

*Thin Films and Surfaces Group*

# Newsletter



## *Comments from the Chair*

We are living through exciting times for surface and interface science. Our subject has made a major contribution (in some ways the defining 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 refreshingly unusual for the physical sciences. Our science has even started to receive the ultimate accolade: scare stories in the popular press! In short, we find ourselves the inhabitants of a 'hot' field.

Yet there are still many challenges ahead. For those of us working in the university sector, the very low success rates for standard 'responsive mode' EPSRC grant proposals are a major cause for concern; meanwhile the continuing difficulties for manufacturing in UK are equally worrying for our members in industry. And, more serious than either of these for the long-term future of surface science and technology in the UK, there is a decline in the number of students wishing to pursue careers in science and engineering.

In view of all this it is good to see the Institute, and our Group, taking some new initiatives as well as persisting in long-established and valuable activities. An example of the former is the new Surface Science summer school, which was organized last August at Warwick with great success. We hope this will become as well established an event as ISSC, our regular flagship conference, which will take place this coming year in Liverpool. A short article on the plans for the meeting can be found later in this newsletter, and I hope we will see as many as possible of you there.

I would like to conclude by thanking all those who give their time to organize these and the other activities of the Group. Since my time as Chair is coming to an end, however, I owe especial thanks to Wendy Brown who is an outstanding Honorary Secretary, and to Martin McCoustra, who has done a superb job of producing the newsletter for the last couple of issues. Hopefully he will be able to continue to produce and publish on a 6 to 8 month timescale but to do so will require your support. If there is anything you would like to see included in the Newsletter, please contact Dr. McCoustra.

To conclude, if you have any comments you wish to make on the activities of the group or suggestions for future activities, please feel free to contact the committee.

Merry Christmas and best wishes for 2003!

Professor Andrew Fisher  
(Chair, TFSG)  
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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 at <http://www.cse.clrc.ac.uk/Activity/TFSG>.

## *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. Wendy Brown (TFSG Secretary).

Dr. Wendy Brown  
(Secretary TFSG)  
Department of Chemistry, UCL  
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## *Diary*

The following meetings will be of interest to group members and have been organised with the support of the TFSG.

### ***Annual General Meeting (AGM) of the Thin Films and Surfaces Group***

This will take place on Wednesday, March 12<sup>th</sup> 2003 at lunchtime during the one-day meeting *Thin Films of Organic Molecules: Fundamentals and Applications* to be held at the University of Birmingham (see details below). Further details relating to the timing and location of the AGM can be obtained from Dr. Wendy Brown (TFSG Secretary). New TFSG committee members will be elected at the AGM. If you would like to serve on the committee and would like to nominate yourself, or someone else, for election to the committee, please contact the TFSG Secretary, Dr Wendy Brown (w.a.brown@ucl.ac.uk), with details of your **nomination by Friday 28<sup>th</sup> February at the latest.**

### ***Thin Films of Organic Molecules: Fundamentals and Applications***

University of Birmingham  
Wednesday 12<sup>th</sup> March 2003

This one-day meeting will look at all aspects of thin organic molecular films from fundamental aspects of their structure and spectroscopy through theoretical approaches to molecule-surface interactions to studies of their electron transport and optical properties. The development of novel molecular films for applications in biology and medicine and micro- and nano-structured thin films will be key issues. Invited speakers include,

#### **Professor R. Berndt**

(Christian-Albrechts-Universität, Germany)  
*Addressing Single Molecules with STM*

#### **Professor G Leggett**

(Sheffield, UK)  
*Photopatterned Self-assembled Monolayers:  
Versatile Templates for Controlling Biological  
Organisation from the Micro- to the Nanoscale*

#### **Professor A. Fisher**

(UCL, London, UK)  
*Electron Transport in Organic Molecules: From  
Films to Single-molecule Devices*

#### **Dr T. Rayment**

(Cambridge University, UK)  
*AFM studies of organic films – from a chemical  
probe to a mechanochemical tool*

#### **Professor S. R. Forrest**

(Princeton University, USA)  
*Organic Light Emitting Devices*

#### **Professor N. V. Richardson**

(St. Andrews University, UK)  
*Growth and Structure of Polyaromatic Thin  
Films on Clean and Oxygen Modified Cu(110)*

There is a registration fee of £35 that includes lunch, morning and afternoon tea. For further details regarding abstract submission and registration, please contact the organiser, Dr. Q. Guo.

