SUPA
Scottish Universities Physics Alliance

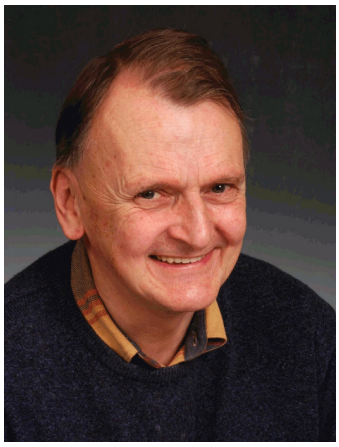
SUPA NEWS

11 DECEMBER 2006

IN THIS ISSUE

REGULAR FEATURES

WELCOME FROM YOUR CEO



Professor Ian Halliday, the man in the hottest seat in SUPA

Welcome to the first edition of SUPA News. This new venture in SUPA is aimed at increasing the visibility of SUPA activities to all of you in your individual departments.

Mentioning "individual departments" so soon might seem a bit contrary to the aims of SUPA, but SUPA *is* its people and its aim is to make us all greater than the sum of our parts. This is also clearly the assumption of the Principals and the Scottish Funding Council (SFC) who have funded us so far!

The First 18 Months

In the first 18 months, there has been a great deal of activity. All the SUPA Lecturers and Fellows agreed in the first round are now in post, and we have recruited many Prize Students of a very high standard. We have also installed the video conferencing rooms to house the SUPA Graduate School, as well as agreeing the courses that are now well under way. Although student numbers are quite low, SUPA as a whole is ideally placed to turn this round, enhancing the education and quality of all our graduate students.

SUPA News will also be a source of information about funding opportunities in SUPA, with news of meetings, visitors, and student support. This edition is a marvellous beginning, with many highlights of activity in the six SUPA themes, including several recent multi-million pound successes in winning funding.

SUPA II – SUPA is not Enough

One particularly topic is the preparation now under way for a bid for SUPA II. This bid will be finalised early next year, with details in the next edition of SUPA News. Each established theme is already hard at work on its bid, with the new theme of Physics and Life Sciences (PALS) also taking shape. The aim is to have a portfolio of bids of around £50m from the themes.

Starting soon these will be tested against departmental and University interest. The aim will be to eventually achieve an injection of resource into Scottish physics at the £20-30m level. SFC are expecting a letter of intent in January 2007 with a bid in May 2007. Such a bid must give a clear managerial plan for raising the game of physics in Scotland and not merely be a request for extra resource. So, if you have views, make them known to your theme leaders!

We recently had a meeting of many of the SUPA physicists interested in PALS. A truly remarkable spread of activity was revealed - the challenge now is to make this both coherent and inclusive, overlapping with mainstream activities in the life sciences themselves.

SUPA Leads the Way

Another meeting I recently attended was organised by the Higher Education Funding Council for England. The topic was research pooling, of which SUPA is the UK's leading example, and many key people were present, including more Vice Chancellors than I could count.

The sharpest point in the discussion was whether we could get added value from collaboration or whether SUPA was just another funding scheme. I claimed we were well on the way to achieving added value. But cynicism exists in England! Nonetheless there will be competing pooling arrangements, probably with Physics very visible due to English Physics Departments well known funding difficulties. We need to keep moving ahead of the pack.

SUPA News

One aim of this newsletter is to ensure that you are all aware of what is happening and have an opportunity to comment.

My email address is ian.halliday@e-halliday.org . You might also like to contact your theme leader, your Head of Department, or the Editor of SUPA News at newsletter@supa.ac.uk.

We look forward to hearing from you.

University of St Andrews · The University of Edinburgh · University of Glasgow · Heriot-Watt University · University of Paisley · University of Strathclyde

RESEARCH STAR HARNESSES LASER-DRIVEN PLASMA WAVES

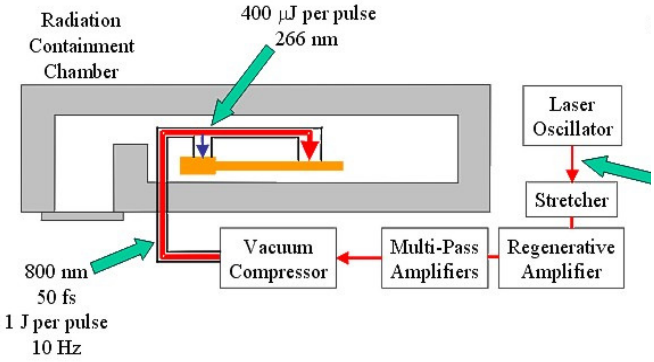
Following funding of more than £4M awarded in 2002, Professor Dino Jaroszynski has just won another £4M from the Engineering and Physical Sciences Research Council for work on harnessing laser-driven plasma waves as particle and radiation sources.

Prof. Jaroszynski said "We're eager to build on the successes of the on-going ALPHA-X project with a brand new programme to explore compact radiation sources that exploit laser-driven plasma waves." The main objective of the work just funded will be to push towards hard x-rays and gamma rays by utilising the very short spatial period undulator-like structures of plasma waves to lay down the foundations of sources in a spectral region hitherto not accessible.

"We'll also expand the frontiers of ultra-short pulse generation by controlling and reducing the electron bunch duration from wake-field accelerators using pre-bunching techniques and by investigating generation and tailoring of arbitrary shaped single cycle pulses by back-scattering tailored terahertz pulses from relativistic mirrors formed by relativistic plasma wakes and ionisation fronts" said Prof. Jaroszynski.

The experimental programme to develop these novel compact radiation sources will utilise unique facilities at Strathclyde University and international resources across the EU, US and China, to provide a mix of long-term development programmes and short-term campaigns that exploit the particular laser beam characteristics available at the facilities. Theory is not forgotten either, with a substantial programme by an established team that has previously worked together under ALPHA-X and new teams to bring fresh insights and backgrounds to bear on the significant challenges.

phys.strath.ac.uk/alpha-x/



Overview of the ALPHA-X laser beam delivery system at the University of Strathclyde

TOP MINISTER TARGETS TEOPS

The Glasgow partners in the SUPA initiative in Technology for Experimental and Observational Physics in Scotland theme were delighted that the First Minister Jack McConnell recently chose to visit the gravitational wave laboratories of collaborators at Caltech to strengthen Scottish involvement in the LIGO gravitational wave project.

Potentially the most exciting discoveries in physical science in the next 10 years are expected in the fields of astronomy, astro-particle physics, and particle physics. Gravitational waves from violent astrophysical events are on the point of discovery, particle physics promises new insights into the fundamentals of matter, and astronomy is targeting evidence of life on other planets.

In SUPA, the TEOPS initiative brings together the Institute for Gravitational Research and the Experimental Particle

The First Minister trying laser interferometry at Caltech

Physics groups at Glasgow University and the UK Astronomy Technology Centre (ATC) in Edinburgh. Following his visit, the First Minister expressed a wish to see the collaboration extended. Negotiations are now in progress to enhance LIGO input from TEOPS and further the ATC-based TEOPS interest in the Caltech Cornell Atacama Telescope.

www.supa.ac.uk/Research/astro/initiatives/SUPA_TEOPS_Ini.html

NIR FIRST FOR FIRS

Carole Helfter, a PhD student with Heriot-Watt University, recently had a paper published in a rather unusual place for physics research – the Journal of Tree Physiology.

