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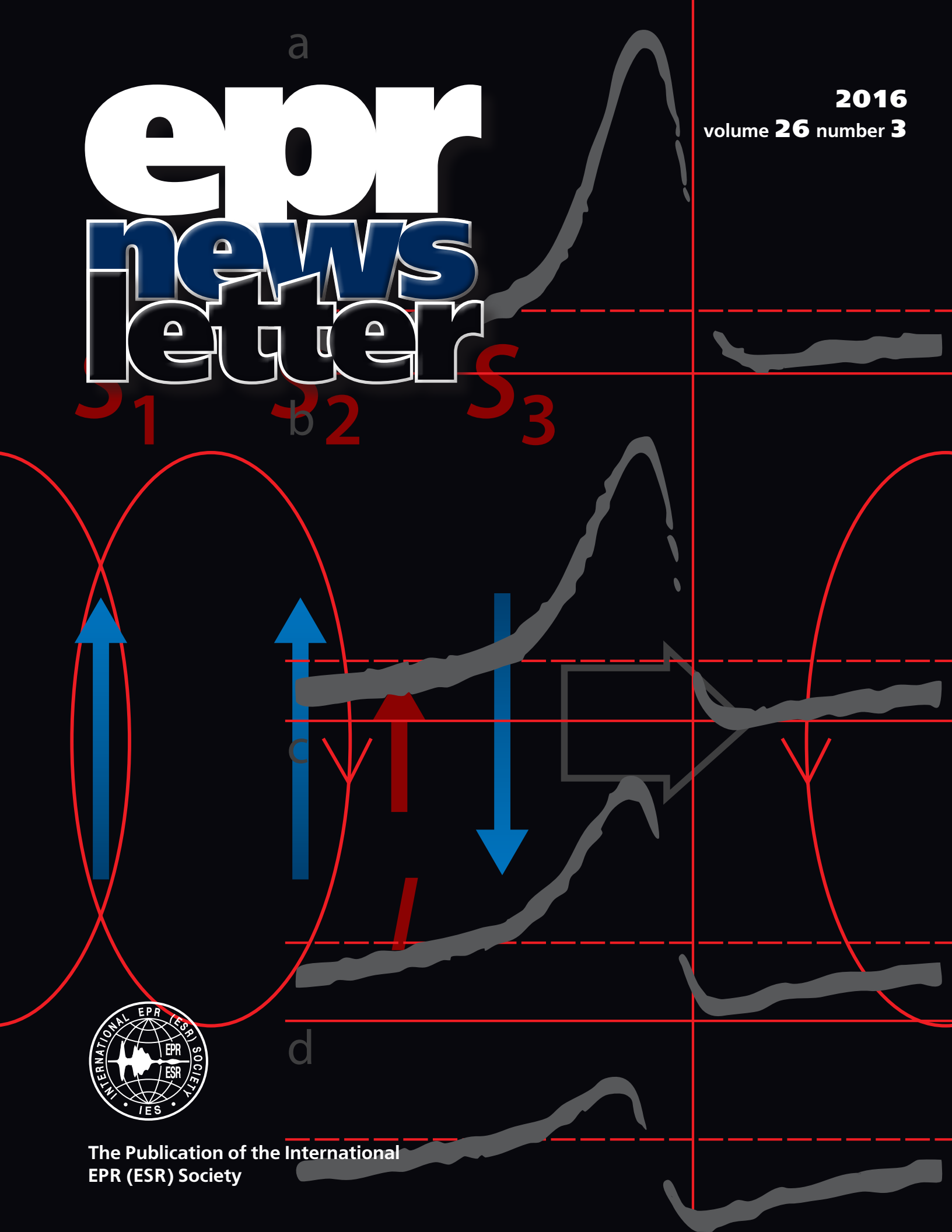

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Please feel free to contact us with items (news, notices, technical notes, and comments) or ideas for the *EPR newsletter*.

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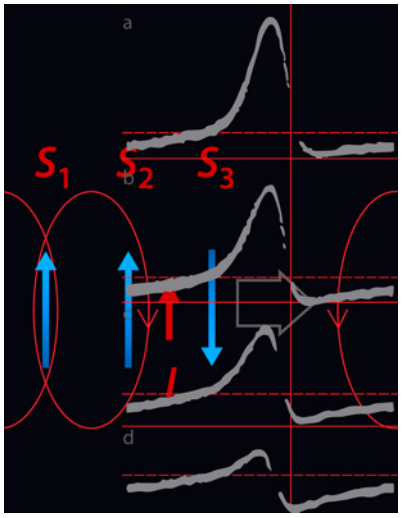


The cover picture illustrates aspects of research carried out by Vadim Atsarkin, recipient of the Zavoisky Award 2015. It shows the specific distortion of the EPR absorption line caused by cooling of the electron spin-spin reservoir (ESSR) and a schematic diagram of the energy transfer between ESSR and nuclear spins (dynamic nuclear polarization via thermal mixing).

epr newsletter

The Publication of the International EPR (ESR) Society

volume 26 number 3 2016

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Editorial

Dear colleagues,

Claudia Tait did it! She was lucky enough to secure a hat-trick of prestigious magnetic resonance awards in 2016: the Bruker Thesis Prize, the John Weil Young Investigator Award and the Ulderico Segre Prize (the latter shared with George Cutsail, co-awardee). This, to date, unique result sets high standards and challenges the upcoming young generation of magnetic resonance researchers. Our heartfelt congratulations to you, Claudia!

Looking at the beautiful cover of this newsletter illustrating the research of Vadim Atsarkin, Zavoisky Awardee 2015 (see also his interview p. 3), our attentive and sharp-eyed reader might wonder why prior to this cover we did not publish covers dedicated to the research of Thomas Prisner and Gunnar Jeschke, Zavoisky Awardees 2014, and also that of Dave Britt, IES Gold Medal winner 2014. The explanation is very simple: in harmony with the Executive guidelines for the articles to be published in the Anniversaries column (21/4, p. 2), namely, "there is no need to feature the same person for $+n\times5$ (n = 1, 2, 3...) anniversaries", we refer you to relevant previous covers of the *EPR newsletter*: 18/1 and 22/2 (Thomas Prisner, recipient of the 2007 IES Silver Medal for Physics/Materials Science and Bruker Prize 2011, respectively), 19/3 (Gunnar Jeschke, recipient of the Bruker award 2009) and 25/1-2 (David Britt, recipient of the IES Gold Medal 2014. We may also recommend additional reading on Thomas Prisner (e.g., Pulsed High-Field EPR – An Expert View, 14/3, pp.18–20; Curve Sketching and Line Etching, 20/1, pp. 6, 7), Gunnar Jeschke (e.g., Pulsed Electron Electron Double Resonance: Distance Distributions, 14/4, pp. 14–16; Validation of Distance Distributions Derived from DEER/PELDOR/DQ-EPR data,18/1, pp. 15, 16) and David Britt (24/1-2, pp. 14, 15).

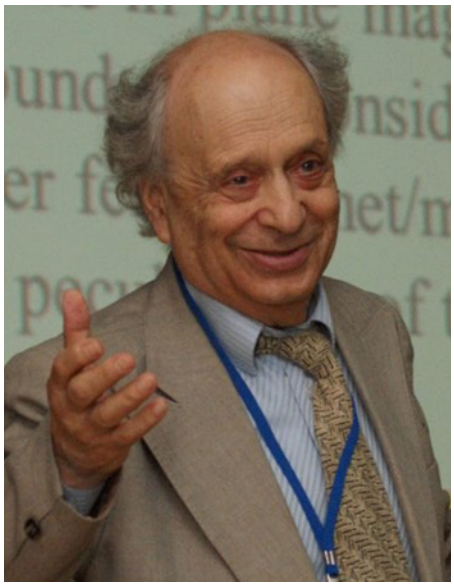
To celebrate Kev Salikhov's 80th birthday [an essay on Kev's 70th birthday was written by Yurii D. Tsvetkov and Yuriy N. Molin (see 16/4, p.9)], Wolfgang Lubitz invited him to contribute to the Guest of the Issue column (pp. 6–8). Kev considers on the role of chance in research and shares with us his algorithm for successful research. Judging by the terrific results he achieved using it, it certainly works. Dear Kev, we wish you many years to come full of inspiration and creativity!