Dr. Q. Guo  
Department of Physics, University of Birmingham  
Tel: 0121 414 4657 Fax: 0121 414 7327  
(q.guo@bham.ac.uk)

## ***14<sup>th</sup> Interdisciplinary Surface Science Conference (ISSC-14)***

University of Liverpool  
16<sup>th</sup>-19<sup>th</sup> June 2003

The ISSC is the flagship UK conference series in the field of surface science, organised by the TFSG of the Institute of Physics (IOP). The ISSC-14 will be held in the historic city of Liverpool. The conference is expected to attract participants from all over Britain and Europe. There are presently 10 confirmed invited lectures from distinguished international scientists on topics of current interest and featuring *The Thin Films and Surfaces Group Plenary Lecture* to be given by **Professor Wilson Ho** (University of California, Irvine, USA). The invited speakers are

**Professor Andrew Fisher**  
(University College London, UK)

**Professor Mikko Ritala**  
(University of Helsinki, Finland)

**Professor Klaus Kern**  
(Max-Planck-Institut, Stuttgart, Germany)

**Professor Elaine Seddon**  
(Daresbury Laboratory, UK)

**Professor Georg Kresse**  
(University of Vienna, Austria)

**Professor Pat Thiel**  
(Iowa State University, Ames, USA)

**Professor Hermann Nienhaus**  
(University of Duisburg, Germany)

**Professor Klaus Wandelt**  
(University of Bonn, Germany)

**Professor Roland Wiesendanger**  
(University of Hamburg, Germany)

The major themes of the conference will be

Imaging at Surfaces  
Single Molecule Spectroscopy  
Surface magnetism / Nanomagnetism  
Molecular Electronics  
Semiconductors  
Adsorption, Reactivity and Catalysis at Surfaces  
Surface Structure  
Oxide Surfaces  
Self-assembly, Recognition and Complex Functions at Surfaces  
Dynamics of Surface Processes  
*In situ* and Real-time Probes

and both oral and poster contributions are sought within these broad themes. Details of abstract submission will be available soon on the first flyer and *via* the conference web site at <http://web.ssci.liv.ac.uk/ISSC-14/>.

Student bursaries will be available to members of the TFSG and SSUK group of the RSC. All enquiries are welcome and for further information please contact Joyce McIntosh [joyce@liv.ac.uk; Tel: 0151 794 3541, Fax: 0151 794 3896].

Professor Rasmita Raval  
(Chair ISSC-14 Local Organising Committee)  
Surface Science Research Centre, University of Liverpool  
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## *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://www.cse.clrc.ac.uk/Activity/TFSG>).

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(Bursary Co-ordinator TFSG)  
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## *Conference Reports*

### **8<sup>th</sup> International Conference on Electronic Materials**

(Xi'an, China, 10<sup>th</sup>-14<sup>th</sup> June 2002)

The 8<sup>th</sup> International Conference on Electronic Materials (IUMRS-ICEM2002) organised by the Chinese Materials Research Society (C-MRS) is one of the most important series of conferences of the International Materials Research Society (IUMRS). The intention of this conference is to provide a specialised forum for the exchange of new ideas and scientific approaches related to all aspects of modern electronic materials.

The conference turned out to be a great success. More than 1200 abstracts were accepted and presented in either oral or poster sessions. The conference included 16 symposia covering most aspects of electronic materials R&D ranging from traditional wide-band gap materials, optoelectronic materials to novel nanomaterials, biomolecular electronics, etc. The Materials Education Forum, organised by the IUMRS, was held in parallel with the conference itself. The president of the IUMRS, Professor Peter A Glasow, gave the opening speech at the conference. Following the opening ceremony, there were five keynote lectures by world famous scientists. Most of these lectures focussed on nanotechnology: nanomaterials, nanostructures, nanotubes, nanopowders and nano smart systems.

I gave a poster presentation entitled *Measurements of Electrical Activation Energy in Black Diamond using Impedance Spectroscopy* during Symposium H: Advanced Characterisation of Electronic Materials. This poster presented a new approach to identifying the electrical conduction paths for diamond films from grain boundaries and grain interiors at a complex electrical impedance plane in an AC domain. We reported the method on nanocrystalline diamond and single crystalline white diamond on silicon supported diamond films. This is our first measurement on freestanding black diamond films, which are traditionally considered as "heat-treatment" grade quality. It was well received and attracted the attention of several key researchers in the field of dielectric, ferro-

electronic materials and diamond. I treasured the chance to discuss the possible physical mechanisms of impedance measurement for diamond films with Professor Eric L. Cross (Pennsylvania State University), who is known for his pioneering work in electronic ceramics.

