

Innovations

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Credit: ESO | Borissova

Photo release - VISTA telescope reveals 96 star clusters

96 new open star clusters, hidden from previous surveys by the dust in the Milky Way, have been revealed by the sensitive infrared detectors of the world's largest dedicated, infrared, survey telescope, VISTA. Based in Chile, the telescope is operated by the European Southern Observatory (ESO). This is the first time so many faint and small clusters have been found at once.

The full press release and high resolution images are available on the ESO website

STFC sponsors astronomy in the UK and manages the UK subscription to ESO.

The VISTA telescope is a UK contribution to ESO as part of the UK accession arrangements.

STFC invests in cutting-edge design for astronomy research

Following peer review, STFC has agreed to provide almost £0.5M in new investment for design studies leading to new capabilities for ground-based telescopes.

The proposed instruments will focus on studying two of the most pressing questions in astronomy:

- how did galaxies (and especially our own galaxy) form and evolve?; and
- what is the nature of Dark Energy?

The developments will exploit STFC's current investments in the European Southern Observatory, the Isaac Newton Group of Telescopes in the Canary Islands and in US-led facilities in North and South America, with unique capabilities.

They will form part of the essential follow-up to the European Space Agency's Gaia mission, to be launched in 2013. Gaia aims to map our own galaxy in exquisite detail, allowing astronomers to piece together its development and understand how the solar system fits within it. The UK is leading the development of on-board software for Gaia data analysis, supported by the UK Space Agency.

In recent years, our understanding of the mysterious 'Dark Energy' has improved, but we are still a long way from fully characterising this force which may make up around 75% of the energy density of the Universe and is driving its accelerated expansion. New, dedicated, instruments on ground-based telescopes will allow us to study the growth of structure and hence dark energy, through all-sky galaxy surveys.

The Very Large Telescope (VLT)



These new instruments will also be able to trace the assembly history of galaxies over virtually all of cosmic time, decoding the physical processes that shape their evolution.

The instruments will require novel, but extremely practical applications of optical fibre technologies allowing the light from stars and galaxies to be captured and analysed by highly sensitive spectrographs. Optical fibre experts at Durham University and technologists at STFC's UK Astronomy Technology Centre (UKATC) and RAL Space will work to determine the optimal designs. Scientists at the Universities of Cambridge, Edinburgh, Oxford, Portsmouth and and University College London (UCL) will lead on aspects of optical design, software development and science exploitation. Professor John Womersley (STFC's Director Science Programmes) said the investment "*confirms STFC's continued support for cutting-edge astronomy and for the UK's advanced technology capabilities*".

STFC and its international partners will review the proposals when the design studies are completed, in around 18 months, to decide which of the projects go forward to full construction.

Joint STFC Futures and BIR workshop - Cancer Care: New Detector and Sensor Technologies and their Potential Impact

5 - 6 October 2011
STFC Rutherford Appleton Laboratory
Harwell Oxford

The Futures Programme of the Science and Technology Facilities Council (STFC) and the British Institute of Radiology (BIR) are holding a joint workshop on cancer care research. The purpose of this workshop is to bring together the cancer care community and the research community funded by STFC in areas where there is significant potential for STFC to contribute, and begin the formation of collaborative research partnerships.

During the workshop the STFC will describe its plans for launching a new Futures Network funding initiative to enable researchers from the different communities to engage and develop collaborative projects.

The workshop will be held over two days at the STFC Rutherford Appleton Laboratory, with a working dinner held during the evening of the first day.

The number of workshop participants will be limited to 100 and we aim at achieving a balance between the cancer community and the research community.



Second STFC Environment Futures Workshop

26 and 27 October 2011
Second announcement

The STFC Futures Programme is holding a second workshop on environmental research which will build on the outputs from the November 2010 workshop and the current Environment Review by the STFC Physical and Life Sciences advisory committee.

The purpose of this second workshop is to bring together the STFC and environmental science communities in areas where there is significant potential for STFC to contribute, and begin the formation of collaborative research partnerships.

