

*Thin Films and Surfaces Group*

# Newsletter



## *Comments from the Chair*

Welcome to the December 2005 edition of the TFSG Newsletter. This has been an exceptionally busy year for the TFSG as we have hosted the 15th meeting in our flagship conference series, the *Interdisciplinary Surface Science Conference (ISSC-15)* at the University of Cardiff in June, and the second *Surface Science Summer School* at the University of Nottingham in August. Both events were a great success, and I would like to express particular thanks to Professors Mike Bowker and Philip Moriarty who chaired the conference and summer school respectively. They and their committees put in a tremendous amount of hard work to ensure these events were such a success. We also sponsored a record number of one and two day meetings this year (10 in all) including support for; *UK Scanning Probe Microscopy* (March, in Warwick), *New Astronomical Challenges in Surface Science* (April, in UCL) and *Ice Surfaces & Interfaces* (April, in Cambridge), and so there is much to report on and several new things to look forward to in the New Year.

We are again living in exciting times for surface and interface science, in that our subject continues to make a major contribution to the development of nanoscience and nanotechnology - and these subjects have taken root in the consciousness of the public and of policy-makers to an extent that is unusual for the physical sciences. Yet there are still many challenges and uncertainties ahead. For those working in the University sector, the very low success rates for standard 'responsive mode' EPSRC grant proposals, coupled with the sheer expense of supporting experimental work in our subject area, and the as yet unknown effect of "full economic costing", are all causes for concern. In view of all this uncertainty it is heartening to see the IoP, and our Group, are addressing new initiatives as well as maintaining established activities to support our community. I hope that the TFSG can continue to do so in the years ahead.

I would like to conclude by thanking all those who give of their time to organize meetings and the other activities of the TFSG. As my time as Chair will come to an end in April 2006, I would also like to take this opportunity to offer a personal debt of thanks to Dr. Wendy Brown (UCL), who was an outstanding Honorary Secretary when I took over as Chair, and to Dr. Martin McCoustra (Nottingham), who took over that role last year, and who has continued the tradition admirably. I would also like to thank Dr. Jamie Cole (Edinburgh) the new editor of the Newsletter. Hopefully he will be able to continue to produce and publish an issue on a 6 to 8 month timescale, but to do so he will require your help and support. If there is anything you would like to see included in the Newsletter, please contact Dr. Cole, myself or any other TFSG committee member.

Finally, my very best wishes to you for a Merry Christmas and a Happy New Year in 2006.

Professor Chris McConville  
(Chair, TFSG)  
Department of Physics  
University of Warwick  
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Further details of the group and its activities, including an up to date diary of supported meetings and conferences, are to be found on our website <http://groups.iop.org/TF/>

## *Support for Meetings and Conferences*

The committee is very happy to offer the support of the TFSG to any meeting or conference in the relevant areas of thin films and surface science organised by the UK scientific community. We would also welcome suggestions from group members for topical one-day meetings that the TFSG could organise alone or in collaboration with other IOP subject groups. If you are organising a meeting or conference and would like to find out if support is available or if you have an idea for a topic meeting, please contact Dr. Martin McCoustra (TFSG Secretary).

Dr. Martin McCoustra  
(Secretary TFSG)  
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## *Diary*

The following meetings will be of interest to group members.

### **Thin Films and Surfaces Group, Institute of Physics, 36th Annual General Meeting**

#### **Wednesday 1<sup>st</sup> March 2006, Institute of Physics, London**

The 36<sup>th</sup> AGM of the Thin Films and Surfaces group will be held at 12.30 p.m. during the lunch break of the meeting detailed below. A formal written announcement for the AGM will follow in the near future.

### **Film Deposition and the Control of Interfaces for Spintronics**

#### **Wednesday 1 March 2006, Institute of Physics, London**

*Organised by the Ion and Plasma Surface Interactions Group (IPSI) of the Institute of Physics and Co-sponsored by the Vacuum Group, Thin Films and Surfaces Group and Applied Physics and Technology Division*

Many groups are working towards the exploitation of electron spin for logic and memory applications. This meeting will focus on the materials issues of spintronics: the growth and characterisation of films and heterostructures, the requirements for interfaces, and how these can be controlled.

Presentations will include:

The role of interfaces in spin-dependent contacts to semiconductors

Dr. ir. Willem Van Roy (*IMEC, Leuven*)

Characterisation of magnetic multi-layers by electron and ion beams

Professor John Chapman (*Department of Physics and Astronomy, University of Glasgow*)

Interface control in pnictide heteroepitaxy: effects of surface reconstruction

Dr Gavin Bell (*Department of Physics, University of Warwick*)

Controlled grain size deposition of magnetic thin films,

Professor Kevin O'Grady (*Department of Physics, University of York*)

Both oral and poster presentations are invited. Interested authors should submit a title and brief synopsis of 100 words electronically to Zoe Barber email: [zb10@cam.ac.uk](mailto:zb10@cam.ac.uk) by **27th January 2006**