Overall attendance at this conference provided me with a chance to meet many other researchers in the field of electronic materials, learn of the current status of the research in this area, discover what other research groups are doing and the techniques they are using, and also to obtain some useful ideas for future work. Although I work solely on diamond, it was very interesting to have the chance to find out more about related electronic materials at this meeting.

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### **7<sup>th</sup> International Conference on the Structure of Surfaces (Newcastle, Australia, 22<sup>nd</sup>-26<sup>th</sup> July 2002)**

This was the seventh in the International Conference on the Structure of Surfaces series, which are held once every three years. The conference attracted a wide range of surface scientists from all over the world, who presented work relating to the entire spectrum of the field, from traditional topics such as electron diffraction to newer developments in carbon nanotube fabrication. There were lecture presentations held every day, and two afternoon poster sessions.

I presented my poster on the first day of the conference, and received a fair amount of interest during the session. My poster outlined the developments in a novel surface sensitive instrument we are currently building, a <sup>3</sup>He Spin Echo Spectrometer. One of its intended applications is the study of surface diffusion processes at unprecedented resolution. As such, the work attracted the attention of researchers who are studying surface diffusion, and led to some productive discussions. Also, researchers with a general interest in instrumentation commented on our work. As a result we were left with many positive comments and valuable suggestions which we will take into account as we continue to develop this technique.

In addition to getting feedback on my own work, I was able to sample a wide range of topics in the field and learn more about techniques and systems, which are not my focus. I found this invaluable as a form of education and as a source of inspiration for what's possible. It was very eye opening to see all that is being done out there. It was also interesting to talk to some of the older professors and hear their views on academic life and the history of surface science.

The conference was a valuable part of my experience as a doctoral student, and I am grateful to the TFSG of the IOP for their support, which helped make the experience possible for me.

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### **Non-contact Atomic Force Microscopy 2002**

(Montreal, Canada, 10<sup>th</sup>-14<sup>th</sup> August 2002)

The fifth International Conference on Non-contact Atomic Force Microscopy (NC-AFM 2002) was held at McGill University, Montreal from the 10<sup>th</sup> to 14<sup>th</sup> August 2002. This being only the fifth annual conference reflects the relative infancy of this exciting technique. Over 120 participants, spanning 23 countries, presented some 80 papers. These will be published in *Applied Surface Science* early in 2003. The conference was preceded by a workshop aimed at students, such as myself, and other newcomers to the field. The attendance at this workshop was high, representing the growing interest in this field. The conference covered a vast range of relevant topics –

instrumentation for non-contact AFM, contrast mechanisms in non-contact AFM, true atomic resolution with non-contact AFM, the theory of non-contact AFM, determination of tip-sample interaction potential, quantitative understanding of measured frequency shifts, damping and dissipation mechanisms, tapping mode versus non-contact, and a wide range of applications in biology, materials and magnetism.

Invited talks were given by leaders in the field including H. J. Mamin, D. Stewart, Y. Sugawara, R. M. Westervelt and C. M. Yip. The accompanying program of talks gave a wide range of applications of NC-AFM in all areas of science. Each talk was followed by interesting discussions which brought together the opinions of researchers in different areas.

The poster session was an excellent chance to speak on a more detailed level with fellow NC-AFM scientists. My contribution, entitled *Imaging in Situ Cleaved MgO(100) with NC-AFM*, attracted interest from several parties, regarded as world leaders in the NC-AFM community.

The panel discussion at the conclusion of the conference summed up many of the outstanding issues in this very young technique. The characterisation of the tip was highlighted as an area where more progress was needed, in order to more fully understand the contrast mechanisms involved in imaging with NC-AFM. The lack of theory groups in this area was also cited as another possible reason why contrast mechanisms are not fully understood. Small amplitude NC-AFM was agreed to be the way forward for reliable atomic resolution of insulating materials.

T. V. Ashworth

(Postgraduate Student)

Department of Chemistry, University of Manchester

### **Physics and Technology of Dilute Nitrides for Optical Communications**

(Baltalimani, Turkey, 8<sup>th</sup>-12<sup>th</sup> September 2002)

This event was designed to inform researchers in the field of dilute nitrides of recent developments and the problems regarding the fabrication, theoretical understanding and device development with this material.

