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The Sun
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For the first time in history a stunning view of the whole Sun is visible to the world. The unique 360° view of the Sun was unveiled on Sunday 6 February after NASA’s two STEREO (Solar TErrestrial RElations Observatory) spacecraft were aligned exactly opposite each other on either side of the Sun.

The 360° coverage from STEREO is enhanced by NASA’s SDO (Solar Dynamics Observatory) mission which images the Sun in high resolution. As the STEREO probes continue flying to the far side of the Sun, the area of unseen solar territory on the near side will increase, and SDO’s cameras will play a vital role in filling the gap. Working together, these new views of the Sun will allow scientists to better predict space weather and the violent eruptions from the Sun’s surface. These can damage satellites, disrupt communications and disable power systems on Earth.

The UK, including STFC scientists and engineers, has provided essential expertise and technology to both SDO and STEREO. The instruments for both missions use cameras designed and built at STFC’s Rutherford Appleton Laboratory. http://stereo.gsfc.nasa.gov/

The Solar Stormwatch project allows members of the public to use images from the NASA STEREO to spot the explosions from the sun and the resulting clouds of particles as they make their way towards the earth. These particles, at their most disruptive, can cause communications to fail and lead to cuts to power supplies.

Visit to watch the latest Backstage science video: http://www.stfc.ac.uk/Public%20and%20Schools/22497.aspx
The International year of Chemistry, 2011 will celebrate the achievements of chemistry and its contributions to society. 2011 is the 100th anniversary of the award of the Nobel Prize in chemistry to Mme Marie Sklodowska Curie - it will also provide an opportunity to celebrate the contribution of women to science. Marie Curie was the first person honoured with two Nobel Prizes—in physics and chemistry. She was also the first female professor at the University of Paris.

100th anniversary of the discovery of superconductivity.
Discovered by Heike Kamerlingh Onnes in 1911, superconductivity is a phenomenon observed in some metals and ceramic materials. When these materials are cooled to temperatures ranging from near absolute zero to liquid nitrogen temperatures they have no electrical resistance.

The magnetic properties of superconductors have been useful in a large variety of applications. Superconductor’s magnetic properties have been used in particle accelerators such as the Large Hadron Collider at CERN. The very high electric currents possible in superconducting wires mean that very powerful electromagnets can be made. These are used in magnetic resonance imaging (MRI) machines.

STFC brings industry and academia together
The 21st annual Machine Evaluation Workshop took place at the end of 2010. Led by STFC’s Computational Science and Engineering Department (CSED), the event strengthens links between industry and academia in the high performance computing community.

As part of the Engineering and Physical Sciences Research Council (EPSRC)’s Distributed Computing Support Programme, the Workshop encourages closer contact between the research communities from EPSRC’s mathematics, chemistry, physics and materials programmes and the major vendors of computational equipment. As well as enabling scientists to discuss their future requirements with HPC suppliers, the event also facilitates industrial participation.

This year’s keynote speaker was Jack Dongarra, Distinguished Professor at the University of Tennessee and Turing Fellow at the University of Manchester. Renowned for his work in establishing the Top500 list of supercomputers, Professor Dongarra emphasised the need for a change in focus from hardware to software development for the next generation of supercomputers.

2011 will no doubt have discoveries and milestones but this will also be a busy year to mark celebrations of the past. 

Rutherford Centenary
Ernest Rutherford, (30 August 1871 – 19 October 1937) was a New Zealand-born (British) chemist and physicist. The link to Rutherford is not just in the name. Although part named in his honour the work of Rutherford Appleton Laboratory STFC would not be possible without his pioneering research.

Often described as the father of nuclear physics his discoveries and papers still influence research work undertaken today. Lord Rutherford made substantial contributions to the understanding of radioactive decay, identifying the alpha particle as a helium atom and was awarded the Nobel Prize for Chemistry for this work in 1908. His most profound work was in developing the nuclear theory of the atom and the backscattering experiment that bears his name to prove this. He also produced the first artificial disintegration of elements by showing that nitrogen atoms colliding with alpha particles decay to oxygen and hydrogen.

