MANCHESTER 1824
The University of Manchester

your manchester

For Engineering and Physical Sciences Alumni

Spring 2014

Stand up for climate change

Stargazing with Tim O'Brien

The real value of our water

Leena Gade

No1 Engineer & 'man of the year'

THE UNIVERSITY OF MANCHESTER TIMELINE

1824
Manchester Mechanics' Institute founded

1851
Owens College founded

1872
Owens College incorporated the **Royal School of Medicine and Surgery**, which had been formed in 1824

1880
Owens College becomes the first constituent part of the federal **Victoria University**, England's first civic university

1883
The Mechanics' Institute converted into the **Manchester Technical School** and in 1892 becomes the **Manchester Municipal Technical School**

1903
Owens College reconstituted as the **Victoria University of Manchester**

1918
The Technical School renamed the **Manchester Municipal College of Technology**

1956
The College of Technology gains independent status as a university college and in 1966 renamed the **University of Manchester Institute of Science and Technology (UMIST)**

1994
UMIST gains its own degree-awarding powers

2004
The University of Manchester created when, after a century of partnership, UMIST and the Victoria University of Manchester agree to combine and form a single, world-class university

MANCHESTER 1824
The University of Manchester

For full history visit **www.manchester.ac.uk/aboutus/heritage/history/**

EPS people

The Faculty is led by the Vice-President and Dean, Professor Colin Bailey, and comprises nine academic Schools and four Research Institutes. The Faculty Leadership Team also includes six Associate Deans who support key areas of activity, including Research, Teaching and Learning, Graduate Education, Social Responsibility, Internationalisation and Business Engagement. The Director of Faculty Operations is responsible for leading the administration across the Faculty.

School of Chemical Engineering and Analytical Science
Head of School,
Professor Mike Sutcliffe

School of Chemistry
Head of School,
Professor Christopher Whitehead

School of Computer Science
Head of School,
Professor Jim Miles

School of Earth, Atmospheric and Environmental Sciences
Head of School,
Professor Hugh Coe

School of Electrical and Electronic Engineering
Head of School,
Professor Tony Brown

School of Materials
Head of School,
Professor Paul O'Brien

School of Mathematics
Head of School,
Professor Peter Duck

School of Mechanical, Aerospace and Civil Engineering
Head of School,
Professor Andy Gibson

School of Physics and Astronomy
Head of School,
Professor Stephen Watts

Dalton Nuclear Institute
Director,
Professor Andrew Sherry

Manchester Institute of Biotechnology
Director,
Professor Nigel Scrutton

Photon Science Institute
Director,
Professor Richard Winpenny

University of Manchester Aerospace Research Institute (UMARI)
Director,
Professor Costas Soutis

Acting Associate Dean (Research)
Professor Stephen Yeates

Associate Dean (Teaching and Learning)
Dr Danielle George

Associate Dean (Graduate Education)
Professor Ann Webb

Associate Dean (Social Responsibility)
Professor Tim O'Brien

Acting Associate Dean (Business Engagement)
Professor Mike Sutcliffe

Associate Dean (Internationalisation)
Professor Stephen Flint

Director of Faculty Operations
Rachel Brealey

Head of Faculty Finance
Pauline Morgan

Head of Faculty HR
Sue Field

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Welcome from the Vice-President and Dean

Universities are all about people, whether students, staff or alumni – and it's the people that make The University of Manchester one of the greatest universities in the world. In this annual Faculty alumni magazine we highlight some of the achievements of our graduates, as well as highlighting some new staff members and news across the Faculty.

As always the articles only scratch the surface of the activities within the Faculty of Engineering and Physical Sciences, which continues to grow its global reputation in education, research and its impact on the economy and society.

Engineering graduate Leena Gade was told 'engineering wasn't for girls', a comment I personally find infuriating. Such narrow-minded thinking has no place within modern society and within the Faculty we are continually engaging with primary and secondary schools to promote engineering and physical sciences to girls. We all know that design teams are much more creative and effective with a reasonable gender balance as well as the leadership qualities that both genders provide. Luckily, Leena completely ignored this nonsensical advice and pursued her passion for a career in engineering and motor racing. But how many other great female engineers and scientists have been lost? We must all work hard to promote the discipline we love and the rewards it gives to all those that follow this path. As you will see from Leena's story she has proved herself to be one of very best engineers in motor racing, helping her Audi team win the Le Mans 24-hour endurance race twice! I am sure she will achieve even more in the future as well as being an inspiration to us all.

Mercy Badu is a scholar who has been recognised as someone who is also set to make an impact in her chosen field. Mercy has been awarded the prestigious L'Oréal-UNESCO Regional Fellowships for Women in Science in Sub-Saharan Africa in a bid to break down any barriers she may face to fulfil her academic destiny in this region.

Equally determined to support the ambitions of developing Africa are three friends – Jamie Proctor, Tom Morris and Aidan Mosley – who have set up their own project to build a new school in a Malawi village in a bid to give local young people their own chance to gain an education. While Peter Mount CBE reveals that a commitment to fundraising can run alongside a demanding career. As well as being the chairman of Central Manchester University Hospitals NHS Foundation Trust, Peter also supports hundreds of schoolchildren to access an education in Uganda and Rwanda through a number of charitable projects.

The work of the Faculty's academic community is also put under the spotlight. Professor Tim O'Brien, Associate Director of Jodrell Bank Observatory, talks about his role in supporting the Faculty's commitment to making our work more accessible and relevant to the wider public. This is an aspect of our work that all staff are passionate about. A good example is the BBC Stargazing LIVE event broadcast earlier this year from Jodrell Bank and featuring our own Professor Brian Cox and science champion Dara O Briain.

In an interesting twist on supporting our public engagement strategy Dr Ruth Wood, a Research Fellow at the Tyndall Centre for Climate Change Research, has taken to the stage to use comedy as a way of getting her message across about the challenges of our vulnerable environment. As you can imagine this is not an easy task but Ruth is a natural!

The changing state of our environment is also very much at the heart of work led by Professor Julien Harou, our new Chair of Water Engineering. Julien's research group will be putting some radical proposals forward on how we can better manage our water supplies so we are not dealing with floods one season and droughts the next.

With the anniversary of the outbreak of First World War being marked this year, we are also reminded of the brave contribution made by our community during this tumultuous period and the sacrifices that were made. Thankfully many graduates and staff returned to Manchester from their front line experiences – although sadly, so many of our University colleagues lost their lives during this terrible time.

