into account the diffusional fluctuation of the exchange and dipolar coupling of the radical pair. The simulation reproduces the experiments with reasonable in-cage diffusion constant of ~10^6 cm^2/s and negligible exchange coupling. These results opened a gate to probing dynamics and interactions of radical pairs by analysis of low-field spin dynamics.

After getting my PhD, I joined Prof. Michael R. Wasielewski's group in Northwestern University as a postdoc, where I started EPR related works. My main project was research on the electron transfer mechanisms and spin dynamics of covalently linked donor(D)-polyaromatics(bridge, B)-acceptor(A) molecules by transient EPR and optically-detected magnetic field effect. In a perylenediimide (PDI) based D-B-A system, our transient EPR studies revealed that there exist three triplet-state generation pathways; namely, direct charge recombination of the singlet radical pair by spin-orbit coupling (short bridge), charge recombination of the singlet radical pair via the hyperfine-induced S-T mixing (long bridge), and spin-orbit induced intersystem crossing in PDI aggregates. From the kinetic analysis of magnetic field effect on some D-B-A molecules, we succeeded in separately determine spin selective charge recombination rates (singlet and triplet manifolds) and the incoherent S-T relaxation rate. It has been demonstrated that the S-T relaxation can be a "bottleneck" process for charge recombination when the 2J coupling is moderately large. It turned out from the spin-dynamics simulation that the S-T relaxation is induced by the fast S-T dephasing, which is mathematically identical to that observed in micellar systems, even though the D-A distance is fixed. The mechanism of S-T dephasing is explained by modulation of 2J coupling by dihedral twisting motion of polyaromatic bridge unit, which was later confirmed by my novel Monte-Carlo MD assisted spin dynamics simulations. We also invented a novel pulse EPR scheme to control and detect the spin dynamics of the radical pairs, and demonstrated large (>100 fold) resonance microwave effect on the lifetime of the radical pair generated in a liquid crystal.

After 2-year postdoc research in Northwestern University, I came back to Japan and joined Prof. Taku Hasobe's group in Keio University as an assistant professor. In parallel with the spin dynamics simulation, I started research projects regarding supramolecular electron transfer in aqueous solutions. We found highly efficient (>10^5 M^{-1}) supramolecular complex formation between water-soluble porphyrin (D) and naphthalenediimide (A) derivatives, which, however, does not give a long-lived radical pair most likely due to ultrafast spin-allowed recombination of the contact pair. For the realization of singlet-born long-lived charge separated state, I constructed a supramolecular complex between nonionic micelle and an amphiphilic viologen derivative, in which hydrophobic coronene was encapsulated. The radical pair generated by photoexcitation shows a negative magnetic field effect characteristic of singlet-born radical pair, which is quite rare in micellar systems. The result demonstrates that separation of D-A distance is crucial for long-lived singlet charge separation.

After 3 years in Keio, I moved to Niigata University and joined Prof. Tadaaki Ikoma's group. I continued research on the soft supramolecular systems. We succeeded in creating a donor-chromophore-acceptor triad by utilizing the viologen-adsorbed micelle and showed that diffusion dynamics of guest molecule can be utilized for long-distance charge separation by detailed analysis of magnetic field effect. Recently, we succeeded in creating a nonionic vesicular system, which exhibits a gigantic magnetic field effect with a negligible escaped free radical yield. In addition to the soft materials, we are currently studying organic functional materials as Pt complexes and organic semiconductors from the aspect of spin dynamics of the paramagnetic intermediates. We are planning to utilize the static and nanosecond-pulsed magnetic field in combination with various spectroscopic methods ▶

as total reflection spectroscopy for revealing complex phenomena in those materials.

Finally I greatly acknowledge all the supervisors, colleagues, collaborators and students whom I worked with.

JEOL Prize 2014

Daniel Klose:

First of all I'd like to express my gratitude to the organizers of the 47th Annual RSC EPR group meeting at the University of Dundee and to JEOL for giving me the opportunity to present my work. Especially the care for the younger generation by the organizers was both kind and inspiring.

The meeting program in 2014 allowed for a further increase in the number of young researchers presenting their work and again eight were chosen to compete for the JEOL prize.

Of all the excellent candidates, the runner up for the JEOL prize was Mika Tamski, who presented electrochemical EPR utilizing loop gap resonators and microelectrodes to detect unstable radicals *in situ* during electro-chemical reactions with lifetimes down to about 100 µs.

The projects of my PhD studies focus on the conformational changes and dynamics of membrane proteins and the methodological interconnection of experimental data with biomolecular modeling and simulations. Since the often large and natively membrane-anchored or -embedded proteins accordingly undergo only slow rotational diffusion, site-directed spin labeling and EPR spectroscopy has emerged as a highly suitable method to study both their conformational changes as well as their dynamics. EPR yields information comprising features of both the protein as well as the spin label. Hence to reach a more atomistic understanding of a biomolecular system, the addition of simulation techniques to generate model ensembles and compare to the experimental data appears as a promising combination.

One of the systems investigated in our research group in Osnabrück, Germany, led by Prof. Steinhoff, is the phototaxis receptor-transducer signaling system *Np*SRII/*Np*HtrII (Fig. 1A) from the Archaeon *Natronomonas pharaonis* on which I presented our recent progress at the conference. Similar to the bacterial chemotaxis systems, these have sparked an immense and continuous interest due to the unique inherent features that microbes exploit for steering and regulating their swimming behavior: About 10,000 to 30,000 of these receptors form densely interconnected and highly stable arrays that localize at the cell poles and provide advanced signaling features for the cell, as reviewed in [1]. External stimuli such as light or chemical compounds are detected with a gradient sensitivity of only 1% over the length of the bacterial cell and signal responses are linear over five orders of magnitude of input intensities. The different signals are integrated and amplified, putatively at several stages, since the arrays show a very high cooperativity between the receptors, as described by Hill coefficients up to 11. However, the signaling and amplification mechanisms that give rise to these robust yet efficient and intricate signaling features still remain largely elusive.

