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BULLETIN DU GROUPEMENT

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Groupement
AMPERE

SE CONNAÎTRE, S'ENTENDRE, S'ENTRAIDER

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Contents

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Editorial

Groupement AMPERE

Dear members of the Groupement AMPERE,

three years ago, the Groupement AMPERE founded the journal „Magnetic Resonance“. At that time, I saw it as an endeavor with an uncertain outcome. Would there be enough support from the magnetic-resonance community for such an open-access journal? Three years later, I think we can conclude that the effort paid off and „Magnetic Resonance“ became an established journal which just got listed by Scopus and PubMed and hopefully soon also in the Web of Science. This should increase the visibility of articles published in „Magnetic Resonance“. I would like to encourage all members of AMPERE to consider MR as a possible journal for your research. Besides open access, we also offer interactive public peer review which I find very attractive since it improves the quality of the review reports.

This past year, I have enjoyed meeting many colleagues again in person at various conferences. I realized again how important personal interactions are also for science and research. But it also made me wonder whether there will be anything changing in the way we do conferences as a consequence of the pandemic. So far, I see not many new ideas despite the fact that there were also new and interesting approaches during the past three years. Maybe we should think about this more and try to develop the way we organize our scientific exchange.

Best regards and I hope all of you can enjoy the holiday season and the new year 2023.

Matthias Ernst

Matthias Ernst
Secretary General
Groupement AMPERE

Portrait:

Paul Vasos

Why magnetic resonance and why NMR and MRI?
Mainly via osmosis during the BSc and MSc diploma period. The passion for NMR was transmitted from the environment created at the Univ. of Bucharest by Prof. Voicu V. Grecu, the head of Atomic Physics Department and Dean of the Faculty, who had been magnetized at the Clarendon Laboratory, Univ. of Oxford, and by Prof. Cornelia Palivan (ESR and NMR).
I found a similar environment in Prof. Jean-Pierre Cohen-Addad's laboratory in Grenoble.

What is your favorite frequency?
This question reminds me that when I arrived in Florence and had the first discussion with Prof. Bertini, I was still unfamiliar to the convention of expressing magnetic fields in frequency units. Maybe it was my physics degree speaking in Tesla.
Hard to choose. I have fond memories of 600 MHz, 500 Hz, 400 MHz, and 800 MHz.
A remark: frequencies of spectrometers with cryoprobes feel differently than frequencies of room-temperature probes, there are aspects in pulse sequences one has to be particularly careful about - especially how one treats water - my fond memories of 500 MHz have this cryo- touch.

What do you still not understand?
Most things. And I like it this way, this is research.

Luckiest experiment you have ever done.
There are a few, I would cite an early one: transfer of proton magnetisation from water to a cytochrome c under ROESY spin lock in Florence (in 2002 or 2003) – seeing the transfer peak appear felt like there was some magic involved.

What was the worst mistake you have made during your lab time?
We were very young researchers trying protein purification on a column for the first time. I, the physicist, vaguely remembered there was one bottle with a dangerous substance. When one of the containers spilled and stuff got on my lab coat and jeans, I looked at the label in disbelief… it was the very acrylamide from the dangerous bottle.

Most memorable conference story
Late-nights at Chianti. San Miniato. Euromar, always convivial. And Gordon Conference late-night stories involving explorations of next-days' breakfast during midnight chats. I will let the other people involved tell these stories.

With whom (historical person) would you like to meet?
Felix Bloch, for his endearing description of water protons spinning around in snow.
And Ionel Solomon, his SpIns are often around.

When do you get your best ideas?
Some of the best ideas come right at the time of / while writing research projects. This makes project writing fun. Other sparks come during daydreaming time and some during whiteboard discussions.

If you had just one month time for travelling - where would you go to?
Greece, Italy, Spain,.. I am fond of the Mediterannean. Also, these are my Greek roots probably speaking.

Your idea of happiness.
Being able to still have time for first-hand research while coordinating a group. Also, to have time to spend with my son.