This workshop will focus on the following six initial research areas, some of which map directly onto planned NERC research programmes or areas of potential future development:

- bioinformatics
- tropical forests
- radioactivity
- space weather (improved forecasting and early warning)
- pollution (of land, water and atmosphere)
- geological repositories (for carbon and nuclear waste storage)

There will also be some discussion of research opportunities not covered by these six headings.

During the workshop the STFC will announce an opportunity for Network funding to enable researchers from the different communities to engage and prepare joint bids for project funding.

The workshop is open to researchers supported by the STFC through grants or facility access, collaborative partners, STFC staff and members of the environmental science community.

The workshop will be held over two days at the Open University, Milton Keynes, with a working dinner held during the evening of the first day.

The number of workshop participants will be limited to 50 and we aim to achieve a balance between the NERC and STFC research communities. In the case that the event is oversubscribed selection will be made on the basis of alignment of research interests with the workshop programme.



Using ESRF to understand proteins that cause disease

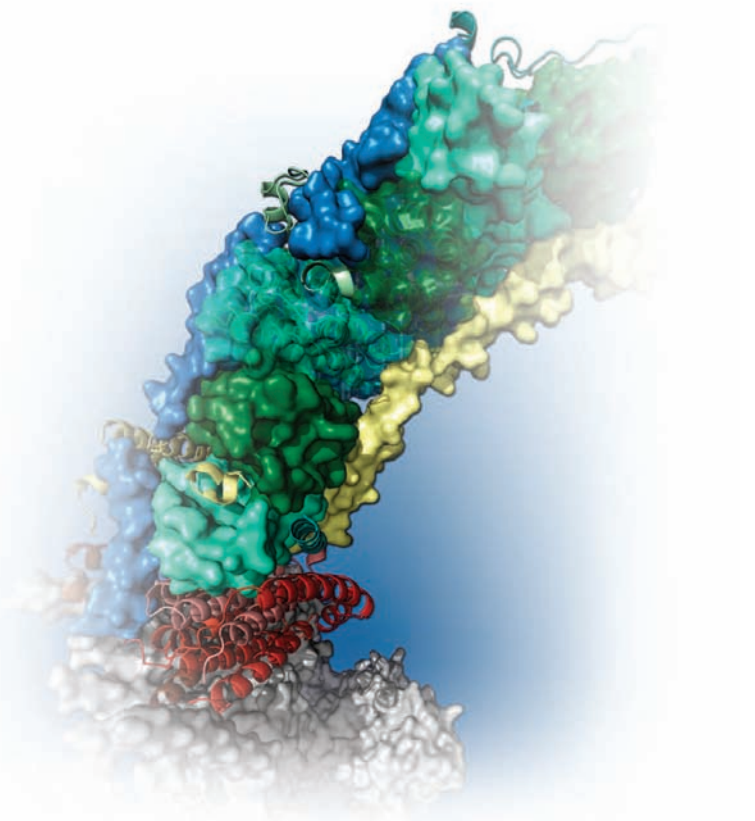
Researchers from MRC Cambridge have used the ESRF to study the structure of 'Respiratory Complex I' where genetic defects can cause disease. This knowledge should greatly help the scientists developing drugs against mitochondrial diseases.

Scientists from the University of Liverpool are linking up to Europe's most intense terahertz light source at Daresbury's ALICE accelerator, with its state-of-the-art tissue culture centre and beamline to understand the effects of terahertz (THz) rays on human cells. This improved understanding of human cells could eventually lead to significant advances in human development and the understanding of diseases, including melanomas and oesophageal cancer.

Defects in mitochondrial DNA are one of the most common types of human genetic disorder. They occur in about 1 in 5,000 of the population and the majority of these disorders involve complex I. So far there is no treatment for these debilitating diseases, which include neurological impairment, deafness, blindness, muscle weakness and cardiovascular disease.