On the conference I presented the part of my PhD projects where we studied the dynamics- and conformational changes upon light-induced signaling of the first HAMP domain in *Np*HtrII. [2] We spin-labeled cysteine mutants and applied time-resolved cw EPR spectroscopy with lock-in detection enabling us to sensitively detect the light-induced spectral changes. This approach in principle provides the light- and dark- state EPR spectra as well as the kinetics of the transition between the two states. These kinetics of the transducer *Np*HtrII were compared to the photocycle kinetics of the light receptor *Np*SRII, which we observed by time-resolved optical absorbance spectroscopy. Finding that both EPR- and optical time-resolved data can be fit using a common set of time constants, allowed us to conclude a tight kinetic coupling between *Np*SRII (probed optically) and *Np*HtrII's spin-labeled HAMP domain downstream in the signaling path. The coupling of the two signaling proteins showed an extended activation period of 500–700 ms for the transducer, induced by the single-photon driven isomerization of *Np*SRII's retinal chromophore. Compared to the much faster turnover rate of the subsequent kinase CheA, this shows how a single activation event is turned into a prolonged phosphorylation burst and thereby it provides a first stage of signal amplification.

Further analyzing the individual spin label positions in the HAMP domain, we determined the light-dark difference spectra which allow a glance at the transient light-state cw EPR spectrum at the obtainable field resolution (cf. Fig. 1B and C). [2] The spectral differences thereby show how the local dynamics change within the HAMP domain.

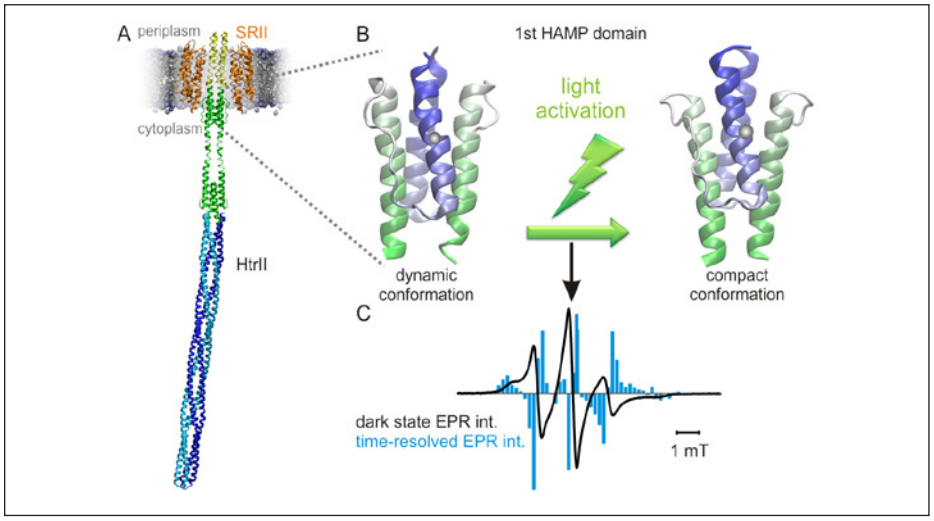


Figure 1. A: The phototaxis signaling system consisting of the light-receptor *Np*SRII and the transducer *Np*HtrII. B: Magnification of the first HAMP domain in the dynamic and compact conformation. A transition triggered by light is indicated by the green arrows. C: Transient difference spectrum (light – dark) (blue) and steady state (black) cw EPR spectrum of *Np*SRII/*Np*HtrII spin-labeled at position 94 (marked by a gray sphere in B) in the HAMP1 domain.

Here our data revealed a general trend to lower mobility upon light-activation in line with the discussed transition from a dynamic to a compact HAMP conformation [1]. Additionally, there is a pronounced dependence of the magnitude of the transient changes on spin label position, giving rise to a pattern of local steric hindrance differences that could be derived from the experimental data. This we compared to a structural transition suggested from different HAMP conformations observed in different HAMP domains by X-ray crystallography [3]. We calculated the local steric hindrance differences from the two structures according to a known algorithm [4] and find agreement with our experimentally observed pattern of mobility changes. Therefore, the previously proposed transition between two HAMP domain conformations is here shown to agree with data obtained for a single HAMP domain upon light-activation at ambient temperatures under near physiological conditions, i.e. using the native archaeal lipids as the environment of the signaling complexes.

To extend the modeling of conformation and dynamics to whole functional units of receptor-transducer complexes, comprising trimers of receptor-transducer dimers, we performed large-scale molecular dynamics (MD) simulations in cooperation with Philipp Orekhov from Moscow State University [5]. After an extensive all-atom modeling phase of the receptor-transducer dimer comprising structure evaluation with respect to the present experimental data, we assembled the trimers-of-dimers unit in coarse-grain MD simulations and induced the signaling on- and off-states by changes in transducer methylation; the parallel between activation and methylation was previously shown experimentally [6]. From the comparison of the complexes in the two signaling states we were able to deduce a model for the signaling mechanism of the transducer, in which activation switches the dynamics of the system: In the ground state a pattern of different dynamics arises from the side chain packing of the coiled-coil transducer. Upon light-activation, the initial conformational changes induced by the receptor [1] alter the side chain packing and in turn also the coiled-coil dynamics. This effect, called dynamic allostery [7], putatively activates the cognate kinase CheA [5].