Position: Researcher, University Professor
Homepage: https://biophysicsmr.wordpress.com/

Awards, prizes, certifications:
Romanian Academy N. Teclu award 2019.
Nominated for EPFL Latsis prize 2010,
ERC second round 2011– project qualified as 'fundable' by the committee
Swiss National Fund Ambizione 2008.

Education:
Ph.D. in Structural Biology University of Florence 2004 (Prof. I. Bertini, Prof. C. Luchinat, Prof. I. Felli)
Post-Doctoral: Univ. of Maryland College Park 2004-2005, (Prof. D. Fushman)
Ecole Polytechnique Federale de Lausanne 2005-2008 (Prof. G. Bodenhausen)

Interests:
Hiking, swimming, chess

Call for nominations:

AMPERE Prize for Young Investigators 2023

The AMPERE prize is given to a young principle researcher (a “rising star”) for her/his first achievements in her/his independent career. There is no strict age limit but typically researchers below the age of forty are envisioned. The prize is given biannually.

The committee now calls for Nominations for the AMPERE Prize 2023 for a young principal investigator in the field of magnetic resonance. The prize will be presented during EUROMAR in Glasgow, Scotland (United Kingdom) 9-13 July 2023. The prize carries a value of € 2000.

You are kindly invited to submit nominations by e-mail to the president of the prize committee:
ampereprize@ampere-society.org

Nominations must be received by 15th February 2023 and should include the following documents:

- Nomination letter
- Curriculum vitae
- List of publications and presentations at conferences

For a list of past AMPERE Prize winners see:
https://www.ampere-society.org/Awards.html

Call for nominations:

Raymond Andrew Prize 2023

In memory of Professor Dr. Raymond Andrew and to honor his pioneering work in the field of magnetic resonance, the AMPERE Group has founded the Raymond Andrew Prize. The prize is awarded to young scientists for an outstanding PhD thesis in magnetic resonance.

For the Raymond Andrew Prize 2023 the AMPERE Prize Committee is seeking your help in searching for qualified candidates who completed their dissertation during the period of 2021/2022. The prize will be presented during EUROMAR in Glasgow, Scotland (United Kingdom) 9-13 July 2023.

You are kindly invited to submit nominations by e-mail to:
andrewprize@ampere-society.org

Nominations must be received by 15th February 2023 and should include the following documents:

- Nomination letter
- Curriculum vitae
- List of publications and presentations at conferences
- PhD thesis in PDF

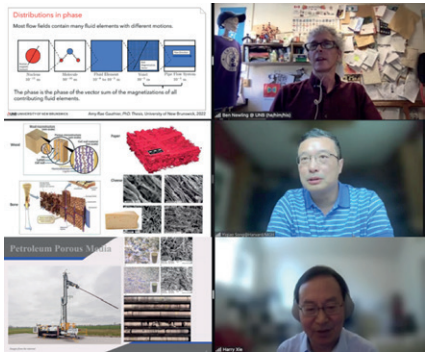
The thesis should be written in English. In exceptional cases, the thesis may also be submitted in triplicate as a hardcopy to the AMPERE Secretariat. Submissions that arrive too late will automatically be transferred to the next year. The prize committee will reconsider excellent contributions for two years in a row.

For a list of past Andrew Prize winners see:
https://www.ampere-society.org/Awards.html

Report:

MRPM15
Hangzhou, China, August 21-26

The 15th International Bologna Conference on Magnetic Resonance in Porous Media (MRPM15) was held in Hangzhou from August 21 to 26, 2022. It was the first time that MRPM was held in China since its establishment. Hangzhou was the east end of the silk road as it has been producing world-famous silk and tea for more than a thousand years. It is called as “the heaven of the living world” in China for its gorgeous view of West Lake and the quiet retreats in tea plantation hills.
The local host of MRPM15 was Zhejiang University, which is a prestigious multidisciplinary higher-education institute in China. Zhejiang University hosts a solid-state NMR center and a medical MR imaging center and it also hosts diverse research groups in the areas related to porous media.