**A Celebration of 25 Years of Tribology at the Institute of Physics**  
**Wednesday 1 February 2006, Institute of Physics, London**  
*Organised by the Tribology Group of the Institute of Physics*

Tribology is defined as the 'science and technology of interacting surfaces in relative motion'. Even though the word 'Tribology' was coined relatively recently in 1966, the subjects of friction, wear and lubrication which make up Tribology have been around for centuries, with notable contributions from Leonardo da Vinci, for example. In the modern world, Tribology encompasses most aspects of every day life, from the lubrication most engineering devices to reduce friction to applications where higher, stable friction is required, such as in brakes and tyres. Tribology is critical in information and storage devices and in MEMS, where major new challenges exist in microscale contacts. Tribology is less known, but equally important in many biological applications, from prosthetic devices to the frictional properties of skin and hair.

Recognising the importance of Tribology, the Institute of Physics created the Tribology Group, chaired initially by David Tabor. Since then, the Group has a long and distinguished history of organising topical meetings on the issue. To celebrate the first 25 years this meeting brings together some of the prominent former members. There is no central theme, rather each individual brings their own outstanding insight to the subject.

**International Conference on Nanoscience and Technology 2006 (STM06 and Nano9)**  
**July 30th - August 4 2006, Basel, Switzerland.**

The scope of this conference is twofold:

- To commemorate the invention and development of SPM (25 years of STM and 20 years of AFM) and related techniques and their impact on the sciences.
- The expansion and reinforcement of nanoscience in general and its potential to unleash future technologies.

Traditionally, two conferences have been held in alternate years over the last two decades. On one hand the series of STM conferences since 1986 and on the other hand the series of Nano1 through Nano8 since 1990.

To fathom whether there will be a common future the organizers will combine STM06 and Nano9 into ICN&T 2006 (International Conference on Nanoscience and Technology) under the auspices of the two respective steering committees and the NCCR (National Center of Competence in Research) Nanoscale Science, located at the University of Basel.

Topics will include:

Nanobiology and Nanomedicine,  
Nanosystems, Nanomechanics and Nano-optics,  
Molecular Electronics,  
Quantum Computing and Spintronics  
Materials Scanning Probe Microscopy Instrumentation

and further details can be found at <http://www.icnt2006.ch/>

## **Condensed Matter and Materials Physics (CMMP06)**

**19th-21st April 2006, University of Exeter, UK**

*Organised by the Condensed Matter and Materials Physics Division of the Institute of Physics and  
Co-sponsored by the Institute of Materials, Minerals and Mining*

The annual Condensed Matter and Materials Physics (CMMP) conference is a major event in the Physics Calendar. In 2006 it will be held in Exeter on Thursday 20 and Friday 21 April, with a Student Day on Wednesday 19 April. The conference is shorter than previous CMMPs, and it will include a range of symposia with speakers and contributions from the UK and abroad. The wide range of plenary, invited and contributed talks plus posters will cover exciting and current aspects of condensed matter and materials physics, and applications. One of the principal features of this annual meeting is the opportunity it gives to young researchers to present their work, and this will again be strongly encouraged through both the symposia and the poster sessions. There will be prizes for the best student posters. In addition, the Student Day will consist of lectures specifically designed for research students, to enhance their appreciation of some of the key scientific issues of the meeting.

### Plenary Lectures:

J. Pendry (Imperial)	Metamaterials open new vistas in optics
A. Wallraff (Yale & ETH)	Superconducting qubits
R. Jones (Sheffield)	Mott Lecture
S. Parkin (IBM Almaden)	Wohlfarth Lecture

CMMP 2006 is centred on five themes and 16 symposia cutting across traditional disciplines:  
Nanoscience

Theory and Simulation of Nanoscale and Biological Systems  
Atomic Manipulation  
Self-Assembly and Self-Organisation at Surfaces  
Nanostructured Materials  
Correlated Quantum Systems and Magnetism  
Unconventional Superconductivity and Quantum Criticality  
Orbital-and Charge-Ordered Systems  
Magnetism, Magnetic Materials, and Devices  
Condensates, Quantum Fluids and Solids  
Semiconductors and Quantum Devices  
Semiconductor Physics and Transport  
Spintronics  
Nanostructures and Quantum Coherent Physics  
Organic Electronics and Photonics  
Jan Evetts Symposium  
Applied Superconductivity  
Soft Matter, Biophysics and Statistical Physics  
Biophysics  
Statistical Physics and Non-Equilibrium Phenomena  
Soft Condensed Matter

Contributions for Oral and Poster presentations are welcomed and should follow the themes of the 16 symposia.

**Abstracts should be submitted by 11 January 2006.**

Further details can be found at <http://conferences.iop.org/cmmp06/>

## *Student Bursaries*

We are happy to encourage postgraduate students to apply for bursaries to assist their attending major national and international conferences. To be eligible for a bursary, applicants must be a student member of the TFSG or the SSUK group of the RSC and be presenting a talk or a poster at the conference. In addition, bursary recipients will be expected to prepare a one-page report on the conference that they attended for the TFSG Newsletter. Student members of the group interested in applying for a bursary to attend a conference should contact Dr. Georg Held (Department of Chemistry, University of Cambridge) for further details. Application forms can be downloaded from the group website (<http://groups.iop.org/TF/>).