The outstanding contribution made by another Manchester legend Alan Turing during the Second World War is also remembered. A new film, The Imitation Game, is about to be released, and it is fitting that Manchester graduate Benedict Cumberbatch (who skilfully portrays Sherlock Holmes in the critically acclaimed BBC TV series) is playing the role of the brilliant code-breaker.

From our earliest heritage to today's success stories, everything we do in the Faculty of Engineering and Physical Sciences is underpinned by a dedication to quality. This was demonstrated recently when we were once again awarded the Queen's Anniversary Prize – one of the most prestigious awards in higher education. The recent award recognises our leading staff and the work they carry out in imaging techniques, which in turn is supporting the UK's strategic development in advanced materials and manufacturing. This is the second Queen's Anniversary Prize presented to the Faculty following recognition in the previous round for our internationally renowned research and skills training for the nuclear industry. Such coveted hallmarks demonstrate the impact we are making to our economy and society as a whole.

I hope you enjoy this latest edition of Your Manchester. We always have an open invitation for you to become even more directly involved with this Faculty and the University, so please contact us with your thoughts and ideas. I look forward to hearing from you.

Professor Colin Bailey FREng, CEng, BEng, PhD, FIStructE, FICE, MIFireE

Vice-President of The University of Manchester

Dean of the Faculty of Engineering and Physical Sciences

0161 306 9111
colin.bailey@manchester.ac.uk

Le Mans World

Leena Gade graduated from the University in 1998 with a degree and Masters in Aerospace Engineering and is now a familiar, and celebrated figure in the motor racing profession. As a No1 Engineer, she's won the Le Mans 24-Hour race twice as part of the Audi Sport team in 2011 and 2012 and in the same year was named the FIA World Endurance Championship's 'Man of the Year', as well as receiving the C&R Racing Woman in Technology Award, a prestigious accolade supported by motorsport specialists C&R Racing as part of the US-based Women in the Winner's Circle Foundation awards.

How did this successful Manchester graduate make the leap into an environment perceived to be a man's world, and does she see the funny side of being crowned 'Man of the Year'?

"Engineering isn't for girls' – that was the advice given to Leena Gade when she was younger. Advice she has always ignored.

When she began her studies at the University she was one of five women in a cohort of 100, and by the time she applied for her Masters she was the only female left. That didn't stop her pursuing her dreams, and in 2007 she landed her perfect job with the "factory" Audi team, where she has become a lead race engineer on one of its sports cars that compete at Le Mans and in the FIA World Endurance Championship. She moved to Germany in 2012 where she is now involved in the early development stage of new race cars.

"Its been a bit of a stepping stone to move out of my comfort zone, but at the same time a really good thing to do. At Audi, we operate differently to other race teams and engineers, and the whole process from inception to race is more integrated. Coming in with a race background allows me to articulate what we need to use on the racetrack.

"My new role means additional team work, discussion and input between the designer and engineers, and has cut down the process of trial and error; we are now more efficient and able to fix problems that previously we were facing maybe four or five tests down the line when it's very close to the final event. As you get closer to Le Mans there is less and less that you can change because you need stability. The race itself is 24 hours but the car is built up on the Wednesday evening and into Thursday morning, bringing the time it's racing closer to 36 hours.

"It's been a great experience as I've learnt a lot about how the system operates at Audi Sport, and how work is prioritised to make sure deadlines are kept. There are many technical developments, whether it's new strategies on software or for utilising tyres, and being part of that process has opened my eyes and hopefully will benefit the team in future races."

Winning the Le Mans 24-hour endurance race twice, Leena is at the top of her game. "As a race engineer, I'm in charge of how the cars go out on track, what needs to be changed during a race, looking at the strategy and working out if you can get 12 laps instead of 10 for a fuel tank – do you push to get that and what does it save you in the long term? As well as making sure I have a good overview of all of the data. I look after all the engineers and I rely on them to do the background

"As a race engineer, I'm in charge of how the cars go out on track, what needs to be changed during a race."

Leena Gade images, including cover photograph, supplied by Audi

“If an engineer happens to be female it’s seen as a big deal. Even in mainstream engineering women are still massively outnumbered. Everyone laughs at the ‘Man of the Year’ award, and a fair few people have asked if I was offended when I received it. I wasn’t.”

management, they feed the information to me and I’m able to see what’s happening including any problems that may arise.

“Usually during a session we have eight to 10 engineers on each car and, although I have one chief mechanic, I will work closely with all of them to ensure they are given the right information so they know what they need to do. It’s a bit like a communications role, but at the same time there’s a lot of technical awareness needed. I also have to ensure that our drivers stick to the stringent driving time limits.”

Despite being warned ‘engineering isn’t for girls’ Leena has pursued her passion regardless.

“It’s been what I wanted to do since I was young, so for me it’s been a case of ‘get on with it’, and it’s always been my job. I think recently it’s become more of a wake up call because I’ve done something in a male-dominated industry and the public perception is that women are only grid girls or are behind the scenes in marketing. It’s unfair actually because people simplify those positions, but they are part of a well-oiled machine that couldn’t function without those female-dominated roles.

“Conversely, if an engineer comes along and they happen to be female it’s seen as a big deal, even in mainstream engineering women are still massively outnumbered. Although everyone laughs at the ‘Man of the Year’ award a fair few people have asked if I was offended when I received it, but I wasn’t. The award existed before I came into motor sport and it’s designed to reward someone from the profession who’s exceptional at what they do. When I won it they made a conscious decision not to change the title, and I agreed because it just proved that the best person that year happened to be female. I don’t see negatives about it, and changing it would come from pressure to be seen as inclusive. That time should come when there are more females in the profession.”

Leena believes that women should not receive special treatment – recognition should be on merit alone. “The best person for the job should get the job, and we are in unsafe waters when positive discrimination takes hold. Anyone can do any job if they really want to. I would hate to think that I got to where I was because I was female and not because I was good at my job.

“If you are female and want to get into engineering you have to accept that there are more men, and that some of them can be quite old school and will call you ‘love’ and may patronise you. At the moment that won’t change, so accept it and use those people to learn the knowledge you need to make yourself a better engineer. It took a long time for me to get into motorsport, and my advice is to persevere,

images supplied by Audi

for girls especially, and accept that there are some things you cannot change."

Leena is an ambassador for both the FIA Women and Motorsport Commission and the 2013 Formula Student initiative, and believes both roles give her the opportunity to support upcoming motor engineers. Leena's ambassadorial role focuses on sharing her experience as a female engineer, while the Formula Student scheme is a European motorsport competition for university students. Backed by industry, it allows upcoming engineers to build a single-seat race car and test the vehicle.