Carole's project, based in Professor Duncan Hand's group, is a collaboration with the University of Edinburgh School of Geosciences. Its aim is to develop a sensor system to measure phloem sap flow in a tree without disturbing the flow.

The system that has been developed uses a near infrared laser to heat a small area on the trunk of the tree, and the flow of heat is monitored to determine sap flow rates.

The NIR sap flow sensor system in action – miniaturisation is possible!

One difficulty with the project is that full testing of the instrument is only possible from late spring to early autumn, so with winter now upon us, it is currently restricted to lab-based mathematical modelling.

www.aop.hw.ac.uk/

GLASGOW TOPS PPARC FUNDING LEAGUE

According to the latest annual report from the Particle Physics and Astronomy Research Council (PPARC), the University of Glasgow receives the highest particle physics funding in the UK. Last year, Glasgow received more than £3.75M - the highest of any UK university. The funding includes work in experimental and theoretical particle physics as well as for the Institute for Gravitational Research.

Glasgow's experimental particle physics group, working in the Institute for Gravitational Research, is dedicated to the study of the fundamental constituents of matter and their interaction. These activities are carried out in collaboration with international laboratories, where cutting edge physics results are obtained.

The Institute for Gravitational Research is focused on the development of detectors for gravitational waves from astrophysical sources. The main areas of research are precision novel interferometric techniques and the development of systems of ultra-low mechanical loss for the suspension of mirror test masses.

The group is also involved in the space-based Laser Interferometer Space Antenna (LISA) mission as well as data analysis activities within the Laser Interferometer Gravitational-Wave Observatory (LIGO) scientific collaboration.

www.gla.ac.uk,
www.pparc.ac.uk

SUPA MATERIALS NETS MILLIONS

At the October meeting of the Physics Prioritization Panel of the Engineering and Physical Sciences Research Council, two Programme Grant Renewals proposed by the University of Edinburgh were each funded in full, netting around £7M in total.

Professor Mike Cates said "I'm absolutely delighted with this news. One programme relates to soft condensed matter and statistical physics and the other is concerned with physics under extreme conditions. This funding will allow us to continue to build on the strong foundations we have established with our existing activity."

A news feature on this will be published in the next edition of SUPA News.
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FRONTIERS IN MILLPORT

For the second year running, the University of Glasgow Physical Sciences Graduate School has held a highly successful residential course for first year postgrads on Frontiers in Physical Sciences at The University Marine Biological Station, Millport on the Isle of Great Cumbrae.

Millport heard about Multiferroic Materials

The course emphasises a range of transferable skills including team work and presentation skills, with topics including The Hunt for Gravitational Waves, Pentaquarks, Extra-solar Planets, Quantum Cryptography, and Multiferroic Materials.

Student feedback was very positive on the core activities and the opportunity to meet a broad group of peers with common interests across different subject areas. All Glasgow University first year Physics PhD students will be attending in future. Details can be obtained from the website www.physics.gla.ac.uk/PG/PAGS/index.htm

OFS-18 PRIZE FOR HERIOT-WATT

Amanda Fender, a third year PhD student in Physics at Heriot-Watt University, was awarded First Prize for her poster at the 18th International Conference on Optical Fibre Sensors held in Cancun, Mexico in October. Amanda's poster was judged against student entries from the USA, Europe and Asia.

Amanda Fender (centre) receiving her award from Janice Walker (ISOE) and Dr Robert Lieberman (Intelligent Optical Systems)

OFS is the major international conference in the field of optical fibre sensing and Amanda attended to present her work on dynamic two-axis curvature measurement using multicore fibre Bragg gratings.

Amanda is with the Applied Optics and Photonics Group, supervised by Dr Bill MacPherson and Dr Jim Barton, and holds a studentship funded by EPSRC and AWE plc.
www.aop.hw.ac.uk/

www.cio.mx/WEB-OFS18/INDEX.html

SUPA READER IS SCIENCE WOMAN OF THE FUTURE

A SUPA academic and inventor who is pushing the boundaries of research to find a cure for dementia has won a prestigious award for "women of the future". Edinburgh University Reader Cait MacPhee won the science category at a business awards ceremony in London attended by Cherie Booth, the Prime Minister's wife and Ruth Kelly MP, Minister for Women.

Awarded a Royal Society Dorothy Hodgkin Fellowship while still a graduate research student, Cait is a highly respected young scientist with a real appreciation of research with potential applications in industry. Already involved in the founding of a start-up, Zyentia Ltd, she is widely published and thrives

Cait McPhee (right) accepts her award from Baroness Greenfield

in physics, now working on complexity in the Statistical Physics group in Edinburgh, which she joined recently from the Cavendish Laboratory at Cambridge University.

Dr MacPhee, who is also using nanotechnology to develop new materials for military and commercial uses, was one of seven women to be honoured in the awards. The winners were selected by a panel of judges chaired by Baroness Susan Greenfield, director of the Royal Institute. They chose Dr MacPhee for her excellence on every front, commenting that "she has a natural instinct for science and has had commercial and personal success, but also spends time training and motivating younger people."

www. womenofthefuture.co.uk/

PROFESSOR STEVE BARNETT, FRS

Professor Steve Barnett has been recently elected to a Fellowship of the Royal Society. He is Professor of Quantum Optics at the University of Strathclyde and is distinguished for his contributions to theoretical quantum optics and electrodynamics.

Prof. Barnett is best known for his work on the quantum theory of optical phase and for the discovery with David Pegg of the phase operator that bears their names. His work has also produced fundamental and patented advances in the development of strategies for the secure transfer and retrieval of quantum-optical information.

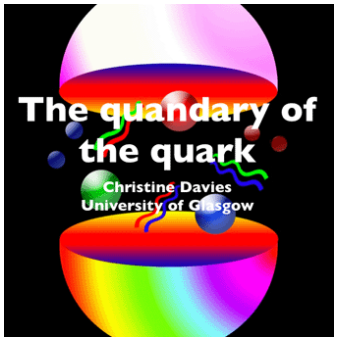
Prof. Barnett works in Quantum Optics in the very highly rated Computational Nonlinear and Quantum Optics Group at Strathclyde, which applies theoretical and computational approaches to investigate problems associated with the fundamental nature of light-matter interactions as well as the capabilities of nonlinear optical devices based on or using laser light. CNQO is one of the largest research groups in the department, with state-of-the-art computational facilities external connections for parallel calculation funded under collaborative multi-disciplinary projects. The group has extensive research collaborations with the EU via substantial European research grants, Australia, Japan, Russia, and the USA.

Within SUPA, Prof. Barnett has shared grants and jointly supervised projects with the Institute of Photonics and the University of Glasgow – combining his theoretical skills with those of experimentalists. Discussions are now under way on a new research programme in Quantum Imaging with Glasgow and Heriot-Watt.

cnqo.phys.strath.ac.uk/People/SMB/index.htm

PARTICLE PHYSICIST'S PRIZE LECTURE

Professor Christine Davies gave the 2006 Rosalind Franklin Prize award lecture to a large audience enticed to the Royal Society in December last year by an eyecatching illustration and an intriguing topic. At the event, Prof Davies was also presented with her medal and certificate.