Dr. Georg Held  
(Bursary Co-ordinator TFSG)  
Department of Chemistry, University of Cambridge  
(gh10009@cam.ac.uk)

## *Conference Reports*

### **ISSC 15 (15<sup>th</sup> Interdisciplinary Surface Science Conference)**

*(June 2005, Cardiff)*

The biannual ISSC meetings bring surface scientists from the UK and the rest of Europe together to discuss the latest research in the many fields that now comprise modern day ‘surface science’. This year’s ISSC was held in Cardiff and I had the opportunity to present some recent results from my PhD work: “A Calorimetric Study of NO Adsorption on the Pt{111}, {211} and {411} Surfaces” in one of the poster sessions. With over 100 delegates and topics ranging from the traditional LEED studies of metal/gas systems to novel techniques for imaging DNA and proteins on metal substrates, the conference showcased the major themes that underpin current surface science research.

As well as attending a whole range of talks with some degree of relevance to my own research, I also took the opportunity to listen to those bearing no relation to my own work as it was a chance to learn firsthand about the diversity of research in our field, the new and emerging topics, and the potential applications of surface science research. The poster session was really my first experience of discussing my work with people outside my own research group and I’m grateful for the suggestions that were made in terms of data interpretation and potential future experiments.

I’m delighted to have been able to attend the conference and thank the Thin Films and Surfaces Group for the funding to cover part of the expenses.

Dave Borthwick  
Postgraduate student  
Department of Chemistry, University of Cambridge

### **ISSC 15 (15<sup>th</sup> Interdisciplinary Surface Science Conference)**

*(June 2005, Cardiff)*

I arrived at Cardiff on Monday 27<sup>th</sup> June. Having settled in and had a good lunch, it was time for the talks to begin. That afternoon, two of the talks which resonate in my memory are those of Dr Fabien Silly, and Ts’enolo Lerotholi. Dr Silly spoke about the growth of Pd nanocrystals on the SrTiO<sub>3</sub> (001) surface, which is a piece of work I am set to continue. Ms Lerotholi presented her work on CO and O coadsorbed on Ir (100). This was particularly poignant as I remember talking to her as she was embarking on this line of enquiry.

Later that evening I presented my own poster entitled “Reconstructions and nanocrystals on the polar SrTiO<sub>3</sub> (111) surface studied by STM”. This included most of the work I have completed during the first 8 months of my DPhil studies. I had a number of enlightening conversations about

my work. Two which stand out are those with Dr Q. Guo, who suggested ways I could improve my images of the nanocrystals, and Dr P. A. Mulheran who recommended I investigate the statistical distribution of the nanocrystals after deposition. After a reasonably long day we finished with a few drinks in a pub.

My favourite talk from the second day was that of N. D. Spencer. He presented his work on the production of varyingly hydrophobic surfaces in a clear and easily understood manner. It was finished with a fantastic video of a water droplet climbing up a slope. The surface was more hydrophilic at the top of the slope, and so it was energetically preferential for the droplet to climb. After the talks I attended the poster session in order to see the rest of the submissions. Following that, I and another couple of people, visited Cardiff bay.

The highlight of the third day was the talk by Flemming Besenbacher. The work presented was highly impressive, and I had not heard him talk before. However, I feel slightly too much information was included for the time available, but when you have so many splendid results it can be forgiven! The day ended with a lovely meal in the setting of the national museum, preceded by a chance to view a selection of their modern art collection. Impressionism is not really to my taste, but thankfully there were a number of more contemporary pieces to take my fancy.

Overall I enjoyed my first scientific conference, and hope to attend more in the future. If results allow, next time I would like to give an oral presentation.

Bruce Russell  
Postgraduate student  
Department of Materials, University of Oxford

### **ISSC 15 (15<sup>th</sup> Interdisciplinary Surface Science Conference)**

*(June 2005, Cardiff)*

This year's Interdisciplinary Surface Science Conference was a thoroughly enjoyable experience, although, as a theorist, I initially thought that I would be most interested in some of Wednesday's theory talks. However, I found that the standard of talks was very high throughout the whole of the meeting, and that the invited speakers were well chosen and gave good lead-ins to the sessions.

I was also pleased (as a PhD student) that this conference was planned with the younger attendees in mind, both in an even distribution of the talk allocations, but also in the large amount of student posters that were on display, which were all of a high quality. The conference itself had a nice, relaxed atmosphere, and I didn't feel like I was too out of my depth (as I have occasionally felt at other conferences). As a smaller meeting the organisers gave it a more personal touch.

Of particular interest to me was a contribution by Mark Basham of the University of Reading which involved differential evolution, a technique that is similar to the one I use in my own research. I was very interested in Matthias Scheffler's talk on Heterogeneous Catalysis, particularly the method used to study the catalytic oxidation of CO on RuO<sub>2</sub>, and the use of kinetic Monte-Carlo techniques to study this system over a variety of time-scales. The talk by Peijun Hu on the effect of surface defects on catalytic reactions was very informative from an elementary point of view, especially for dissociation reactions.