Complex I, due to its sheer size, resisted the efforts to determine its structure for a long time. Now a group at the MRC Mitochondrial Biology Unit in Cambridge (UK), led by Dr. Leonid Sazanov, succeeded in determining the atomic structure of the membrane-embedded part of the protein, involved in many of the diseases. Knowing the structure of the protein helps us to understand the molecular basis of the disease, which is a starting point for drug development to treat these diseases.

UK access to ESRF is funded by STFC.



The structure of the membrane domain of respiratory complex I from *E. coli* is shown in colour and the aligned hydrophilic domain of complex I from *Thermus thermophilus* in grey. Complex I is a large molecular proton-pumping machine. Its structure is strongly suggestive of a mechanism that involves conformational coupling via connecting elements acting like a coupling rod in a steam engine, driving symmetry-related domains instead of wheels. Credits: Rouslan Efremov and Leonid Sazanov, MRC

Their results were published in *Nature*, advanced online publication, 7 August 2011, DOI: 10.1038/nature10330.

For the full story, visit the ESRF website

Triple success for STFC at the UK Energy Innovation Awards 2011

STFC is celebrating triple success following the announcement of the winners of the Energy Innovations Awards 2011. STFC's Innovations Technology Access Centre (I-TAC), Atmos Technologies Ltd and Cella Energy Ltd each scooped a prestigious first prize award in their categories at The Hilton Deansgate Hotel in Manchester, 23 June 2011. The awards celebrate outstanding achievements of individuals and organisations across the UK that are leading the way in energy innovation and sustainability.

STFC's Innovations Technology Access Centre (I-TAC) scooped the Best Service Provider Award. Based at the Daresbury Science and Innovation Campus (DSIC), I-TAC is a pioneering establishment that enables high-tech SMEs and researchers to access state-of-the-art technology that is rarely available to anyone but big budget companies. Only just over a year since it was established, almost one third of I-TAC's tenants are heavily involved in the energy sector. Most of these have experienced significant benefits as a direct result of being based within I-TAC, whether as a result of the unrivalled access to the facilities and expertise on-site, the networking opportunities available or the successful funding opportunities which have arisen as a result of being based there. Since it opened, I-TAC tenants have secured in total more than £270,000 in funding and investment and have created 18 new jobs.

One of these tenants, Atmos Technologies Ltd, also picked up the New Energy Generation Award. Atmos Technologies is developing innovative economic, efficient and non-toxic methods of generating hydrogen from sea water using sunlight energy. On collecting his award, Jeff Boardman, Managing Director of Atmos, praised I-TAC for the essential role it has played in enabling Atmos to win the award. [more](#)



Triple success for STFC at the UK Energy Innovation Awards 2011

Martin Morlidge, I-TAC Manager said: *"It is fantastic to see I-TAC recognised at the Energy Innovation Awards for our service provision, which also included helping Atmos Technologies, who won an award for their own research and development. This caps a highly successful year for I-TAC. We are all extremely happy and proud to have won."*

Cella Energy Ltd, a new spin out from STFC's ISIS facility at its Rutherford Appleton Laboratory in Oxfordshire, also prevailed winning the Consumer Benefit Award. Cella Energy is developing revolutionary technology that allows hydrogen to be stored in a low-cost, safe and practical way, making it suitable for widespread use as a carbon-free alternative to petrol or diesel.

Catherine Ewart, Head of STFC's Futures Programmes said: *"Energy is a key research challenge for the UK and, through its Energy Futures Programme, STFC is making major efforts to address this challenge by helping to find and support new and innovative ways to deliver secure, clean and efficient energy. It is fantastic news for STFC to be so closely associated with the success of the three award winners yesterday."*

Now in its second year, the Energy Innovation Awards is run by the Energy Innovation Centre, a partnership between CE Electric, Electricity North West, Scottish Power, Scottish & Southern Energy, NWDA and EA Technology Group.



RAL Space rovers roam the Science Museum

RAL Space robotic rovers were given extra tasks last week when they visited the Science Museum, London. Between the 2nd and 4th August, the five rovers were given centre stage in the Antenna Gallery as part of the museum's, "Spend your summer in Space" activities. Positioned underneath the IMAX Cinema, the rovers attracted huge attention, with 2,600 members of the public visiting the event and taking part in activities.