Dilute nitrides are materials where the group V element is partially replaced with nitrogen. This results in a non-linear variation of the band gap, for example incorporating 3% nitrogen on arsenic lattice sites in GaAs results in a ternary alloy with a band gap of 1 eV. This band gap is significantly smaller than the band gap of 1.4 eV of GaAs. The remarkable nature of this effect can be demonstrated by the following analogy. When two semiconductors AC and BC are mixed, this typically results in the formation of a disordered alloy  $A_xB_{1-x}C$ . If the physical properties of A and B do not differ greatly from each other, the properties of the resulting alloy change smoothly and linearly from those of BC to those of AC as x is changed from 0 to 1. This effect is observed in a ternary alloy such as  $Ga_xIn_{1-x}As$ . As x is varied, the physical properties of the alloy vary linearly from those of InAs to those of GaAs. However, the band gap in dilute III-N-V semiconductors does not exhibit this linear behaviour. In fact, these alloys exhibit huge bowing effects and band gap lowering occurs as a result.

The major attraction of these materials lies in the fact that the band gap can be tuned to previously unavailable regions of the electromagnetic spectrum and the resulting alloy can be lattice matched to substrate material thus facilitating high quality growth and incorporation into existing electronics infrastructure. These materials have enormous applications in the electronics industry due to their lattice matching potential, for example in high efficiency solar cells, vertical cavity surface emitting diode lasers used in fibre optic communications, microdisk lasers to name just a few. Dominant research in this field is currently taking place on the GaInNAs material system. This material can be fabricated with appropriate nitrogen concentrations to have a band gap of 0.8 eV. This opens up the

possibility of the 1.3  $\mu\text{m}$  wavelength being achieved, which has enormous applications for optical fibre communications as this wavelength gives optimal coupling to the optical fibres. Further, due to the large conduction band offsets in this material in a quantum well structures, better carrier confinement results thus enabling this material to be employed in high temperature environments hence eliminating the need for thermoelectric coolers (a requirement for the current InP 1.3  $\mu\text{m}$  wavelength devices) and resulting in a substantial saving in cost.

My personal objectives at this workshop were to present my research work, a poster entitled *Surface Electronic Properties of  $\text{InN}_x\text{Sb}_{1-x}(001)$* , and discuss its implications, understand and learn of the problems in this field, consider how these problems can be solved with techniques I have available to me, develop collaborations to enable myself to understand and refine theory for my own unique applications and develop collaborations to acquire material that can be analysed at the University of Warwick. I am pleased to report that all of these objectives have been successfully accomplished. In particular, in regard of the last two points, I will be collaborating with personnel from the University of Essex to develop theory for my applications. Further we will be in a position to receive material grown via MBE, MOCVD and MOVPE from groups in France and Finland.

Finally, I would like to say that this event from my point of view was extremely well organised and I found the whole workshop highly educational and informative.

I. Mahboob,  
(Postgraduate Student)  
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## *The Surface Science Summer School 2002*

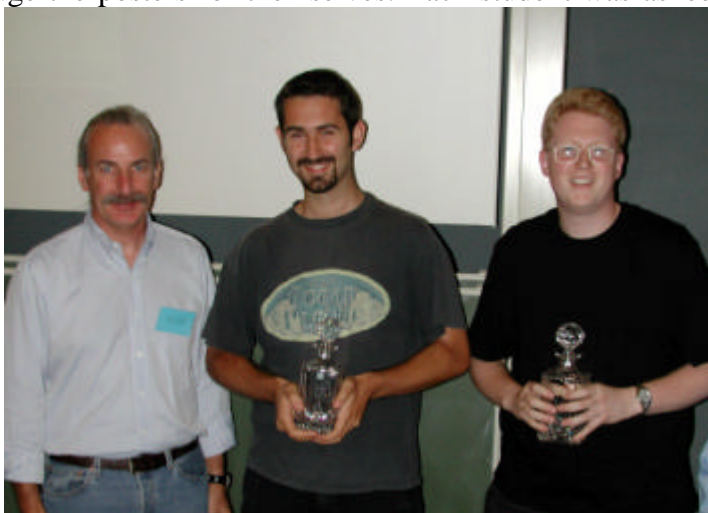
For the first time in over 15 years a Surface Science Summer School was held in the UK for graduate students in all areas of surface science. The need for such a summer school reflects the continued growth and evolution of the subject in recent years, in particular the increased diversity of research areas that are now fundamentally underpinned by surface science. The summer school, which was funded by the Institute of Physics' Thin Films & Surfaces Group and the EPSRC Physics Programme, took place from the 4<sup>th</sup>-9<sup>th</sup> August at the University of Warwick. The weeklong event brought together 65 UK and European Ph.D. students and 20 invited speakers in surface and nanoscale science from across the broad range of research activities in Physics, Chemistry, Material and Earth Sciences, Biology and the Life Sciences Interface.