Matthew Mizieliński was the well deserved winner of one of the student prizes for his talk on nonadiabatic effects in the adsorption of atomic adsorbates on metals (and also proved that large equations don't detract from the quality of a talk). The other student talk winner, Angela Wolff, gave an excellent talk on experimental techniques used to study the adsorption and desorption of mixed water/methanol ices on laboratory approximations to cosmic dust grains whilst also having to

cope with failing projection equipment. The fact that two students (rather than one) were awarded prizes shows the high level of the student contributions.

The invited talk on quasicrystals, as well as providing some excellent pictures, also raised some interesting questions about their properties. I would be very interested in seeing the results of proposed DFT calculations which Rónán McGrath discussed briefly at the end of this talk, especially the supercells that would be used in those calculations.

Although I am not too familiar with STM, I found Gavin Bell's talk on the STMBE apparatus that is used to study the growth of InAs/GaAs quantum dots very informative. He is a well deserved winner of the Birch Prize. I must also mention the work done at my own department which combines both experimental data and DFT calculations in the study of Holmium Silicides that Hervé Ménard presented.

I would like to thank the conference organisers for an excellent meeting with a superb choice of venue, and for giving me the opportunity to present my poster on genetic algorithms for surface, interface and bulk calculations. I would also like to thank the conference committee and my research group in York for providing the funding that allowed me attend this meeting. I look forward to ISSC 16 in two years time.

Nathan Luke Abraham  
Postgraduate student  
Department of Physics, University of York

### **ECOSS 23 (23<sup>rd</sup> European Conference on Surface Science)** *(Sept 2005, Berlin)*

The 23rd European Conference on Surface Science was held in Berlin, Germany, at the Freie Universität from September 4-9 2005. I was fortunate enough to attend this conference due to financial assistance from the Thin Films and Surfaces Group of the Institute of Physics and Queen's University Belfast.

The conference's format consisted of invited talks and contributed papers which were presented in plenary, oral and poster sessions. This edition of the ECOSS conference had more than 900 participants and around 1000 submitted abstracts. I was impressed by the quality of the presentations. Moreover, I found the plenary talk by K. Kern entitled "Self organized growth of nanoscale structures at surfaces" to be particularly clear and inspiring.

My research is focused on the study, using first principles total energy calculations, of the great variety of atomic scale surface reconstructions observed on the (001) surface of Strontium Titanate (SrTiO<sub>3</sub>). At the ECOSS 23 I presented a paper entitled "Stability of Sr adatom structures for SrTiO<sub>3</sub>(001) surface reconstructions", which dealt with part of the aforementioned research work. This presentation gave me the opportunity to have some very useful feedback on my work and also to discuss my research with different experts.

Finally, I would like to say that the ECOSS 23 was the best conference I have attended so far. It gave me the opportunity to present my work to a new and international audience, and also improve my knowledge in different facets of surface science. For this I would like to thank the Thin Films and Surfaces Group of the IOP for the financial support that assisted my participation in this conference.

Leandro Liborio  
Postgraduate student  
Atomistic Simulation Centre, Queen's University Belfast

## **PSI-K 2005**

*(Sept 2005, Schwaebisch Gmuend)*

The PSI-K 2005 Conference held in Schwaebisch Gmuend, Germany on the September 17 - 21 2005 was the third general conference organised by the Psi-k community. This conference, titled "Towards Atomistic Materials Design" was aimed at bringing together the community active in theoretical and computational research of electronic structure and properties of condensed matter. Although the Psi-k community is mainly localised in Europe, there were participants from 33 countries including large contingents from the US and Asia-Pacific. In total, there were 560 attendees.

The days were started early by plenary lectures followed by three parallel sessions. The latter including 14 topical symposia and of particular interest to me were the sessions on surface science and catalysis, nanoscale and complex magnetism, and nanostructures and quantum dots. This was an excellent opportunity to get up to date on the latest surface science and magnetism research, as well on the currently "hot" ab initio modelling techniques.

I was also happy to present my work "High Temperature Ferromagnetism in Carbon-based Materials" to interested ears which resulted in much discussion. Also in between each session and during the poster sessions, it was possible to talk with many of the other attendees about the presentations and each other's work which could result in future collaborations.

An organ concert in the Muenster Cathedral was also organised on one evening of the conference. This was a rather spectacular event leaving many of us in awe. It was also a pleasure to walk around the picturesque town and nearby villages when there was a chance to take a break from the conference.

I would like to thank the conference organisers for a bursary towards the registration fee and the Thin Films and Surfaces Group of the IOP for the financial support that gave me the opportunity to attend this very successful and enjoyable event.