Prof. Davies is head of the Particle Physics Theory group at the University of Glasgow and was awarded the prize in recognition of her successful numerical calculations in the theory of the strong force and her work for women in physics.

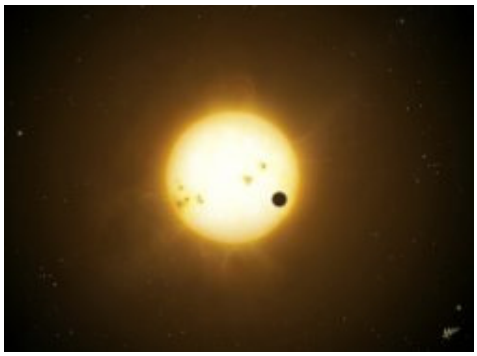
Prof. Davies's lecture was entitled 'The quandary of the quark'. 99.9% of the visible material in the universe is made of quarks and yet surprisingly little is known about them. For example, the mass of the electron is known to a tiny fraction of a percent; that of the up or down quarks has a factor of two uncertainty.

The reason for the difficulty is that quarks are never seen as free particles, but are inextricably bound together by the strong force that in turn holds the atomic nucleus together. This has been difficult to understand, but recent theoretical advances have meant that groups such as those of Prof. Davies are at last getting to grips with it.

For more on this fascinating topic, a video of Prof. Davies's lecture is available at www.theroyal society.org.uk/page.asp?id=3965

PLANETS IN THE SHADOWS

Astronomers from St Andrews have found two new planets deep in space using an inexpensive technique which hunts for stars that "wink".



Artist's impression of a 'hot Jupiter' during transit (Mark A. Garlick / markgarlick.com)

The St Andrews' team is part of an international collaboration which found the two new Jupiter-sized planets around stars over 1000 light years away in the constellation of Andromeda, and about 500 lights years away in Delphinus.

The collaboration uses wide angle lenses and cameras comparable in operation to normal digital cameras to survey million of stars across large tracts of the night sky. They recently joined forces with astronomers from France and Switzerland to pick out which "winks" were being caused by planets.

By pinpointing those stars which winked and measuring the gravitational pull of the unseen objects whose shadows were causing the winks, the astronomers were able to show that a transient dip in the brightness of an observed star was caused by an orbiting planet passing in front of it. The duration and depth of the dip in the light curve allowed them to measure the radius of the planets.

These planets are the first to be found during the UK-led SuperWASP (Wide Angle Search for Planets) programme and their discovery is being hailed as a significant breakthrough in the search for new planets orbiting distant stars. Named WASP-1b and WASP-2b, the planets are among the hottest ever found.

Approximately 200 planets around other stars are now known, but almost all of them were discovered using large telescopes costing tens of millions of pounds. This requires laborious study of one star at a time, in the hope of finding stars with planets around them. In contrast, the SuperWASP telescopes look at hundreds of thousands of stars at a time, allowing all those with transiting planet candidates to be identified in one go.

The two planets themselves are of a type known as 'hot Jupiters'. They are both giant gas planets, like Jupiter, the largest planet in our solar system, but they are much closer to their parent stars. Whilst Jupiter is nearly 800 million km from the Sun, WASP-1b is only 6 million km from its star and WASP-2b is only 4.5 million km from its star. The very close orbits mean that these planets are even hotter than Mercury, the planet nearest the Sun in our solar system.

The SuperWASP team are currently planning follow-up observations of the two new planetary systems with the Hubble Space Telescope and the Spitzer Space Telescope in order to measure more accurately the sizes and temperatures of the planets, and also to look for indications of any other planets in these systems.

star-www.st-and.ac.uk/astronomy/

Astronomers from St Andrews have found two new planets deep in space – using a budget search technique which hunts for stars that "wink".

NUCLEAR VISITOR FROM CHINA

Professor Jie Meng ,who holds the Cheung Kong Chair of Nuclear and Particle Physics at Peking University, Beijing, is to be a SUPA Distinguished Visitor with the experimental nuclear physics groups of Prof. Phil Woods, University of Edinburgh, and Prof. Robert Chapman, University of Paisley, next summer.

Prof. Meng is currently one of the world's leading nuclear theoreticians. He was appointed early to his chair at one of the two leading Universities in China, and also has substantial overseas experience.

The existing SUPA nuclear physics groups have no academics working on theory and Prof. Meng will help fill this gap, interacting closely with research students and delivering several guest lectures.

Prof. Meng's expertise in nuclear theory covers important issues relating to the properties of exotic nuclei, including halo and shell structures, nuclear shapes, and responses of nuclei subject to rapid rotation.

The Edinburgh and Paisley groups already have strong experimental programmes, and the collaboration with Prof Meng will lead to new ideas for them to explore.

www.paisley.ac.uk/es/physics/enp.asp

RS UNIVERSITY RF FOR HW

Dr Robert Hadfield will be joining Heriot-Watt University in January 2007 as a Royal Society University Research Fellow. He was previously with the University of Cambridge and the National Institute of Standards and Technology (NIST) in Boulder, Colorado, USA.

Dr Hadfield has extensive expertise in nanoscale superconducting devices. At NIST he carried out groundbreaking work integrating a new class of high-speed infrared single-photon detector, based on a superconducing nanowire into practical cryogen-free systems for applications in quantum information.

Dr Hadfield's work in SUPA will relate particularly to single-photon counting applications.

DRUG DELIVERY: TARGET AND DESTROY!

Scientists from the Universities of Dundee and St Andrews have won a major research grant to develop completely new technology for cell-by-cell medical treatments. The research is aimed at developing non-invasive surgical techniques using ultrasound and laser technology which could be used in cancer and gene therapies.

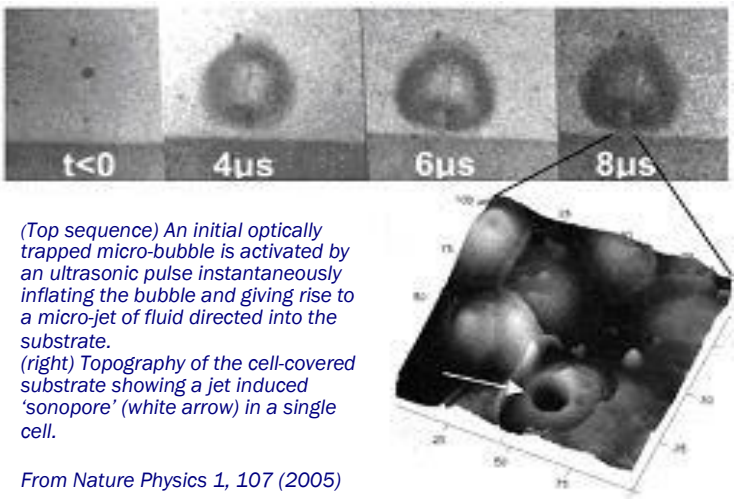
Professor Kishan Dholakia of St Andrews and Dr Paul Campbell of Dundee have each been awarded more than £1 million through the UK "Basic Technology" Programme, administered by the Engineering and Physical Sciences Research Council.