1. Klare, J.P., Bordignon, E., Engelhard, M. and Steinhoff, H.-J. (2011) Eur. J. Cell Biol. 90, 731.
2. Klose, D., Voskoboynikova, N., Orban-Glass, I., Rickert, C., Engelhard, M., Klare, J.P. and Steinhoff, H.-J. (2014) FEBS Lett. 588, 3970.
3. Airola, M.V., Watts, K.J., Bilwes, A.M. and Crane, B.R. (2010) Structure 18, 436.
4. Altenbach, C., Froncisz, W., Hemker, R., Mchaourab, H.S. and Hubbell, W.L. (2005) Biophys. J. 89, 2103.
5. Orekhov*, P.S., Klose*, D., Mulkidjanian, A., Shaitan, K.V., Engelhard, M., Klare, J.P. and Steinhoff, H.-J. (unpublished)
6. Bornhorst, J.A. and Falke, J.J. (2001) J. Gen. Physiol. 118, 693.
7. Tsai, C.J., del Sol, A. and Nussinov, R. (2008) J. Mol. Biol. 378, 1.

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

International conference "Magnetic Resonance: fundamental research and pioneering applications" (MR-70) and XVII International Youth Scientists School "Actual problems of magnetic resonance and its application"

Kazan, June 22–27, 2014

International conference "Magnetic Resonance: fundamental research and pioneering applications" (MR-70) and XVII International Youth Scientists School "Actual problems of magnetic resonance and its application" dedicated to the 70 anniversary of the electron paramagnetic resonance discovery by E. K. Zavoiskii at the Kazan State University in January 1944 were organized by the Kazan Federal University and Kazan Zavoiskii Physical-technical Institute, Russian Academy of Sciences. The scope of the conference and school covered the state-of-the-art in application of magnetic resonance (EPR, NMR) in physics (strongly correlated systems, quantum magnets, molecular magnetism, nanoparticles and porous systems, phenomena in high magnetic fields, quantum technology materials, quantum computing, etc.), organic, bioorganic and physical chemistry, biology, medicine, geochemistry and geological prospecting, etc.

Leading scientists in the field of magnetic resonance from Japan, Switzerland, Germany, The Netherlands, USA, Serbia, France, Finland, Ukraine, Turkey, Moldova, Canada and Israel attended the conference. Unfortunately, K. A. Muller, Nobel Prize Laureate, who discovered high-temperature superconductivity together with H. Bednorz, could not come to Kazan. However, the participants of the conference could listen to the talk of K. A. Muller "The impact of ESR (EPR) on the understanding of the cuprates and their superconductivity" sent as a video file. There were 38 invited talks (11 reports were made by Russian scientists) covering all aspects of magnetic resonance presented at the conference. The majority of reports were presented during two sections: the application of magnetic resonance to studying condensed matter and application of magnetic resonance in medicine, biology, chemistry, including magnetic tomography.

There were 24 invited and oral talks (14 talks by Russian scientists) in the section "Electron paramagnetic resonance (EPR), nuclear magnetic resonance (NMR), acoustic magnetic resonance (AcMR), ferromagnetic resonance (FMR) and antiferromagnetic resonance (AFMR) in condensed matter". There were 23 invited and oral talks (11 talks by Russian scientists) in the section "Magnetic resonance in medicine, chemistry and biology. Magnetic resonance imaging. Bioinformatics". Reports of scientists from Moscow, Chernogolovka, Nizhniy Novgorod, Novosibirsk, Kazan were presented in the sections "Magnetic resonance and nanostructures" and "Magnetic resonance in porous materials and disordered media".

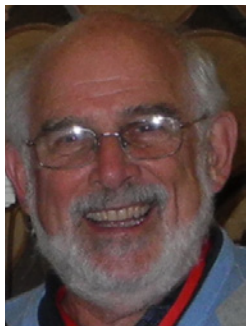
Thanks are due to our sponsors and exhibitors. The Government of the Republic of Tatarstan participated actively in the organization of the conference. In addition to the Russian Foundation for Basic Research, Bruker Ltd, a well-known manufacturer of NMR and EPR spectrometers, supported the conference.

Conference favored the exchange of ideas and recent achievements in the field of fundamental problems of magnetic resonance and its application to studying condensed matter, and also in medicine, biology, chemistry, and geology.

Chair of the Organizing Committee
MR-70, Rector of the XVII School,
Professor Murat Tagirov

After MR-70 in Kazan: Reflections of Four IES Presidents about the future of EPR

Lawrence Berliner:



The four Presidents of the IES were special invited guests/speakers at this prestigious celebration of the 70th anniversary of the discovery by Zavoisky of the spectroscopy that we all use, develop or provide new applications. The city of Kazan is beautiful, filled with history and houses some first class institutions in the physical and natural sciences. The quality of the work presented was high level and very timely and significant. The applications were quite impressive. In particular, the work coming from the various institutes and universities from Tatarstan, home of Kazan, were first class. This was my third (possibly fourth) visit to Kazan, the first time being the AMPERE meeting denoting the 45th year since Zavoisky made his important discovery that moved the field of magnetic resonance . It was wonderful to be in a city steeped in so much history, political, cultural and scientific. When one reflects on the fact that several of the world's greatest minds were housed here during the latter part of World War 2 in order to preserve Soviet science from a possible domination by the invading forces, including Zavoisky and his colleagues, it puts very much reality into our unique field. The saving grace appeared to be that no bombings occurred here so that all of the historic buildings remain intact.

Last, the organization of this meeting was superb from the greeting at the airport by a scientific colleague or graduate student, to meeting all of our needs and accommodations to the same concerns for our departure from this magic city. It is a meeting that I won't forget and look forward to another opportunity to visit again.