"I had the chance to go to Silverstone and see the event, as well as a trip to Hockenheimring in Germany. What struck me was how creative the students were, using their engineering skills to produce racing cars to meet very strict criteria – very similar to what we do. The students were really enthusiastic and got a good grounding in hands on engineering, which is really important. Using the knowledge you gain at university on a practical project is invaluable, and they get an overall picture of what motor racing is about. It's a unique programme. I spoke with many of the students and offered them advice."

The year 2014 is shaping up to be a busy one for Leena, with Le Mans firmly in her sights once again. "Although Audi scored its 12th victory at Le Mans since 1999, 'my' car didn't win in 2013 as we had to deal with a 45-minute pit repair issue, which meant we lost out on the world championship title we'd won the previous year. It was a bit annoying as the statistics showed that we had one of the fastest cars of the season. We will use the mistakes we made and learn from them. My work within the development team means we are now in a better position because we know what works at an earlier stage, and we can head into this year with more information than some of our competitors. I'm really looking forward to this coming season – it's going to be a different type of racing compared to what we've known before, with different challenges."

"The award is designed to reward someone from the profession who's exceptional at what they do. When I won it they made a conscious decision not to change the title, and I agreed because it just proved that the best person that year happened to be female."

A new school for Mlambe

Jamie Proctor in the Liwonde National Park

The Mlambe Project was set up by a group of recent physics and engineering graduates in a bid to help fellow graduates gain experience of volunteering in Africa. The first project to begin in 2014 will see the group build a new village school in Mlambe, a community based in south Malawi.

Meeting The Director of Basic Education in Lilongwe

Classroom at Mlambe Junior Primary School

Teachers' houses at Nanthomba

Jamie Proctor, Tom Morris and Aidan Mosley are three friends determined to make a difference – so they founded The Mlambe Project. This original team graduated from Manchester in 2012 with degrees relating to physics and engineering and their fledgling project is already attracting support from like-minded graduates from other UK universities.

Jamie, a Physics and Philosophy graduate, is project manager of The Mlambe Project, which aims to support primary education in Malawi, an impoverished and landlocked country in southeast Africa bordered by Zambia, Tanzania and Mozambique.

> "We decided it made sense to use our brains as well as the skills we'd developed during our time at university."

"The idea came when I was in my second year at Manchester," explained Jamie. "I wanted to do something that would benefit other people, so I discussed this with a group of friends, and we decided it made sense to look at using our brains as well as the skills we'd developed during our time at university. We also had an idea for a programme to develop creative roles for new graduates to gain experience and benefit a community at the same time.

"I had some experience of working for the education charity Wings of Hope, as I had spent a gap year with them before my studies. It provides free education for poor children in India and Malawi, funded through its national social enterprise programme for UK school children. We got together some information and presented Wings of Hope with our ideas, and they agreed to help us."

Malawi is a one of the ten poorest countries in the world, with foreign aid accounting for 15% of its GDP. Ten per cent of that goes towards education, which has given many children a free school place, but there is no extra funding for more schools, which results in large overcrowded classrooms. Building more schools would drastically reduce classroom sizes, and lead to a better education experience for children.

Jamie and his fellow students were keen to build something sustainable, which would provide local jobs, adding real benefit to that community. "We initially looked at setting up something in Malawi because Wings of Hope had experience in that country, and we would be able to use their contacts, such as NGOs and local communities.

"Within Malawi we tried to find a project that was also suitable for us and ticked the boxes of what we wanted to do, and in that process we came across HELP Malawi, an NGO whose mission is to help children from rural areas to access primary education and to further support them through secondary school scholarships."

On his first trip to the country last year Jamie toured a school that HELP Malawi had built. "The school has been operating for six years and is flourishing. We were able to meet a group of students who had

Jamie Proctor with the headmaster of Nanthomba and Help Malawi representatives (in Nanthomba School).

Zochonis Special Enterprise Fund can support current students with the cost of a project or special study which demonstrates enterprise or originality of thought in planning and execution. It is one of the three schemes available to students wishing to travel either as part of their course or during University vacations. More information can be found on the My Manchester student portal: **https://my.manchester.ac.uk**

Project volunteer Will Barkley at School

come through the primary school, moved onto secondary school, and were now seriously considering university, which was a first in the area. Seeing the fruits of all of this hard work is the real acid test, and definitely spurred us on to want to do more.

"Inspired we started looking at nearby sites to build another similar school and the Mlambe community were, in particular, very welcoming, and excited about the prospect of a new school within their community. In fact the entire village turned out for a meeting, and we were able to explain our vision and meet the elders and chief. They have even committed to mould all of the bricks needed to build the school, and to supply, free of charge, the labour of 20 people for the duration of the build."

Although Jamie and the team have great vision, the support of the local community in Mlambe, and NGOs on the ground, there is still the small matter of raising the funds necessary to begin this project in earnest. "We've taken a few approaches, and initially worked towards applying for grants. We were successful in securing a grant from the Zochonis Travel Awards at the University, and we are also trying some direct fundraising activities.

"In 2013 we ran a mobile phone charging tent at Glastonbury Festival, and we run events across the UK which include a regular 'backjamming' night in Brighton; a mix of musicians jamming and backgammon. People have volunteered their time for free, so this has been a good avenue for raising funds.

"We are still working to raise more funds, but we will go to Malawi in spring this year, and will begin work on the school, perhaps setting our sights a little lower and building a smaller school with fewer classrooms."

> "The entire village turned out for the meeting, and we were able to explain our vision and meet the elders and chief."

Jamie's ambition is clear and, although he is heading to Sandhurst this year for Army officer training, he has great hopes for the project. "In the future we'd like to help students to design their own similar projects whilst studying for the undergraduate degrees, with a view to working for the project after graduation, and managing their projects in Malawi. It would be a great benefit to the community, and would give the graduates some tangible work experience before they embark on their careers."

What else is in the pipeline for 2014? "We're looking for new recruits and volunteers for this year, as our time managing the project will come to an end, and we are planning to recruit them with the help of course tutors at Manchester."