The grant announcement follows preliminary research over the past year, which achieved a notable breakthrough in 2005 in understanding how cancer cells can be targeted and destroyed by a single pulse of ultrasound using a "sniper rifle" approach developed from military technology.

Professor Dholakia and Dr Campbell, together with colleagues at their respective institutions, are now developing the techniques that originated in this research to create tools which will revolutionise the delivery of genes, drugs and therapeutic molecules to single cells and tissue samples. This new technology - utilising ultrasonics and photonics - promises to deliver a quantum leap for biologists studying the cell's chemical pathways and signals.

The basis of the new technology involves a somewhat unexpected property of light: when sharply focused, it can exert a tangible force on microscopic objects, acting as a miniaturised hand to grab hold of tiny objects, and controllably moving them to other locations in a process called "optical tweezing". Using this process, the scientists can gather arrays of cells and load them with molecules of choice, such as DNA or some other therapeutic agent.

Dr Campbell said, "The overriding objective of this project is to revolutionise the activation and delivery of genes, drugs and therapeutic molecules into live biological materials. Developing a means to controllably deliver drugs at remote anatomical sites, yet in a very non-invasive fashion, is a significant challenge of heightened academic and industrial interest. This is underscored by the market for delivery technologies which is estimated to be around $30bn in the USA alone."



(Top sequence) An initial optically trapped micro-bubble is activated by an ultrasonic pulse instantaneously inflating the bubble and giving rise to a micro-jet of fluid directed into the substrate.
(right) Topography of the cell-covered substrate showing a jet induced 'sonopore' (white arrow) in a single cell.

From Nature Physics 1, 107 (2005)

The ultrasound-based approach the scientists explored last year has now been augmented by a new technique developed at St Andrews using laser technology. "This dual approach allows us, in principle, to inject any molecule into any cell. Indeed, we have shown that even genetic material can be introduced into cells using the laser-based approach with successful downstream biological effects," said Professor Dholakia.

The Universities of St Andrews and Dundee jointly host the Institute of Medical Science and Technology, a research and development initiative concentrating on interface science (between biology, physics and engineering) for future interventional medical technologies.

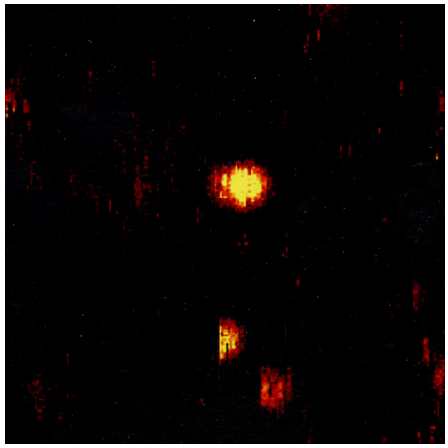
The collaboration between these disciplines is a key factor in the new project being led by Dr Campbell and Professor Dholakia, with key figures including Professor Sir Alfred Cuschieri, University of Dundee Medical School, and Professor Andrew Riches and Dr Frank Gunn-Moore, both of St Andrews University, supporting the research.

BIG MONEY FOR SMALL WORK

The University of Strathclyde has won a £5m award to expand its groundbreaking research into nanometrology – the ability to measure and characterise molecules.

The prestigious Science and Innovation Award is made up of £2.8m from the Engineering and Physical Sciences Research Council (EPSRC), £1.5M from the Scottish Further and Higher Education Funding Councils and £0.5M of institutional support.

The project is led by Professor David Birch, Head of the Department of Physics, in collaboration with Professor John Pickup's team at King's College London School of Medicine. The Strathclyde team includes Professor Duncan Graham, from Pure and Applied Chemistry, and Professor Martin Dawson, from Strathclyde's Institute of Photonics.



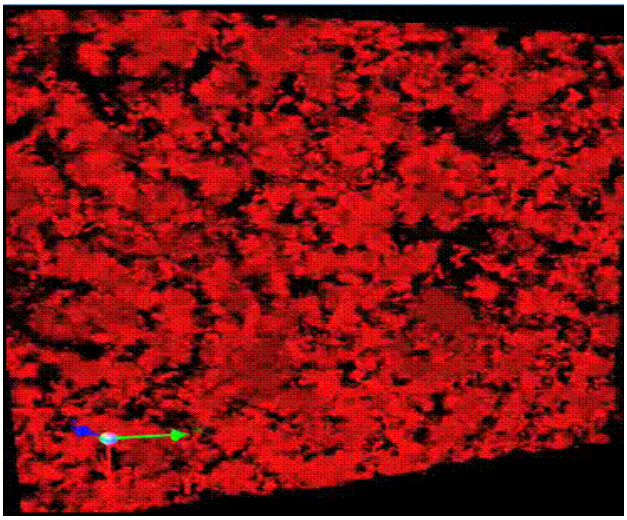
Single molecules in a sol-gel pore captured blinking like stars in a confocal image. Baseline scale is 50 nm.

Continued on page 7

DOUBLE FIRST FOR SUPA MEN

Professor Wilson Poon from the University of Edinburgh has just won more than £1M for a Senior Fellowship on the non-linear physics of driven colloids and bacteria. Along with another Senior Fellowship won earlier this year by Professor Ifor Samuel of the University of St Andrews, this makes SUPA unique in UK physics in simultaneously hosting two senior fellows.

Prof. Samuel's work is on advanced organic optoelectronic materials and devices. "The importance of light cannot be overstated: it allows us to see the beauty of the world around us as well as supplying the energy to our planet that supports all life. The purpose of my fellowship is to develop a new generation of optoelectronics, materials and devices which use light in combination with electricity" he said. "My work will focus on plastic-like organic materials which can be deposited in simple ways such as ink jet printing, to make solar cells, light-emitting diodes and lasers." Areas which will be explored include advanced materials, lasers and optical amplifiers, and medical applications.



An early-stage biofilm of bacteria reconstructed from laser scanning confocal micrographs. (Image courtesy of I. Robinson and G. Dorken)

Semiconducting polymers glowing under an ultra violet lamp

Light allows us to see the beauty of the world around us as well as supplying the energy to our planet that supports all life.

Prof. Poon's work is just as ambitious, involving experimental research to probe two kinds of driven system: dense colloidal suspensions and collections of bacteria. Colloidal suspensions comprises microscopic particles suspended in a liquid and their flow properties are both a fascination for fundamental science and important for applications which can be as simple as the way tooth paste behaves as a liquid when squeezed out a tube but as a solid when sitting on the tooth brush.

"My other work is devoted to the emerging area of statistical mechanics dealing with the study of 'agents' which result in novel collective behaviour. The entities can be mobile phones on a network, or stock brokers on a trading floor, but I am going to be looking at collections of bacteria" said Prof. Poon. "I want to find out about behaviour such as clumping to form 'biofilms' - complex two-dimensional bacterial 'cities' – and how these deal with 'cheaters' who take advantage of their neighbours."