To continue in this festive tune, we all join in congratulating Elena Bagryanskaya, IES Vice President (Asia-Pacific) and President of the Russian EPR Society, on being elected President of the Asia-Pacific EPR Society, and Sabine Van Doorslaer, Associate Editor of the *EPR newsletter*, on being elected President of the European Federation of EPR groups.

Reports on the 58th Rocky Mountain Conference on Magnetic Resonance: EPR Symposium (Breckenridge), the International Conference Asia-Pacific EPR/ESR Symposium 2016 (APES 2016) (Lake Baikal) and the Xth Conference of the European Federation of EPR groups (Torino) will be published in the forthcoming issue of the *EPR newsletter*. Look forward to the comprehensive information about the vibrant life of the magnetic resonance community! Talk to you soon.

Laila Mosina

Interview with Professor Vadim Atsarkin on the Occasion of His Zavoisky Award 2015



EPR newsletter: *Dear Professor Atsarkin, on behalf of the readers of the EPR newsletter we congratulate you on your Zavoisky Award 2015. We are most appreciative that you agreed to answer the questions of this interview. Why did you start towards your career in science?*

From my childhood I believed that I should be a researcher – not obligatory in physics and even in natural sciences at all, but certainly I should study, investigate, classify, discover. My parents were academic scholars (history and linguistics). So I dreamt of learning at the Lomonosov Moscow State University and then working in the Academy of Sciences. And this dream came true.

Who introduced you into magnetic resonance?

After graduating from the University (1959), there was a possibility for me to join the Quantum Electronics laboratory headed by Prof. M. E. Zhabotinsky at the Institute of Radio Engineering and Electronics (Moscow), where EPR was an urgent problem related to microwave quantum devices (masers). My first tutor in the laboratory was Andrey Frantsesson, who was really a magician in physical experiment. Maya Isaakovna Rodak familiarized me with basics of spin thermodynamics. In fact, however, there were no systematic studies in magnetic resonance in the laboratory, and I experienced the strong influence of the Kazan scientific school headed by Professor S. A. Al'tshuler.

What part of your research is most dear to your heart and why?

I like magnetic resonance not only for its innumerable applications, but rather for the unique beauty of this phenomenon which is often called "spin ballet". I think pure physics is a rather practical thing, since it satisfies directly one of the most important human needs – curiosity, desire for learning the world where we live. I do not know another branch of science where we can do so sophisticated, really fantastic manipulations with microscopic objects – in our case, spins. Magnetic resonance and spin dynamics became a polygon for testing the most daring physical ideas, such as time reversal, quantum computing – and, among others, spin thermodynamics and dynamic nuclear polarization, which are my favorite fields and the subject of this Zavoisky Award.

What is your message to the young generation of magnetic resonance researchers?

I think that magnetic resonance remains to be a very attractive and prospective field of science promising a lot of new discoveries and applications. So I strongly recommend it to young people who are choosing the direction of future studies. My general advice is as follows. Firstly, do not limit yourself to collecting experimental facts but try to search for a deep physical sense, to find a link to general physical problems. And secondly, do not limit yourself to standard experimental methods and commercial equipment. Try to invent and construct original techniques for your specific experimental ideas. I think that this is the best way to find something new.

Larry Berliner – 2016 Rudi Lemberg Travelling Fellow of the Australian Academy of Science

Professor Larry Berliner has recently spent about three weeks in Australia as the 2016 Rudi Lemberg Travelling Fellow of the Australian Academy of Science. In fulfilment of the Fellowship, Larry presented a fascinating and informative lecture entitled "Alfred Nobel and The History Of The Nobel Prize" in Brisbane, Sydney, Canberra, Adelaide and Melbourne. In addition he presented a lecture at LaTrobe University in Melbourne entitled *Detection of Nitric Oxide: Combining EPR and NMR*.

The Rudi Lemberg Travelling Fellowship commemorates the contributions of Professor M. R. Lemberg FAA FRS to science in Australia. The Fellowship, financed through the generous bequest of Mrs Hanna Lemberg and the Society for Biochemistry and Molecular Biology, is awarded every two years. Its purpose is to enable either Australian or overseas scientists of standing to visit Australian scientific centres and to deliver lectures.

Rudi Lemberg (1896–1975) was born in Germany where he trained initially as a Chemist. Leaving Germany in the early 1930's, he first worked in Cambridge before moving to Australia in 1935 where he carried out significant research until 1972 at the Royal North Shore Hospital in Sydney. It was in Australia that Lemberg succeeded in making the transition from Chemist to Biochemist. Elected a Fellow of the Royal Society of London in 1952, he was an Inuagural Fellow of the Australian Academy of Science when it was established in 1954.

Larry is to be congratulated on having been honoured by this most significant award.

The Bruker Thesis Prize 2016 and The John Weil Young Investigator Award 2016

Claudia E. Tait:

I am honoured to have been selected by the ESR group of the Royal Society of Chemistry and the International EPR society for the Bruker Thesis Prize 2016 and the 2016 John Weil Young Investigator Award for my thesis work on the investigation of electron delocalisation in supramolecular porphyrin structures by EPR. I am very grateful to the EPR community for this sign of recognition and for the invitation to present my research at the 49th Meeting of the Royal Society of Chemistry in Essex. I would like to express my gratitude to Profs. Christiane Timmel, Marilena Di Valentin, Jeffrey Harmer, Stefan Stoll and Dr. William Myers, for their support and encouragement and for teaching me about the various aspects of EPR spectroscopy during the different stages of my studies. Many thanks also go to my fellow students for helpful discussions and suggestions.

In my presentation at the RSC meeting I talked mainly about the results of the study on electron delocalisation in photoexcited triplet states of linear and cyclic multi-porphyrin structures performed during my doctorate in the group of Prof. Christiane Timmel at the University of Oxford.

Porphyrin-based π-conjugated materials inspired by natural photosynthetic antenna complexes and reaction centres are of great interest for applications as molecular wires [1] and in artificial energy conversion devices [2, 3]. EPR is amongst the methods best suited for investigating the efficiency of electronic communication between individual porphyrin units and has been used extensively for the investigation of natural photosynthetic systems [4, 5]. In the context of molecular wires, previous studies had found extensive delocalisation in the radical cation states, but localisation of the corresponding triplet states on a single monomeric unit [6]. The conclusion on limited delocalisation for triplet states was reached based on the absence of significant changes in zero-field splitting for increasing oligomer lengths. We believed that new insights into triplet state delocalisation in molecular wires might be gained by a detailed analysis of both zero-field splitting (ZFS) and hyperfine interactions, and therefore set out to investigate the photoexcited triplet states of porphyrin oligomers designed and synthesized in Prof. Harry Anderson's group at the University of Oxford. Many thanks go to him and his group, especially Dr. Patrik Neuhaus, for fruitful discussions and for accommodating my many requests for different samples.

Time-resolved EPR measurements on a porphyrin monomer and dimer revealed a slight increase in the ZFS *D* parameter in the dimer, in contrast to what would be expected in case of increased delocalisation. However, the proton and nitrogen hyperfine couplings measured by triplet state ENDOR and HYSCORE [7, 8] were reduced by a factor of two, indicating complete delocalisation of the triplet state spin density over both porphyrin units. By combining magnetophotoselection experiments and orientation-selective measurements of the hyperfine couplings, I was able to prove the occurrence of a reorientation of the ZFS tensor between the porphyrin monomer and dimer [8]. The Z axis of maximum dipolar coupling shifts from the out-of-plane axis in the monomer, as characteristic for a system with an oblate spin density distribution, to the long axis of the molecule in the dimer, characterised by a prolate spin density distribution. This reorientation also leads to a change in the sign of *D* from positive in the monomer to negative in the dimer and explains why its magnitude is slightly increased in the dimer, even though the triplet state is now delocalised over two porphyrin units.