> FIND OUT MORE
You can help The Mlambe Project to raise funds by making a one off donation at **www.themlambeproject.com**

Children at Mlambe

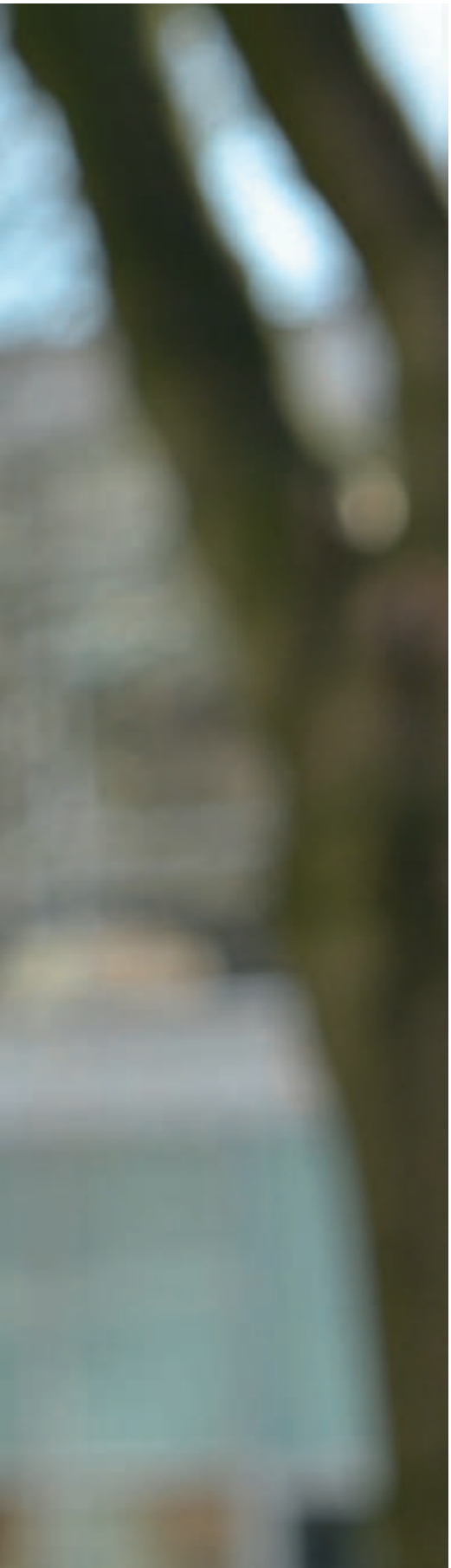
Will Barkley with some local children at Mlambe

Jamie Proctor and Will Barkley meeting village chiefs

The real value of

Portrait by Christine Twigg

our water resources



So often taken for granted, we can all easily forget water is a precious natural resource. But is it being managed in the best interests of our society? Professor Julien Harou has recently joined The University of Manchester to lead research in hydro-economics and to help decision-makers recognise the true value of water.

"I've only been here a few weeks," says Professor Julien Harou, nodding briefly towards the empty bookshelf and a lonely copy of Water International. "I've been busy finishing off a grant proposal before the deadline, so unpacking has had to wait."

Professor Harou has taken the journey north from University College London, and before that California, to bring a new perspective to the University's expanding portfolio in water research.

"Manchester is a great place for water research," he notes, not missing the irony of his remark. "It was here where several essential discoveries of modern hydraulics were made, so it is a privilege to build on such heritage."

But it is not hydrology, hydrodynamics or hydraulics which will benefit from Professor Harou's work. As the new Chair of Water Engineering, his research interests involve water management, analysing the engineering, hydrological and socio-economic impacts of water resources management and planning decisions. Hydro-economic analysis aims to help decision-makers choose investments and policies that are in the public's best interest over the long-term. Framing decisions as trade-offs between different societal goals allows analysts to help real-world water managers and policy-makers improve their decisions.

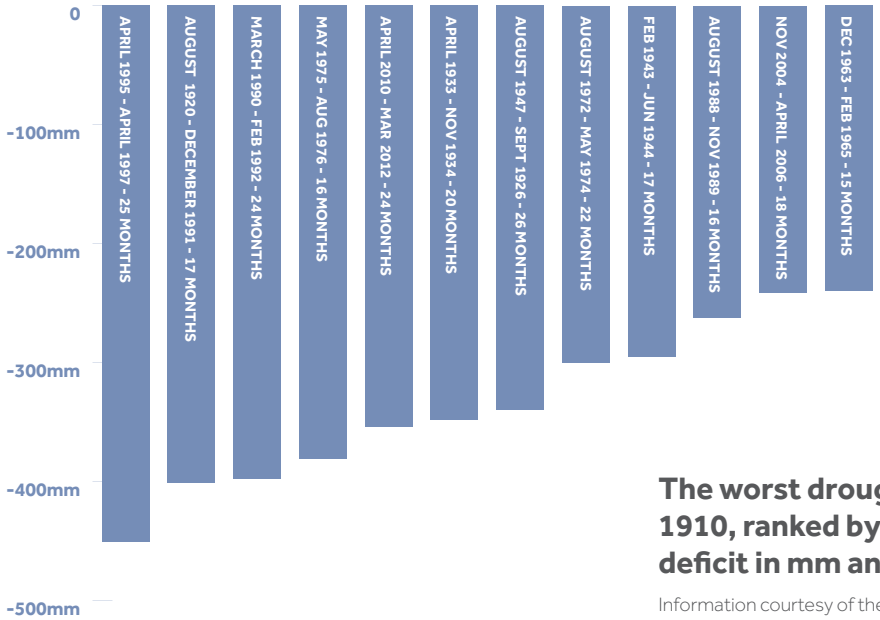
"This is a relatively new field of research and a new development for Manchester," he comments. "Our hope is for Manchester to become an international leader in this area in future."

Where to invest in water, and how?

If your home water supply is metered then you will have some idea on what domestic water consumption – around 150 litres per person per day – can cost. But a thorough valuation of water resources goes deeper; using different modelling techniques Professor Harou and his group help water companies, regulators and governments to assess the social and economic value of water. His work helps them make better decisions on where to invest, how to reorganise the water sector and how to secure reliable, sustainable and affordable supplies and reduce water demands in the face of an uncertain future.

"So what is water worth?" he asks. "Water companies charge one price, but our research goes beyond price to come up with how the societal value of the resource varies over space and over time, between seasons or years with different rainfall. We also track a range of performance metrics, not just economic value, but ecological and social metrics as well, and look at how different plans or policies imply different trade-offs between them. This helps water

KEY DROUGHTS OF THE LAST 100 YEARS



The worst droughts across Lowland England since 1910, ranked by rainfall deficit and showing the deficit in mm and the duration of the drought.

Information courtesy of the Met Office www.metoffice.co.uk

companies and regulators make informed choices about investments and policies, helping them make decisions that achieve multiple societal benefits rather than just 'least cost'."

Professor Harou led the technical contribution to the 'Value of Water' project funded by the UK Water Industry Research Association and is working with several water companies to improve their future plans.

