FRIDAY 8TH MAY 2020, from 09.00-18.00 CEST

DAY OF WEBINARS
ON
FAST FIELD CYCLING NMR RELAXOMETRY APPLICATIONS

OPEN TO ALL

PROGRAM ORGANIZED BY STELAR AND COST EURELAX NETWORK

If you are interested in participating in any of these webinars, you can receive a Webex connection invitation by sending an email with your request to Prof. Danuta Kruk at: eurelax@matman.uwm.edu.pl
Requests must be sent by 16.00 hours CEST Thursday 7th May.

Connection will be possible for up to 300 participants on a first come first served basis.

Time (CEST)	Webinar title
09.00 – 10.00	**FFC NMR Relaxometry: a powerful experimental method for probing dynamical properties in liquid and solid systems. Theory and applications** Prof. Danuta Kruk, University of Warmia & Mazury in Olsztyn, Poland
11.00 – 12.00	**Relaxometry of cancer: Role of intracellular water lifetime as a tumour biomarker by in vivo fast field cycling** Prof. Simonetta Geninatti Crich, University of Torino, Italy
14.00 – 15.00	**Fast Field Cycling NMR Relaxometry in environmental science** Prof. Pellegrino Conte, University of Palermo, Italy
16.00 – 17.00	**NMR investigation of structure and transport in solid electrolytes for Li batteries** Prof. Steven Greenbaum, Hunter College, CUNY, USA

For more details of each webinar and speaker biographies, please see below:

FFC NMR Relaxometry: a powerful experimental method for probing dynamical properties in liquid and solid systems. Theory and methods

Danuta Kruk

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FFC NMR relaxometry is an extremely versatile experimental method probing dynamical properties of systems in different physical states (liquid, solid) and degrees of complexity (small molecules, electrolytes, macromolecules, biological tissues, soils and foodstuffs). It is amazing to see how quantum physics (NMR relaxation is, after, all, a complex, quantum-mechanical phenomenon) can be transferred to tools aiding the design of advanced materials or serving as quality control methods. Several examples of applications of NMR relaxometry will be shown and explained.

Author Biography

The expertise of Danuta Kruk (professor of physics at the University of Warmia and Mazury in Olsztyn (PL) covers theory of spin resonances and relaxation processes in connection to dynamics of viscous liquid, glass-forming systems and macromolecular systems (polymers, proteins) and transport phenomena in solid and liquid electrolytes. She is the author of two book on NMR relaxometry; she has also been appointed as an Editorial Advisor to the New Developments in NMR Editorial Board.

RELAXOMETRY OF CANCER: ROLE OF INTRACELLULAR WATER LIFETIME AS A TUMOUR BIOMARKER BY IN VIVO FAST FIELD CYCLING

S. Geninatti Crich

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Conventional diagnostic magnetic resonance imaging (MRI) techniques have focused on the improvement of the spatial resolution by using high magnetic fields (1-7T). High field allows the visualization of small tumour mass but lacks to give a precise evaluation of tumour grading and metastatic potential. Recently, we showed that the intracellular water lifetime represents a hallmark of tumour tissue cells status that can be easily monitored by measuring T1 at different and relatively low magnetic field strengths, ranging from 0.2 to 200 mT. A fast exchange through cell membranes indicates a high metabolic rate and thus a high activity of the tumor cells. Thus, it is possible to measure the high metabolic pressure by an enhance water exchange with the exterior of the cell. Therefore, intracellular water lifetime can be considered an important tumour biomarker directly depending on the rate of cell proliferation, cell migration and in responding to external stimuli as hypoxia or extracellular acidosis. Moreover, currently tumour responses to therapy are monitored primarily by imaging evaluating essentially the decrease of tumor size. This approach, however, lacks sensitivity and can only give a delayed indication of a positive response to treatment. In our study, we propose the use of FFC-NMR to provide relevant information about response to treatment by monitoring changes of water exchange rates through cell membranes that are directly dependent on the metabolism alterations caused by the chemo- or radio-therapy.