In the linear oligomers with more than two porphyrin units, the *D* value does not change significantly compared to the dimer. However significant differences in the spin polarisation of the triplet state EPR spectra were observed, indicating changes in the mechanism driving intersystem crossing for the longer chains [9]. Measurement of the proton hyperfine couplings and DFT modelling was required to reach a conclusion on the extent of triplet state delocalisation in these systems and indicated unevenly distributed spin densities, with increased contributions on the central porphyrin units [9].

In order to gain more insight into the factors determining triplet state delocalisation in these systems, the influence of the conformation of the porphyrin oligomers on the extent of triplet state delocalisation was investigated by excitation-wavelength dependent transient EPR and ENDOR. Photoexcitation at different wavelengths allows selection of conformations with different torsional angles between the planes of adjacent porphyrin units. ^{1}H ENDOR spectra recorded after photoexcitation at different wavelengths have shown localisation of the triplet state on a single porphyrin unit in the dimer for conformations with the two porphyrin units at right angles to each other [10]. Similarly, the extent of delocalisation in longer oligomers also depends on the torsional angle between the porphyrins.

In addition to the linear porphyrin oligomers, we also investigated a six-membered porphyrin nanoring [11]. The transient EPR spectrum revealed a significantly reduced zero-field splitting *D* parameter, indicating increased triplet state delocalisation. Proton ENDOR showed that the largest hyperfine coupling is reduced by a factor of six compared to the corresponding coupling in the porphyrin monomer and confirmed complete delocalisation of the triplet state over this symmetric cyclic hexamer [9]. The increased delocalisation in this system was attributed to the equivalence of all six porphyrin units in the nanoring and its reduced flexibility. Our discovery that the triplet wave function is delocalised over such a large π-system suggests that triplet delocalisation in even larger π-conjugated porphyrin macrocycles might be possible.

After completing my doctorate, I moved to the University of Washington as a postdoctoral research associate in the group of Prof. Stefan Stoll, where I am currently working on experimental and theoretical aspects of EPR with arbitrarily shaped pulses. I am as excited ▶

about working in the field of EPR spectroscopy as ever and hope I will continue to contribute to the field's development in the future.

1. James, D.K., Tour, J.M. in Molecular Wires: From design to properties, 33–59. Springer Verlag 2005.
2. Gust, D., Moore, T.A., Moore, A.L. Mimicking photosynthetic solar energy transduction. Acc. Chem. Res. **34**, 40–48 (2001)
3. Wasielewski, M.R. Energy, charge, and spin transport in molecules and self-assembled nanostructures inspired by photosynthesis. J. Org. Chem. **71**, 5051–5066 (2006)
4. Lendzian, F., van Willigen, H., Sastry, S., Möbius, K., Scheer, H., Feick, R. Proton ENDOR Study of the photoexcited triplet state P^T in *Rps. sphaeroides* R-26 photosynthetic reaction centres. Chem. Phys. Lett. **118**, 145–150 (1985)
5. Lubitz, W., Lendzian, F., Bittl, R. Radicals, radical pairs and triplet states in photosynthesis. Acc. Chem. Res. **35**, 313–320 (2002)
6. Angiolillo, P.J., Uyeda, H.T., Duncan, T.V., Therien, M.J. Impact of electronic asymmetry on photoexcited triplet-state spin distributions in conjugated porphyrin oligomers probed via EPR spectroscopy. J. Phys. Chem. B **108**, 11893–11903 (2004)
7. Tait, C.E., Neuhaus, P., Anderson, H.L., Timmel, C.R., Carbonera, D., Di Valentin, M. HYSCORE on photoexcited triplet states. Appl. Magn. Reson. **46**, 389–409 (2015)
8. Tait, C.E., Neuhaus, P., Anderson, H.L., Timmel, C.R. Triplet state delocalization in a conjugated porphyrin dimer probed by transient electron paramagnetic resonance techniques. J. Am. Chem. Soc. **137**, 6670–6679 (2015)
9. Tait, C.E., Neuhaus, P., Peeks, M.D., Anderson, H.L., Timmel, C.R. Transient EPR reveals triplet state delocalization in a series of cyclic and linear π-conjugated porphyrin oligomers. J. Am. Chem. Soc. **137**, 8284–8293 (2015)
10. Tait, C.E., Neuhaus, P., Peeks, M.D., Anderson, H.L., Timmel, C.R. Excitation wavelength-dependent EPR study on the influence of the conformation of multiporphyrin arrays on triplet state delocalization. Phys. Chem. Chem. Phys. **18**, 5275–5280 (2016)
11. Sprafke, J.K., Kondratuk, D.V., Wykes, M., Thompson, A.L., Hoffmann, M., Drevinskas, R. *et al*. Belt-shaped π-systems: Relating geometry to electronic structure in a six-porphyrin nanoring. J. Am. Chem. Soc. **133**, 17262–17273 (2011)

The column "Guest of the Issue" exists since 2010 in the *EPR Newsletter* and since 2014 I am the responsible editor. Various articles have been published by eminent scientists from our field, including Richard Ernst (Zurich), Peter Hore (Oxford), Alex Müller (Zurich), Klaus Möbius (Berlin), and Howard Halpern (Chicago). The material presented covered a wide range of topics, including personal views on science and society, interesting conferences like the Lindau Nobel Laureate Meetings, and the description of fascinating scientific experiments like the magnetic compass in bird navigation (by P. Hore), EPR imaging of the human body (by H. Halpern), and establishing bridges between EPR and NMR (by K. Möbius and A. Savitsky).

The present guest of the issue is Kev Salikhov from the Kazan Zavoisky Physical-Technical Institute, Tatarstan Russia. Kev is a major figure in EPR – well-known not only in his home country but worldwide. Since he moved from Novosibirsk to Kazan in 1988 as director of the Institute of the Russian Academy of Sciences, he has initiated several important activities in addition to his own excellent work for the benefit of science in Russia and abroad: i) "Applied Magnetic Resonance", the first journal in Russia published entirely in English (in 1990), ii) a prize given annually in honor of the inventor of EPR, the "Zavoisky Award" (since 1991), and iii) hosting the *EPR Newsletter* of the International EPR Society that is handled very professionally by Laila Mosina since 2002. All this – together with regular international magnetic resonance meetings – has made Kazan a Mecca of the EPR community.

On November 3rd Kev is celebrating his 80th birthday; this is honored by an EPR Symposium in Kazan. Many eminent researchers from the EPR field will attend this meeting. I invited Kev on the occasion of his birthday to be our next "Guest of the Issue" and asked him to write an article for the *EPR Newsletter*, which you can find below. He is addressing a special aspect of science, namely the ability to listen carefully to other researchers from your own or also different fields and carefully digest the received information. According to Kev, this sometimes gives you a twist to your thinking leading to a new idea, and motivates you to start a research project. He is illustrating this aspect of his scientific life by a nice example from his own experience, which is very educating – especially for younger people who often only focus on their own narrow field of work. It is also telling a lot about Kev, his way of thinking and his scientific approach. Kev, we congratulate you to your 80th birthday and hope that many young scientists will read the article and become your followers!

Wolfgang Lubits

On the role of chance in research: Is there an algorithm for successful research?

Kev M. Salikhov

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TAKEN BY VITALII YANCHISHIN (WWW.ELITAT.RU)

I recently looked over my 60 years in science wondering about key contributing factors to the fruitful research I delivered over the years. Much to my surprise I've discovered that many highlights in my career originated from unexpected and seemingly unrelated conversations with my colleagues. When Wolfgang Lubitz kindly invited me to contribute the "Guest of the Issue" column, I decided to use this opportunity to explore the role of chance in scientific research and the value of simplicity, which brings the clarity and beauty often associated with scientific breakthroughs.