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Continued from page 6

The Science and Innovation Awards aim to address the shortage of academics to lead future research in areas of strategic importance to the UK, and will fund recruitment and support for at least three lecturers, six research fellows and six PhD students.

The global market for nanotechnology is predicted to reach $1 trillion by 2015. However, without the ability to measure and characterise molecules at the resolution of a nanometre, much of the predicted potential of nanotechnology will go unrealised. The new field of nanometrology is still in its infancy but is widely seen as crucial to bridge the molecular measurement gap needed for the next generation of nanoscale devices.

The generic nature of the research means it will find diverse applications which span materials manufacture as well as molecular science and medicine. The Science and Innovation programme in nanometrology will help shape the future of important areas such as disease pathology, diagnostic tools in nanomedicine, and the design of new structural materials, while aiding knowledge transfer into the healthcare, chemical and instrumentation industries.

The project will be focused around the new Centre for Molecular Nanometrology, set up at Strathclyde in 2005 with over £2m investment. The Centre combines capabilities in physics and chemistry based on novel molecular properties for emitting and scattering light as means of revealing molecular structure and dynamics on the nanometre scale.

SUPA GRADUATE SCHOOL

GRADUATE SCHOOL IS UP AND RUNNING

Avril Manners, Director of the SUPA Graduate School

Greetings from the Grad School! Did you know that SUPA brings together internationally leading physics research across Scotland to form the largest physics grouping in the UK?

In the Grad School, we have over 400 Physics Postgraduate students.

A central part of the Graduate School strategy is the provision of a state-of-the-art video-enabled teaching rooms in each of the six SUPA partners and in the University of Dundee, at a total cost of £1M.

SUPA students have access to a comprehensive selection of advanced courses being delivered pan-Scotland by SUPA partners pooling expertise in the main theme areas of SUPA.

Learning Technologists

To support this activity, three Learning Technologists have been appointed underpinning our video-enabled teaching and developing e-learning materials. They have also set up My.SUPA — a customised learning portal for students and staff to enhance and support teaching, learning, communication and collaboration within the alliance.

Both the Graduate School Management Committee (GSMC) and the Research Strategy Group (RSG) have been instrumental in the development of the Graduate School curriculum covering technical courses and transferable skills under the Robert's Agenda.

In the first Semester, 22 lecture courses were available to students and over 200 students and staff were registered on My.SUPA. Enrolment for Semester 2 courses opened in the week commencing 20th November and closed on the 1st December.

Ambitious and wide-ranging

However, an activity as ambitious and wide-ranging as the SUPA Graduate School was unlikely to start without some hiccups and I would like to take this opportunity of apologising to staff and students who have experienced technical difficulties with the video-conferencing of lectures.

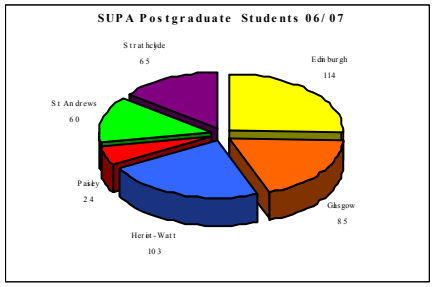
Delays in building work within the individual institutions resulted in us having to go live with lectures before the technology could be bedded in properly. Technical issues are being resolved between local teams, the supplier and the SUPA Learning Technology Team. Meantime I must just thank you all for your patience.

Workshops and Visitors

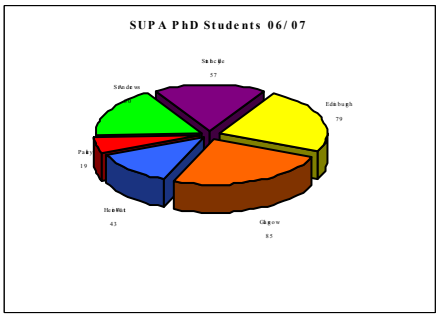
Since January 2006, we have also allocated £85,000 to fund Advanced Workshops, International Summer Schools and a Distinguished Visitor Programme.

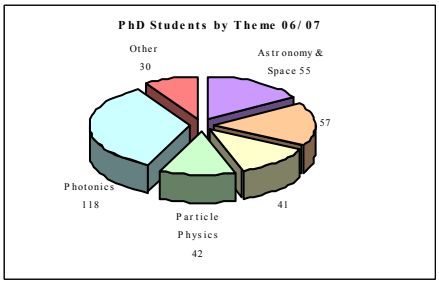
We welcome proposals for these activities from all researchers within SUPA. Applications should be submitted, for consideration by the GSMC, on standard forms available from the www.supa.ac.uk or from Kasia Kokowska and Joanna Richards at SUPA Central in Edinburgh.

More information is available from www.supa.ac.uk



Number of SUPA postgraduate students





Numbers confirmed to SUPA by departments Dec 06

PRIZE STUDENTSHIPS

The online SUPA Prize Studentship competition attracts very high calibre physics PhD students from around the globe and is in line with the Scottish Executive's 'Fresh Talent Initiative'; looking to recruit the best early stage researchers for Scotland from a worldwide market to come to Scotland and help drive the research agenda in physics.

Currently, a SUPA Prize Studentship covers fees, living costs of about £12,500 per annum for three years and £1,000 for travel and other costs per annum, with a review for 2007/8 presently under way to ensure parity with other funding bodies.

The competition has now run twice, with very successful results, recruiting high calibre students for SUPA from the UK, the European Union (EU) and from overseas (OS).

Applications are short listed by theme and then reviewed and ranked by the Graduate School Management Committee (GSMC).

In the first year, the Prize Studentship Competition had 127 applications from 34 countries and 10 studentships were awarded – 1 from the UK, 5 from the EU and 4 from OS across the SUPA themes, representing an expenditure of £150,000.

In its second year, the competition saw an increase in applications and countries represented with 186 applications from 50 countries. 8 studentships were awarded – 4 to applicants from the EU and 4 from OS across the SUPA themes, bringing the total expenditure to £315K.

SUPA Prize Studentships have now been awarded to outstanding students from the UK, Germany, Italy, France, China, Indonesia, the Czech Republic, Iran, Brazil and South Korea.

Continued on page 9

PRIZE STUDENTSHIPS

Continued from page 8

Recruitment for 2007/8 is already open with a deadline of 31 January 2007. There are 8 places available across the six themes - now including the Physics and Life Sciences. Given the calibre of applicants, SUPA would like to make more awards but the current funding does not allow this. However, this is being reviewed by the Executive Committee.

In addition, Physics Departments within SUPA have access to the ranked list of candidates through their GSMC representatives and may use this to allow other opportunities for funding to be sought.

MARIA UBIALI — SUPA PRIZE STUDENT

Maria and her husband are both studying for PhDs in Edinburgh

Maria Ubiali, a SUPA Prize Student, comes from Italy. She graduated in Milan in July 2005, her final work in the area of perturbative quantum chromo dynamics. In particular she dealt with the Landau pole in the context of resummation of large enhanced contributions in the soft region. She is now researching this subject in depth in the field of the parton distributions functions with her supervisors, Richard Ball and Luigi Del Debbio.