J.A. Chan  
Postgraduate student  
Department of Chemistry, Imperial College

## **ICSOS8 (Eight International Conference on the structure of surface) (18-22 July 2005, Munch, Germany)**

This conference is the eight conference of the series of the international conference on the structure of surface, which is held every three years. This eight conference was held in Munich, Germany this year from 18 to 22 July. It focused on showing the new developments and research in the Quantification of Surface Structure, Nature and Modeling of Surface Structure, New Developments in Theory, Experiment and Instrumentation, Relations between Structure/Bonding at Interfaces and Physical/Chemical Properties, Novel Applications of Interfacial Structure in Materials Science, and Nanostructures

This conference was successful in bringing a huge number of researchers, students and interested people in the above research areas. This gave the opportunity for the people to meet and have a good idea about the new developments. I attended many interesting talks, some of which were directly related to my current research and some that were not closely related but very interesting such as the talks given by David King (relationships between structure, dynamics and catalytic activity at surface), A. Kawasuso (structural studies of silicon surface by total reflection positron diffraction). The most relevant presentations in my area were the talk titled (development of a

LEED apparatus using STM tips), and some of the work that was presented on preparing and characterising single-atom tips for the STM.

The poster session was very interesting and helpful in meeting people and discussing their work in depth. I presented a poster with the title “Adsorption of 6-trifluoroacetoxy-norbornadiene on the Si(001) surface”. The poster session was very helpful to me as I discussed my work with many people and got their ideas and suggestions.

I think this conference was very successful, I enjoyed it very much. I would like to thank the Thin Films and Surface group of the Institute of Physics for providing some support and allowing me to attend this conference.

Sherin Sarairoh

Postgraduate student

Department of physics, School of math and physics, Newcastle University Australia

## *Surface Science Summer School 2005*




*University of Nottingham, 21<sup>st</sup> – 26<sup>th</sup> August, 2005.*

The UK Surface Science Summer School, which we hope is now established as a regular triennial event, was held this year in the University of Nottingham from 21<sup>st</sup> – 26<sup>th</sup> August. Following the Warwick school in 2002 (the first UK surface science summer school to be held in over 15 years), the Nottingham event brought together 72 postgraduate students from a range of diverse backgrounds to not only experience a series of exciting lectures from many of the key world-leading authorities in surface and nanoscale science but to get involved with hands-on training sessions, a nanotechnology debate, dedicated careers and “surface science in industry” sessions, poster presentations, and proposal writing activities. While the majority of students came from a broad subset of UK universities (practically every major UK surface/ nanoscience group was represented), a sizeable minority from institutes/universities in France, Germany, Ireland, Romania, Slovenia and Spain also attended the school.

Funded by the EPSRC and the IoP Thin Films and Surfaces Group, the school was additionally sponsored by a range of commercial organisations, *viz.* Accelrys, Allectra, Asylum Research, Hewlett Packard, Kratos, Leybold, Nima Technology, Omicron, Pfeiffer, Specs/Scanwel, and Varian. The Council for the Central Laboratories of the Research Councils (CCLRC) also provided sponsorship in the form of a £500 prize for the winning team in the student research proposal competition (more on this below). The Organising Committee comprised Martin McCoustra (Nottingham), Clive Roberts (Nottingham), Georg Held (Cambridge), Fran Jones (Eastman Institute, University College London), Nic Harrison (Imperial College London and Daresbury Laboratory) and myself and we endeavoured to provide a summer school event that combined exciting lecture presentations with ‘hands on’ training and a great deal of student interactivity.

What motivated our decision to organise the Nottingham summer school? Well, for one, surface science plays a central role in the now ubiquitous areas of nanoscience and nanotechnology. Indeed, much of the research that is currently labelled as nanoscience would have been described as surface/interface science no more than 10 to 15 years ago. Notwithstanding this ‘rebranding’, however, surface science currently encompasses nanoscale techniques and technologies which push the limits of microscopy and spectroscopy towards (or beyond) the single molecule level. The primary motivation for running relatively regular (*i.e.* triennial) UK summer schools in surface science lies with the realization that, in this rapidly evolving subject, postgraduate students must be well-informed regarding the state-of-the-art in the subject *and* they should have a keen understanding of the manner by which surface science underpins and directs so many areas of nanoscience. Moreover, to stimulate new and exciting research from the next generation of surface/nanoscience, it is important that postgraduates are prompted to see beyond their own particular specialist sub-field in order to appreciate the highly interdisciplinary nature of surface science.

To this end, the summer school lectures spanned eight key areas (see Figure 1), each representing exciting topical and multidisciplinary activity in the field. We were delighted to welcome a total of 30 speakers (from the UK, Europe, and the US) to Nottingham to speak on topics ranging from single molecule vibrational spectroscopy and the electronic properties of low dimensional surface structures to biointerfaces and the ultimate limits of surface/nano science. All lectures were very well attended (with delegates and speakers braving rather inclement Nottingham weather to attend the sessions!) and it is clear from student questionnaire responses at the end of the summer school that many students appreciated the opportunity to learn about new developments in not only their area of surface science but in the many sub-fields that were described by the speakers.

