

Newsletter

Neutron Scattering Group

IOP Institute of Physics | **RSC** Advancing the Chemical Sciences

March 2014

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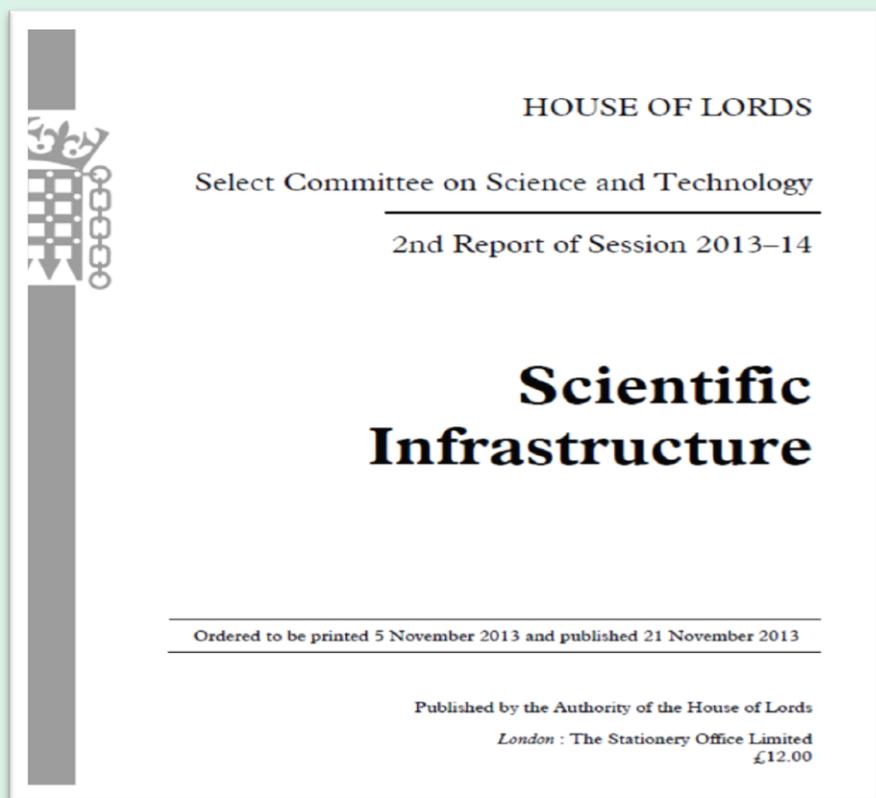
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NSG has contributed to the Select Committee on Science and Technology regarding UK Scientific Infrastructure.

The Second point of the summary from Select Committee state: *“On operational costs, there is a marked lack of adequate provision for operational costs at scientific infrastructure facilities. This has meant that the UK has not been extracting maximum value from its assets. We recommend that the BIS DGKI, in developing a strategy and an investment plan, examines how capita linvestment and the funding for operational costs can be tied together in one sustainable package.”*

WHAT ARE YOUR THOUGHTS ON E.S.S.?

The UK has just committed £165M capital to this project to build a high power spallation source in Lund Sweden. Any investment in facilities is important, so in order for us to have the right message, the NSG committee now need to hear your views. We would appreciate hearing from you, the community, to fully understand what you expect to gain from the facilities proposed for this new source.

CONFERENCE REPORT

The International Conference on Neutron Scattering 2013 in Edinburgh

The International Conference on Neutron Scattering (ICNS) took place from 8 – 12 July 2013 in Edinburgh, Scotland - the ninth conference of this well-established series. ICNS2013 brought together approximately 800 Scientists from 34 different countries who took the opportunity to present high-quality science and to discuss and develop ideas for exciting new work. The weather was astonishingly good with the sun shining until the sunset after 22:00, so that the umbrellas supplied in the delegate bags remained unused.