During this year several events will be happening to honour the work of Lord Rutherford. Look for these in future editions of Fascination.
Strong support for STFC science from Government

In December 2010, the Government announced the financial allocations for STFC and the other UK research councils for the next four years, and STFC published its 2011-15 Delivery Plan outlining our science and technology programmes, and our plans to continue to help strengthen the UK’s science base while maximising the economic, societal and international benefits of our research for the UK.

After a tough negotiating process that began in May and included the October Comprehensive Spending Review announcement, the UK’s science and research budget received the government’s undoubted support in the form of a flat cash settlement. Against a backdrop of spending reductions across almost all spending departments STFC Chairman Professor Michael Sterling welcomed the budget outcome.

“Our settlement is extremely welcome and recognises government’s strong support for our science and technology, although the next four years will not be without challenges. STFC and its research communities are well positioned to deal with these – we carried out a thorough prioritisation of our programme in 2009 which focused on our highest priority activities.”

The STFC Delivery Plan includes a commitment towards continuing a world-class research programme in astronomy, particle physics and nuclear physics, as set out in our 2009 science prioritisation process. These include the Large Hadron Collider at CERN, European Southern Observatory telescopes, R&D for the E-ELT and SKA and grant support for additional projects.

Our Delivery Plan is structured around the findings of the 2010 Drayson Review, which partitions our budget into three groups: international subscriptions; domestic large facilities; and; the core programme of science, technology and enabling support. The partitioning ensures that financial pressures on subscriptions or facilities will not affect research grants to university-based academics. In addition, STFC and Government agreed a process to reduce or eliminate the foreign currency fluctuations arising from our membership of major international scientific organisations, such as the European particle physics laboratory CERN or the European Southern Observatory (ESO) organisation. Negotiations with these bodies also led to reduced cost pressures over the next four years.

Our large facilities – the Diamond Light Source, Central Laser Facility, and ISIS pulsed neutron/muon source – are operated on behalf of all the research councils, and are now funded under a cross-Council agreement based on the planned needs of researchers. Our funding allocation allows full operation of the Diamond Light Source, but reduced operation of ISIS and the Central Laser Facility from current levels.

We are committed to maintaining resource spending on research grants to keep studentship numbers at a constant level whilst at the same time introducing a new Fellowship scheme and Student Enhancement Programme which aim to nurture future research leaders. The Delivery Plan also sets out the Council’s commitment to new activities aimed at inspiring the next generation of scientists and improving the public’s understanding of scientific advances. We will also introduce additional funding schemes to support Global Challenges, innovation, and collaborative R&D through the redirection of £16m into these areas.

Given the changes that will take place within the STFC programme over this period, the Council has committed to ensuring that its organisation is aligned and restructured to match its priorities and current activity levels, resulting in a tighter focus on laboratory activities and the establishment of new Campus Centres.

The STFC Delivery Plan is available online at http://www.stfc.ac.uk/resources/pdf/DP2011-15.pdf
Many, if not most, organisations that undertake drug research and development have access to X-rays, nuclear magnetic resonance (NMR) and other core crystallography and spectroscopy techniques. Neutron sources are in short supply which largely explains the limited use to date of neutrons in the drug discovery and development process.

STFC's ISIS neutron source uses neutrons to provide unique insights into the arrangement and behaviour of atoms and molecules in a material. It explores the properties of matter by measuring the locations of atoms and the forces between them.

Neutron scattering was of great use for Dr David Barlow, a principal investigator at King's College London's Pharmaceutical Biophysics Group, who is conducting retrospective drug discovery research into the mode of action of amphotericin B. Amphotericin B has been the first line of defence against fungal infections since the mid 1950s, but unfortunately resistance is beginning to emerge. This is of grave concern because immuno suppressed people such as AIDS and chemotherapy patients often get fungal infections, which become a problem if they spread to the lungs or circulatory system. The normal route to replacement drugs would be to examine compounds that have a similar mechanism of action. The problem is that amphotericin B’s mechanism of action is not properly understood, meaning a return to first principles of drug discovery and development is necessary.