 <p><b>Key-note lecture</b></p> <p><i>Low dimensional surface structures</i> Franz Himpsel, University of Wisconsin</p>	 <p><b>Debate</b></p> <p><i>Nanotechnology: Radical New Science or Plus Ça Change?</i></p>	 <p><b>Workshop</b></p> <p><i>Developing Research Proposals</i></p>	
<p><b>1. Single Molecule/ Nanoparticle Spectroscopy</b></p> <ol style="list-style-type: none"> <li>1. <i>Single molecule vibrations</i> J Pascual (FU Berlin)</li> <li>2. <i>Near-field Raman spectroscopy</i> Bruno Pettinger (FHI Berlin)</li> <li>3. <i>Force-distance spectroscopy</i> Phil Williams (Nottingham)</li> </ol>	<p><b>2. Electronic Structure</b></p> <ol style="list-style-type: none"> <li>1. <i>Water adsorption</i> P. Feibleman (Sandia National Labs)</li> <li>2. <i>"Low dimensional" magnetism</i> Samjeet Dhesi (Diamond Light Source)</li> </ol>	<p><b>3. Self-organisation &amp; Pattern Formation</b></p> <ol style="list-style-type: none"> <li>1. <i>Reaction diffusion system</i> Harm Rotermund (FHI Berlin)</li> <li>2. <i>Self-organised se nanostructures</i> Bert Voigtlaender (Juelich)</li> <li>3. <i>Supramolecular Organisation</i> James O'Shea (Nottingham)</li> <li>4. <i>Wetting and dewetting</i> Uwe Thiele (Dresden)</li> </ol>	<p><b>4. Surface Science at Central Facilities</b></p> <ol style="list-style-type: none"> <li>1. <i>Overview</i> Mike Chesters (Daresbury Lab.)</li> <li>2. <i>Structural Analysis</i> Rob Jones (Nottingham)</li> <li>3. <i>Real space and reciprocal space methods</i> Geoff Thornton (UCL)</li> </ol>
<p><b>5. Out of UHV</b></p> <ol style="list-style-type: none"> <li>1. <i>Surface EXAFS at high pressures</i> Trevor Payment (Cambridge)</li> <li>2. <i>Photoemission from liquid surfaces</i> B. Winter (MBI Berlin) TBC</li> <li>3. <i>Electrochemical SPM</i> Julie MacPherson (Warick)</li> </ol>	<p><b>6. Biological Interfaces</b></p> <ol style="list-style-type: none"> <li>1. <i>Biointerfaces</i> Dr. Janos Vörös (ETH Zürich)</li> <li>2. <i>Biomedical Polymers</i> Sally McArthur (Sheffield)</li> <li>3. <i>Biological soft matter theory</i> Roland Netz (TUM, Muenchen)</li> </ol>	<p><b>7. Surface Science in Environmental &amp; Astronomical Sciences</b></p> <ol style="list-style-type: none"> <li>1. <i>Atmospheric reactions</i> Michel Rossi (Lausanne)</li> <li>2. <i>Interstellar grains: surface chemistry</i> Gianfranco Vidali</li> <li>3. <i>Surfaces of Icy Materials</i> Andy Horn (Manchester)</li> </ol>	<p><b>8. Surface Science in Industry</b></p> <ol style="list-style-type: none"> <li>1. Drew Murray (Veeco)</li> <li>2. Martyn Green (Omicron)</li> <li>3. Shen Luk (Molecular Profiles) TBC</li> </ol>

*Overview of the 2005 UK Summer School in Surface Science. In addition to the sessions described above the School also featured hands-on training in XPS, LEED, SPM, and computational chemistry.*

There is insufficient space in this short report to list the many highlights in the various tutorial lecture sessions but a wealth of fascinating results were presented relating to (to name but a few areas): spectroscopy of single atoms and molecules; the complicated behaviour of simple and not-so-simple adsorbates on surfaces; developments in nanomagnetism; recent advances in electron, X-ray and optical surface spectroscopy; state-of-the-art density functional theory; and nanoscale surface modification using scanning probes. It was also clear that, as compared to surface science in decades gone by (and echoing comments made in relation to the previous summer school in Warwick), increasing numbers of researchers are now moving "out of UHV" to study surface and interface properties in a range of challenging environments. Nevertheless, there are many exciting developments afoot in the UHV domain, including those reported by our key-note speaker, Professor Franz Himpsel (University of Madison Wisconsin), who gave a wonderfully enlightening insight into the fascinating properties of low dimensional structures on semiconductor surfaces.

Complementing the scientific lectures were a number of broad, non-technical graduate-focussed sessions on academic and industrial careers. A particular highlight, as identified by many of the students in their exit questionnaires, was the session led by Professor Peter Feibelman (Sandia National Labs.) on careers pathways in academia and industry. Author of *A PhD is not Enough!*, and a heavily in-demand speaker at many US universities, Feibelman's thought-provoking presentation was followed by a considerable amount of discussion and many insightful and incisive questions by the student delegates. The 'Surface Science in Industry' session held on Monday evening and involving speakers from Omicron, Veeco, and Molecular Profiles, was also highlighted by many students as particularly beneficial.