"Water has an intrinsic environmental value too," he continues. "It provides habitat for aquatic life, lakes for boating, fishing, leisure. Where would the Lake District and its tourism be with poorly managed water resources? The modelling tries to take this into account so we can assess how water decisions have wider environmental, social and economic impacts."

Trading water?

Perhaps one of the more controversial topics considered in Professor Harou's research group is the idea that water companies should work more closely together, sharing assets and in some cases trading water. While the engineering for a nationwide water grid is not cost-effective because under normal conditions water is expensive to pump around in large quantities, strategic interconnections that allow regions to share water under special circumstances can be very beneficial.

Professor Harou turns back to his computer screen and pulls up a map showing the disjointed, unconnected water networks in the country. His work shows how more interconnectivity, with trading between some neighbouring suppliers, could significantly improve the security and affordability of the UK's water supply.

"At the moment, the entire sector is geared around water companies investing in their own sources – building more reservoirs and extracting more water from the ground, rivers and lakes rather than piping it across from a neighbour, even if that makes sense for both parties. There is next to no trading between water suppliers because current regulations do not encourage it.

> "Manchester is a great place for water research. Several essential discoveries of modern hydraulics were made here. It is a privilege to build on such heritage."

"Our research shows how greater interconnectivity and trading increase resilience and lower costs, especially when linked to a balanced portfolio which includes reducing demand where possible," Professor Harou explains.

Professor Harou and his team have provided modelling and analysis for two projects of national importance in this area co-funded by government regulators and water companies. The 'Water Resources of the South East' and the 'Water Resources of East Anglia' projects have fostered collaboration and joint planning between water companies as they have developed their five year business plans, submitted to Ofwat, the economic water regulator, in December 2013.

"The idea is that water development and investment programmes are optimised across a region," Professor Harou explains. "Just creating a forum where companies can come together to talk and plan their investment cycle openly and strategically is a great step forward for the sector and eventually for consumers."

Looking ahead

The UK's fundamental need for secure supplies of food, water and energy – despite the uncertainties around fossil fuel reserves and the impact of climate change – is now recognised by government. Funding for research in these areas has increased substantially in recent years.

Despite all the storms and flooding around Christmas 2013, drought is an increasing risk in the UK. A combination of changes in rainfall patterns, rising population and changes in land use is likely to make water shortages more common in the future, especially in the South East where annual rainfall is similar to some areas in the Mediterranean.

"In my line of resource management research you don't get to make discoveries as such, but still the work is immensely satisfying. Everything we do is applied and

> "Despite all the recent storms and flooding, drought is an increasing risk. A combination of changes in rainfall patterns, rising population and changes in land use is likely to make water shortages more common."

we work directly with water managers and policy makers and quickly see how the research makes a difference. Simulating different government policies and regulatory frameworks helps explore the potential impact of changes and helps government and companies make balanced decisions.

> "The idea is that water development and investment programmes are optimised. Creating a forum where companies can come together is a great step forward for the sector and eventually for consumers."

"Internationally, the water-food-energy 'nexus' is attracting the attention of countries who want to guarantee their resource security. In this area our contribution will focus on planning water investments and policies given future uncertainties and how these can simultaneously fulfil multiple societal goals.

"This is an exciting time to be involved in water management research and Manchester is a great place to start a new group in this area."

He glances out again toward the sun, the prospect of a weekend walk exploring the beautiful countryside around Manchester beckons. The unpacking can wait a little longer.

"In 20 years I expect the UK water industry will look quite different and I'm excited to be involved in research

supporting these changes. If water bills remain affordable and the quality of our water and aquatic environments improves, then I'll be proud of our contribution. Internationally, helping countries plan their water future and collaborate with neighbouring countries is an area we look forward to contributing to."

> FIND OUT MORE
www.water.manchester.ac.uk

MANCHESTER'S COLLABORATIVE WATER PROJECTS

SmartH2O
A European Union funded collaboration to study how smart water metering and social media can change citizens' attitudes and water usage.

WiseUp to Climate
A German Environmental ministry-funded project that will demonstrate how natural and built infrastructure jointly enable effective climate change adaptation and sustainable development.

Jordan Water Project
Will develop an integrated agent-based modelling framework to evaluate water policy interventions in water-stressed countries using Jordan as a model system.

Mesopotamia Water
This UN sponsored project aims to assess joint water infrastructure investments between Syria, Iran and Iraq, using multi-criteria evaluation and the trade-off of benefits between countries and water using sectors.

Transforming Water Scarcity Through Trade
This EPSRC funded project looks at how local trading between water users (abstractors from all sectors, not just water companies) could help reduce the societal cost of water scarcity today and into the future.

Hydra Platform
This open water management software platform is a Technology Strategy Board funded joint venture between University of Manchester and Halcrow/CH2M Hill. An earlier proof of concept version was chosen by NASA as a top 10 global water innovation.

Stand up for climate change

Dr Ruth Wood, a Research Fellow at the Tyndall Centre within the University's School of Mechanical, Aerospace and Civil Engineering, is proving climate change is no laughing matter by highlighting the issue at comedy clubs. Ruth's research involves climate change mitigation, predominantly by looking at how greenhouse gas emissions can be reduced both in the UK and internationally in line with international commitments to avoid dangerous climatic shifts

Ruth talks to *Your Manchester* about her unusual way of sharing knowledge with a wider audience.

TyndallManchester
Climate Change Research

Public engagement plays an important role across the University, and is embedded in its strategic vision, and so researchers are always looking for ways to bring their findings to new audiences.

"Climate change is one of the biggest challenges we will face in our lifetime, and the consequences of ignoring it are enormous and devastating. If as a society we are going to have a chance of avoiding such consequences we all need to play a role in some way. Getting clearer messages across about the challenge and what we need to do to meet it to the public is paramount," says Dr Ruth Wood.

Ruth uses the usual routes for disseminating research findings through peer reviewed journals, industry publications and conferences, but she has recently moved towards direct contact with the public in a more unconventional way - through a series of comedy shows.

The Bright Club in Manchester is home to the 'thinking person's variety night', and plays host to comedians and UK researchers. How, and why, did she make this move from the lofty heights of academia to the beer soaked floors of dimly lit clubs?

"I'd been to a few Bright Club events in Manchester, and had seen the diverse audience. I've given general public talks on climate change, and you tend to find that the audience is filled with people already interested in the subject, who already know the answers to what you are going to say. Bright Club gives researchers an opportunity to reach an audience that may not come to a university lecture. I enjoyed attending them and listening to other people's sets, and I was asked if I would be interested in taking part.