The effects of amphotericin B are well documented – it punches holes in the fungal cell walls, and the leaky cells then die. This could potentially happen to a patient’s cells but the drug has a much higher selectivity for fungal cells, so at normal doses side effects are minimal and tolerable. However, the raised doses necessary to overcome resistance mean the side effects can become problematic. Quite how amphotericin forms holes in the cell walls is not entirely clear, but one idea concerns one of the key components of cell walls, sterol. Fungal cell membranes contain ergosterol rather than cholesterol. It’s thought to be the preferential interaction of amphotericin B with the fungal sterol that confers the drug selectivity.

Dr Barlow’s research aims to find out precisely why this difference between cholesterol-containing and ergosterol-containing cell membranes is critical, and why, therefore, amphotericin B is so damaging to fungi and not to humans. The research uses liposomes, prepared using different mixtures of fats and either cholesterol, ergosterol or some other kind of steroid, so that they mimic fungal or human cells. The structures of the membranes surrounding these liposomes, and how they were altered when saturated with amphotericin B, were studied using the Loq instrument at ISIS, the most successful time-of-flight SANS (small angle neutron scattering) instrument in the world.

“Interestingly, we found that they were equally affected. However, this experiment only investigated the end point as the drug was delivered directly to the membrane. We’re now looking at the preceding steps to see how the drug would normally get taken up by the membrane – this maybe where the difference in fungal and human cells lies,” says Dr Barlow.

www.isis.stfc.ac.uk
The question of how the Universe evolved following the Big Bang into its highly structured state of stars, galaxies and clusters of galaxies is a key question for modern cosmology. Much of the intervening period is hidden from view during the so-called cosmic dark ages and it is only after the first stars ignited that the Universe began to be visible once again.

To be able to make such observations a telescope of unprecedented size would be required. The largest optical telescope planned is the European Extremely Large Telescope (E-ELT). Current major ground-based telescopes have mirrors ranging between 8-10 metres in diameter. The mirror for the proposed E-ELT will have a diameter of 42 metres.

A telescope of this size would need to be ground-based rather than space-based and yet its imaging qualities must approach those of a space telescope. This means overcoming the effects of looking through atmospheric turbulence above a ground-based telescope. The technology to do this has been under development for the last twenty years or so and is called Adaptive Optics. This technique uses special mirrors that can adapt themselves to cancel the evolving atmospheric distortions at speeds of many hundreds of times per second.

To survey the early Universe efficiently much larger fields of view must be corrected simultaneously. This is the role of the EAGLE instrument, which is being designed in France and the UK, and which will be able to look in detail at 20' targets at a time, each one of which will be separately corrected for atmospheric distortion. This new technique is called Multi-Object Adaptive Optics and it has just been demonstrated on-sky for the first time by members of the EAGLE team at the William Herschel telescope on La Palma.

The William Herschel Telescope has a 4.2 metre diameter primary mirror and is therefore exactly one tenth of the size of the future E-ELT. The new technical demonstrator system for EAGLE is called CANARY.

CANARY has been used for the first time and the results were a spectacular success. The new technology of Multi-Object Adaptive Optics worked the first time it was used, and furthermore it operated at the hoped-for performance level. The figure shows the image of a test star with the correction system switched off and then with it working. The corrections were applied 250 times per second using information gathered from three other stars some distance from the test star. This information was used to infer the correction required in the direction of the test star and it is this crucial ‘tomography’ of the atmosphere above the telescope that is the novel achievement of CANARY.

The next phase of the CANARY experiment will be to replace the natural guide stars with artificial guide stars generated in the atmosphere using powerful lasers. Such laser guide stars are essential for operating EAGLE on the E-ELT. Laser guide stars have been used before, but never to perform tomographic measurements - this will be a first for CANARY.