Unlike any previous events, MRPM15 was held in a hybrid form combing both online and offline sessions. The arrangement allowed the participations across different countries and time zones despite the tough travel restrictions caused by the COVID-19 pandemic. MRPM15 had around 150 online participants and more than 100 offline participants. The participants came from the United States, Sweden, Japan, Singapore, Germany, Argentina, and many other countries. A total of 17 different sessions were arranged for the conference. The presentation topics covered diverse fields such as hardware, petrophysics, environment, biomedicine and advanced materials.

The first day of the MRPM15 was the tutorial session in which the basics of magnetic resonance and its applications were introduced by the senior scholars. The lecturers included Bernard Blumich from RWTH Aachen University, Bruce Balcom and Ben Newling from University of New Brunswick, Daniel Topgaard from Lund University, Yiqiao Song from Harvard University and Harry Xie from Corelab USA.

From Aug. 22nd to 24th, 69 oral presentations were given online. The presentations were selectively invited or peer reviewed by the organizing committee and they were focused on the cutting-edge technologies and the state-of-the-art applications of magnetic resonance. The keynote speakers at the online conference included Jeffrey A. Reimer from the University of California, Peter Basser from the National Institutes of Health, Leonardo Brizi from the University of Bologna, Klaus Schmidt-Rohr from Brandeis University.

From Aug. 25nd to 26th, the offline conference, including 36 oral presentations, was held in Jinxi Villa by the West Lake. The keynote speakers included Jiangfeng Du, from the University of Science and technology of China; Lizhi Xiao, from the China University of Petroleum; Xin Zhou, from the Wuhan Institute of Physics and Mathematics; Zhong Chen from the Xiamen University and Wei Wang from the Lanzhou University. There were also about 20 offline poster presentations.

The honorary chair of this conference was Jiangfeng Du, and the executive chairs were Xueqian Kong and Ruiliang Bai of Zhejiang University. This conference was generously supported by Zhejiang University, Limecho Technology, Bruker, Siemens, Tenglong Microwave Tech., Megritek, Megnetway, Niumag Coorporation, Pure Devices, and Magic Editors.

The conference selected the GC Bogia Award sponsored by University of Bologna and MRL oral and poster presentation awards were sponsored by the journal of Magnetic Resonance Letters (MRL). The awardees are as the follows:

Giulio Cesare Borgia Award
Awardee: Fangrong Zong (Beijing University of Posts and Telecommunications, China)
Presentation title: Data processing in multi-dimensional NMR and MRI

MRL Excellent Oral Presentation Award
Awardee: Yao Fu (French Alternative Energies and Atomic Energy Commission (CEA), France) Presentation title: Revealing hidden defects in Metal-Organic Frameworks by solid-state NMR

MRL Poster Award
First Prize: Yu Yin, Second Prize: Zhaowei Cheng, Yifan Zhang, Third Prize: Rupeng Li, Lixian Wang, Yifan Song

Giulio Cesare Borgia Award:

Ass. Prof. Fangrong Zong

Q & A session:
Why magnetic resonance and why NMR and MRI?
MR is amazing, especially the link between the pulse sequence and the physical properties of the matter. One can manipulate the particles in a tiny scale to understand the mechanism in both petrophysics and biophysics.

What is your favorite frequency?
Any frequency that can be resonant. I had the working experience from the field as low as earth field strength for relaxometry, up to the field as high as 9.4T for multi-nuclei whole-body imaging scanner. Each frequency has its own merit.

What do you still not understand?
There are many NMR related topics I'm interested but have not enough time to learn, solid-state spectroscopy, hyperpolarization.

Why are the MRI experiments so time consuming?
The imaging quality has been largely improved since 1990's. I have been involved in two topics to accelerate the MRI procedure, developing the fast-imaging sequence and designing proper under-sampling strategy. Even though, due to a key parameter SNR, one always needs to repeat the measurement to obtain sufficient data which costs time.