The background to this event stems from the early 1970's to the mid-1980's, when a series of surface science summer schools were organised at the rate of one every 3 years, so that one would fall during every Ph.D. student's period of study. These earlier summer schools were concerned with covering the basic physics and chemistry of what was then a new field of research with its own unique problems and difficulties (especially the universal use of ultra-high vacuum!). In the intervening 15-20 years the field of surface science has moved on considerably, with biological interfaces and nano-technology representing two of the most prominent new areas. There has also been the development of new techniques, most notably the family of scanning probes, including scanning tunnelling microscopy (STM) and atomic force microscopy (AFM). This move away from the core of single subject but multidisciplinary surface science, and particularly with much non-UHV surface science is now of greater interest and importance in the biological and life sciences area, convinced us that this was an ideal time for a new style of surface science summer school. The objective was to cover the latest techniques for surface structure determination, and demonstrate how these can be applied to study new materials; such as quasi-crystals, carbon nanotubes, real catalysts and quantum dot structures; to outline studies of novel liquid-solid, electrochemical and biological interfaces and to show the progress in surface studies of organic molecules, polymers and biocompatible surfaces and interfaces.

The summer school was structured around a number of research themes: (i) Structure properties of surfaces, (ii) Surface reactivity & catalysis, (iii) Novel techniques, (iv) Biological surfaces & interfaces, (v) Nanoscience and (vi) Electrochemical & liquid-solid interfaces, with 3 or more invited speakers within each theme (- some of which were unheard of at the time of the last UK surface science summer school!). Within each theme, an introductory approach was followed by varied examples from the field; for example in Nanoscience, Julie Macpherson (Warwick) first introduced the theory and operation of STM, AFM and SECM techniques, Peter Beton (Nottingham) then described the application of different force microscopies to investigate and manipulate carbon based nanostructures on surfaces (e.g. C<sub>60</sub> and C-nanotubes), Johannes Barth (Lausanne) discussed STM studies of different metal-metal growth systems and the formation of metallic nanostructures, while Tim Jones (Imperial College) outlined methods of semiconductor growth (MBE & MOCVD) and described the growth and properties of III-V semiconductor materials from 2D thin layers and the fabrication of quantum dot structures, through to their incorporation in device structures with potential commercial applications.

One of the stated objectives was also to provide the graduate students with a permanent record of the summer school and so each invited speaker was requested to provide an electronic copy of their presentation to be burned on to a master CD and copied for every student to take away at the end of the summer school: 100% success was achieved in this so the presentations of all the lecturers are collected together on the CD. The presentations will also be available on a dedicated web site (accessible from <http://www.phys.warwick.ac.uk/surface/>).

A major contribution to the overall success of the Summer School was the interaction amongst the 65 Ph.D. students. As well as attending the lectures, each student came prepared with a poster on some aspect of their research work. These were displayed at poster sessions on the first two days of the summer school. These sessions worked very well and the overall quality of the posters, both in terms of the science and the effort that had gone into producing them, was without exception, excellent. We decided to let the students judge the posters for themselves. Each student was asked to vote for their top three posters after the last session, having had an opportunity to talk to all the presenters. With a massive turn out at the polls, the result produced ..... a dead-heat! The winners were Jean-Paul de Mussy from the Université de Bruxelles for his poster entitled “*A New Look at the Reactivity of Composite Electrode Surfaces*” and James Theobald from the University of Nottingham for his poster “*Hydrogen Bonded PTDCI Nanostructures on Ag Terminated Si(111)*”. The prize of an etched crystal decanter was presented to each of them.