High Quality Science

Many talks and posters were presented at ICNS2013 on a wide variety of fields, for instance, the structures of diverse materials, magnetism, neutron instrumentation, biology, geosciences, engineering, energy research and cultural heritage. Aside from the conference, delegates could also participate in nine workshops and satellite meetings organised to foster understanding on techniques and instruments, and also to provide space for brainstorming about new collaborations and projects.

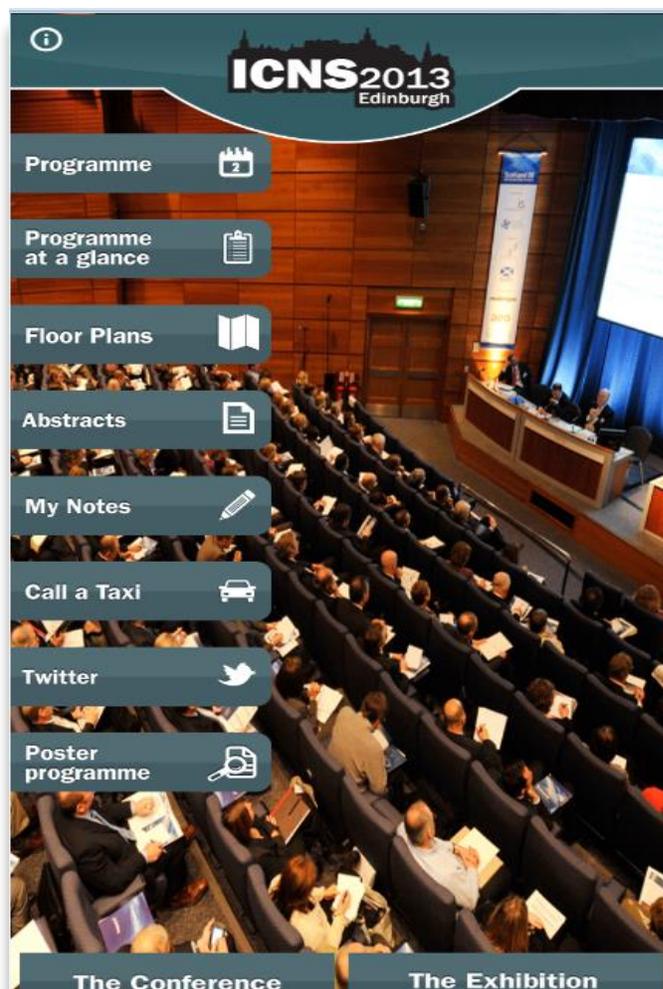
Prizes Ceremony

17 student posters were chosen for prizes sponsored by the UK Science and Technology Facilities Council. The future of neutron research depends on the next generation of scientists, the International Union of Crystallography (IUCr) awarded the “Young Scientists Prize” to Elisa Wheeler from ILL for her work on “Probing the magnetic excitations of frustrated spinels”, which was considered the best piece of research underpinned by crystallography. The “AONSA Prize” recognises outstanding research careers with a significant impact or contribution to the use or development of neutron science or technology in the Asia-Oceania Region. This year the prize was awarded to Balebail Anantha Dasannacharya, retired from the

Bhabha Atomic Research Centre in India, “for his pioneering contributions to neutron scattering in the Asia-Oceania region, through his early development of neutron spectroscopy and its applications for the dynamics in low-temperature liquids and molecular solids, and his active promotion of regional and international science as well as the national user program in India.” The European Neutron Scattering Association (ENSA) also took the opportunity to present two prizes in Edinburgh together with the European Crystallographic Association (ECA).

The next ICNS, it will be held in July 2017 in Daejeon, Korea.