Both Maria and her husband are doing their PhD in Scotland. They started to submit applications for studentships in January 2006 and were planning to get married in September 2006.

They were both glad to discover that the university that offered most opportunities for European students was the University of Edinburgh, because they both anticipated an attractive lifestyle in the capital of Scotland.

They married in Italy on 2nd of September and, immediately after the wedding party, left for Scotland in their car, completely filled with their worldly possessions.

They enjoy living in Edinburgh, not only because of the spectacular beauty of Scotland and its capital, but also for the good relationships with the people they have met and work with here.

Scottish Universities Physics Alliance (SUPA)

Prize PhD Studentships

SUPA
Scottish Universities Physics Alliance

The Scottish Universities Physics Alliance (SUPA) is offering up to 8 fully funded PhD studentships for outstanding students from anywhere in the world. The alliance brings together internationally leading physics research across Scotland to form the largest physics grouping in the UK. Major research themes being pursued are astronomy, condensed matter and material physics, nuclear and plasma physics, particle physics, photonics and physics and life sciences.

These prestigious and competitive awards are intended to attract outstanding students to study for a PhD in Scotland. Applicants will be registered for a PhD in physics at one of the participating Universities namely Edinburgh, Heriot Watt, Glasgow, Paisley, St Andrews and Strathclyde. An excellent training environment will be provided by the SUPA Graduate School, giving candidates access to a wide range of courses across Scotland.

THE UNIVERSITY OF EDINBURGH

UNIVERSITY of GLASGOW

HERIOT WATT UNIVERSITY

UNIVERSITY of PAISLEY

University of St Andrews

UNIVERSITY OF STRATHCLYDE

Applications should be made at www.supa.ac.uk

by 31 January 2007

SUPA KT OPENS UP OPPORTUNITIES

SUPA KNOWLEDGE TRANSFER

Knowledge Transfer (KT) was included as an important part of the original SUPA proposal. However, unlike the research themes and Graduate School, no specific mechanism or resources were identified to realise it.

Subsequently, a KT Team has been set up, comprising academic representatives from each of the SUPA universities, and representation from Scottish Enterprise and the university KT Offices. Contacts have also been made with the relevant UK Research Councils and their staff attend on invitation. Care was taken to ensure that the academic representation also covered each of SUPA's technical themes.

Working with great enthusiasm and entrepreneurial vision, as befits its background and interests, the KT Team first developed a statement of what it wanted to do, then set about obtaining resources to realise this. There was an immediate realisation that the present KT activity in SUPA was not very well understood. This would obviously hamper managed development. Therefore, with the help of Scottish Enterprise, funding was obtained for an Opportunity Study.

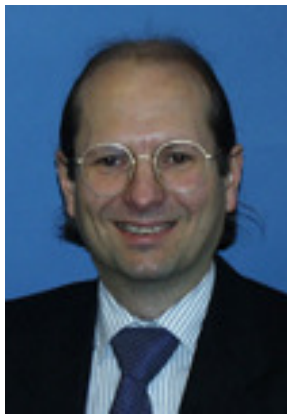
This study has taken place over the past few months. It involved over 50 interviews with staff in SUPA and more than 10 interviews with industry leaders and staff in the Research Councils and the government's Department of Trade and Industry.

The Opportunity Study has clearly identified that SUPA already plays a substantial role in underpinning technical industrial activity with major collaborative research programmes. Nevertheless, significant opportunities to expand KT activity have been highlighted. The biggest and surest of these in the next 2—5 years is to develop multi-£M research programmes relying on SUPAs joint capabilities and with a very high degree of collaboration with industry. Technically, the Life Sciences, Optical/ Electronic Components/ Subsystems, and Chemicals/Materials sectors were highlighted as most promising.

In addition, SUPA has a strong track record in Intellectual Property development and the Opportunity Study highlighted the possibility of between 10 and 20 new businesses or licensing deals leading to £50M or more of annual product revenues in the next 2—5 years.

The next stage in the development of KT activities in SUPA is to turn the Opportunity Study into an action plan. Funding has already been obtained to support this activity, along with resources from the six university KT Offices.

The action plan will respond to the study recommendations and, in particular, will consider the steps to be taken to realize funding for a number of full-time SUPA KT staff following the pattern successfully established in the SUPA Graduate School.



Prof. Julian Jones, Chair of the SUPA KT Team

These staff will be led by a SUPA KT Development Director. They will be embedded within SUPA and will interact closely with the existing KT Offices specifically to support the development of large collaborative programmes with public and industry funding from the UK, the EU and elsewhere.

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PARTICLE PHYSICS

SUPA THEME NEWS

A lot has happened in the Particle Physics theme since the start of SUPA. All six SUPA funded appointment have been completed: three lecturers and one advanced fellow in theory (Tilman Plehn, Luigi del Debbio and Dominik Stockinger in Edinburgh and John Cambpell in Glasgow) and one lecturer (Victoria Martin at Edinburgh) and an advanced fellow (Samir Ferrag at Glasgow) in the experimental PPE groups. Recently, Edinburgh appointed two more theory lecturers (Thomas Binoth and Peter Boyle), and the Glasgow PPE group made a teaching buyout for Val O'Shea through the Astronomy and Space Physics theme.

With these posts the phenomenology effort has been considerably strengthened. This allows us to exploit the physics at the Large Hadron Collider (LHC), both within the Standard Model of particle physics (Higgs boson) and beyond (Supersymmetry models, e.g. MSSM). The QCDOC supercomputer ("QCD On a Chip") is a parallel computer purpose-built for lattice quantum chromodynamics (QCD) calculations and was designed and built jointly by Edinburgh, Columbia,

Continued on page 10

Prof. Franz Muheim, SUPA Theme Leader in Particle Physics

SUPA THEME NEWS

SUPA IN SPACE

The past year has seen an enormous amount of activity within the Astro-Space theme in SUPA.

Nine new SUPA-funded appointments have been completed - a reader (Jane Greaves) and three advanced fellows (Christianne Helling, Aleks Scholz, Ettore Pedretti) in St. Andrews, a lecturer (Ken Rice) and two advanced fellows (Wing-Fai Thi and Adam Woodcraft) in Edinburgh, and a teaching buyout (Val O'Shea) and an advanced fellow (Calum Torrie) in Glasgow.

Two major new pieces of equipment have been purchased. The first is a new Silicon £150k Silicon Graphics supercomputer. Sited in St. Andrews, it will be available to all researchers within the theme, and in particular is expected to facilitate collaborative simulation work in both cosmology and planet formation. The second equipment is a cryogenic test facility purchased by the new SUPA-TEOPS Fellow at UK ATC/Edinburgh University (Adam Woodcraft) to enable characterisation of novel materials for astronomical, gravitational wave and particle physics instrumentation at temperatures down to 4K.

Seven new Graduate Course modules have been developed and are currently being delivered in the fields of: Advanced Astronomical Technology, Introductory Astrobiology, Physics of Astronomical Disks, Advanced Cosmology, Gravitational Wave Detection, Astrophysical Plasmas, and the Science of SETI.