Luckiest experiment you have ever done.
Multi-nuclei MRI experiments I've conducted on 9.4T scanner we developed, a big project and innovation we made to figure out the decoupling, tuning and data processing to obtain the ^{1}H ^{23}Na and ^{31}P images for monkey brain.

What was the worst mistake you have made during your lab time?
I destroyed the gradient system by running a multi-dimensional diffusion sequence with a very short ramping time. But I appreciated the experience that we were free to try anything.

With whom (historical person) would you like to meet?
Paul Callaghan. We first and last met in the summer of 2011 at the 11th International

Conference on Magnetic Resonance Microscopy which was held in Beijing. His keynote speech inspired me to pursue my PhD study in New Zealand. It was unfortunate that I did not find a chance to meet him personally before he passed away.

When do you get your best ideas?
When I became a PhD student in a group with diverse cultures and backgrounds, I was always enlightened by my supervisor (A. Prof. Petrik Galvosas) and colleagues from different angles. And when I lead the group gathered by young and talent students who are twenty years younger than me, they always inspire me with fresh and “weird” ideas.

If you had just one month time for travelling - where would you go to?
China. Many landscapes are so amazing and I’m still way too busy to visit.

Your idea of happiness.
Share the knowledge to the community and serve the community with the ideas my team developed.

What‘s your most important research project and why?
My research interests are centered around the development of novel diffusion MRI techniques and their applications in porous media. The most important one started at the year of 2020, when I was funded to lead a group to explore the microstructure of the brain by using diffusion imaging method with clinical acceptable time. It is a multi-discipline project (AI+Med+Phys). High-sensitivity RF coils, rapid diffusion-encoding methods and robust data reconstruction algorithms need to be implemented in this project. It helps to build my research group, confidence and collaborations.

What will you do when you get the GC Borgia award?
This award is a teamwork milestone and we appreciate this. Our group will continue to develop a vast of diffusion-related MR methods for early diagnosis of brain diseases and mental disorders, and push their uses in clinical community. I will continuously contribute to the magnetic resonance in porous media (MRPM) through attending and organizing meetings, educating new generations, and bridging collaborations between multiple disciplines and across the world.

Excellent Oral Presentation Award:

Yao Fu, MRPM15

Revealing hidden defects in Metal-Organic Frameworks by solid-state NMR

Yao Fu[1,2], Subhradip Paul[1], Xueqian Kong[2], Gaël De Paëpe[1]

1. Univ. Grenoble Alpes, CEA, IRIG, MEM, Grenoble 38000, France; 2. Center for Chemistry of High-Performance & Novel Materials, Department of Chemistry, Zhejiang University, Hangzhou 310027, China

Metal-organic frameworks (MOFs) are crystalline materials with various functionalities and tunable porosity. Even if MOFs allow a reticular design of the lattice and a precise control of their internal geometry and chemistry, their periodicity is often disrupted by the presence of defects, leading to a modification of the structure and/or the expected properties. Nevertheless, the presence and impact of these defects remain elusive: their existence is often not even acknowledged and the determination of their structure is therefore a formidable challenge since most of the techniques are insensive to local non-periodic structures. Herein we show that solid-state NMR plays a leading role in revealing the hidden defects in 2 types of MOF matrix: MOF-74 and UiO-66.

For the regular synthetic MOF-74, we will show that the presence of formate was first discovered by accident in the spectra of solid-state and solution-state NMR. The structure of the defects was then revealed by ^{13}C-^{13}C correlation solid-state NMR combined with density function calculations. We can further show that the concentration of defects linearly relates to the reduced surface area and the decreased uptake of CO_2 in defective MOF-74. The in-situ NMR pattern analysis of CO_2 dynamics suggest that the adsorption mechanisms in both ideal and defective MOF-74 are similar except the partial reduction of adsorption sites in defective MOF-74.