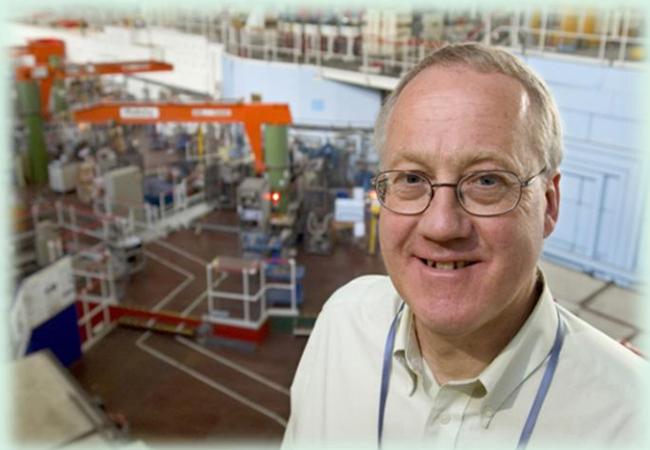
*Keith McEwen
Chairman of ICNS2013 Organising Committee*



CONFERENCE REPORT:

The Impact and Future of Scattering techniques in Soft Matter

Joint with the RSC SCI Colloid Group ISIS and IOP held this remarkable 2day Rideal award conference at Keble College Oxford, celebrating the contribution and impact of Professor Jeff Penfold, the 2013 award winner. 120 delegates braved the March flash winter weather participating in lively discussions following excellent talks. In his presentation, Bob Thomas made people think twice about using alternatives to neutron reflectivity to measure surface activity of surfactants. Adrian Rennie reported on the surface activity of the extracted seed protein from *Moringa oleifera* and *Moringa stenopetala* studies of adsorption and interaction with surfactants at solid surfaces. Jordan Petkov demonstrated the application of reflectivity to surfaces which are a proxy for cotton. Thomas Zemb took us all back to school in his talk on membrane properties of self assembled structures, Lionel Porcar demonstrated the detailed flow properties of such structures and how well neutrons contribute to understanding in this field, and Isabelle Grillo reported on the timescales over which these could form and deform. Ali Zarbakhsh reported on buried interfaces at the liquid solid interface, and there were several excellent contributions concerning biological membranes, from Jian Lu, Dave Barlow, Jeremy Lakey, Giovanna Fragnetto, Steve Holt and Luke Clifton. Rob Hillman, Roberto Felici and Tom Waigh further expanded the boundaries with their talks on static and dynamic solvent permeation of thiophene-pyrrole copolymer films, heterogeneous catalysis, and Coherent X-ray imaging of Colloids. Imke Greving detailed scattering studies on protein



fibres harvested from Spider silk, and Jeff Penfold covered about every aspect of scattering applied to Soft Condensed Matter in his Rideal lecture. A healthy clutch of student presentations in the form of posters made judging an almost impossible task but Jeff, aided by Claire Pizzey and John Webster decided to award the Kindle Fire (donated by Diamond Light Source) to W. Arunmanee for her poster on Unravelling the interaction of bacterial toxin with the specific receptor by EM and neutron scattering. It was very clear that there is a healthy breadth of activity in Soft Matter and in particular that there is a growing impact from the Biological community. This was a fitting tribute to Jeff Penfold (*pictured above*) who retired from STFC in May 2013. The organizing committee are pleased to recognize the contribution from the sponsors, ISIS/STFC, Unilever, RSC, Malvern Instruments, Biolin Scientific, Diamond Light Source and of course, the NSG.

Organising committee:

Claire Pizzey,

John Webster,

Jian Lu,

Ian Tucker

& Jordan Petkov

Theoretical and Experimental Magnetism Meeting

4 – 5 July 2013

Report by D T Adroja

The eleventh Theoretical and Experimental Magnetism Meeting (TEMM) was held at the Cosener's House Abingdon, UK from July 4-5 2013. This year's two-day meeting was organised by the CECAM, Hartree Centre, ISIS-facility, SEPnet, Hubbard Theory Consortium and the Magnetism and Neutron scattering Groups of the Institute of Physics. As we did last year this year TEMM was scheduled to coincide with the SEPnet Condensed Matter in the City programme, being part of a week focused on Orbital Magnetism. The meeting attracted 80 registered participants from eight different countries. There were 25 oral presentations, out of which 13 were given by the international speakers, and 10 poster presentations. The meeting provided a substantial boost to the visibility to CECAM, ISIS, SEPnet, IOP and PSI. The participants included academics, senior researchers, post-doctoral fellows and Ph.D. students. The meeting presented an excellent opportunity to hear and discuss with leading experts from all over the world on topics of current research in magnetism such as exotic superconductivity in Fe-based systems as well as in high temperature superconductors, heavy fermion systems, manganites, multiferroics, ferroelectric, orbital ordering, low-dimensional and frustrated magnetism including spin-ice and spin-liquid, skyrmions and quantum phase transitions. Prof. Keith McEwen, on behalf of the organizing committee, welcomed the participants at the beginning of the meeting.



The meeting commenced with an excellent scientific presentation by Qimiao Si (Rice University) on the theoretical aspects on orbital-selective correlations and neutron resonance excitations in iron pnictide superconductors. He made a direct comparison between experimental and theoretical results and discussed the role of orbital degree of freedom on the observed spin excitations in the iron-based systems. He was followed by Francis Pratt (ISIS) who discussed an evidence for odd-frequency pairing in a quasi-one-dimensional superconductor. The third talk of the session was given by Chris Lester (Bristol University) on quantum criticality in $\text{Sr}_3\text{Ru}_2\text{O}_7$ studied with inelastic neutron scattering. The last talk of the first session was given by Alice Taylor (Oxford University) on Spin fluctuations and superconducting pairing in a new iron-based system.

The discussion was focused on Quantum and Frustrated Magnetism, especially on theoretical and experimental aspects in the second session after the lunch. In the first talk of the second session Shivaji Sondhi (Princeton University) gave an excellent theoretical review on hydrodynamics of spin liquids. He was followed by Yong-Baek Kim (University of Toronto) who discussed on Magnetism and anomalous Hall effect in metallic pyrochlore systems. Jon Goff (Royal Holloway University) gave an excellent experimental talk on vacancy defects and monopole dynamics in oxygen-deficient pyrochlores and he was followed by Andreas Bauer (TU Munich) who talked on skyrmions and fluctuation-induced first-order transitions in chiral magnets.

Following tea, the third session was on Manganites and Multiferroics and the talks on manganites were given by Andrew Boothroyd (Oxford University) on a ferroelectric-like transition in metallic LiOsO_3 and Je-Geun Park (Seoul National University) gave an interesting talk on spin waves and heat capacity anomalies of multiferroic $(\text{Y,Lu})\text{MnO}_3$, followed by Durga Paudyal (Ames Laboratory) who talked on computational and experimental aspects of rare earth magnetic materials including PrAl_2 . The finally talk of this session was given by Paolo Radaelli (Oxford University) on chiral magnetic multiferroics. The first day was concluded with a late evening poster session and drinks with many discussions on complex magnetism and a delightful conference dinner.

The discussion on quantum magnetism was continued on the second day. The first session was on low-dimensional and quantum magnetism and there were three very interesting talks. The first talk of the session was on theoretical aspects. The first talk was given by Rodric Moessner (Dresden) on dipolar order by disorder in the classical kagome Heisenberg antiferromagnet. He was followed by Christian Rüegg (PSI Switzerland) who discussed on quantum and thermal melting of order in quantum magnets. The last talk of the session was given by Bella Lake (HZB, Berlin) who talked on Magnetic soft modes in the distorted triangular antiferromagnet $\alpha\text{-CaCr}_2\text{O}_4$.