Wolfgang Lubitz:

EPR is one of the most underestimated methods in the field of science. It has always been standing in the shadow of its sister method NMR that has been widely used during the last 50 years in the sciences for analysis and characterization of materials. Slowly it is recognized by many chemists that the world is not only diamagnetic but that open shell molecules and paramagnetic complexes and materials are playing an important role in an increasing number of reactions. A similar development took place in physics, now covering so exciting fields as spin teleportation, quantum computing, quantum magnets and other quantum technology materials, molecular magnetism, biophysical systems, phenomena in high magnetic fields etc. For many systems EPR is the method of choice – and it is extremely powerful in elucidating the electronic structure and dynamics of molecules, complexes and solid state materials.

One striking example is the application of EPR and related methods in photosynthesis research. Here, our knowledge of such important processes as primary photochemistry, charge separation, electron and proton transfer, light-induced water splitting and the catalysis performed by many other metal centers would be much poorer without the application of EPR.

The diamagnetic world has been invaded by EPR via spin labeling techniques that have recently seen a renaissance with the development and application of advanced multifrequency pulsed electron-electron double resonance spectroscopy (PELDOR/DEER) and concomitant development of related theoretical concepts for data evaluation.

The great sensitivity of EPR can be used for the detection of NMR transitions, e.g. via double resonance methods like ENDOR, and for polarizing nuclei in NMR experiments via DNP. In recent years this has widely opened doors for a renewed discussion between EPR and NMR spectroscopists, which is obvious in many conferences during the last few years.

Not to forget magnetic resonance imaging, MRI, a method strongly based in NMR and since long in the medical clinic. Contrast enhancement is done here with paramagnetic metal complexes, again a cross fertilization between the two fields of magnetic resonance. And last but not least, EPR Imaging has also made significant progress.

All this has its roots in the discovery of EPR in 1944 by E. Zavoisky in Kazan; we are celebrating the 70th anniversary of this important event this year! Zavoisky's seminal work marks the first detection of the magnetic resonance phenomenon, which had a profound effect on scientific research worldwide.

The anniversary has been celebrated with a large symposium MR-70 in Kazan, Tatarstan in June 2014. The program beautifully demonstrated the large breadth of this method ranging from instrumental and methodological developments, via theory to applications in physics, materials research, photo- and radical chemistry, biochemistry and more. Many prominent scientists working in the field from Russia and many European and other countries took part in this remarkable event (see report by Murat Tagirov), in particular also the present and several past presidents of the International EPR/ESR Society IES.

The symposium nicely showed that EPR has a bright future in the sciences.

Klaus Möbius:

The Kazan Federal University and the Zavoiskii Physical-Technical Institute had organized – supported by the Government and the President of Tatarstan Republic, Bruker Ltd (Moscow) and the Russian Foundation for Basic Research – the International Conference "Magnetic Resonance: Fundamental Research and Pioneering Applications" (MR-70) in Kazan from June 23 to June 27, 2014. It was devoted to the 70th anniversary of the discovery of EPR by E. K. Zavoiskii on January 21, 1944.

The scientific program was a superb mixture of plenary and contributed lectures and poster presentations covering both historical and actual overviews as well as brand-new methods and applications of EPR in material sciences, molecular biology and medical diagnostics. From the more than 80 oral presentations, which were amended by a similar number of poster presentations, it became again crystal clear that magnetic resonance in general, and EPR in particular, is currently in full bloom, but owes its blooming period first and foremost the functioning international cooperation between excellent laboratories around the world. Hand in hand with rapid exchange of information at international conferences. Indeed, about 40% of the lectures were presented by non-Russian scientists – which is not a bad number considering the politically difficult times in which MR-70 took place. Apparently, the

importance of internationality of science has been recognized by the organizers and participants of MR-70 as well as by the financial (and moral) supporters of the meeting. To all of them we owe special thanks.

Evidently, it is impossible to cover here all the excellent contributions at MR-70, but only one example will be mentioned here that was totally in the spirit of remembering E. K. Zavoiskii, the magnetic resonance pioneer, who tried to detect NMR and failed, but detected EPR instead: This was the lecture by A. V. Dooglav, I. I. Silkin and F. R. Vagapova, "Zavoiskii and NMR: The analysis of the logbooks and rerunning of the experiments". The logbooks reveal that as early as 1941, from January until June, Zavoiskii continuously attempted to observe NMR of different nuclei in condensed matter samples. By repeating these NMR experiments according to the laboratory logbooks, Dooglav and co-workers could demonstrate that the detection sensitivity of the "grid current" method invented by Zavoiskii was quite sufficient to observe cw NMR in water solutions of paramagnetic salts. But the poor reproducibility of Zavoiskii's NMR signals was caused by the inadequate magnetic field homogeneity of the electromagnets he had used. Bad for E. K. Zavoiskii, but good for F. Bloch and E. M. Purcell in USA who, in 1945, discovered NMR when they had more adequate magnets at their disposal (they shared the 1952 Nobel Prize for this discovery).

Since the Age of Enlightenment – and despite the dark periods of dictatorships and tyranny of the 20th century – science seemed to be open for challenging problems to be solved in order to widen our horizon and to better understand the secrets of Nature. And to apply our increased understanding to the benefit of mankind, to fight hunger and diseases, to improve quality of life without ruining the natural environment. Science, this was the hope, is open for uncensored thinking. Science allows for individual creativity and one's own decisions on what to do in scientific research and with its results – and what not to do. This hope appears now somewhat naïve, I have to admit, when looking backward to the 100 years after 1914. Also when looking forward to the coming decades of the third millennium, which had such a heady start promising a glorious future after the end of the Cold War! Now, we have to foresee frightening restrictions of uncensored thinking as a result of growing nationalism and ideological parochialism in many parts of the world, even in Europe. Where will it lead to?