Author Biography

Simonetta Geninatti Crich graduated in Chemistry in 1993 and she got her Ph.D. in Biochemical Sciences at the University of Torino (Italy) in 1997. She is Associate Professor of General and Inorganic Chemistry at the Molecular Biotechnology and Health Sciences department. She is co-author of 100 original scientific papers in peer reviewed journals (H-index 37), 5 patents and 2 book chapters. She has given about 45 oral presentations nationally and internationally. She is member of ISNCT (International Congress on Neutron Capture Therapy) Executive Board (2016-2020) and of the GIDRM (Gruppo italiano risonanze magnetiche) Executive Board (2019-2023). Her current research is focused on the development and preparation of nanosized agents for the delivery of both therapeutic and MRI agents, on the setup of efficient cellular labeling procedures for both “in vitro” and “in vivo” pre-clinical models and on the development of innovative contrast agents for low field FFC-MRI applications.

FAST FIELD CYCLING NMR RELAXOMETRY IN ENVIRONMENTAL SCIENCE

P. Conte

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Environmental issues are nowadays the main concerns in scientific discussions due to their relevance for the evaluation of the strategies needed to protect all the forms of life. Soil desertification, water and air pollution are the main problems that we are all called to solve to ensure sustainable living conditions for future generations.

Fast field cycling (FFC) NMR relaxometry can play a very important role for the aforementioned issues due to its powerfulness as a technique used for monitoring purposes.

Here, different case studies are discussed in order to show how FFC NMR relaxometry can be applied to reveal environmental problems and suggest possible remediation strategies.

Author Biography

Pellegrino Conte is full professor at the University of Palermo (Italy). He is an organic chemist with a PhD in soil chemistry. His teaching activity has been related in the past to General Chemistry and Organic Chemistry, while at the moment he is teaching Soil Chemistry and Recovery of Contaminated Sites. One of his research activities concerns the application of fast field cycling NMR relaxometry to environmental problems, food quality, and new materials. He has a record of publications of more than 110 papers on international journals, and book chapters.

NMR investigation of structure and transport in solid electrolytes for Li batteries

Carla Fraenza, Nishani Jayakody, Mounesha Garaga, David Clarkson, Steve Greenbaum

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The major bottleneck in the development of safe and high energy density lithium-based batteries is the lack of a suitable electrolyte needed to eliminate the flammable liquid carbonate electrolyte solvents in use today. Among replacement candidates are a broad array of solid electrolytes based on inorganic oxides and sulfides, ionic liquids (ILs) immobilized in a pseudo-solid matrix, and polymers.

Our laboratory is focused on application of various nuclear magnetic resonance (NMR) techniques to help understand structure and dynamics of energy storage materials, in particular novel electrolytes. In this presentation we discuss two recent collaborative efforts.

(i) In collaboration with UCLA (B. Dunn, D. Ashby), we have investigated ionogels, which are pseudo-solid-state electrolytes consisting of the IL BMIM TFSI plus LiTFSI salt electrolyte confined in a mesoporous silica matrix. We report here NMR measurements of ionic self-diffusion coefficients as well as fast field cycling broadband relaxometry with emphasis on elucidating confinement effects of the silica matrix on ionic transport.

(ii) With Ionic Materials, Inc. (M. Zimmerman, R. Leising), we discuss results for a solid polymeric electrolyte based on semicrystalline polyphenylene sulfide and Li salts such as LiTFSI and LiFSI. This polymer electrolyte can be reliably extruded into thin films, is non-flammable, has attractive mechanical properties for lithium dendrite suppression, is electrochemically stable against Li, and is compatible with a variety of different cathodes, including NMC811. NMR diffuser measurements reveal Li room temperature self-diffusion coefficients that are the highest in any known solid.

Author Biography

Dr. Steve Greenbaum is CUNY Distinguished Professor of Physics at Hunter College, and a Fellow of the American Physical Society. He earned his PhD from Brown University and was a Postdoctoral Fellow at the Naval Research Laboratory in Washington, DC. Dr. Greenbaum was a Fulbright Scholar at the Weizmann Institute of Science and a Senior Research Fellow at the Jet Propulsion Laboratory, and has held Visiting Professorships at several universities, including Stony Brook, Rutgers, Tel Aviv, Paris-Sud, Padova, and Roma/Sapienza. His lab investigates materials for electrochemical energy storage and conversion by magnetic resonance and synchrotron x-ray spectroscopy. He has authored or co-authored over 270 peer reviewed publications and given over 60 invited talks at international conferences. He received the White House-sponsored 2002 Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring, and served (2014-15) as one of eleven Jefferson Science Fellows as senior Science and Technology advisors to the U.S. Secretary of State.