The School featured four different hands-on training sessions (of which students attended three): X-ray photoelectron spectroscopy (XPS), low energy electron diffraction (LEED), atomic force microscopy and spectroscopy, and computational chemistry. We were hopeful that these sessions would introduce students whose PhD research is largely theory-based to experimental techniques

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and *vice versa*. Interestingly, it appears that this was indeed the case with, for example, a considerable number of experimentalists being impressed with their first exposure to high level quantum chemistry calculations via Accelrys' *Materials Studio* package. Similarly, theorists who had not yet suffered the 'vagaries' of experimental research were introduced to key experimental techniques in surface science. The hands-on training sessions were universally appreciated by the students.

On Wednesday the 24<sup>th</sup> of August, the school featured a lively, entertaining, and well-attended debate on the science, feasibility, and potential of nanomachines and nanotechnology. For the first time in the UK, proponents of Eric K. Drexler's controversial and radical vision of molecular manufacturing (where computer-controlled nanoscale machines build macroscopic products and structures atom-by-atom or molecule-by-molecule) debated in a public forum with leading members of the UK nanoscience community. Dr. David Forrest (president of the Institute of Molecular Manufacturing) and Dr. Josh Hall (Chief Scientist of Nanorex and author of *Nanofuture*) discussed and debated the technical issues surrounding molecular machine nanotechnology with Professor Richard Jones (University of Sheffield and author of *Soft Machines: Nanotechnology and Life*) and Professor Saul Tandler (University of Nottingham and a member of the panel commissioned by the Royal Society and Royal Academy of Engineering to produce last year's wide-ranging report on nanotechnologies). In addition, the debate panel featured Jack Stilgoe, a researcher from the *Demos* thinktank heavily involved with public engagement with nanotechnology, who provided an entertaining and perceptive commentary on the issues from his, non-technical, perspective. Indeed, the debate did not focus solely on purely scientific issues and featured discussion related to the societal impact of nanotechnology. The debate was chaired by Faye Lucas from *Involve* – an institution which has been tasked by the government to lead a nanotechnology engagement group.



*Debating nanotech (l-r): Prof. Richard Jones (University of Sheffield), Dr. David Forrest (President, Institute of Molecular Manufacturing), and Dr. Josh Hall (Chief Scientist, Nanorex).*

I will forego a discussion of the proceedings of the debate as a detailed commentary will be published in a forthcoming issue of *Nanotechnology Perceptions*. What is important to note is that the postgraduate students who attended the summer school all enjoyed the debate, finding it informative and entertaining. Indeed, many questionnaire comments picked out the nanotechnology debate as a key highlight of the summer school. Further discussion of the nanotechnology debate, surface science in general and a variety of rather less scientific issues (!) ensued at the summer school dinner held in the University Senate Chamber following the debate. Similarly, throughout the school the informal interactions between students and between students and speakers were of arguably as much importance as the formal lecture and training sessions and it was clear that many students were making best use of the opportunity to discuss 'thorny' problems related to their PhD research with their peers and with leaders in the field.

A central component of the school which fostered a large amount of student discussion and interactivity was the research proposal competition. The students were divided into groups of six and, following a brief introductory session, were asked to produce a one page research proposal (based on a *pro forma* handed out to the groups) where the budget to be awarded for the project was £500k. The proposals were handed in at the end of the summer school and then, in a process mirroring that endured by the professional scientific community, the 'grant applications' were distributed to other student delegates. The winning proposal was on the topic of controlling molecular orientation in Langmuir films and was submitted by a group comprising Anthoula

Papageorgiou (UCL), Tanya Ekers (UCL), Paul Kirkham (Manchester), Stuart Carnally (Nottingham), Christopher Chatwin (Manchester), and James Hayton (Nottingham).

While it was a pleasure to see students animatedly discussing their proposals during tea/coffee and lunch breaks - the proposal writing exercise certainly increased the level of student interactivity! - reaction to the scheme (as judged from questionnaire comments) was mixed. Although a considerable number of students identified the exercise as the most satisfying element of the school, others found it somewhat difficult to complete. Many students complained that there was insufficient time allocated for proposal preparation. This was certainly true and the time scales for proposal preparation will need to be carefully considered if the scheme is adopted in future schools. Nevertheless, notwithstanding the fraught timescale, a number of original, exciting and impressive proposals were produced by the student teams. Moreover, those students involved in refereeing generally produced well-argued and carefully written reviews.

Through the generous sponsorship of the various companies listed in the introductory paragraphs, we were able to award three prizes (of £50, £100, and £250) for student posters. The poster judging



*The summer school poster prize winners (prizes presented by Prof. Peter Feibelman). Top to bottom: Anna Stróżecka, Jonathan Bramble, and Richard Fawcett.*

committee comprised Professor Franz Himpsel, Professor Trevor Rayment (Birmingham), and Dr. Georg Held (Cambridge) and due to the very high quality of the posters, they spent a considerable amount of time reaching a difficult final decision. In third place, for her work on low temperature STM-based electronic and vibrational spectroscopy of adsorbed fullerene molecules, was Anna Stróżecka from Forschungszentrum Jülich, Germany. Second prize went to a poster entitled *Liquid Crystal Alignment on Patterned Self-assembled Monolayers* by Jonathan Bramble, University of Leeds, while the 1<sup>st</sup> prize was awarded to Richard Fawcett of the University of Nottingham for the fabrication, analysis, and modification of supramolecular hydrogen-bonded surface nanostructures.