Despite all this – I am still optimistic that working in science, in particular in basic research, will continue to be distinguished by its opportunities for independent thinking, for interacting with many colleagues across political borders and ideological incrustations, for developing new ideas, for keeping one's own moral standards. And to share this unique experience of alternating excitement and frustration with the co-workers when new experiments are running. What a glorious feeling of success when ultimately the spectrum of a new system appears at the screen! Such a feeling Evgeny Zavoiskii must have had 70 years ago when he recorded the first EPR spectrum (of $CuCl_2 \cdot H_2O$) in the world.

I am absolutely excited about the young generation of EPR researchers growing up around the world. Many of them I had the chance and privilege to meet in person, be it in the laboratory or at international meetings and workshops. Or for whom I was asked to write evaluations concerning their papers, graduation theses, postdoctoral fellowships and appointments at the various stages of their academic career. Let's be honest: In most laboratories it is the young researchers who are implementing new methodologies in advanced EPR spectroscopy. Or applying sophisticated EPR and NMR techniques to more and more complex and challenging systems in material sciences, biochemistry and biophysics. And who are doing the laborious sample preparations and instrumentation repair and improvements without which the experiments are doomed to failure. As a kind of compensation for doing this work the young researchers are developing their own creativity and professional competence (which is comforting to know).

My message to the young generation of EPR researchers is: Feel responsible for what you are doing, above all towards humanity. Don't bow to established thinking of the authorities, be it your professors and superiors, or the famous authors whose papers you read in the scientific literature or in the public media. But speak up when you see alternatives! Don't trust those who tell you about the necessity of building up barriers between the "good guys" and the "bad guys" in the world. Perforate those barriers by making use of the opportunities of our science community to meet people from around the world. Take up the chances for international contacts and co-operations. Attend international summer schools, conferences and workshops and listen to the lectures of EPR seniors and juniors from around the world and contribute to controversial discussions. Defend your own results with faith in the quality of your work, but listen also to constructive criticism from outside. Don't fall into despair when the problems seem to get out of control, but keep in mind that your research will ultimately lead to better knowledge in your field. Keep in mind that EPR spectroscopy also provides an excellent broad-band training and qualification in a variety of scientific disciplines including microwave and magnet engineering and complex data analysis. This is a highly attractive bonus for subsequent appointments in academic, industrial and medical professions.

What about the future of EPR? This is a difficult question, but I think one trend to future applications is clearly emerging: The growing importance of high magnetic fields in EPR and NMR in the material and life sciences. In life sciences, this becomes most obvious at ▶

the borderline between molecular biology, supra-molecular chemistry and molecular physics. Trying to understand some of the riddles Nature proposes to us, for example: How can we copy the essential components of oxygenic photosynthesis to manufacture bio-inspired powerful photovoltaic cells and solar fuels?

During the last two decades, the science community witnesses a boost of new and exciting EPR applications in chemistry, biology and physics. This is largely due to technological breakthroughs in the development of pulsed microwave sources and components for frequencies up to several hundred GHz, sweepable-cryomagnet design and ultrafast data-acquisition and -handling instrumentation. This enables the EPR spectroscopists to introduce multiple-pulse microwave irradiation schemes at very high Zeeman fields, in analogy to what is common practice in modern NMR spectroscopy. And to apply high-field EPR and its powerful extensions to ENDOR, ELDOR-detected NMR and PELDOR (DEER) methods with their unique potential for the elucidation of structure and dynamics of transient complex paramagnetic systems – stable or short-lived – in disordered matrices and proteins.

To sum up: Modern multi-frequency/multi-field EPR spectroscopic methods, both in cw and pulse mode of operation, will continue to flourish in material science and life sciences by providing unique information on orientation-resolved structure and dynamics of stable and transient paramagnets, such as radicals, radical pairs and triplets states as well as transition-metal ions occurring in chemical and biological processes. New insights are being gained which are complementary to what can be learned from other techniques such as X-ray crystallography, optical and IR spectroscopies, FRET or NMR. High-field/high-frequency EPR may even provide unique structural insights that remain inaccessible by high-resolution X-ray diffraction techniques. This applies, for example, to large bio-systems lacking long-range order, such as glasses or frozen solutions. High-field/high-frequency cw EPR generally provides, by lineshape analysis, shorter time windows for molecular motion than X-band EPR does, down to the ps range. This allows one to study correlation times and fluctuating local fields over a wide temperature range. They are associated with characteristic dynamic processes, such as protein, cofactor or lipid motion and protein folding. Optimized time windows can be selected by a multi-frequency EPR approach to disentangle different modes of motion at biologically relevant time scales.

The big issues in the natural and life sciences – Health and Disease, Environment, Sustainable Energy, Learning from Nature – ask for the best of all methodologies to apply. This will work best only by collaboration between scientists from many different fields of education and expertise. MRI (magnetic resonance imaging) is no longer exclusively a domain of NMR; EPR Imaging is already on the way to become a powerful diagnostic tool in new-materials medical diagnosis laboratories. It is my conviction that the future of modern EPR in material science, chemical kinetics, molecular biology and medical applications is bright – and waits for young researchers to enter the field and to attack new tasks with new ideas and new enthusiasm. In short: The field of EPR spectroscopy is flourishing – like science in general – and this as a result of international exchange and networking. International cooperation is the best drug to use against narrow-mindedness and ideological prejudices. Let's use it!