On the role of chance

It's remarkable that as scientists in the precise discipline of physics, we have to recognize that chance can play an important role at all stages of scientific research. Let's consider the role of chance only with respect to the "choice" of a problem to solve. Several times in my career an unexpected conversation led to developing an interest in the subject. Later on that interest got added to key research subjects which I keep returning to throughout the years.

One of the most remarkable examples is studying of spin exchange between paramagnetic particles in dilute solutions.

In the 1970-s I worked at the Institute of Chemical Kinetics and Combustion of the Siberian Branch of the Russian Academy of Sciences in Akademgorodok. As a theoretical physicist, I was involved in a project that studied the spatial distribution of free radicals, which are formed by irradiation of organic materials. To solve this problem, it was necessary to use the pulse electron paramagnetic resonance (EPR) technique which had been recently developed at the Institute. I was particularly interested in the relaxation of spin coherence caused by the dipole-dipole interaction between paramagnetic centers in dilute paramagnets.

In 1969 during a casual meeting in a corridor, Yury Molin told me about an interesting experimental observation: he and his colleagues studied the effect of different paramagnetic complexes on the shape of the EPR spectra of spin probes (stable free radicals). They observed that copper ion complexes affect the spectral shape much more strongly than cobalt ion complexes. These findings had nothing in common with my interests at the time.

Until then I had only a vague idea about spin exchange. But this conversation evoked my curiosity, and I was excited by the ideas. I couldn't get the experimental data out of my head and the next day presented Yuri with a formula for the efficiency of spin exchange between stable radicals and paramagnetic complexes, which described the experimental data very well.

The different effects of different ions were associated with the difference in their electron spin-lattice relaxation times. At the time I did not give this my full attention as I was fully absorbed by the theory of the manifestation of the spin-spin dipole-dipole interaction on the spin relaxation of solid paramagnets.

However since then the problem of spin exchange in dilute solutions has followed me throughout the rest of my career up to today. Over the years new experimental data appeared which posed new questions for the theory. In a particular series of cases I was able to adequately meet challenges posed by the experiments and to develop the theory of spin exchange and its manifestations on the shape of EPR spectra.

I feel particularly fortunate that I was able to formulate kinetic equations for the spin density matrix with allowance for the bimolecular spin exchange similar to the Boltzmann kinetic equations. In contrast to the Bolzmann equations, my kinetic equations relate to any kinematics of the mutual motion of two colliding particles, e.g. diffusion passage by particles in the region of their mutual interaction. These equations describe in a consistent way re-encounters of two colliding particles in condensed matter. These equations also contain a recipe for the calculation of the spin exchange rate. The problem of spin exchange and its manifestations in EPR experiments thus became a very important topic for me. It provided me with motivation to make several theoretical predictions, which were subsequently confirmed by experiments. A detailed discussion of spin exchange, its manifestation in EPR experiments and applications can be found, e.g., in [1–6]. The exchange narrowing of spectra has been studied for about 60 years now but not everything is fully understood as yet.

Forty six years later, in 2016, I proposed a new approach to the well-known effect of so-called exchange narrowing of multicomponent spectra into one narrow line under rapid spin exchange (rapid spin coherence transfer) between different sub-ensembles of spins [1].

Is it not wonderful that a chance conversation 47 years ago resulted in my life-long interest in the remarkable bimolecular process of spin exchange? Of course only the very first conversation happened by chance. The rest was deliberate and was driven by my scientific curiosity, and my natural drive to understand the world.

The observation of my own career is that one can have an extraordinary life and get far by following these three fundamental approaches which I have mastered over the years:

1. Be opened to and ready to discuss a new problem.

2. Be keen listener and learn to capture a problem's essence.

3. Actively consider how to contribute to its solution.

Science is about contribution and participation. I like to believe that I'm known as a person who is never focused on just my research. Instead I'm attuned to contribution where my knowledge and expertise is required.

The essence of scientific research is in continuous discovery. Fundamentally, no one solution is truly final. As time goes we develop a better understanding of nature. Often that means change. Without change there is no science. And as scientific research becomes more complex, there is a growing need to understand not just a very narrow area of science, but to have a wider education, a wider knowledge. Quite often young researchers do not attend seminars and lectures if they consider the talks to not be associated directly with their own immediate research. It's possible that they "miss" insights into how they might conduct their research in the best way.

The message here really is that there could be connections between different research and each of us might become the key to remarkable solutions "by chance". Let's not disregard problems even when they seem to be "alien". It can happen that you are actually better prepared for solving them than you think. It only takes a moment to pay attention!

Search for the "simplicity" in problems

Regarding the creative work of a scientist it's my feeling that it's of great importance to ask oneself where one or the other property and behavior of a system originates from. I think that the creative work of a scientist is stimulated by questions, to which he/she is passionate about getting answers. Then the scientist will be persist and ingenious enough to make some progress towards getting the answers. Of course, a scientist can come across an outstanding observation fortuitously. But this happens, most probably, if the scientist has persistently searched for answers to a range of other questions.

Like many other scientists, I constantly ask myself and others "why"? When attempting to solve a new problem, trying to understand its essence I try to formulate the simplest questions. Quite often answers to simple questions help a lot. Below I give an example from my recent work, in which the search for answers to simple questions associated with the effect of spin exchange on the shape of the EPR spectra led to interesting results and made it possible to reveal new aspects of the well-known phenomenon of the exchange narrowing of spectra. I believe that a scientist should always have an open mind and go ahead asking questions, even in situations which are very familiar and seem to be well understood.

When we consider an EPR spectrum from a dilute solution of spin probes, we must realize that such a spectrum commonly consist of several components. We assume that the bimolecular spin exchange implements the coherence transfer between spins which relates to different components of the spectrum. It is well-known that with the increase in the coherence transfer rate with the increase of the spin concentration, a collapse of the whole spectrum into one narrow line occurs. For instance, in the example given above I wondered about the collapse of a set of resonances into a single resonance. Does it mean that a degeneracy of resonances appears? In this case, we would have a "phase" transition from the case of "inhomogeneous" resonances to the case of "homogeneous" (degenerate resonances). If resonances under the condition of the exchange narrowing are not degenerate, why do we see only a single resonance?

Some time ago I noticed that even under conditions of exchange narrowing of the spectrum, the number of resonances is the same as that in the absence of the exchange coherency. *The number of resonances should be conserved*. To prove this statement, one can use the approach I formulated as early as 1977 when writing a book on spin exchange [2a]. The essence of the approach was to analyze *not the final expression for the spectral shape*, which is obtained on the basis of kinetic equations for the matrix of the spin density (magnetization of the spin system), *but the character of the motion of the free system without the alternating magnetic field* B_1, which is used for recording the spectrum. The free motion of the system is described by the Liouvillian L (see [1]). The eigenvalues of the evolution operator L of the system are determined by the equation

$$|L-\lambda I| = 0,$$

where I is the identity matrix. Each eigenvalue λ_k characterizes the possible resonance condition.

For each eigenvalue λ_k one finds the eigenstate (eigenvector) $x^{(k)}$ solving equations

$$L\,x^{(k)} = \lambda_k\,x^{(k)}.$$

These eigenvectors give independent collective modes. This approach allowed me to elucidate [2, 5, 6] that at slow coherence transfer, the components of the spectrum can be of mixed shape – i.e. an admixture of the absorption and dispersion terms. This approach makes it evident that the number of potentially allowed resonances should not change when the coherence transfer rate changes. Examples considered in detail in [1] showed that for the spin exchange the eigenvalues of L are not degenerate.