In summary, the 2005 UK Surface Science Summer School provided an informative and entertaining snapshot of the state-of-the-art in international surface (and nano) science. Featuring a series of extremely high quality presentations from world-leading scientists, the breadth of exciting new science presented was astounding. Much of the success of the school, however, lies with the postgrads who made the event so memorable: it was gratifying to speak with so many bright and keen students who clearly had a great deal of enthusiasm for the field. Mirroring a comment Chris McConville made in his report on the Warwick school in 2002, it is likely that amongst the Nottingham school student delegates are the organisers of a future summer school. If so, I'm certain that, just like the Organising

Committee of the 2005 Summer School, they will find running the school an immensely rewarding experience!

Philip Moriarty

Chair of the 2005 Surface Science Summer School Organising Committee

## *Progress on 4GLS*

The 4GLS project is making rapid progress. The prototype energy recovery linac is under construction and funding has been allocated for the preparation of the technical design report (TDR) for the full 4GLS facility. The TDR will essentially define the structure and characteristics of 4GLS and it is a crucial step in the preparation of the final case for the facility. In order to update the user community on progress in the construction of the prototype, on current thinking on the design of 4GLS and to ensure that the TDR is consistent with the needs of users an information and interaction meeting was held at Daresbury on the 4th of July 2005.

The meeting was attended by over two hundred members of the UK community and the strong presence of leading international scientists confirmed the international reputation of the project. The UK Research Councils were also well represented.

Elaine Seddon outlined the latest thinking on the design of 4GLS and questionnaires were distributed in order to assess the detailed experimental requirements of the user community. The meeting heard presentations on the potential of 4GLS for studies in chemistry and biology from Majed Chergui (Lausanne), in electronic structure from Zhi-Xun Shen (Stanford University), in the control of ultrafast phenomena in atoms and molecules from Kiyoshi Ueda (Tohoku University) and in the study of surface reaction dynamics from Anders Nilsson (Stanford Synchrotron Radiation Laboratory). These presentations demonstrated the world leading potential of 4GLS for research in a wide variety of fields.

During the day the participants divided into a number of parallel breakout sessions. These breakout sessions were concerned with the scientific potential of 4GLS and with the technical requirements of a number of experimental techniques and yielded valuable information for the 4GLS design team.

Since the meeting, we have received some detailed feedback that is allowing us to refine the planned source characteristics. However, we would like to draw your attention to, and ask for your input on, the 'summary of estimated science needs' document that is downloadable at <http://www.4gls.ac.uk/Meetings/parameter/4GLStablesv3.doc>. This contains a table of possible 4GLS beamlines, and gives space for input on the preferred energy ranges, pulse lengths, synchronisation levels to other sources etc. If you have comments on the 4GLS source design that you have not already relayed to us, we would be grateful if you could use this as a vehicle for your comments. Alternatively, if it looks far too daunting, just email us your thoughts in any other format.

Regular updates on the progress of the project can be found on the 4GLS website (<http://www.4gls.ac.uk>).

Peter Weightman, Wendy Flavell and Elaine Seddon  
4GLS Steering Group

## *Influence the Future Direction of a Major DTI Measurement Programme – Contribute to the Formulation of the 2006-9 VAM-Physical Programme*

Formulation of the new VAM-Physical Programme is underway. The Programme supports UK industry to ensure that analytical measurements are carried out competently and accurately. It is a DTI-funded Programme supporting the development of the UK's National Measurement System (NMS) - the technical and organisational infrastructure that delivers world-class science for business, trade and regulation.

The research carried out under the VAM-Physical Programme falls into three technical areas: surface/nano analysis, gas analysis and particulate analysis.

### **How can you contribute to formulation?**

- Submit your views in the three questionnaires (one per technical area) on the VAM-Physical formulation website): [www.npl.co.uk/formulation/vam/questionnaires.html](http://www.npl.co.uk/formulation/vam/questionnaires.html)
- Attend the focus groups and meetings scheduled for October: [www.npl.co.uk/formulation/vam/focus\\_groups.html](http://www.npl.co.uk/formulation/vam/focus_groups.html)
- Contact the formulation team directly: [vam@npl.co.uk](mailto:vam@npl.co.uk) / 020 8943 6443

The feedback received will be used to shape the structure of the new Programme. If requested, contributors will be kept up-to-date with all formulation activities, and given opportunity to input their views as the new Programme takes shape.

- Visit the VAM-Physical formulation website for full details of all formulation activities and regular updates on progress: [www.npl.co.uk/formulation/vam](http://www.npl.co.uk/formulation/vam)

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