Hitoshi Ohta:

Trends to go higher frequency and higher magnetic field ESR with higher sensitivity are unavoidable. This is due to the general reason common to NMR that higher frequency and higher magnetic field give higher spectral resolution. On the other hand, we need higher sensitivity because the ESR intensity is spread in the wide field region. We also need higher field homogeneity for the high spectral resolution. With these it should be extended to THz ESR with high resolution and high sensitivity. Main problem of THz ESR, which we are working, is the sensitivity. Therefore, we are working on the micro-cantilever ESR, which enables us to increase the sensitivity dramatically without the frequency limitation. The increase of sensitivity in the THz ESR opens a new field in science. The main stream of ESR is now shifting from the material science to the application of biology and medicine. In the cases of biology and medicine, we usually face the problem of sensitivity due to the low spin concentration and the small amount of samples. In the cases of biology and medicine, there exist many problems, which should be overcome for THz ESR to understand the energy structure of the system, and high sensitivity THz ESR will be a powerful means to solve the remaining problems. Of course the micro-cantilever ESR cannot be applied to pulsed ESR, which is becoming powerful to study the long distance and dynamics, due to the limitation of time response. However, there are other new ESR techniques to extend to that direction. I think the application of pulsed ESR is very important to study the structure of proteins and their dynamics. This application of ESR has advantages to NMR and I really think that the directions of high power high frequency pulsed ESR sought by Graham Smith and Mark Sherwin are the next generation of ESR with applications to proteins. The final goal is to understand the bio-functions of protein by ESR. For the future material science studies, we are also developing the multi-extreme ESR measurement systems. Combinations of high frequency, high magnetic field, low temperature and high pressure ESR is the key to get rich information of new materials.

The International conference "Modern Development of Magnetic Resonance 2015" (MDMR-2015)

Kazan, September 22–26, 2015
www.kfti.knc.ru/mdmr/2015

The Zavoisky Physical-Technical Institute of the Russian Academy of Sciences, the Academy of Sciences of the Republic of Tatarstan and the Kazan Federal University organize the Zavoisky Week in the period from 22 till 26 September 2015 including the annual International Conference "Modern Development of Magnetic Resonance 2015" and the Zavoisky Award 2015 ceremony (www.kfti.knc.ru/en/zavoisky) supported by the Government of the Republic of Tatarstan.
The conference is organized under the auspices of the Groupement AMPERE.

The scope
Theory of magnetic resonance
Low-dimensional systems and nano-systems
Electron spin based methods for electronic and spatial structure determination in physics, chemistry and biology
Molecular magnets and liquid crystals
Spin-based information processing
Strongly correlated electron systems
Chemical and biological systems
Medical physics
Magnetic resonance imaging
Other applications of magnetic resonance
Modern methods of magnetic resonance
Magnetic resonance instrumentation
Related phenomena

Important Dates
Deadline for the registration and submission of abstracts June 30, 2015
Notification of the report acceptance July 15, 2015
Opening of the conference September 22, 2015
Zavoisky Award 2015 ceremony September 25, 2015
Closing of the conference September 25, 2015
Departure of participants September 26, 2015

Chairman
Kev M. Salikhov, Full Member of the Russian Academy of Sciences
e-mail: salikhov@kfti.knc.ru

Secretariat
Violeta K. Voronkova, Dr. Sci
Laila V. Mosina, Ph.D
Vlad A. Latypov, Ph.D
e-mail: mdmr@kfti.knc.ru
phone: 7 (843)2319096
fax: 7 (843)2725075

Online registration & Abstract submission
www.kfti.knc.ru/mdmr/2015

Market place

POSITIONS

Research Scientist (Postdoctoral associate)
The Institute of Macromolecular Chemistry AS CR, v.v.i. seeks a postdoctoral associate / research scientist to join the Laboratory of electron paramagnetic resonance of polymer systems (EPR)
Requirements: University degree and PhD in the field of chemistry, physical chemistry or physics / Practical experience with the method of electron paramagnetic resonance (EPR) / Knowledge of and working experience with polymers and EPR imaging will be an advantage / Stays abroad will be an advantage / Good knowledge of English language / Good publication activity / Independence, reliability.
Details about research work can be obtained from RNDr. Petr Štěpánek, DrSc., stepanek@imc.cas.cz
Candidates should submit a structured CV emphasizing experience relevant to the advertised position, a motivation letter and a list of publications and other results to e-mail: fencl@umch.cz HR department tel. (420) 296 809 385.

Available: Used EPR Spectroscopist
Old, but well maintained EPR Spectroscopist, with wide application experience, seeks opportunity to support active research group. EPR- based publications over 5 decades, most recently 2011, mass spectrometry publications to 2014. Experience in the study of transient organic and organometallic free-radicals; transition metal complexes; spin-trapping; spin probe; radical ions; matrix isolation

and γ-radiolysis techniques; photocatalysis; polymer degradation and stabilisation etc. Has Bruker, Varian and JEOL operating experience, plus track record in NMR and mass spectrometry techniques. Would prefer to work in biochem/biological area, but would consider anything interesting. Opportunity arises due to restructure of Research Department in Australian steel company after 26 years faithful service. Excellent grant writing skills, 100% success rate. Speaks English, German and some French.

Please Contact: Phil Barker pba02985@bigond.net.au or pbarker@uow.edu.au to receive user logbook and publications list.

Postdoctoral Associateships in Magnetics at NIST

We offer postdoctoral opportunities in magnetics at the National Institute of Standards and Technology in Boulder, Colorado, USA. Annual salary is $65,600 plus benefits. Appointments are for two years. Application deadlines are 1 February and 1 August annually (but inquire earlier).

The application process is competitive. Typical successful applicants have a strong research background and academic record. Letters of reference and an original research proposal are required.

U.S. citizenship and a background investigation are required (no exceptions).
www.nist.gov/pml/electromagnetics/magnetics

EPR Specialist Position at Johns Hopkins

Postdoctoral or specialist (staff) position is available immediately to study membrane proteins at the Johns Hopkins University School of Medicine in Baltimore, Maryland, USA. We study conserved membrane enzymes with implications for human health (see Nature Chem Biol 8:759, eLife 1:e00173, and Nature Rev Micro 7:411), and are generously funded by the National Institutes of Health (NIH) and the Howard Hughes Medical Institute (HHMI). The project uses site-directed spin labeling (SDSL) with nitroxide probes to study the dynamics, distance measurements, and saturation kinetics with CW-EPR methods. The applicant must have at least 3 years of prior experience in SDSL, EPR, spectrum simulations, and distance measurements as evidenced by publications. Experience with membrane proteins is preferred but not essential. Position will come with generous salary and benefits, depending on experience and record of achievement. Interested applicants please send detailed CV and contact information for 3 references to rosanna@jhmi.edu.