In the case of UiO-66, we will show that the use of formic acid as modulator lead to the appearance of dangling linker as revealed by solid-state NMR and dynamic nuclear polarization (DNP) enhanced NMR. To some extent, the concentration of dangling linker can be tuned according to the amount of formic acid that is used in the synthesis. In addition, we have also investigated the dangling linker dynamics both in dry UiO-66 and UiO-66 impregnated with solvent (i.e. glycerol). This was done using variable temperature analysis of chemical shift anisotropy (CSA) patterns and ^{13}C spin–spin relaxation times (T_2). Furthermore, we will also show that the presence of dangling linkers in UiO-66 has a direct effect on the catalytic efficiency of Ag@UiO-66 for the electrochemical reduction of CO_2.

Overall, this presentation elucidates the detailed molecular picture of defects in MOF-

74 / UiO-66, and demonstrates their direct impact on adsorption / catalytic properties respecively. This work demonstrates the unique input of solid state NMR and DNP to the field of defect enginneering in MOFs and other porous structures.

Poster Award:

Yu Yin, MRPM15

23Na Relaxation in the Cellular Environment under 14 T Ultrahigh Field

Yu Yin[a], Yifan Song[a], Yinhang Jia[b], Ruiliang Bai[b*], Xueqian Kong[a]

a. Key Laboratory of Excited-State Materials of Zhejiang Province, Zhejiang 310027, China;
b. Zhejiang University School of Medicine, Institute of Systems, Neuroscience and Cognitive Sciences, Zhejiang 310027, China

Sodium plays a critical role in the homeostasis of electrolytes, the transduction of nerve potentials, the contraction of muscle cells and related cellular metabolisms[1]. The study and measurement of sodium ions in tissues are of great importance to provide biochemical information on normal and abnormal body functions. In practice, the clinical adaptations of 23Na MRI are hampered by the low signal-to-noise ratio (S/N) of 23Na signal. The utilization of stronger magnetic fields can significantly increase the S/N and make 23Na MRI more appealing for biomedical research and clinical diagnosis[2]. In this work, we study the relaxation of sodium in different protein solutions and in living cells under 14 T ultrahigh magnetic field.

It is known that the relaxation of 23Na exhibits a bi-exponential behavior in gel-like solutions[3]. Through the study of the quadrupole nuclear properties of sodium and the double quantum signal, we found that the transverse relaxation can quantitatively bound sodium within a certain range, and experimentally verified it with different types of samples including agarose, various proteins, and yeast cells (Fig. 1a), which are consistent with the theoretical derivation.

Due to the concentration balance of intra- and extracellular sodium, the 23Na relaxation in the cellular environment is more complex[3, 4]. We analyze the single quantum (SQ) and double quantum (DQ) T2 relaxation behaviors of sodium as well as its diffusivity. We found and verified with the Akaike Information Criterion that the three-component fit of the relaxation is more in line with the actual situation of complex organisms where the ratio of T2,free is in good agreement with the ratio of extracellular free sodium (Fig. 1b). In order to verify the reliability and generality of the above conclusions, we used U87 tumor cells to conduct hypoxia-induced cell death in vitro experiments. The results showed that bound sodium and extracellular free sodium increased and decreased with cell death, respectively, and the volume of cells decreased (Fig. 1c). Microscopic observation of cells in the 6th hour of hypoxia and significant analysis of the volume of dead cells and live cells, the volume of dead cells was significantly ($P<0.001$) greater than that of live cells, which was consistent with the NMR results.

For the first time, we reveal the underlying linear relations of different 23Na NMR measureables in biological environments. It means that a simple measurement of SQ T2 relaxation can determine the intracellular sodium concentration and also the fraction of bound sodium.