"The first Bright Club performances I gave were based on research I'd been doing examining the carbon emissions associated with producing everything we consume in the UK. For example if you consider the food we eat, greenhouse gases are produced at each stage of the supply chain involved in getting it onto our plates - from the production of the fertiliser and pesticides used on the farm, the farm machinery, transportation, processing and packaging, the supermarket and so on.

"Similarly for everything else we consume there is a long, often global supply chain. At each stage of the supply chain, energy -–usually in the form of a fossil fuel – is used releasing CO2 into the atmosphere causing global warming and as a consequence climate change. My colleagues and I examined the current consumption based emissions in the UK

Ruth performing in Edinburgh demonstrating the amount of CO2 that would be released if we burnt different types of fossil fuels compared to the limit (half a pint in the photo) to avoid dangerous climate change using an analogy of the drink drive limit.

and how we might reduce those over time at the scale necessary to avoid dangerous climate change. It's quite a challenge to deliver; we have to try to balance growth in population and consumption while reducing the climate and environmental impacts of producing everything we consume."

> **"It was so scary. Absolutely terrifying! I prepared and prepared and prepared, and managed my nerves by testing and trialling my material amongst colleagues and friends. Fortunately they laughed in all of the right places."**

After her initial tread of the boards, Ruth was invited to attend the Green Man Festival in the summer of 2012. "Bright Club was running an event each evening, and I performed at the festival along with researchers from across the UK." Then in 2013 Ruth performed at a Bright Club at the Edinburgh Festival Fringe in 2013.

"The talk I gave in Edinburgh was based on a project on shale gas. It aimed to place the debate on shale gas exploitation within the context of climate change. I looked at what fossils fuels we have already, and how much CO2 would be released if we burnt them, putting the results in the context of the amount of CO2 that can be put into the atmosphere before causing dangerous climate change. Turns out there's more than enough conventional fossil fuels out there to cause dangerous climate change before we get to more unconventional sources like shale gas or tar sands. Using the analogy of the drink drive limit and a well stocked bar I tried to convey visually what can be quite an abstract concept."

Delivering research talks to a 'safe' audience in the comfort of a university lecture hall is a far cry from stand-up comedy. "It was so scary. Absolutely terrifying! I basically prepared and prepared and prepared, and managed my nerves by testing and trialling my material amongst colleagues and friends to check they understood what I was trying to say, and all importantly that it was funny. Fortunately they laughed in all of the right places.

"I was helped in developing my material by a workshop run by the organisers, and was given three things to think about when writing. The first, was to use anecdotes and stories to bring my work to life, then to use afterthoughts – comments after I'd finished a sentence – for comedic effect; and last to think about my attitude on stage, and the influence that has on the audience. Inviting people to laugh with you is very important - although having them laugh at you will also do."

"The difference between my usual style of performance at a lecture is that I had to be much more careful about the order in which I explained a topic, as well as having to be much tighter with my sentences and structure. Lots of people came and told me afterwards that it was funny and they enjoyed the show and learnt something new, so I'm hopeful that it was well received!"

In all seriousness is this avenue of public engagement worthwhile, and is it something Ruth would like to pursue? "It's definitely been worthwhile. For me, it makes academic research much more relevant and accessible to a wider audience. It's designed to enhance understanding not cloud things in academic jargon, so I think it makes all research more available. I probably will do some more; I think there are plans for this year, and I would love to take part."

> FIND OUT MORE
There are Bright Clubs in towns and cities across the UK. You can find out more about upcoming events at **www.brightclub.org**

We are made of stars

Professor Tim O'Brien is a man of many guises. He is Associate Director at the iconic Jodrell Bank Observatory, part of the University's School of Physics and Astronomy; Associate Dean responsible for leading on social responsibility at the Faculty of EPS; and a dedicated scholar who needs to find time to carry out research and to teach. However, for many, Professor O'Brien is familiar from his media work, including the popular Stargazing LIVE programme broadcast earlier this year on BBC2 to millions of viewers.

"It's the fourth year we've done Stargazing so it's feeling like a bit of a fixture at Jodrell. Average audiences reach three million, which is staggering for a prime-time science programme and a great showcase for Jodrell and the University.

"I think the most recent series in January was possibly the best yet. It featured live viewing of the Northern Lights from Norway – an amazing natural phenomenon triggered when plasma ejected from the Sun crashes into the Earth's magnetic field. The team even chartered an aircraft to fly above the clouds which was very ambitious – I think it was the first time the aurora had been broadcast live from an aircraft."

The other amazing event was the discovery of a new astronomical object live on TV - not something that happens every day. We featured a 'Citizen Science' project called Space Warps in which the audience were invited to help us discover new distant galaxies with the help of a weird phenomenon called gravitational lensing. This is something very close to our hearts at Jodrell Bank, as the first example of this was discovered in 1979 by a team led by scientists here.

"As the light from distant galaxies travels towards us it can be bent around other galaxies in the foreground because space is bent by the mass of the galaxy, something that Einstein suggested. The foreground galaxy acts like a lens, a gigantic natural telescope, and we see a magnified and distorted view of the distant galaxies.

"On the Tuesday evening programme we invited the audience to start searching through data. Within just a few hours there had been a million attempts at classifying galaxies from tens of thousands of people, an incredible response. The Space Warps team then had to statistically analyse their information to find the best candidates – one of which turned out to be really very exciting indeed!

"Our e-MERLIN team at Jodrell worked hard to co-ordinate six of our radio telescopes across the country, including the Lovell Telescope, to view the target object. We were only ready to go just a few minutes before the start of the Wednesday evening programme. In fact, the Lovell telescope swung in to action as the programme was being broadcast, so viewers may have seen it turning as they watched.

"The target was followed by all of the telescopes until it set in the west, then our astronomers worked hard to process the data overnight, until we finally obtained an image of it at 5.45 the next afternoon. We were able to show that e-MERLIN image in the Thursday evening programme; real, live science in real time to an audience of three million people. I hope that goes to prove that science is exciting and that people can get involved."

The theme of increased involvement in science is one that's close to Tim's heart, and a large part of his role is to encourage participation, making science accessible to a wider audience. He added: As he continues: "Of course we don't expect to turn all of our viewers into astronomers, but if they are excited by what we do, and especially whilst at school, we can help inspire the next generation of scientists and engineers".

Tim's role on Stargazing LIVE is to take the lead from Jodrell Bank in liaising with the BBC and to act as an adviser on science content. Usually around June, he starts to get involved with discussions with the producers to help develop ideas for the series. "I chip in suggestions for content, and as the host for Jodrell, I go on air to talk about what we do and to join in discussion of a range of topics covered in the programmes." He is also responsible for setting up any observations that take place. "This year we wanted to show the audience how we can see the spiral arms of our own Milky Way galaxy, which is no mean feat considering we are actually inside it. Our radio telescopes can see right across the galaxy, picking out the spiral arms, as we demonstrated live on air.