CANARY was built and operated by Observatoire de Paris LESIA, the UK Astronomy Technology Centre, and the Centre for Advanced Instrumentation at Durham University. Funding came from STFC, CNRS, and the EU Framework 7 Programme.
The idea of using hydrogen to replace fossil fuels is not new, but Cella Energy Ltd, a brand new spin out company from STFC’s Rutherford Appleton Laboratory, has developed a novel technology that allows hydrogen to be stored in a cheap and practical way, making it suitable for widespread use as a carbon-free alternative to petrol.

Hydrogen, which produces only pure water when burned, is considered an ideal solution to cutting carbon emissions from petrol, which are estimated to cause 25 per cent of all carbon release in the UK. Until now, attempts to store it have not been consumer friendly so this has not been a viable option.

Currently, storing hydrogen requires either high-pressure cylinders at up to 700 times atmospheric pressure or super cooling to a liquid at -253oC.

Scientists from STFC’s ISIS neutron source, working with the London Centre for Nanotechnology at University College London and the University of Oxford, have developed a way of making tiny micro-fibres 30 times smaller than a human hair. These form a tissue-like material that is safe to handle in air and which contains as much hydrogen for a given weight as the high pressure tanks currently used to store hydrogen.

The new material can also be made in the form of micro beads that can be poured and pumped like a liquid. It could be used to fill up tanks in cars and aeroplanes in a very similar way to current fuels, but crucially without producing the carbon emissions.

“In some senses hydrogen is the perfect fuel; it has three times more energy than petrol per unit of weight, and when it burns it produces nothing but water. But the only way to pack it into a vehicle is to use very high pressures or very low temperatures, both of which are expensive to do. Our new hydrogen storage materials offer real potential for running cars, planes and other vehicles that currently use hydrocarbons on hydrogen, with little extra inconvenience to the driver”, said Professor Stephen Bennington, ISIS, and lead scientist on the project.

Cella Energy Ltd, which already has one investor in specialist chemical company Thomas Swan & Co Ltd, is seeking further partners to help commercialise their products.

http://www.cellaenergy.com/

NEWSFLASH

Cella Energy has been named as the national winner for the Shell Springboard Awards 2011. Cella won £40,000 for developing this technology.
First IMAGES from LOFAR

Fascination issue 2 described the installation of LOFAR at the STFC’s Chilbolton Observatory in Hampshire. LOFAR (Low Frequency Array), which is co-ordinated by ASTRON in the Netherlands, is a network of radio telescopes designed to study the sky at the lowest radio frequencies accessible from the surface of the Earth with unprecedented resolution.

For the first time it was connected to others across Europe and has delivered its first ‘radio pictures’. The images of the quasar 3C196 (a black hole in a distant galaxy) were taken in January 2011.

The UK based telescope, is the western most ‘telescope station’ in LOFAR. The addition of Chilbolton to other stations in Europe makes the LOFAR array almost 1000 km wide - ten times as large as the original array in the Netherlands - and creates the largest telescope in the world.

“The images show a patch of the sky 15 degrees wide (as large as a thousand full moons) centred on the quasar 3C196 “, said Dr Philip Best, Deputy LOFAR-UK leader from the University of Edinburgh. “In visible light, quasar 3C196 (even through the Hubble Space Telescope) is a single point. By adding the international stations like the one at Chilbolton we reveal two main bright spots. This shows how the International LOFAR telescope will help us learn about distant objects in much more detail.”

LOFAR was designed and built by ASTRON in the Netherlands and is currently being extended across Europe. As well as deep cosmology, LOFAR will be used to monitor the Sun’s activity, study planets, and understand more about lightning and geomagnetic storms. LOFAR will also contribute to UK and European preparations for the planned global next generation radio telescope, the Square Kilometre Array (SKA).

http://www.lofar.org/

Technology Breakthrough:

Niobium SRF Technology

One hundred years after superconductivity was discovered, Superconducting Radio Frequency (SRF) has become the preferred technology for the design, development and construction of many large international experimental machines. A collaboration between experts at the STFC and Shakespeare Engineering Ltd, has given the UK the technical capability to supply key specialist components for these large international experimental facilities.