The second session, after tea, of the meeting was focused on Quantum and Frustrated magnetism -II. Peter Orth (Karlsruhe Institute of Technology) gave a talk on emergent critical phase and Ricci flow in a 2D frustrated Heisenberg model, who was followed by Rasmus Toft-Petersen (Helmholtz Center Berlin) who talked on field induced magnetic structures of frustrated magneto-electric lithium orthophosphates. Achim Rosch (Koeln University) gave an exciting theoretical talk on topological magnetic textures: from skyrmions to emergent magnetic monopoles and he was followed by Christopher Stock (University of Edinburgh) who gave an experimental talk on incommensurate correlations to mesoscopic spin resonance in

YbRh_2Si_2 . Olga Young (Warwick University) gave an interesting experimental talk on highly frustrated magnetism in SrLn_2O_4 systems and showed the coexistence of two distinct types of magnetic order at low temperatures.

The third session, after lunch, was on magnetism through μSR . The first talk was given by Tom Lancaster (Durham University) on using muons to probe the exotic ground states and excitations in low-dimensional pyrazine-based molecular magnets. The second talk by Tim Ziman (ILL, Grenoble) on probing spin polarisation in semiconductors with negatively-charged muonium ions; a puzzle and a theory. Michael Smidman (Warwick University) gave an experimental talk on neutron scattering and μSR investigations on non-centrosymmetric heavy fermions. Devashi Adroja (ISIS Facility) gave an experimental talk on neutron scattering and μSR investigations on frustrated double perovskites. The meeting closed with an excellent presentation by Joe Paddison (ISIS Facility) on data analysis. He showed how much we can learn from the powder diffraction data of spin correlations in frustrated magnets.

Overall, the meeting was a great success, very useful and enjoyable opportunity for experimentalists to have discussions with theoreticians on various aspects of current research in magnetism. Finally, on behalf of the organizing committee we would like to express our gratitude to all speakers who had taken great care for giving excellent and stimulating presentations as well as chairmen and participants. We would like to thank CECAM, Hartree Centre, SEPnet, Hubbard Theory Consortium, ISIS, the IOP magnetism and neutron scattering groups and PSI for providing funding.

SPOTLIGHT

Report by A Zarbakhsh

Dr Sihai Yang, Leverhulme Early Career Fellow at the University of Nottingham wins neutron prize for his work to understand gas storage and separation properties of porous materials.



Dr Sihai Yang, Leverhulme Early Career Fellow at the University of Nottingham, has been awarded the B T M Willis Prize for 2013 by the Institute of Physics and the Royal Society of Chemistry Neutron Scattering Group. The award recognises Dr Yang's outstanding research in the application of neutron scattering science to understand gas storage and separation properties of porous materials.

Over the past decade, the development of functional porous materials has attracted tremendous interests worldwide owing to their potential applications in hydrogen storage and carbon capture. Understanding the mechanism by which porous materials adsorb and trap gas molecules is essential for the design of better systems. However, this study represents a major scientific challenge. Dr Yang's research work focuses on using inelastic neutron scattering and neutron diffraction techniques to gain insight into the interactions between adsorbed gas molecules and porous framework hosts, and a series of developments were achieved over the past 4 years. For example, he has developed a family of anionic framework solids with gated pore structures. These materials show interesting hysteretic hydrogen adsorption properties; a behaviour that is significant for the practical

hydrogen storage. In addition, Li ions were introduced into these frameworks to improve the hydrogen storage properties. Significantly, Dr Yang used inelastic neutron scattering to explain the binding interaction of adsorbed hydrogen molecules within these framework materials, representing great advance in understanding their interesting hydrogen storage properties. These research results have been published in a series of high profile journals, such as *Nature Chemistry*, *Faraday Discussion*, and *Inorganic Chemistry*, and are highlighted by *Nature News and Views*