"The BBC comes to us because of our reputation as a world-leading observatory – we are seen as iconic for astronomy in the UK – and our research is always featured in the series. Most professional observatories tend to be in exotic places, on mountains where they are above the clouds or even in space. But Jodrell is in the UK because, handily, our radio telescopes can see through cloud!"

"One of the amazing occurrences was the discovery of a new astronomical object live on Stargazing. The Lovell telescope swung into action. Real, live science in real time to an audience of three million."

Apart from Stargazing LIVE he also features each month on two BBC Radio 5 Live programmes. On Saturday Edition he discusses topical issues in science with presenter Chris Warburton, whilst on Phil Williams' show he has a Night Sky phone-in where he talks astronomy and answers listeners' questions on all things space-related.

Although his involvement with the media is what makes him most recognisable, Tim is passionate about his academic roles at both Jodrell and elsewhere in the University. A key part of Tim's role as Associate Dean for Social Responsibility is to communicate the University's research with a wider audience. "Public engagement with our research is very important, not least because we are funded by the tax payer. Our research is not conducted in an ivory tower and we want to talk to people and get them involved with what we do where we can.

"I love talking to school students as well as their teachers. Both are important; I hope I can inspire the students by face-to-face interaction, but by inspiring the teachers who deal with their pupils day in day out, year after year, you can multiply the effect."

Giving people the opportunity to access science and education, especially those who wouldn't typically think about such routes for themselves, is important for Tim. "I went to a comprehensive school and was the first in my family to go to university. I appreciate that if your eyes are not opened to the possibilities, your chances of success are reduced. As a local lad I'm very proud of the University's record in widening participation in higher education, and where I can help, I do."

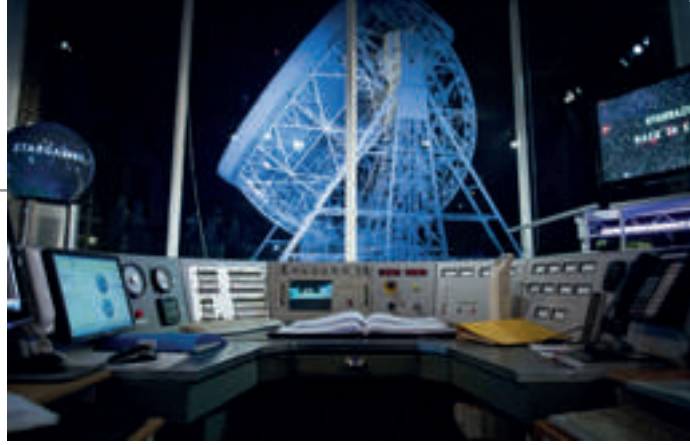
As principal investigator at Manchester for the School-University Partnerships Initiative - a three-year initiative to create structured and strategic mechanisms for universities to work in partnership with secondary schools and FE colleges - Tim works with colleagues to manage projects aimed at getting teachers and pupils involved in research. "It's a Research Councils UK project in which we are taking research across the University into schools to inspire both pupils and teachers to get involved.

"We recently held a networking event for teachers, where they were able to talk to researchers to find out which projects their pupils might like to get involved with. We will then link researchers to specific schools, and they will go and work with pupils in projects related to their work. Only 12 universities have received funding for this initiative, so it's a prestigious project for us to be involved in."

When he is at Jodrell Bank, Tim works closely with staff in its rebuilt Discovery Centre, including the Director Teresa Anderson, providing scientific input to its exhibitions, such as its newest arrival charting how large telescopes work around the world.

Jodrell is also home to a well known series of musical events, and Tim is part of the team that puts together mini science festivals at each of them. "We've had The Flaming Lips, Elbow, Sigur Ros, New Order and the Halle perform at Jodrell Bank, to name a few, and I go on stage between bands to talk to the audiences about the work we do at Jodrell – fortunately I've not yet been booed off! It's never simply a venue for music; we always ensure we get across the excitement of research going on at Jodrell and in other groups across the University who also come along to take part in the festival."

Professor Tim O'Brien in front of the iconic Jodrell Bank Observatory



Other artistic endeavours aimed at broadening engagement with research to new audiences, include work with artists and musicians Tasawar Bashir and Brian Duffy on the creation of an audiovisual installation Silsila: Infinite Qawwali, part of the Asia Triennial Manchester 2011; the creation of the sound content for the Pulsar Polyphon which was exhibited in the European Capital of Culture in Linz 2009, and Tim has also worked with composer Alan Williams and the BBC Philharmonic Orchestra in the science background and schools programme for "Wonder: A Scientific Oratorio", a new work which was premiered in 2009.

"Public engagement is very important. Our research is not conducted in an ivory tower and we want to get the public involved with what we do."

Although he is a busy man, his first love is of course his research, and his main strand of work looks at exploding stars. "I've been researching stellar explosions for many years. When we see a new star in the sky, people used to think it was a star being born, but we now know they mark a point at or near the end of a star's life. Studying stars is fundamentally important; we are made of stuff from stars – the oxygen we're breathing now was made inside a star, billions of years ago, before the Sun and planets were formed. Exploding stars spread these elements into space, making the next generations of stars and planets.

"One of the most interesting aspects of this research is its unpredictability; one night there is nothing there and the next, bang! A star has exploded. My email inbox fills up too as, working with colleagues around the world, we coordinate telescopes to follow up on the aftermath.

"I'm very lucky to be able to use telescopes around the world and in space - although I am still to get to space myself. Many of these telescopes are at high altitude in beautiful places. For example, before a night's work begins at the Very Large Telescope in the Andes Mountains you can watch the Sun set over the Pacific. There's a real sense of wonder to that, and I'm still inspired by the beauty of the night sky at these very dark sites."

It's an exciting time for radio astronomy at Jodrell. "The international headquarters of the next big thing in radio astronomy, the Square Kilometre Array, is now at Jodrell Bank" explains Tim.

"The SKA is a truly ambitious project. It will be the world's largest telescope, thousands of dishes and other receivers spread over hundreds, perhaps thousands of kilometres in the deserts of Southern Africa and Western Australia.

"Our astronomers and engineers are playing a leading role, working with colleagues around the world and with staff at the SKA HQ in designing aspects of the telescope systems and in setting out its scientific programme. This programme includes looking to answer some of the biggest questions in astronomy, including what is dark energy, was Einstein right and are we alone in the Universe."