SUPA-led astrophysics research highlights have included:

- Discovery of the most distant massive galaxies in the universe (McLure et al. 2006)
- Commencement of UKIDSS, the largest infrared survey ever undertaken (Lawrence et al. 2006)
- Publication of the ESA-ESO working group report on fundamental cosmology (Peacock et al. 2006)
- Computational demonstration that large planet building material may grow in the spiral waves present in self-gravitating discs around young stars (Rice et al. 2006)
- Confirmation of the extreme fast electron energy budget in solar flares (Fletcher et al. 2006)
- Successful flight of a new SUPA-funded astrobiology experiment on the ESA parabolic flight campaign by Helen Fraser (Strathclyde)

Currently discussions are underway within the theme as to how best to bid for future SUPA funding in order to further develop the recognised strengths in cosmology, exoplanets, gravitational waves, solar physics, survey astronomy, and astronomical instrumentation. One attractive option involves the development of a new detector centre at the UK Astronomical Technology Centre, which could provide a focal point for new SUPA developments in astronomy, gravitational wave research and experimental particle physics.

Prof. Jim Dunlop, SUPA Theme Leader in Astronomy and Space Physics

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PARTICLE PHYSICS

Continued from page 10

RIKEN and IBM. Since last year QCDOC has been operating at Edinburgh and first results have been presented. Christine Davies of Glasgow was awarded an OBE for services to Science.

The experimental groups are preparing for the LHC at CERN in Geneva which will start operation in 2007. The Glasgow group has produced several hundred silicon detector modules for the ATLAS experiment which will hunt for the Higgs boson. The SUPA post has allowed the group to focus on the Higgs analysis. Both PPE groups are jointly measuring the properties of 550 Hybrid Photo Detectors, the photo sensitive devices for the LHCb Ring Imaging Cherenkov detectors. The LHCb experiment will make precision measurements of CP violation in mesons containing bottom quarks.

SUPA funding contributed to SUSSP61, a Scottish Universities Summer School on “Neutrinos in Particle Physics, Astrophysics and Cosmology”. SUSSP61 was organized by SUPA physicists and held at St. Andrews in August 2006. Recently, the Edinburgh group organized a workshop on “LHC Physics Beyond the Standard Model” and BUSSTEPP 2006, the 36th British Universities Summer School in Theoretical Elementary Particle Physics.

The SUPA particle physics training programme was the first one established for the SUPA Graduate School. 19 courses with about 130 lectures were run successfully in 2005/06. This is arguably the best particle physics training programme in the UK.

The particle physics theme has decided to make the International Linear Collider (ILC) the highest priority future project. The appointment of Victoria Martin allows us to broaden our activities. In order to become a major leader in the ILC and we are currently preparing a bid for future SUPA funding.

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SUPA THEME NEWS

CONDENSED MATTER AND MATERIAL PHYSICS

Much has happened since the start of SUPA within the theme of Condensed Matter and Material Physics and some of the most important developments are highlighted here.

Andrew Huxley, appointed last year to the Chair in Quantum Ordering at Extreme Conditions (QOEC), has been busy setting up laboratories in both Edinburgh and St Andrews, where new low temperature apparatus has been ordered and will be installed soon. This is a potent symbol of the collaborative potential unleashed by SUPA.

Meanwhile, Richard Nelmes from Edinburgh University has won the IoP Duddell Medal and Prize 'for pioneering new techniques and instrumentation that have transformed high pressure science'.

Maureen MacKenzie from Glasgow University won a prize for the best paper at the Third International Symposium on High Dielectric Constant Gate Stacks, and Rosalind Allen from Edinburgh won the Harrison Memorial Prize of the RSC.

SUPA CMMP theme members, primarily at Glasgow, are involved in two major new spintronics projects, one an EPSRC funded consortium to address spin effects in metal-based systems at room temperature and the other an EU Framework 6 project on current-induced magnetic switching. They are also involved in a consortium that gained renewed funding from EPSRC for the SuperSTEM project, the UK's aberration-corrected scanning transmission electron microscope.

At Strathclyde, a team led by David Birch has gained £5M for nanometrology - the ability to characterize and measure molecules, relevant to CMMP as well as the Photonics theme— as featured elsewhere in SUPA News. Neil Hunt, also from Strathclyde, has won an EPSRC Advanced Fellowship for work on ultrafast 2D IR and Robin Perry, from St Andrews but moving to Edinburgh, a Royal Society University Research Fellowship to study quantum ordering.

New SUPA-funded academics Chris Pickard and Paul Clegg have gained grants from EPSRC, while Andy Mackenzie, the Theme Leader, won a Leverhulme Study Abroad Fellowship and is using it to establish new collaborations between SUPA and Cornell, Stanford and Kyoto.

Following the similar success by Ifor Samuel last year, the EPSRC Senior Fellowship won by Wilson Poon will allow him to expand his activities at the physics/biology interface, while maintaining full involvement in the CMMP Nanocolloids initiative.

Prof. Andy MacKenzie, SUPA Theme Leader in Condensed Matter and Material Physics

Within that initiative, SUPA Advanced Fellows have now been appointed in Edinburgh, St Andrews and Glasgow and various new collaborative projects are getting under way.

Not surprisingly, given all this activity, there is a sensation across the CMMP Theme of taking pause for breath. The next job is to make sure the new collaborative structures, particularly within the QOEC and Nanocolloids initiatives, really are working properly while keeping an eye on future funding opportunities.

Within a field as large and as diverse as CMMP, it is of course a challenge for the "theme team" to foster the genuinely inclusive atmosphere that will bring the most benefits to SUPA. We would particularly welcome suggestions as to how better to achieve this.

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NUCLEAR AND PLASMA PHYSICS

As with all the established themes in SUPA, there has been very significant activity in Nuclear and Plasma Physics.

Plasma Physics at Heriot-Watt is centred on microwave-driven plasmas in low pressure gases to synthesise thin-film materials, from diamond to polymers. Recently the production of thin-film Si solar cells on textiles has been accomplished.

Strathclyde's Atoms, Beams and Plasmas (ABP) group collaborating with St Andrews and CCLRC, RAL, has recently simulated auroral kilometric radiation in laboratory experiments confirming the predictions that the mechanism is horseshoe velocity-space instability. Using novel surface photonic bandgap structures to provide two dimensional distributed feedback, the Strathclyde ABP group has achieved 60 MW of coherent mm wave output from a new free electron laser.

The ABP group also provides free electron laser theory and modelling expertise for the UK 4GLS project at CCLRC. The ABP group's creation of the leading computational Atomic Data and Analysis Structure (ADAS) addresses plasmas ranging from the interstellar medium through the solar atmosphere and laboratory thermonuclear fusion devices to technological plasmas. Following successful application of ADAS to the JET tokamak and its adoption by the majority of the internationally leading plasma laboratories,

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SUPA THEME NEWS

NUCLEAR AND PLASMA PHYSICS

Continued from page 12

ADAS is now being further refined to analyse ITER, the world's largest plasma project.

The Laser Driven Nuclear Physics team at Strathclyde is working towards their vision of a laser accelerator for applications to medicine (proton therapy), transmutation studies (spallation) and developing beams for pion, muon and neutrino physics. This is also coupled to ELI, a European initiative (2012-2014) to develop an exa/zetawatt laser system.