Aron Kisdi, Wayne Tubby and Christina McQuirk, of the RAL Space Robotics Team, gave expert guidance and supervision to visitors eager to operate the rovers. Visitors found out about Robotics at RAL Space and the difficulty in operating rovers remotely. Children were also able to try their hand at manoeuvring the rovers, giving simple commands to navigate a course and retrieve and return samples to base control.

Intense activity over such a short period, coupled with some lively and enthusiastic operators, bent more on speed and collision, tested the rover's robustness. Fortunately, their durable design and engineering proved they were more than a match for these tasks, with all five rovers running smoothly throughout the workshop. The Robotics Team were delighted with the fleet's performance and now move on to the next stage of development.

Space activities are taking place at the museum throughout the summer holidays, details can be found on the Science Museum's website

www.stfc.ac.uk/Public+and+Schools/1281.aspx



Coldest Place in the Solar System for Edgcam Components

Telescope components created through Edgcam and manufactured on a 2.5-axis Bridgeport Interact milling machine have to perform in the coldest place in the Solar System.

The UK Astronomy Technology Centre (UKATC), based in the Royal Observatory on a hill overlooking Edinburgh, builds scientific instruments for the world's biggest and most powerful telescopes, for use both on the ground and in space.



As a world leader in their field, astronomer Dr John Davies says the UKATC specialises in equipment that has to be operated at extremely low temperatures. "A lot of our instruments work in the infra-red section of the spectrum, and in order to operate effectively they have to be supercooled, often below minus 200° Celsius."

One instrument assembled from numerous components manufactured through Edgcam Computer Aided Manufacturing software, has to operate at even lower temperatures. The core of a new generation wide-field sub-millimetre camera known as SCUBA-2, for the James Clerk Maxwell telescope on a 14,000 foot mountain in Hawaii, has to work at a fraction of a degree above Absolute Zero (defined as 0° on the Kelvin scale, minus 273.15° Celsius, and minus 459.67° Fahrenheit).

Dr Davies says: "When this instrument is turned on, its insides are not only the coldest place on the planet, they are the coldest place in the Solar System."

UKATC 's components have to be manufactured to very high tolerances to ensure they will work constantly in such out-of-this-world conditions. "A lot



of care has to go into precision machining and precision assembly, to account for the levels of contraction and expansion. Some of the instruments are 2 – 3 cubic metres in size, which is a lot of metal that has to be slowly cooled down for operation, and then slowly warmed up again. As these are essentially optical instruments which bounce light inside from mirrors and gratings, everything has to contract in a controlled way so that everything is still lined up to micron-type precision when they're cold."

A completed assembly comprises a number of parts, ranging from just two or three, right up to 100 or more. Instrument technician George Davidson says Edgcam gives them the reliability of manufacturing high quality components every time on their Bridgeport 2.5-axis and Haas 5-axis milling machines. "It's vital to our manufacturing process. We'd be lost without it; it's the be all and end all for producing CNC codes for our machines, which on average are in action for 4 days out of 20." [more](#)

Coldest Place in the Solar System for Edgcam Components

For the Bridgeport, the Edgcam features they find most useful include pocketing, roughing cycles, profiling cycles and hole cycles. Autodesk Inventor files are easily imported into Edgcam, where George Davidson and his team set the datum positions, apply the tools and generate the CNC code. *"It really is that simple, and the time for programming a part can be as little as 10 minutes. I've never had an issue with Edgcam not producing absolutely reliable, accurate cnc code."*

The team of three technicians are also impressed with Edgcam's automatic notification when any existing parts have been altered. *"If a part is up-issued by the design office we can see instantly what has changed – it might be a hole position, or the overall size of the part might have changed. It's then very easy to make the required modifications."*

Much of the work they have done so far on their recently-acquired Haas has been 3-axis where they have moved from standard datum indexing to an angular datum through using the trunion. A post processor is in place to use - for 5-axis machining, and George Davidson has undertaken a 5-axis training course at Edgcam's training centre in Wakefield. *"I've now got a few parts waiting for my attention for 5-axis milling, so we will be making a start on that in the near future."*

George Davidson with Haas



Edgcam seamlessly integrates 4- and 5-axis simultaneous machining strategies, enabling a range of multi axis cutting strategies to be applied to even the most complex of parts. UKATC will experience reduced cycle times when machining complex components using the Haas 5 axis machine. In addition, the potential for positioning errors between setups will be reduced.