Until now there has been no manufacturing capability for SRF in the UK. However, collaboration between Shakespeare Engineering Ltd and ASTeC, STFC’s accelerator science and technology division, means that the UK will soon be able to bid for work to supply SRF technology components for light source and particle accelerator projects around the world. The market for supplying highly specialised technology for the construction of next generation light sources and particle accelerators could be worth £1billion globally over the next 10 years.

ASTeC and Shakespeare, in association with Jefferson Laboratories in the USA, have just reached a significant milestone in this collaboration, by completing the design, manufacture and validation of the UK’s first bulk Niobium SRF accelerating structure. Niobium SRF technology is a highly efficient way of accelerating beams through particle accelerators to very high energies and is a core technology in current and future particle accelerators. However, it is a highly specialised technology as the Niobium material must be extremely pure for accelerator applications, and any impurities will significantly limit acceleration performance.

Funded by STFC, the Mini Innovations Partnership Scheme (Mini-IPS) is designed to transfer technology and expertise developed by STFC scientists and engineers to the marketplace in partnership with UK industry and other academic disciplines.
Beyond the geopolitics

Rare Earth metals are a group of 17 elements widely used in high-tech goods and low carbon technologies across the world.

China has enjoyed a dominant market share of their extraction and export for many years now, but its recent moves to reduce export quantities and increase prices to market value have led commentators to speculate on the security of the supply of the elements that go into everything from high-powered magnets to touch screen phones.

Global rare Earth metal production currently operates at around 124,000 tonnes, in contrast to basic metals such as Zinc, which is approx. 11.1 million tonnes. Although China highly dominates this export market, Russia, Brazil and Vietnam all contribute to the world’s supply on which Japan, the US, UK and the EU are all 100% dependent. Due to their application, most UK manufacturing only requires small quantities of these materials for their downstream products; however the potential shortages of ‘rare Earths’ (as they are more commonly known) such as neodymium and dysprosium (used in higher quantities for high field magnets) are far from trivial for the world’s high-tech manufacturing. Indeed, as Brazil, Russia, India and China continue to grow, global demand is predicted to dramatically increase to 205,000 tonnes by 2015.

The House of Commons Science and Technology Select Committee have launched an inquiry into this issue which will hope to raise awareness of this issue and direct the UK Government response.

Alternative supplies do look like becoming available however, as despite their name rare Earths are found in deposits in the Earth’s crust across the globe. In the US and Australia, the previously closed mines of Mountain Pass (USA), Mount Weld and Nolans (both Australia) all containing rare earth deposits are due to be re-opened shortly with their production reaching the international markets by 2013/14. As such, it is hoped that physical exhaustion of these resources will become unlikely, and the UK’s supply needs met.

What remains uncertain for scientists worldwide however is the finite resources of other vital elements that support much of the world’s leading scientific research. Supplies of isotopes such as Helium-3 (He3), obtained mainly from the decay of Tritium, are finite, highly valued and very difficult to obtain.

He3 is used in cryogenics, medical imaging scanners and by all neutron facilities across the globe. Indeed, it is a vital material for these multi-million pound public investments, like the STFC’s ISIS facility. ISIS, which completed its Target Station 2 (TS2) upgrade in 2009, uses the gas in neutron detectors. Fortunately, given that the current price of He3 is three times that of gold, it already has a supply to last for 10-20 years.

Given the rising cost of He3, Professor Robert McGreevy, Head of the ISIS Diffraction Division, believes that were the ISIS TS2 project to have been delayed by as little as three years, then “we would have faced real difficulties in either acquiring or affording this vital material. Other new neutron facilities, such as that at J-PARC in Japan, were much less fortunate.” The intricacy of the problem is also magnified by the complex, technology dependent design of these facilities, which means that finding an alternative material capable of delivering the same level of performance is highly difficult.