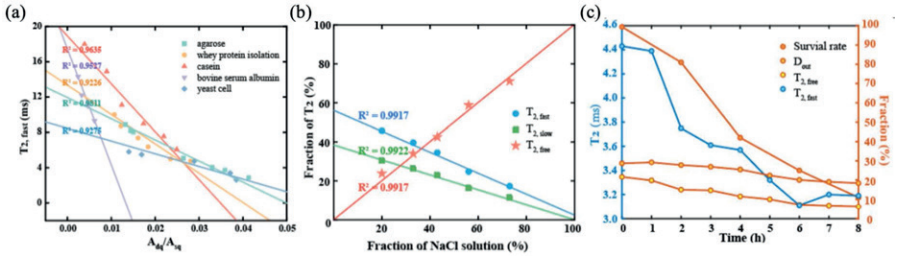


Figure 1 – (a) Relative quantification of bound sodium, (b) Quantitative results of extracellular free sodium, (c) Results of in vitro hypoxia-induced death experiments on U87 tumor cells.

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[3] Rooney, W. D. & Springer, C. S. A comprehensive approach to the analysis and interpretation of the resonances of spins 3/2 from living systems. NMR Biomed. 4, 209–226 (1991).
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Report:

Alpine Conference on magnetic Resonance in Solids
Chamonix, France, September 4-8

Scientific committee: Anja Bockmann (MMSB Lyon), Alexej Jerschow (New York University), Anne Lesage (CRMN Lyon)
Organizing committee: Jean-Nicolas Dumez (Nantes Université), Daniel Lee (University of Manchester) Michal Leskes (Weizmann Institute), Józef Lewandowski (University of Warwick), Charlotte Martineau-Corcos (CortecNet), Paul Schanda (IST Austria)

The Alpine Conference on Magnetic Resonance in Solids 2022 took place in Chamonix, France, from Sunday 4 to Thursday 8 September 2022. The conference gathered over 160 participants from more than 15 different countries, for 4 intense days of scientific exchanges on Magnetic Resonance in Solids, with over 110 submitted abstracts. The conference was originally planned in September 2021 and was postponed because of the COVID-19 pandemic.

The talks given at the conference were organized in four plenary sessions including a prize session. They covered a broad range of topics covering both methods developments and applications, in systems ranging from NV centres to ion channels. There were 9 invited lectures, including one in the field of EPR and one in MRI, and 16 promoted talks selected from the abstracts.

The Regitze R. Vold Memorial Prize was awarded to Prof. Tatyana Polenova, from the University of Delaware. Tatayana Polenova has contributed to shaping protein solid-state NMR from the very beginning. She has achieved some of the most important milestones in this field, starting from sequential assignments of one of the first protein samples measured, to advanced recent concepts like fast magic angle spinning and dynamic nuclear polarization. Besides her outstanding contributions to science, she is centrally taking part in the life of NMR, being always supportive and enthusiastic of initiatives to further develop the field, encouraging young scientists, organizing meetings, promoting knowledge transfer, and beyond….

The Caldarelli Prize in Magnetic Resonance for Young Investigators was awarded to Prof. Ashok Ajoy, from the University of California, Berkeley. Ashok Ajoy has performed pioneering work on quantum-enhanced NMR and MRI to generate new analytical tools on-chip or on the benchtop. His activities include efforts to develop miniaturizable NMR probes, innovative hyperpolarization methodology, and the study of nanoscale spin dynamics. This work provides novel types of measurement modalities, and also allows the elucidation of new nanoscale and quantum phenomena. The Caldarelli Prize recognises the contribution of young scientists (within 10 years of completing their Ph.D. degree), and is sponsored by Bruker Biospin.

Two afternoons were dedicated to round-table sessions, during which small groups of participants engage in focused discussions on the basis of someone's abstract and pitch presentation. Roundtables were first introduced to the Alpine Conference in 2017, and they have again been very enthusiastically received by the participants, resulting in two afternoons of lively scientific discussions.

Two Young Scientist awards, sponsored by Elsevier, were given based on the roundtable sessions. The SSNMR prize went to Pinelopi Moutzouri, from EPF Lausanne, whose roundtable presentation was the highest-rated by the participants; the JMR prize went to Lea Marti, from ETH Zurich, whose roundtable abstract was the most solicited.