Thus, we have the following situation. Under conditions of fast coherence transfer, only one of all possible resonances is manifested in the experiment. In such situations I try to remember if I had encountered something similar before. Let this approach of solving a problem be called the search for analogies. I met an analogous situation long ago [7], as early as working on my PhD thesis, in which I studied the dielectric relaxation of polymer chains. The spectrum of relaxation times of the dielectric polarization of these chains was calculated and it was found that the time distribution of the dielectric relaxation is rather wide. Dielectric losses were calculated and it transpired that not all characteristic relaxation times of polymer chains are manifested in dielectric losses. Only *particular* "modes" of the relaxation motion appear, the *symmetry of which coincide or are close to the symmetry of the impact of the external alternating field on the system*.

Thus, two conditions for the observation of resonance should be fulfilled. The free system should have independent modes of motion, the frequency of which coincides with the frequency of the external alternating field acting on the system. Certain selection rules for the excitation of these modes of motion by the external alternating field should be also fulfilled (e.g., the coincidence of the symmetry of the interaction of the system with the external alternating field and the spatial symmetry of modes of motion of the free system). Bearing in mind these considerations, it is possible to understand why under conditions of exchange narrowing, only one of the possible resonances can be observed. In fact, all other resonances are also manifested but their intensity is much less than that of the exchange-narrowed resonance. On the one hand, their low intensity is associated with the large width of these resonances, and, on the other hand, their integral contribution is small due to the fact that these resonances are less effectively excited by the external alternating field B_1. In principle, the contribution of different resonances can be detected in the experiment under conditions of exchange narrowing of the spectrum. This is supported by the fact that the resonance frequencies can be different even in this case (see [1]). The initial state can differ strongly from the equilibrium state and spins can be prepared in such ordered states when the external field resonantly excites broad resonances and not the exchange-narrowed resonance.

It can be seen that it suffices to ask simple questions in order to understand more deeply the nature of the remarkable phenomenon of exchange narrowing of spectra.

The driving force for my research are my own questions and those from my colleagues. First of all, I pay attention to observations which do not fit current paradigms. Attempts to understand them provides the chance to obtain a new scientific result.

Today on the eve of my 80th birthday I wish to get many more opportunities to answer questions posed by you, my fellow colleagues. I feel fortunate to be in good creative state and am looking forward to working with many of you in the years to come. Together we can and will contribute to the further development of science.

1. Salikhov K.M.: Appl. Magn. Reson. (2016) DOI: 10.1007/s00723-016-0823-3
2. a) Zamaraev K.I., Molin Yu.N., Salikhov K.M.: Spin Exchange. Nauka, Siberian Branch: Novosibirsk 1977 (in Russian); b) Molin Yu.N., Salikhov K.M., Zamaraev K.I.: Spin Exchange. Principles and Applications in Chemistry and Biology. Springer-Verlag: Berlin Heidelberg New York 1980.
3. Currin J.D.: Phys. Rev. **126**, 1996 (1962)
4. Galeev R.T., Salikhov K.M.: Khimicheskaya fisika **15**, 48 (1996), in Russian
5. Salikhov K.M.: Appl. Magn. Reson. **38**, 237 (2010)
6. Salikhov K.M., Bakirov M.M., Galeev R.T.: Appl. Magn. Reson. (2016) DOI 10.1007/s00723-016-0818-0
7. Gotlib Yu.Ya., Salikhov K.M.: Vysokomolekulyarnye soedineniya **4**, 1163–1171 (1962), in Russian

65 Years Ago: The Birth of the AMPERE Society

Sixtyfive years ago in the fall of the year 1951, the AMPERE Society was born through the initiative of Prof. R. Freymann to form an association of scientists in France engaged in the study of molecules with radio waves following the "revelation of the work of Rabi, of the discoveries of Zavoisky, of Purcell and Felix Bloch, of the existence of microwave spectroscopy of molecules" as Kastler reminisced on the occasion of the 20th anniversary of the society. This mission is preserved in the acronym AMPERE meaning Atomes et Molécules Par Études Radio-Électriques. Only five years later and 60 years ago from this year, the Society had transgressed the territory of France and was incorporated in Switzerland with the founder Prof. Freymann as President and Prof. Georges Béné serving as Secretary General. On account of the complex state of Europe in those days, the aim of the Society was to coordinate electromagnetic physics research in Europe, in particular, to maintain the links between Western and Eastern Europe, and to help scientists in difficult economic or political situations. In these days the Bulletin du Groupement AMPERE was the central communication channel between the different laboratories in Europe forming the AMPERE Society. Interestingly, the British Radiofrequency Spectroscopy Group was also founded in 1956 with Prof. Raymond Andrew being their first president. Along with the European Experimental NMR Conference, these associations subsequently merged to form EUROMAR, the annual European Magnetic Resonance Conference under the umbrella of the AMPERE Society.

Until the foundation of EUROMAR, the main event of the Groupement AMPERE was the Colloque AMPERE which later became the Congress AMPERE. The most remarkable meeting probably was the one in September 1961 in Leipzig, just a few weeks after the infamous division of EUROPE on August 13th, 1961 with the establishment of the iron curtain. Even then, science was stronger than politics and the Congress succeeded with many participants from East and West. This tradition continued in the years of the cold war thereafter, and the Congress AMPERE was the place to meet despite political differences. With time specialized colloquia and autumn schools were organized by member laboratories of the AMPERE society and new Divisions were established. Among the several schools, the Varenna Schools (Italian Physical Society) on lake of Como, organized under the auspices of the Groupement AMPERE in 1986, 1992 and 1998 had a particularly important role and their contents were published in books, which contain, among several monographic subjects, the beautiful introduction to Magnetic Resonance of Alex Pines and the fundamental work of Peter Mansfield on MRI, in which he describes for the first time, the possible ways of reading planar echo in

The AMPERE Society today supports a diverse range of activities from conferences to schools on a manifold of topics in magnetic resonance.

the *k*-space. The AMPERE homepage www.ampere-society.org is an informative source on the activities and history of the society.

Prof. Jan Stankowski published a booklet reminiscing the history of the AMPERE Society on the occasion of its 50th anniversary and 31st Congress Ampere in Poznan in 2002. Among others it includes the abstracts of selected lectures presented at AMPERE meetings, for example, N. Bloembergen, Cross-Relaxation Effects in Magnetic Resonance, Pisa 1960; A. Abragam, Polarisation dynamiques des noyeaux, Leipzig, 1961; S. A. Al'tshuler, Spin-Photon Interactions in Paramagnetic Ion Crystals, Ljubljana, 1966; E. R. Andrew, Nuclear Magnetic Resonance in Rapidly Rotated Solids, Ljubljana, 1966; E. L. Hahn, Developments in Nuclear Magnetic Double Resonance, Ljubljana, 1966; K. A. Müller, Jahn-Teller Effects in Magnetic Resonance, Ljubljana, 1966; I. Solomon, Magnetic Resonance of Conduction Electrons, Ljubljana, 1966; M. Goldmann, Nuclear Antiferromagnetism, Grenoble, 1967; K. M. Salikhov et al., Modulation phenomena in Electron Spin-Echo, Grenoble, 1968; R. Blinc, Nuclear Double Resonance Studies of Order-Disorder Ferroelectrics, Turku, 1972; A. Lösche, Some NMR investigations of Liquid Crystals, Turku, 1972; J. S. Waugh, M. G. Gibby, S. Kaplan, A. Pines, Proton-Enhanced NMR of Dilute Spins in Solids, Turku, 1972; P. C. Lauterbur et al., Magnetic Resonance Zeugmatography, Nottingham, 1974; P. Mansfield, P. K. Grannell, A. A. Maudsley, Diffraction Microscopy in Solids and Liquids by NMR, Nottingham, 1974. C. P. Slichter, NMR of Dilute Alloys of Magnetic Atoms in Nonmagnetic Hosts, Heidelberg, 1976; R. R. Ernst et al., Application of Two-Dimensional Spectroscopy to Problems of Physical, Chemical and Biological Relevance, Tallin, 1978; A. Pines, NMR with Lots of Protons and no Magnetic Fields, Rome, 1986; H. W. Spiess, 2D and 3D Solid State NMR of Polymers, Athens, 1992; P. T. Callaghan, Microimaging Studies of Flow and Diffusion, Canterbury, 1996; A. Schweiger, Dances with Electron and Nuclear Spins, Berlin, 1998. Many other milestone lectures remain in the books of abstracts, including the famous lecture by Jean Jeener proposing 2D NMR spectroscopy at the AMPERE Summer School in Basko Polje, 1971.