In a bid to tackle this problem the ISIS detector group has joined forces with other groups from across the world, including those in Germany, Japan and the US to look for a solution. Working as an international collective, the scientists aim to test and evaluate the alternatives to find a common and sustainable solution, and whilst the rare earths debate grabs the attention of Westminster, scientists world-wide are thinking about what will come next after Helium-3. Indeed, even the much more common isotope Helium-4, used to inflate party balloons, is now being considered as a potential strategically important material.
Lasers scan the barcodes on our shopping and read the data from the DVDs we watch. Laser light in optical fibres carries the world’s communications and internet traffic. Lasers manufacture the silicon chips in our computers, music players and games consoles. Lasers cut, weld and drill materials as diverse as steel, fibreglass and even chocolate. They can, in the hands of surgeons, even cut and weld us.

Lasers remain a major scientific research tool across all branches of science and engineering, from physics and chemistry to medicine and molecular biology. They can, when required, dramatically change the state of matter, but they can also reveal detailed information about its atomic, molecular and structural properties.

The work undertaken at STFC’s Central Laser Facility (CLF) covers a broad range of topics from investigating complex biological reactions within cells to examining new ideas for future production energy.

The CLF’s largest lasers can be used, for example, to recreate the extreme conditions found in stars. High-power laser pulses are focused down to a tiny spot where the temperature reaches millions of degrees and the pressure rises to billions of atmospheres. CLF scientists are working with these lasers to develop practical schemes such as the harnessing of nuclear fusion as a source of abundant, safe energy. In contrast, the ultra-short pulsed lasers at the CLF can follow transient changes in atoms and molecules, even tracking the subtle and complex reactions of biomolecular species in living cells.

Over time, lasers have been developed from a scientific concept to have huge and diverse impact on our daily lives.
**New microscopic techniques help to develop improved chicken vaccines**

A collaboration between BBSRC and STFC-funded scientists has been using a new form of low energy laser microscopy to observe how poxviruses interact with components inside live cells. Genetically modified fowl pox viruses have been used extensively in Mexico and south east Asia to vaccinate chickens against bird flu and the scientists hope that the technique will help them develop more effective vaccines that reduce the chances of healthy birds acting as a reservoir for influenza virus. The research was published in the December 2010 edition of the "Journal of Virology".

Dr Stan Botchway of the STFC Rutherford Appleton Laboratory who developed the advanced microscopy technique and worked on the study said: "The type of microscopy we used to study the viruses interacting with the chicken cells is particularly valuable for several reasons. For example, by using near infra red laser light we are able to see deeper into cells and tissues and observe them for a long time, even over days without damaging them. This allows us to observe how all of the different proteins interact without disturbing the process by firing high energy lasers at them. Also, the technique doesn't require us to extract the proteins from the cells before we determine the protein interaction, which is the method used in nearly all laboratories currently."

Improved vaccination against bird flu is especially important because the current H5N1 type is both highly contagious and has a high mortality rate in birds. It is widely estimated that at least 200 million domestic birds have either died or been culled as a result of H5N1. H5N1 virus also presents a risk to human health. Over 500 cases have been identified in people, resulting in 300 deaths. Most of the cases so far have been in rural Asian populations where cases may be under-reported and there is an ongoing fear that the virus may evolve the capacity to spread from person to person causing an influenza pandemic.

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**New technology offers prospect of better bone disease diagnosis**

Scientists and medics are set to test a unique technology which could help in the early diagnosis of conditions such as the painful brittle bone disease. The technology, which uses a novel laser technique devised by STFC’s CLF, is to be tested for the first time with NHS hospital patients.