A perspective session was held on Tuesday evening, during which invited lecturers shared a personal view on their favourite unresolved question in Magnetic Resonance in Solids. The session took place after a free afternoon during which participants had the opportunity for a walk or a hike.

The conference was held at the centre des congrès de Chamonix, in the familiar setting of the Majestic building. Industrial and academic sponsors were present and contributed to the scientific content and exchanges, as well as to the social dimension of the conference. A “wine and cheese” evening was organized by CortecNet on the second day, and an aperitif was organised by Bruker Biospin on the evening of the third day.

Thanks to the generosity of sponsors, the conference was able to award 14 student stipends, which covered registration costs and accommodation, on the basis of their scientific abstract and CV. Participation of young scientists is an important aspect of the conference.

The next edition of the Alpine Conference will take place in Chamonix from Sunday 10 to Thursday 14 September 2023. The scientific committee is composed of David Bryce (University of Ottawa), Sabine Hediger (CEA Grenoble), and Matthias Ernst (ETH Zurich).

The organising committee is very grateful to the sponsors: Bruker, CEA, CortecNet, Doty Scientific, Elsevier, Jeol, NMR Bio, NMR Service, Phoenix NMR, RMN GBP, Rototec/Spintec, and Nantes Université, for supporting the conference. The contribution of Bruker, whose major support is essential to the conference, is especially acknowledged. The organising committee would also like to thank the scientific committee and all the participants for their active participation. The dedication of Ms. Roudier and the personnel of the centre des congrès, and the support of Hélène Bonin from Nantes Université, are warmly acknowledged.

Executive Officers and Honorary Members of the AMPERE Bureau

The AMPERE BUREAU includes the executive officers (which take the responsibility and the representation of the Groupement between the meeting of the committee), the honorary members of the Bureau and the organizers of forthcoming meetings.

President
Anja Böckmann, CNRS/University of Lyon, France
anja.bockmann@ibcp.fr

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jani.dolinsek@ijs.si

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maer@nmr.phys.chem.ethz.ch

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sebastian.hiller@unibas.ch

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Guinevere Mathies, University Konstanz, Germany
guinevere.mathies@uni-konstanz.de

Young Member
Quentin Stern, University of Lyon, France
quentin.stern@protonmail.com

EF-EPR
Sabine van Doorslaer, University of Antwerp, Belgium
sabine.vandoorslaer@uantwerpen.be

SRMR
Luisa Ciobanu, CEA/Neurospin, France
luisa.ciobanu@gmail.com

MRPM
Yi-Qiao Song, Schlumberger-Doll Research,USA
ysong@slb.com

MR-Food
John van Duynhoven, Wageningen University & Research, The Netherlands
john-van.duynhoven@unilever.com

Hyperpolarisation
Geoffrey Bodenhausen, ENS, France,
geoffrey.bodenhausen@ens.fr

Publication Division
Gottfried Otting, Australian National University, Australia
gottfried.otting@anu.edu.au

Biological Solid State NMR
Hartmut Oschkinat, Leibniz Forschungsinstitut für Molekulare Pharmakologie, Germany
oschkinat@fmp-berlin.de

Euromar
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prisner@chemie.uni-frankfurt.de

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Prize Committee

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Members:
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Annalisa Pastore, King's College London, England
Alexej Jerschow, New York University, USA
Enrica Bordignon, University of Geneva, Switzerland

Future conferences

Ampere Event 2023

AMPERE Biological Solid-State NMR School	Aarhus (Denmark)	online: to be announced onsite: June 4-9
AMPERE NMR School	Zakopane (Poland)	June 18-24
Euromar 2023	Glasgow (United Kingdom)	July 9-13
17th ICMRM	Singapore (Republic of Singapore	August 27-31
Alpine Conference on Magnetic Resonance in Solids	Chamonix (France)	September 10-14
HYP23	Leipzig (Germany)	September 24-28

Groupement
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