After the fall of the iron curtain and with the beginning formation of a unified Europe, the AMPERE Society continues to serve its mission in the spirit of its founders, *Se Connaître*, *S'Entendre*, *S'Entraider*, i.e. to get to know each other, to listen to each other, to aid one another. It serves as the umbrella organization for numerous magnetic resonance activities in Europe which together form the AMPERE tree, a living organism, which has grown two new branches within the last year, the European School on Biological Solid-State NMR and the Division in Hyperpolarized Magnetic Resonance. The AMPERE Society maintains and expands its services for the whole community engaged in Magnetic Resonance and Related Phenomena in Europe and worldwide. It aims at accommodating new developments in new areas which are progressively opened by the scientific evolution.

Although 65 years of age the AMPERE Society is still going strong. Happy anniversary and many happy returns!

Bernhard Blümich, (President) and
Bruno Maraviglia (former President)

Warning: Extractable Nitroxide Radicals in Plastic Consumables

André Karbach, Patrica Schweickert, Elke Litmianski and Wolfgang E. Trommer

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We have shown that relatively stable nitroxide radicals can be extracted from conical tubes of various sizes and different manufacturers. These extractable radicals are presumably oxidized hindered amine light stabilizer (HALS) embedded in the plastic matrix of the consumables. EPR spectra of the extracted nitroxide radical were obtained after two types of organic solvent were kept in conical tubes. During the incubation time the tubes were either kept in the dark or exposed to light.

The *p*-Nitro-*o*-methoxystilbenenitrone **1** had previously been synthesized to serve as fluorescent spin trapping agent that accumulates in mitochondria (Fig. 1) [1].

In order to identify the radical, cells were harvested, disrupted by sonication and extracted with ethyl acetate. The extract was degassed, concentrated and studied by EPR spectroscopy. The intensity of the detected three-line signal typical of nitroxide radicals was unusually strong for the given parameters employed in this experiment. Also, the expected hyperfine interaction with the proton was missing. When the experiment was repeated in the absence of **1** the same signal was obtained. Hence, the nitroxide radical could not have arisen from the spin adduct **2** (Fig. 2).

It has been described in the literature that hindered amine light stabilizers, so-called HALS compounds are common additives in polyolefins and other polymers, both as radical scavengers and antioxidants to protect the material against photo degradation [3]. We presume that oxidized HALS compounds are the source of the strong EPR signal (Fig. 3).

In a series of experiments, consumables such as conical tubes (15 ml and 50 ml), pipette tips and microcentrifuge tubes from two different manufacturers (Greiner: A and Sarstedt: B) were incubated for 2 or 7 days, respectively in different solvents comprising ethyl acetate, dimethyl formamide, dimethyl sulfoxide as well as water, with and without exposure to light. These extracts were degassed ▶

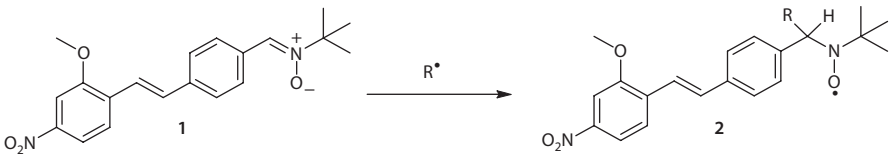


Figure 1: Addition of a radical (R•) to 1 forms the corresponding nitroxide radical 2 under concomitant quench of fluorescence as followed by confocal laser spectroscopy of adherent human carcinoma cells.

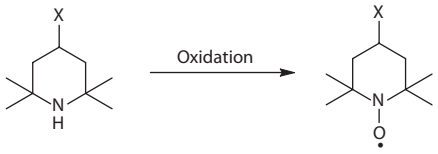


Figure 3: (Photo-) oxidation of a TEMP-(HALS)-compound to the corresponding TEMPO derivative.

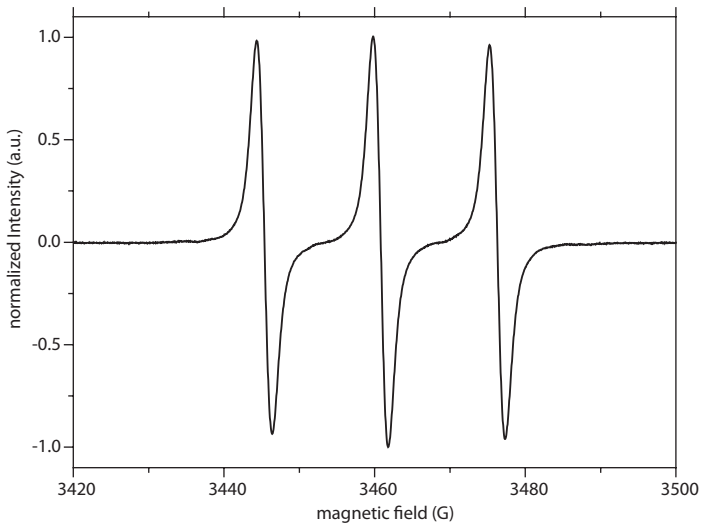


Figure 2: Normalized EPR spectrum of ethyl acetate previously kept in a plastic consumables for several days.

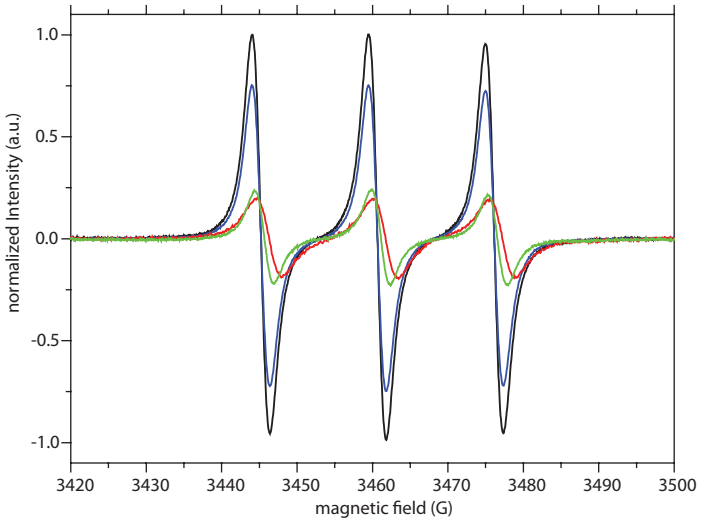


Figure 4: Normalized typical EPR spectra of extracted nitroxide radicals from conical tubes of various sizes from different manufacturers with varying solvent incubation times and light exposure.
Black – 50 ml conical tube; Sarstedt; EtOAc, 7d. Blue – 50 ml conical tube; Greiner; DMF, 7d. Red – 15 ml conical tube; Greiner; EtOAc, 2d. Green – 15 ml conical tube; Greiner; EtOAc, 2d, light exposure.

multiple times, concentrated and EPR spectra were recorded.

EPR spectra obtained from all consumables kept in DMSO and those kept in water did not show the nitroxide radical. Likewise, EPR spectra obtained after incubation of pipette tips and microcentrifuge tubes in all of the solvents showed no signals of nitroxide radicals.

However, EPR spectra of ethyl acetate and dimethyl formamide incubated in conical tubes with and as well as without exposure to light confirmed the presence of nitroxide radicals. As shown in Fig. 4, only minor differences in the intensity of the EPR signal as seen by the signal/noise ratio were observed in conical tubes independent of the manufacturer. Questioning the manufacturers about potential HALS compounds in their plastic products did not lead to any further information.