The Spatially Offset Raman Spectroscopy (SORS) instrument, the first to be commercially available, was delivered to the Institute of Orthopaedics and Musculoskeletal Science, University College London (UCL) on the Royal National Orthopaedic Hospital (RNOH) site in Stanmore, Middlesex. The machine, which is being supplied by Cobalt Light Systems Ltd, will undergo testing to assess its usefulness with the long term aim of developing a specialist medical device to diagnose and detect early signs of diseases such as brittle bone disease and osteoarthritis.

The instrument will be used to take measurements on volunteering patients coming in for routine appointments for specific bone disorders that have already been diagnosed. The measurements will test the way the technology works and the methods used for analysing the results. If successful, this could lead to preventative measures being taken at an early stage of disease development and the improved monitoring of the effects of treatments. At the moment brittle bone disease, a genetic bone condition, is often diagnosed after multiple painful fractures have already occurred to newborn babies.

The instrument was developed for bone scanning through collaboration with the CLF’s spin out company, Cobalt Light Systems Ltd, and the Institute of Orthopedics and Musculoskeletal Science at University College London, one of the UK’s specialist centres for bone disorders.

Rolls-Royce were the first researchers to use a brand new facility at Diamond to help develop one of their latest turbofan engines, the Trent 1000. The new engine powers the Boeing 787 Dreamliner and is due to enter service in 2011. Rolls-Royce used Diamond’s newest research station, an addition to the Joint Engineering, Environmental and Processing (JEEP) beamline, to assess the effectiveness of local surface treatments.

The new research station can create molecular-scale 3D images of large objects such as aerospace and engineering components, and explore their structure in atomic-scale detail.

Professor David Rugg, Material Specialist at Rolls-Royce, explains the benefits of the JEEP beamline to the company’s materials research programme: “The use of advanced materials in safety critical applications requires a high level of understanding and good predictive capability. To this end, improved material characterisation with respect to the evolution of microstructure, crystallographic texture and residual stress is planned by Rolls-Royce. This will be conducted mainly via research programmes with leading academics using the JEEP beamline.”

Rolls-Royce apply a surface treatment to the base of the fan blades on some of their Trent engines to provide additional integrity margins. The treatment works by imparting a compressive stress into the surface of the fan blade root, effectively reducing potential for the initiation and propagation of cracks. Rolls-Royce used JEEP to examine the effectiveness of the treatment.

The team of researchers from Rolls-Royce and Diamond used energy dispersive X-ray diffraction to examine the stresses within the fan blade. They focused a powerful beam of multi-wavelength X-rays onto the contact area of the fan blade root. The X-ray beam is diffracted by the sample, producing a spectrum with characteristic intensity peaks at specific photon energies. The position of these peaks provides information about the structure of the sample. Shifts in peak position are used to measure internal strains, enabling the researchers to measure the extent of the compressive strain.
A bright future for three new businesses

As STFC’s I-TAC facility reaches its first anniversary three innovative start-up companies, each aiming to make the world a better place by addressing the world’s greatest global challenges, have been awarded free access to the unique cutting-edge research facilities and expertise.

PV Glaze, BiSN and Chris Underwood are all winners in a challenge run by STFC’s Futures team, which seeks to exploit scientific research to find solutions to the government’s grand challenges in energy, environment, healthcare and security.

The I-TAC Futures Challenge was aimed directly at any UK company involved in research and development within the global grand challenge areas. Each winner has received six months free access to their own dedicated, fully equipped laboratory at Daresbury’s Innovations Technology Access Centre (I-TAC), which provides unrivalled access to more than £3m cutting edge scientific research facilities. In addition to this, the winners will have access to all of the wider benefits associated with moving on to the Daresbury Science and Innovation Campus, including STFC’s scientific expertise and the business development support of the Daresbury Innovation Centre.

About the three winners

BiSN is a newly formed, highly technical service company serving the oil and gas industry. At I-TAC, BiSN will be carrying out a study on enhanced oil recovery, with a view to enabling better access to oil reserves which have previously been abandoned and facilitating the extraction of oil from them, resulting in more efficient use of resources. The study will allow BiSN to offer its clients a more complete service, and will put BiSN in a position to offer cutting-edge services to the worldwide oil and gas industry.