They will also gain improved surface finish and extended tool life due to the tool tilting to maintain optimum tool-to-part contact point at all times. And there will be improved access to undercuts and deep pockets through tilting the tool or component, which allows shorter series tooling. This will improve the surface finish even more and do away with the need for secondary setups.

While UKATC will increase its use of Edgcam's range of features for the Haas, one in particular they will run every time for 5-axis milling, is the collision detection. *"This is totally necessary for our peace of mind."*

As well as SCUBA-2, the UK Astronomy Technology Centre has also used Edgcam to build elements of an instrument known as MIRI, for the James Webb Space Telescope, which will be the largest and most sensitive infrared space telescope ever launched. Other parts created using Edgcam are also contained in the SPIRE instrument onboard the European Herschel Space Observatory, along with components for ground-based telescopes such as VISTA, the Very Large Telescope in Chile, and the UK Infrared Telescope in Hawaii.

UK Astronomy is currently liaising with the medical profession about the possibility of its technology for improving optical images coming from space, to be used to correct eye problems such as glaucoma and cataracts. So Edgcam's outer space components could be used in inner space, too, in the future.



Dr John Davies with SPIRE part



Emerging Technologies for Earth Observation

Coseners House, Abingdon, Oxfordshire
12th – 13th October 2011

The UK Centre for Earth Observation Instrumentation (CEOI) is holding its 2nd Challenge Workshop on Emerging Technologies for Earth Observation at The Cosener's House, Abingdon, Oxfordshire on 12th-13th October 2011.

This two day event aims to identify technologies that have the potential to open up new opportunities in Earth Observation and meet the instrumentation challenges identified in the previous science-based workshops. Day 1 will focus on highlighting technology developments, whilst Day 2 will include presentations from other non-EO areas. A breakout session will also be held in order to facilitate discussion on issues arising from the workshop.

We aim to have wide involvement from the technology and EO communities, and hope to attract input and attendees from science and technology areas outside the range of organisations who do business in the space and EO technology arenas.

Further details and an agenda will be issued soon, but in the meantime if you would like any more information, please contact Dr Chris Mutlow - christopher.mutlow@stfc.ac.uk

To reserve your place at the Workshop, please contact the workshop administrator Niki Legge at the Rutherford Appleton Laboratory (niki.legge@stfc.ac.uk or telephone 01235 445621). If you require overnight accommodation at Coseners House we have some rooms reserved which can be booked through Niki on a first come first served basis. Details of Coseners House can be found at <http://www.scitech.ac.uk/About/Find/Coseners/Introduction.aspx>



CLASP Grant award success

The following Grants for the CLASP Medical Call have now been announced:

Dr Weidmann - STFC

Laser isotope ratiometer for non-invasive medical diagnostics through breath analysis

Professor Elliot - Cambridge University with Mr Dunn - STFC

Multi-analyte Disease Diagnosis using MEMS Detection

Dr Lees Leicester University with Professor Perkins - Nottingham University

Nu views

Professor Harra - UCL

Improving intensive care unit effectiveness and efficiency through improved data processing and analysis techniques.

Dr Seviour – Lancaster University with Dr Owen - Manchester University

Compact Neutron Source for Medical Isotope Production

Professor Edgecock - STFC

The Development of a Commercial Boron Neutron Capture Therapy Facility: establishing a clinically useable facility at Birmingham University

Professor Muller - UCL

BUGhunter: laser fluorescence for visualisation of bacterial contamination in a hospital environment

Dr Villani STFC

In vivo RF Dosimetry for medical applications