<http://www.nature.com/nchem/journal/v1/n6/full/nchem.345.html>. Recently, he has successfully developed the novel application of inelastic neutron scattering to study the binding interaction and dynamics of adsorbed carbon dioxide and sulphur dioxide molecules within a porous host NOTT-300 which was discovered in Nottingham. The results lead to the direct visualisation and understanding of the molecular mechanism by which these harmful gases (CO₂ & SO₂) are captured by NOTT-300 material. This study represents important progress in the field of porous carbon capture system, because NOTT-300 does not contain toxic amine functional groups as in traditional carbon capture systems. The study on the binding interactions by using neutron scattering has led to the discovery of entirely new mechanism for the binding of carbon dioxide in such non-amine-containing system. The result was published in the journal *Nature Chemistry* as front cover article. Sihai was invited to give a science lecture and presented with his award at the NMUM 2013 meeting held on 8th April and said 'Neutron scattering is an extremely powerful technique and absolutely important to the success of my research projects. I am honoured to receive this prestigious award and I am grateful to the selection committee for their kind remark on my research work. I would like also to thank my collaborators, scientists from ISIS and Diamond, for their invaluable inputs to these research achievements. I shall continue my research projects at these state-of-the-art central facilities in collaboration with scientists there'.

The BTM Willis prize is sponsored by the Institute of Physics and the Royal Society of Chemistry. It is named after Professor Terry Willis, one of the pioneers of the use of neutron scattering in the United Kingdom.

WHAT'S ON

Advanced School in Soft Condensed Matter: "Solutions in the Spring" will be sponsored by NSG 2014-2017

Aims and innovative aspects of the proposed project

This proposal aims to train, each year, ~35 young scientists (PhD students and early career postdoctoral researchers) working in the broad area of soft condensed matter. This will be done through an Advanced School in Soft Condensed Matter: "Solutions in the Spring". This School will cover a wide range of topics in modern soft matter, including discussion of experimental and computational techniques, theoretical approaches, and issues of cross-disciplinary science. We propose that this school will be organised in conjunction with the Institute of Physics Liquids & Complex Fluids Group, with support from the Polymer Physics, Neutron Scattering, and Biological Physics Groups. The school will rotate, in both content and location, over the next three years.

The project is innovative on many levels. At its core, the School aims to provide young researchers with a broadly based training in the multidisciplinary field of soft-matter. We recognize that it would not be possible to do this over a single three-day school, and we therefore envision a rolling three-year programme of lectures and open-access lecture notes and support materials. Together these will provide a foundation for scientists embarking on a career in soft matter and related areas. Each School will be self-contained, and will cover subject material in sufficient depth to challenge and excite early career researchers. We therefore propose to invite four expert lecturers each year covering complementary areas, each having three lecture sessions plus support materials. There will also be a general lecture introducing students to the field as a whole. An idea of the topics, and the quality of the invited experts, can be seen in the following table. Lecture notes and the school summary will be produced as an open-access booklet.

B.T.M. WILLIS PRIZE 2014

The IOP Neutron Scattering Group and the Faraday Division of the Royal Society of Chemistry have established a prize for outstanding neutron scattering science. The prize is named in honour of the founding chairman of the Neutron Scattering Group, Professor B T M Willis. It is intended that the prize will be awarded annually, usually in conjunction with the annual Neutron and Muon Beam Users Meeting, NMUM.

Terms

The prize is awarded to an individual in recognition of a single outstanding piece of work, or a longer term coherent body of work, in the application of neutron scattering to a significant problem in physics, chemistry, materials science, earth science, the life sciences, or engineering, or alternatively in recognition of a major development in neutron scattering instrumentation or techniques.

Eligibility

The recipient of the prize will normally be a young physicist, i.e. in the first 12 years of a research career (allowing for career breaks) e.g. following an award of a PhD., who has made a substantial contribution to the development or reputation of physics / Chemistry / Biology in the UK or Ireland.

Nomination and further details please

E-mail: tatiana.guidi@stfc.ac.uk

Deadline date: 23rd March 2013.



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To join the Neutron Scattering Group, please visit either:

Institute of Physics <http://physics.iop.org/IOP/Member/>

Royal Society of Chemistry <http://www.rsc.org/members/join.htm>

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