The posters were also used to provide the themes to divide the students into small groups for one of the final exercises of the summer school. Each student had been requested to bring two overheads on some aspect of their research work. The task for each group was then to use these overheads (and any others they made as a group) to prepare and present a 20 minute talk. The groupings were: Semiconductors, Nanotubes, Organic molecules, STM, Techniques, Catalysis, Dynamics and Surface Structure, each lead by one of the invited speakers. This degree of involvement by the students provided an excellent opportunity to interact directly and present not only their own work, but that of the group. The resulting presentations, typically shared by 2 or 3 students, were again of

an extremely high quality and demonstrated good collaboration and interaction between the members of the various groups.

The informal interaction of the students and speakers during the week and between the students was widespread and excellent throughout the week, particularly in the bar after the sessions. On the social side, Jim Matthew (York) also provided a light-hearted insight into science with an excellent and very personal history of scientific cartoons. However, the undoubted highlight of the social events was the conference dinner, a medieval banquet held at Warwick Castle. Our party was met at the Castle gates by The Red Knight (wearing the traditional colours of the Earl of Warwick) and following drinks in the Great Hall and a tour of the Kingmaker exhibition, a fine meal of broth, salmon and chicken was consumed, washed down with considerable quantities of ale and mead. Indeed it was a Knight to remember!!



The final presentation at the summer school was given by Don Eigler (IBM, San Jose) who gave a keynote address entitled “*Computational Studies with Nanometer Structures*” and in a strange way brought us back full circle. In the very first presentation Phil Woodruff (Warwick) had described what was traditionally a favourite molecule-surface system, CO-Ni(100,) as the “fruit-fly” of surface science, and a lot of what was discussed thereafter was directed towards how far we have come in the years since the last summer school in the mid-1980’s. Characteristically, Eigler’s talk challenged some of these ideas and took us right back to basics as he described a series of experiments which developed from a very simple question, “How close together can you place two or three CO molecules on a Cu(111) surface?” He described how, simply by manipulating individual CO molecules and placing them in different positions on the surface, specific chains of events could be triggered resulting in the molecules moving at speeds faster than could be measured (possibly even ballistic velocities). He then demonstrated how this could be used to design and construct a series of logic gates capable of performing the same principal operations, but on a scale some 260,000 times smaller, than the most up-to-date CMOS equivalent circuitry: a truly elegant example of nanotechnology.

So the first Surface Science Summer School for 15-20 years is over and I would like to think we have all learned a lot as a result. The quality and diversity of the surface science being undertaken was absolutely phenomenal, the interactions of the students and the presentations by the speakers (who were successfully bullied into providing their talk electronically *and* well in advance!) was excellent throughout and, of course, from these students will hopefully come the future leaders in the field and perhaps the organiser of a future Surface Science Summer School (although I’m sure I didn’t think that when I attended the York summer school in 1983!). The feedback from the students and all the speakers was universally favourable, with a few suggestions for the next summer school, possibly in Nottingham in 2005. However, the overall feeling seemed to be that we got it about right.

Dr. Chris McConville  
(Chair, Summer School Organising Committee)  
Department of Physics, University of Warwick  
(C.F.McConville@warwick.ac.uk)

## *The IOP and Your Career*

### **On-line Careers' Discussion Forum**

The Institute's career website, <http://careers.iop.org> has been developed further to include an open access discussion area. Members are encouraged to post questions or comments and share their own wealth of experience by answering the questions of others. The Discussion Board will be a permanent part of the website and I hope you find it useful in the future.

### **Career Break Support**

The IOP offers a number of services in support of members taking a break in their careers. In the first instance, members on a career break are entitled to a *Reduced Membership Subscription Rate*, which is currently just £10. All you need to do is email [membership@iop.org](mailto:membership@iop.org) including your membership ID number in the text, to qualify for this rate.

The Institute's *Career Break Grants* help members to stay in touch with the wider physics community by providing contributions towards attendance and associated costs at conferences *etc.* Members can apply by going to <http://careers.iop.org/resources> or by emailing [cbg@iop.org](mailto:cbg@iop.org). Of course, members can attend all IOP conferences at a reduced *Career Break Rates for Conferences*.

Alex Byrne  
Professional Development Officer

## Committee and Contact Details

<b>Chair</b>	<p>Professor Andrew Fisher          Department of Physics and Astronomy          University College London,          Gower Street,          LONDON, WC1E 6BT.          (andrew.fisher@ucl.ac.uk)</p>	
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