Due to its many advantages, the use of HALS additives in plastic consumables is necessary and unavoidable. Therefore everyone using EPR should be aware of radical contamination, if their samples are dissolved in organic solvents and in contact with plastic consumables.

Acknowledgments: The authors thank Dr. Stefan Hauck and Professor Dr. Antonio J. Pierik for helpful discussions.

1. Synthesis of novel fluorescent stibenenitrones via a mild, ligand-free Heck-type reaction of (E)-(4-(1,3-dioxolan-2-yl)styryl)trimethylsilane with benzenediazonium tetrafluoroborate derivatives. Karbach, A., Stemler, T., Kopp, C. & Trommer, W. E. (2014) *Synthesis* **46**, 3103–3109.
2. On the disruption of biochemical and biological assays by chemicals leaching from disposable laboratory plasticware. Olivieri, A., Degenhardt, O. S., McDonald, G. R., Narang, D., Paulsen, I. M., Kozuska, J. L. & Holt, A. (2012) *Can. J. Physiol. Pharmacol.* **90**(6), 697–703.
3. Effect of hindered amine light stabilizers on the resistance of polypropylene towards ionizing radiation. Przybytniak, G., Mirkowski, K., Rafalski, A., Nowicki, A., Legocka, I., Zimek, Z. (2005) *Nukleonika* **50**(4), 153–159.

Readers corner

SharedEPR

The National Science Foundation has awarded funds for the establishment of a Research Coordination Network (RCN) named "Supporting, Highlighting and Advancing Recent Developments in Electron Paramagnetic Resonance" (SharedEPR). The primary goal of the network is to promote the development and dissemination of innovative instrumentation and techniques for expanding the scope of Electron Paramagnetic Resonance (EPR) in scientific research. The last decade has seen enormous growth in the range of samples and scientific problems that can be addressed by EPR research. EPR techniques are commonly used in diverse areas of science such as chemistry, physics, materials science, medicine and biology. The explosive growth in the developments and applications has led to an increased degree of specialization within the field as researchers focus on their particular area of expertise. This specialization, whether with respect to samples studied, equipment developed or techniques used, has also unfortunately led to increased isolation of research groups, which often hinders the cross-fertilization of ideas within the community and limits the impact of advances that can be applied to scientific problems.

The SharedEPR network is designed to lower the barriers of interaction between research groups, to help edify a common ground of language and understanding between various disciplines using EPR, to promote the exchange of ideas and to foster new collaborations, all with the ultimate goal of developing the discipline of EPR. By bringing together a wide range of expertise in the EPR community, it is expected that through this network new research areas will be identified, obstacles will be surmounted, and the field of EPR spectroscopy will be advanced. The network also aims to promote student and postdoc interaction across different research groups and research areas. Young scientists will have the chance to get to know the true scope of EPR research and the potential of these methods; thus, they will be enabled to utilize this potential for their own research as they become the investigators of the future.

There are four primary goals of the SharedEPR network, which are discussed in detail below.

Primary Goal 1: *Expanding the impact of EPR by advancing EPR methodology, instrumentation and techniques*. Current funding databases reveal that EPR instrumentation and techniques are being constantly developed and advanced in both individual laboratories and in federally supported research facilities. It is vital that these advancements be targeted to address the most important scientific challenges facing researchers today. To achieve this, the EPR community must come together to identify these challenges and develop strategies to address them. A primary function of the network will be to expand the impact of EPR advances by sponsoring a semi-annual "Grand Challenge Workshop" (GCW), to be associated with a major scientific meeting which is typically attended by a large portion of the EPR community.

The Grand Challenge Workshop:
The GCW program will not follow the typical "conference presentation" model. Specialists in the proposed topic area will be invited to present brief overviews of the work that is ongoing in their labs, together with problems or challenges that impede the attainment of the ultimate research goals. These presentations are expected to last no longer than half an hour, and published work is not included or is only briefly discussed to give context. These "in-progress" talks will provide a synopsis of the state-of-the art, as well as the issues that remain to be addressed, in the selected Grand Challenge subject area. These presentations will serve as a point of departure for discussions among all participants regarding the issues raised by the speakers.

The anticipated result of the GCW is the generation of a "Grand Challenge White Paper". This will be a document which summarizes the content and conclusions of the presentations and general assembly discussions. Its purpose will be to inform the general EPR and scientific community about the proceedings of the Workshop, as well encourage those who have not yet joined the SharedEPR network to do so. Moreover, the GCW White Paper will define the "targets" that will serve as the guidelines when deciding how to support other activities of the SharedEPR network aimed to facilitate establishment of inter-lab collaborations, seeding of new proposals and/or exchange of students (Primary Goal 3).The white paper will be posted on the SharedEPR website (Primary Goal 2) and submitted to the International EPR/ESR Society newsletter for publication.

Location and Timing of GCW: The First Grand Challenge Workshop was held on July 30 and 31, 2015, in conjunction with the 57th Rocky Mountain Conference on Magnetic Resonance, held in Snowbird, Utah, USA. The topic of the Workshop was "EPR on a Chip: Development and Applications of Micro EPR." The workshop took place on the Thursday afternoon and Friday morning following the conference and was attended by 74 participants from the U.S., Europe, Japan, Israel and Brazil. The program consisted of 7 internationally recognized speakers presenting cutting edge research in the area of Micro EPR technology, followed by discussion sessions. Further details and descriptions of this and future Grand Challenge Workshop will be announced soon on the web portal www.sharedepr.org.

Primary Goal 2: *Create and maintain a SharedEPR Web portal*. The SharedEPR web portal (www.sharedepr.org) is now online and is currently under development to expand its utility to the EPR community. It is envisioned that the web portal will communicate the goals and mission of the SharedEPR network and serve as a gateway into the U.S. EPR community. Possible content of the website includes network membership application and information, solicitations for GCW topics, links to requested travel funds, page(s) describing National Laboratories, Research Resources, and other research facilities which develop and disseminate EPR technology and/or provide EPR-related services, conference notifications, employment opportunities and other EPR-related information. Suggestions and volunteers are encouraged in order to make the network website an effective educational tool for the promotion and development of EPR spectroscopy – please contact the executive committee members listed at the end of this article for more information.

Primary Goal 3: *Fostering Creative Innovation: cross-fertilization and establishment of new collaborations*. EPR spectroscopic techniques are used in all areas of science and technology, including chemistry, physics, biology, engineering, materials, biochemistry and medicine. A fundamental goal of the SharedEPR Research Coordination Network is to provide avenues through which researchers in these disparate disciplines can interact and learn about EPR-related developments in other fields, helping to edify a common ground of language and understanding between groups using EPR. This cross-fertilization will lead to new collaborations, open new research areas, and stimulate the advancement of EPR techniques and instrumentation.

This cross-fertilization process will be initiated through Primary Goals 1 and 2 described above; specifically, by sponsoring a semi-annual Grand Challenge Workshop and creating an informative and up-to-date network website, the network seeks to communicate and create awareness of EPR advancements across scientific disciplines. However, facilitating exposure to new EPR developments is only one criterion gauging the success of the network. Awareness of new research must ultimately lead to the actual transfer of EPR advances from one lab to another to truly complete the process of dissemination throughout the network. In certain circumstances the exportation of EPR developments into a new lab may require more extensive interaction than can be provided by workshops, meetings or websites. Thus, the SharedEPR network can foster creative innovation by providing funds for graduate students, postdoctoral researchers and non-tenure track faculty to spend time in other laboratories to get "hands-on" training in new EPR methodologies and bring these advances back to their home labs: these SharedEPR sponsored exchanges are termed *"EPR Technology Transfer Experiences" (ETTE)*. The SharedEPR network will also provide travel funds for students to EPR-related conferences, workshops and schools. And finally, the network will impact the youngest generations of EPR spectroscopists by sponsoring and supporting the participation of pre-college students in the Steppingstone Magnetic Resonance Training (SMART) Center program located in Farmington Hills, Michigan, under the direction of Dr. Philip (Reef) Morse (www.smart-center.org). The SMART Center provides a multi-day research-based science experience to middle and high school students centered on the design and execution of EPR-based experiments. By funding the ETTE awards, supporting the attendance of students and postdocs at national meetings, and sponsoring students at the SMART Center, the SharedEPR network will facilitate the cross fertilization of EPR advances across the disciplines of science. It is anticipated that such interaction will not only serve to disseminate technology throughout the network but lead to new inter-discipline collaborations and joint research projects as well.