Research Positions – Advanced EPR of Biochemical and Chemical Systems

Several research positions (doctoral and postdoc level) are presently available in the Biophysical Chemistry Department of the Max Planck Institute for Chemical Energy Conversion in Mülheim/Ruhr, Germany. We are looking for highly motivated young scientists in the field of Electron Paramagnetic Resonance who are interested in studying biochemical and chemical systems related to the topic of the institute.

In-house projects: Photosynthetic systems (reaction centers, water oxidation) / Hydrogenase enzymes and related model systems / Radical enzymes and protein maquettes.

Collaborative projects: EPR instrumental developments dedicated to EPR studies of (single) protein micro crystals / Advanced EPR investigation of highly reactive chemical intermediates and their weakly bound intermolecular complexes.

Our lab is equipped with 10 modern EPR spectrometers covering the frequency range from 2 to 244 GHz capable of the complete repertoire of CW EPR and pulse techniques (ENDOR/TRIPLE, ELDOR, ESEEM) in combination with laser excitation and freeze quench techniques. More details can be found on our website: www.cec.mpg.de.

Candidates should have project relevant knowledge and be trained in Magnetic Resonance Spectroscopy, preferably in EPR. Candidates with an interest in EPR instrumental development and microwave engineering are specifically encouraged to apply.

Please send your application including CV and the scope of scientific interests to:
Prof. Wolfgang Lubitz
Max Planck Institute for Chemical Energy Conversion, Stiftstrasse 34-36, 45470 Mülheim an der Ruhr, Germany
e-mail: wolfgang.lubitz@cec.mpg.de

Bruker BioSpin Corp

Bruker BioSpin Corp is looking for a highly motivated individual to join our EPR Service team to install and support high technology EPR Spectrometer Systems in customer research labs. This individual will install and service our EPR Spectrometer Systems and train customers for basic operation of the equipment. A BS in electrical engineering, electronics or related fields or equivalent experience is required. Experience diagnosing and repairing electronic, electromechanical and/or mechanical equipment is required. General understanding of analog electronics, digital electronics, high voltage circuitry/circuits, microwave technology, vacuum technology, cryogenics; strong technical skills on analytical instrumentation required.

Please send resume, cover letter and salary requirements to bruker.jobseprfse0620@bruker-biospin.com

EQUIPMENT

Wanted: Badly needed certain parts of, or even a complete Bruker X-Band microwave unit from the mid-seventies, the one which came with the Bruker B-ER 420 system. Particularly, the klystron heating and protection board, B-E-Z 10. Please contact Prof. Dr. Wolfgang E. Trommer, Department of Chemistry, TU Kaiserslautern, P.O.Box 3049, D-67653 Kaiserslautern, Germany. E-mail: trommer@chemie.uni-kl.de.

EPR parts, electronics and hardware

Pulse generators, amplifiers, frequency counters, etc. We also offer X-band cavities, waveguide, klystrons, cells, etc. for Varian instruments.

Please contact techepr03@gmail.com for availability and pricing.

Design and construction of EPR electronics

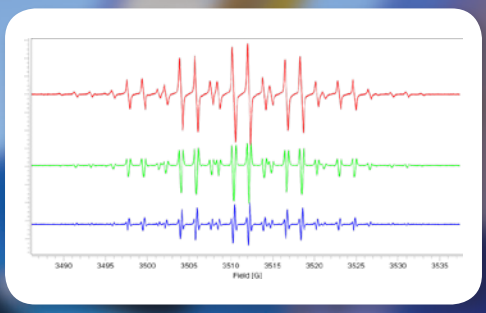
The University of Denver can supply electronic design and construction services for EPR applications. Low-noise pulse amplifiers, low-noise 100 kHz preamplifiers, boxcar integrators, and pulse timing systems are available. We also supply a conversion kit to convert Varian field-control units to voltage-controlled 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: Used Varian EPR equipment

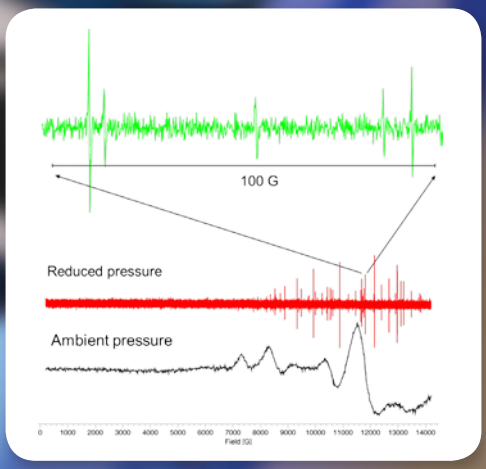
(1) Varian E-104 EPR spectrometer with vertical style bridge and e-line fieldial. (2) Varian E-9 EPR spectrometer. Both available with warranty and continued service support. (3) Varian TM cavity with flat cell holders and flat cells. (4) Varian E-257 variable temperature controller with heater sensor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

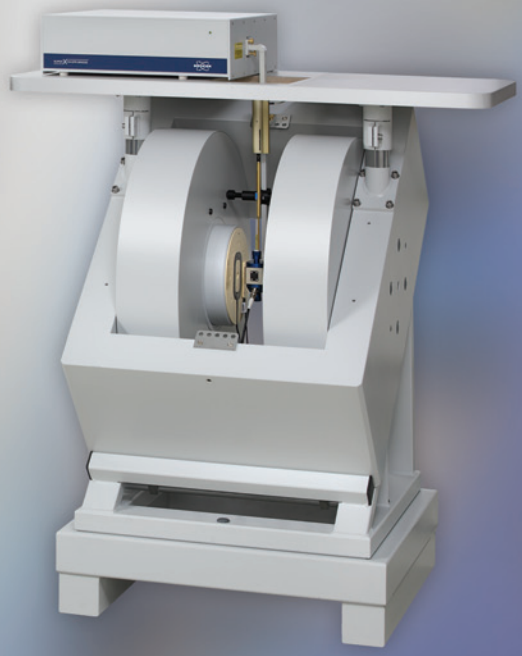
CW-EPR Digital Upgrade



Simultaneous detection of 1st, 2nd and 3rd harmonics of PNT sample.