The TOPS team at Strathclyde leads a project to evaluate the use of laser-driven plasma waves as compact accelerators and new high power light amplifying media. The group has recently demonstrated the use of a plasma echelon, produced when two waves collide in a plasma channel, as an efficient broadband amplifier to amplify laser pulses with durations of several tens of femtoseconds.

SUPA activity in Nuclear Physics, based on collaboration between Edinburgh, Glasgow and Paisley, takes in work at many different sites internationally.

Significant advances have been made in measuring, for the first time, the magnetic moment of excited nucleons at the Glasgow Tagger in Mainz, Germany. A "complete" experiment to unravel the structure of the nucleon using polarised photon beams, targets and recoil polarimetry at the Crystal-Ball facility at MAMI is being designed. The first experiment on Generalised Parton Distributions in the nucleon using the new HERMES Recoil Detector has started at DESY in Hamburg/ Germany and will take data until summer 2007. At CLAS in Jefferson Lab (JLab) in the US, the hunt for pentaquarks goes next year by setting up a new frozen spin target for data taking next year. In 2006, the charge distribution within the neutron was successfully measured out to very high four-momentum transfers using the Dutch/US/UK large acceptance spectrometer BigBite in Hall A at JLab. The Glasgow design of the new GlueX photon tagger at the 12 GeV upgraded CEBAF accelerator was recently accepted by an international committee at JLab. GlueX will search for exotic hybrid mesons (excited gluons) and is expected to start generating data in 2014.

Another long-term project, the Antiproton-Proton Annihilation Experiment, PANDA, at Darmstadt has also made good progress in the search for new forms of hadronic matter, charmed hybrids and glueballs. PANDA is the hadron physics flagship project at the €1.2B Facility for Antiproton and Ion Research, FAIR, in Germany. Glasgow leads the magnetic spectrometer project, Edinburgh and Glasgow are in charge of the forward particle identification and Edinburgh and Paisley have finished the design of the Nuclear Structure

DESPEC implantation detector at FAIR's Super Fragment Separator.

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Prof. Guenther Rosner, SUPA Theme Leader in Nuclear and Plasma Physics

SUPA PALS GET TOGETHER

Following a suggestion from its Advisory Committee that SUPA should strengthen its focus on physics in biology and medicine, the first SUPA meeting on Physics and Life Sciences (PALS) was held at Strathclyde University on 10 October, including fifteen technical presentations and some vigorous discussion.

Like the existing themes, thinking on the future of SUPA PALS has been energised by the joint £30M bid to the Scottish Funding Council along with other themes, floated by the Chief Executive, Ian Halliday.

The meeting included presentations by fifteen SUPA academics covering a wide range of topics. Some people chose to present a broad overview, with Wilson Poon talking on "Biological Physics @ Edinburgh" and John Girkin, Strathclyde University, on "Photonics in the Life Sciences: the Next Ten Years". Others chose to focus more specifically, such as Jason Crain, Edinburgh University, on "Physics in drug discovery: structure and properties of aqueous peptides" and Miles Padgett, Glasgow University, on "Non-invasive monitoring of oxidative stress". It was also good to hear from Paul Campbell of Dundee University, talking about "Therapeutic ultrasound: a novel route to non-invasive surgery".

Overall, the presentations amply illustrated the diversity of PALS work in SUPA and the potential for funding in this area. They were followed by lengthy discussion on how to make progress over such a vibrant by also diverse range of topics. The result was a clear vote to form two working groups, one on physics concepts and instrumentation to improve the understanding of biological systems and the other on novel physics infrastructure to improve the delivery of existing biological needs. Each of the working groups includes representation from the six SUPA universities, as well as Dundee, in recognition of its strong PALS activity and is now developing proposals to take forward PALS in SUPA.

Further information on SUPA PALS is available from the Chief Executive's office, contact joanna@supa.ac.uk.

SUPA FOR NEWCOMERS

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The **Scottish Universities Physics Alliance** brings together internationally leading physics research across Scotland to form the largest academic physics grouping in the UK, with more than 1,000 people.

Major research themes include Astronomy and Space Physics, Condensed Matter and Materials Physics, Nuclear and Plasma Physics, Particle Physics, Photonics and Physics and Life Sciences.

The Scottish Universities Physics Alliance has brought together the Physics research activity of six Scottish universities. These are Edinburgh, Glasgow, Heriot-Watt, St Andrews, Strathclyde and Paisley. The University of Dundee is also part of the Graduate School.

The complete range of activity across SUPA is overseen by the Executive Committee, on which all six universities are represented. It is assisted by four other committees.

- The Graduate School Management Committee looks after Graduate School matters, including the very important Prize Studentship scheme.
- The Knowledge Transfer Team has the task of progressing SUPA's KT agenda.
- The Research Management Committee and Research Strategy Group are responsible for the development of research in SUPA.

Research in SUPA is structured around five established themes: Astronomy and Space Physics, Condensed Matter and Material Physics, Nuclear and Plasma Physics, Particle Physics and Photonics. Each theme has a leader and a team drawn from the SUPA universities.

SUPA also has an international Advisory Committee which meets twice each year to review progress and suggest ways to develop SUPA as a whole. For example, last time the Advisory Committee met, it suggested the new theme in Physics and Life Sciences.

SUPA is a very large organisation, with more than 1,000 people engaged in physics research, including more than 200 academic staff. Together, these people bring in around £30M in research funding each year.

Although SUPA is large, its staff is very small. The Chief Executive is Ian Halliday and the Graduate School Director is Avril Manners. There are also three full-time web development staff for the Graduate School and two adminstrators, Joanna Richards, and Kasia Kokowska. Most of these people are located in Edinburgh, in offices now known affectionately as SUPA Central.

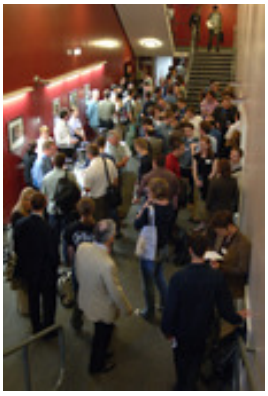
More details can be found at www.supa.ac.uk

SUPA CONFERENCE 2007

Following a very successful event in 2006 at the University of Strathclyde, (*pictured, right*) the SUPA Conference 2007 will take place in Edinburgh on Thursday 14 June.

Keep your diaries clear and watch out for announcements of exciting speakers and a packed day of discussion about all the important topics in Physics in Scotland.

www.supa.ac.uk



SUPA NEWS

This edition of SUPA News was put together by the Editor with great assistance from Kasia Kokowska and Joanna Richards at SUPA Central and contributions from all the SUPA institutions.

Ideas for future editions include adverts for situations vacant (studentships and research and academic posts), requests for collaborators in SUPA, a SUPA calendar of events, a list of who's who in SUPA and profiles of interesting SUPA people.

If you have any comments or suggestions or have an interest in contributing to future editions, either with articles or editorial support, please address them to:

The Editor at newsletter@supa.ac.uk.

University of St Andrews · The University of Edinburgh · University of Glasgow · Heriot-Watt University · University of Paisley · University of Strathclyde