Primary Goal 4: *Establish International Collaborations*. In order to fully leverage the capabilities of the SharedEPR network, a major effort will be made to establish interactions with international laboratories. Exciting EPR research is currently being carried out throughout the world, and the formation of SharedEPR in the U.S. will facilitate the creation of fruitful collaborations between our network and researchers in other countries.

A unique opportunity made possible by the formation of the SharedEPR network has been the establishment of an international collaboration with the German EPR network titled SPP 1601 titled "New Frontiers in Sensitivity for EPR Spectroscopy: From Biological Cells to Nano Materials" (http://spp1601.de). This network is a Deutsche Forschun-

gsgemeinschaft (DFG) funded Priority Program Funds established to support primary research in approximately 25 laboratories distributed throughout Germany with the common goal of maximizing EPR sensitivity under a wide range of experimental conditions and samples. In addition, SPP 1601 finances travel and student exchanges between laboratories as well as an annual meeting with required attendance by all SPP 1601 members.

It is expected that the scientific interchange of ideas achieved through the German SPP 1601 and U.S. SharedPR network interaction will lead to the establishment of international collaborative projects, publications and grant proposals. Significant enthusiasm has been expressed on the part of the German network and the DFG, and tangible steps have been taken towards laying the foundation for this international collaboration.

Although ties have already been forged with the SPP 1601 network in Germany, active communities of EPR researchers exist throughout the world. These entities are annually represented at the Rocky Mountain Conference and by membership in the International EPR(ESR) Society. Using our relationship with the German network as a model, SharedEPR will provide an excellent point-of-contact to establish international collaboration with these worldwide EPR communities. The Grand Challenge Workshops at the RMC, the regional workshops and the website will expose international EPR researchers to the activities of the SharedEPR network and provide the opportunity to establish international collaborations in addition to that with Germany.

Further Information on the SharedEPR Network. If you would like to join the network, participate in the development of its programs, apply for travel or ETTE funds, assist in the expansion of the web portal, or have any questions regarding SharedEPR, please visit our website www.sharedepr.org or contact a member of the network Executive Committee: Christoph Boehme (boehme@physics.utah.edu), Gail Fanucci (gefanucci@gmail.com), Gary Gerfen (gary.gerfen@einstein.yu.edu), Stephen Lyon (lyon@princeton.edu), Mark Sherwin (sherwin@physics.ucsb.edu) or Stefan Stoll (stst@uw.edu).

EPR Technology Transfer Experiences (ETTEs)

Call for Proposals

The NSF-funded Research Coordination Network (RCN) named "Supporting, Highlighting and Advancing Recent Developments in Electron Paramagnetic Resonance" (SharedEPR) invites proposals for the awarding of funds for US-based students, postdocs and non-tenure track faculty to participate in an inter-lab exchange program named EPR Technology Transfer Experiences (ETTEs).

The overall goals of the SharedEPR Network are to significantly lower the barriers of interaction between research groups, to help edify a common ground of language and understanding between biology, chemistry, materials science, physics, and other research groups using EPR, to promote the exchange of ideas and to foster new collaborations. By bringing together a wide range of expertise in the EPR community, we expect that through this network new research areas will be identified, obstacles will be surmounted, and the field of EPR spectroscopy will be advanced. Visit the website at sharedepr.org for more information.

The ETTE award is a vehicle to achieve these network goals by providing travel funds for researchers to spend time in other laboratories to get "hands-on" training in new EPR methodologies and bring these advances back to their home labs. The duration of the participant's inter-lab experience will depend on the details of the technology to be learned and transferred and is expected to range between 1 to 3 weeks. The specific research areas of the participant's home lab and the exchange lab must be sufficiently distinct as to constitute a true inter-discipline transfer – applications for which the home lab and the exchange lab share similar expertise will be considered weak. Consistent with the mandate for RCNs, funds will be provided for travel, room and board, but not for supplies or equipment. At the conclusion of the ETTE, the student and sponsoring PI must agree to provide a brief report of the specific technology and/or techniques that were learned and transferred to the home laboratory. These summaries will also be posted on the main SharedEPR website.

Eligibility. The application process is open to graduate students, postdocs and non-tenure track faculty members who are affiliated with research institutions based in the United States. Applicants must be or become members of the SharedEPR network, available through the SharedEPR website (sharedepr.org).

Application details. Applicants must submit a one-page written proposal which includes the following: 1) a summary of the proposed work; 2) the specific EPR technology and/or methods which are to be learned that are not available in the "home" laboratory and 3) reasons the particular lab for the ETTE was chosen. Please also include the applicant's CV and letters of consent from the PIs of the "home" and ETTE laboratories. The entire application should be submitted as a single pdf file by January 15, 2017 to the SharedEPR website. Up to 4 ETTEs of up to $2500 will be awarded. Notification of awards will be made by January 30, 2017. Deadlines for future ETTE applications (approximately every 4 months) will be posted on the SharedEPR website www.sharedepr.org.

POSITIONS

Research Specialist Senior Position at West Virginia University

The Department of Biochemistry is searching for a Research Specialist Senior, with a strong background in RF/MW engineering experience. This position is available immediately and will be in the In Vivo EPR Multifunctional Magnetic Resonance center, Department of Biochemistry, Health Sciences Center, West Virginia University in Morgantown, WV. The selected candidate will assist Dr. Tseytlin in designing and manufacturing electron paramagnetic resonance (EPR) spectrometers and imagers. The position will be for one year in length, with a possibility of extension. The duties and responsibilities for this position are: designing, manufacturing, assembling, and experimental testing of EPR spectrometers and imagers. Applicants must hold a minimum of Master's Degree (or foreign equivalents) in Electrical Engineering, Physics or a related field and two years of experience, or a combination of education and experience. Qualifications must be met by time of appointment. All interested, qualified candidates should apply to jobs.wvu.edu with a cover letter of interest and current CV.

West Virginia University is an Equal Opportunity/Affirmative Action Employer and the recipient of an NSF ADVANCE award for gender equity. The University values diversity among its faculty, staff and students, and invites applications from all qualified individuals, including minorities, females, individuals with disabilities and veterans.

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.

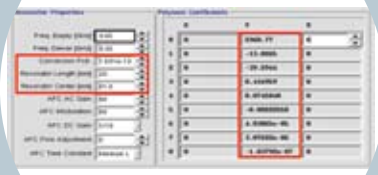
Bruker BioSpin

Single Measurement Quantitative EPR

Spin Counting

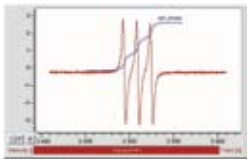
Determine the absolute number of spins in your sample

Factory Preparation



Critical resonator properties included

Double Integration



New tool for high precision double integration

User Input

Minimum user interaction

Software Reporting

Results for further analysis

- An easy to use high precision method
- Single measurement
- No reference sample required
- One-time factory calibration of cavity response function

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EPR Solutions

The EMXnano

Bringing EPR to the Wider World

The EMXnano is a compact, state-of-the-art bench top instrument designed to give the power and flexibility needed for a range of analysis and teaching applications. With the latest digital and microwave technologies, the EMXnano provides superior sensitivity and stability.

Experimental flexibility

- Adjustable internal marker
- Liquid nitrogen VT system
- UV/Vis irradiation system

Software Features

- SpinCount for Quantitative EPR
- SpinFit for Fitting of EPR spectra
- Python interface for flexibility

For more information please visit: www.bruker.com/emxnano