High resolution, molecular oxygen Q-band EPR spectrum. Zoomed area shows the resolved individual EPR lines of the low pressure spectrum.



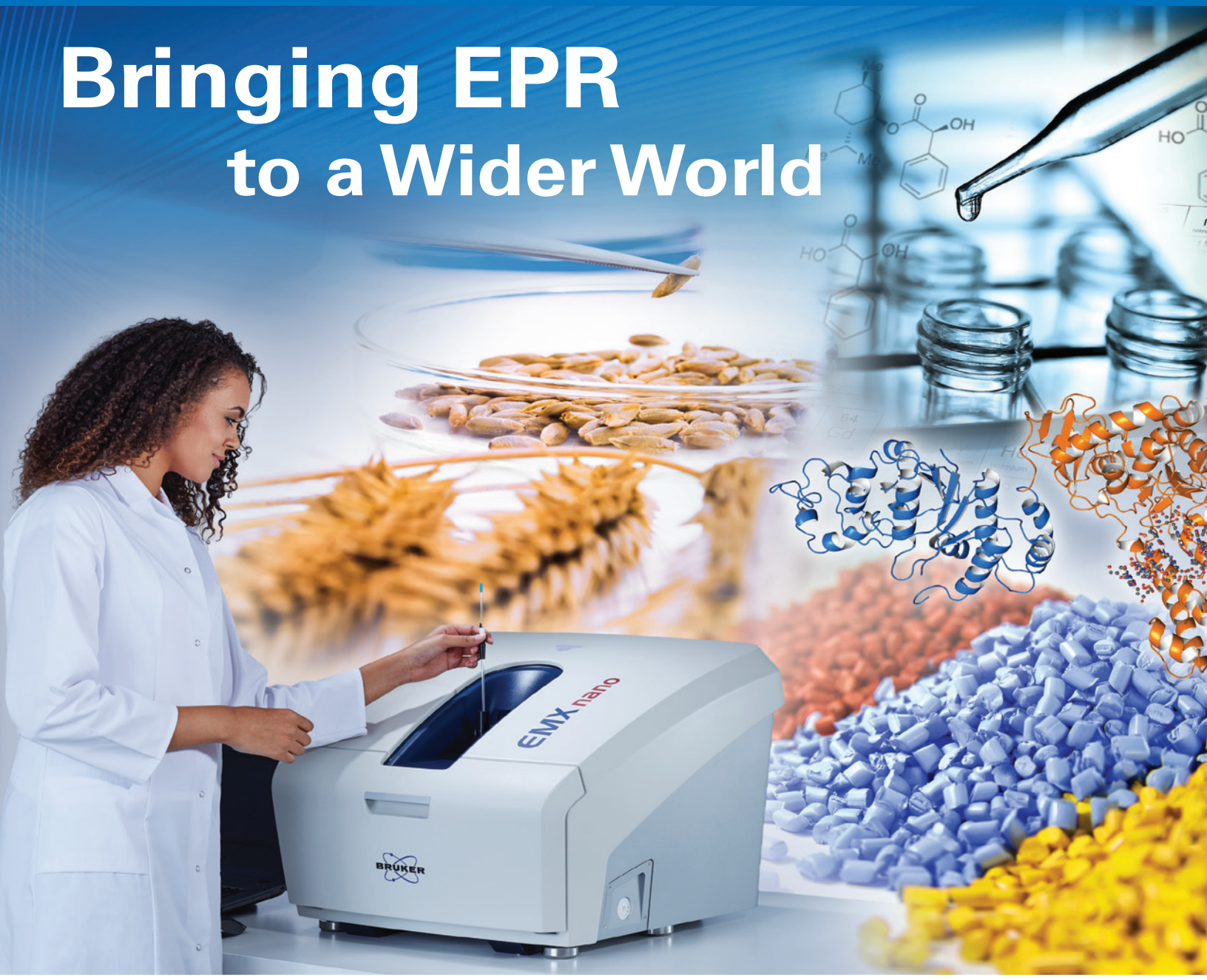
The latest digital technology for your ELEXSYS E500

Already well-known for exceptional CW-EPR performance, the ELEXSYS is evolving to provide you with the benefits of the latest digital technology and meet the demands of advanced EPR research. Update your ELEXSYS transputer/OS9 system with our Digital Upgrade Package:

- New field controller and Signal Processing Unit
- High dynamic range in both field and signal amplitude resolution
- Transient and rapid scan acquisition
- XEPR software for reference-free quantitative EPR and spin trapping data analysis

Discover new CW-EPR possibilities: www.bruker.com/epr

Bringing EPR to a Wider World



The EMXnano from Bruker is a compact, state-of-the-art benchtop instrument designed to give you the power and flexibility you need for a range of analysis and teaching applications. With the latest digital and microwave technologies, the EMXnano provides superior sensitivity and stability with minimal infrastructure and a low cost of ownership.

To learn how you can add EPR to your lab, please visit: www.bruker.com/emxnano