PV Glaze is developing a renewable energy technology using silicon-based cells that can convert solar radiation into electricity. Normally opaque due to the nature of their materials, these transparent, high clarity solar modules, known as Building Integrated Photo-Voltaics, will enable such renewable energy technologies to be better incorporated into the construction of buildings, motor vehicles and agricultural greenhouses, resulting in less CO2 in the air and less reliance on imported fuels.

Dr Chris Underwood is working on a novel design for a Vascular Access Graft, a type of artificial blood vessel which is implanted in the arms of people who require lifesaving dialysis. Incorporating a new type of biomaterial, this product is intended to prevent some of the common complications currently associated with this procedure and the unique materials technology being used has the potential to lead to improved product designs for other cardiovascular applications as well, such as bypass grafting in the legs or around the heart. Access to I-TAC will enable Dr Underwood to make the prototypes to prove his design concept and go on to develop other related products, including some for use in the emerging field of tissue engineering.

Fascination will be reporting regularly with updates from the winners. In addition to these first prize winners, the Futures team will also be announcing runners up who will receive one or two months access.
To tie in with the BBC’s Stargazing Live! programmes in January, STFC organised an event with support from the Wiltshire Astronomical Society, Swindon Stargazers and Hitachi Europe. 800 people turned out to learn about science, space and the stars at a Dark Sky event at Lacock, Wiltshire on 8 January.

The picturesque village of Lacock has been seen in the Harry Potter films and TV period dramas such as Cranford and Pride and Prejudice, but is also situated under some of the darkest skies in southern England, making it an ideal spot for stargazing – but that wasn’t all that was on offer at this event. In the afternoon talks about missions to the Moon and Mars and the latest research findings from these were supplemented by a talk by TV archaeologist Julian Richards about how astronomy has guided people for millennia, with particular reference to Stonehenge. There was also an opportunity for people to get upclose to samples of meteorites, rocks and samples they’d brought along themselves using the latest Hitachi electron microscope, to build and launch their own (water-powered) rockets, to discuss whether it was worth people trying to go to Mars at a Café Scientifique and do some daytime observing of the Sun through specially adapted telescopes.

But the real excitement came as darkness fell and the stars and planets became visible. An excited hubbub arose as queues of people formed at telescopes to see Jupiter and its moons and Saturn and its rings. There were guided tours of the constellations in a clear night sky and for those for whom the crisp night air had proved too chilly, an indoor planetarium show gave tours of the heavens in a little more comfort.

Events at the Royal Observatory Edinburgh Visitor Centre were also very successful with everyone enjoying superb views of Jupiter and its moons. Thanks to the fantastic publicity from the BBC series and website, public observing nights at the Centre are now fully booked through to March. These hugely popular events are the latest successes in the STFC’s award-winning Dark Sky programme.

http://www.darkskydiscovery.org.uk/
Enjoying the activities at Lacock, members of the public view the skies.
Microvisk Technologies

In the last issue of Fascination we told you about Microvisk Technologies; a successful spinout from STFC. We are pleased to update you that Microvisk have announced that they have completed a further internal funding round in December 2010 for £6M – this brings the fund raising total for 2010 to £10.5M which is believed to be the highest amount raised in 2010 in the UK for a pre revenue biotech company.

SET FAIR Standard

STFC has been nationally recognised for promoting and encouraging gender diversity in its staff. The SET Fair Standard, awarded by the UK Resource Centre for Women in Science, Engineering and Technology, recognises and celebrates progress in developing inclusive workplaces. The award was announced by Nicola Blackwood MP, during a visit to the STFC Rutherford Appleton Laboratory on 11 February 2011.


The STFC Annual Report is now available to view on line: http://www.stfc.ac.uk/3434.aspx