New projects are being planned which might include Tim spending more time on SETI – the search for extra-terrestrial intelligence. "We are at a very interesting time for astronomy. In the last 20 years we've discovered many planets orbiting other stars, we know there are billions of planets in our Milky Way. I think there must be life on some of those planets.

"The difficulty is that distances in space are so vast that it's hard to imagine travelling to see what's out there. If there is extra-terrestrial life there is a chance that it may have evolved to the point where it is capable of communicating. So if we can send and receive signals that travel at the speed of light then we can cross those distances in a matter of years instead of tens of thousands of years.

"During a five-year programme from 1998-2003 we used the Lovell Telescope at Jodrell to listen for signals coming from extraterrestrial intelligence – that is, alien lifeforms, but found nothing after searching a thousand stars. Technological advances, including the new e-MERLIN telescope array, mean it's now becoming feasible for us to piggy back on observations made by other astronomers doing different science; searching through the data for other types of signal. This makes it win-win, we get the core science but we don't miss the chance of seeing something unexpected in the same data, whether it's a signal from ET or new astronomical phenomena. Although this approach is in its infancy, it's a very exciting time."

Professor O'Brien's role as Associate Dean for Social Responsibility has meant that his teaching hours have been reduced, but it remains an area of his job that he relishes and enjoys. As he explains: "My main teaching is to first year students on my Introduction to Astrophysics and Cosmology course. Manchester has the largest Physics department in the UK with 280 students each year, and their first lecture on the first day of term at 9am is with me. It's great to talk to students right at the beginning of their time with us. I hope I don't put them off!

"I also work closely with undergraduate students in their final year of study. Currently students under my supervision are building computer models of stellar explosions, running large numerical models in gas dynamics and using physics to calculate how the explosions develop to compare with observations. Their hard work will hopefully result in a research paper, which is relatively unusual at this level.

"I'm very proud to work at The University of Manchester. It's fantastic to be involved in new approaches to research engagement at a strategic level within the University, and also to work closely with the next generation of physicists."

> FIND OUT MORE
www.jb.man.ac.uk

MY CAREER

Peter Mount

Peter Mount graduated in 1961 from UMIST – a forerunner of The University of Manchester – with a BSc in Mechanical and Production Engineering. "I have extremely good memories of UMIST. During a very happy three years I established the Mechanical Engineering Society, was Chairman of the Catholic Society, and a member of the Students' Union Council. Any spare time was spent on the rugby field and tennis courts, and I played both sports competitively for the Faculty."

Peter went to work at Rolls-Royce and obtained his chartered membership of the Institute of Mechanical Engineers.

From his mid 20s to early 30s Peter spent time working at Urwick Orr, now part of Price Waterhouse Coopers then spent time working at Thorn EMI, rising to Chief Executive of one if its large international divisions in the late 1980s.

After leading an almost successful management buyout of Thorn EMI in the 1990s. ("As a result of being the 'leader of the revolution', I was the first to go!") he moved to the NHS, when it was beginning the Trust movement. "It was good timing . I found myself chairman of Salford Royal Hospital - an extremely good hospital and kick-started my career in the NHS."

Busy people always find time

Manchester graduate Peter Mount CBE with fellow HUGS fundraisers

Peter Mount CBE is a man who likes to keep busy. Being Chairman of Central Manchester University Hospitals NHS Foundation Trust would keep the most industrious of us fully occupied, but this graduate takes it to a different level.

As well as being in charge of eight hospitals, Peter's charity work sees him travelling regularly to Africa, raising funds and building schools. He is a founding member of HUGS (Help Uganda Schools) which delivers programmes to bring education and skills development to children in Uganda and Rwanda. "I got involved in 1995 through my Catholic parish in Marple Bridge. A visiting Ugandan priest had been asked to take over the leadership of a major new university in Uganda, and had travelled to the UK to complete a doctorate at The University of Manchester, and we began to form a friendship.

"He told me that he was personally paying for about 15 young children to go to school. I began to wonder what we could do to help. My network of friends raised enough for these children to attend school.

"Three years later the priest returned to Manchester and, over a Chinese takeaway, we discussed the progress of the children. An idea emerged: perhaps instead of 15 children going to school, we could work with the village and local people to buy land, build a school, and give 100 children an education? So we did! The land was bought, the villagers made the bricks, and we opened in 2001. The primary school now has around 400 pupils and is in the top 5% of 11,000 schools in the country."

A great achievement, which would be enough for most. But not for Peter. "We've now also built a secondary school for 150 children, and with the help of Mike and Jean Oglesby, founders of the Bruntwood property group, we have funded a vocational school. So we now have a campus from junior through to vocational skills, so children leaving these schools have a chance to make a living for themselves." The vocational school is due to open in 2014.

Peter travels regularly to Uganda. "We have a great team there, so my focus is on raising the money for other projects such as a special needs school in the west of the country. The Good Shepherd school came out of a visit from a Catholic nun who was studying for her Master's at The University of Manchester – we Manchester graduates are everywhere! Children with learning disabilities get a very raw deal in Africa. Even if these children do get the chance to go to mainstream school, with typical Ugandan classes of over 100 such children get no personal attention and are often bullied.

"The school was opened in 2009, and it's a beautiful school with its own small farm, a woodwork shop, and practical textile and garment making lessons for the children.

"We've also carried out some work on a seriously under-resourced school in Rwanda. Hopefully in the next couple of years we can expand this and build a secondary school. We do have to be mindful of the tribal diversity in countries such as Rwanda. The schools are essentially Catholic, but children from all faiths are taken, and their faiths are respected."

HUGS is now helping to provide primary and secondary education to nearly 900 children as well as helping an orphanage with 40 children in the north of Uganda.

"We want to look at further education opportunities now. We began with 11 students who have now moved on to further education and degree level, and we are sponsoring a number of students through university. They must promise to stay in the country, use their skills and knowledge to improve their communities"

> FIND OUT MORE

HUGS has raised more the £750,000 since its inception. Incidental costs are privately funded, and all of the money raised goes to the schools and to find scholarships. **If you would like to become a regular small donor please visit www.helpingugandaschools.org**

Dream come true for Mercy

The groundbreaking work of Mercy Badu, an international scholarship student at Manchester, has been recognised with a prestigious accolade as part of a scheme to boost the profile of women in the global scientific community.

Mercy has been awarded the 2013 L'Oréal-UNESCO Regional Fellowships for Women in Science in Sub-Saharan Africa.

The PhD student from Ghana has been studying at The University of Manchester for nearly 12 months, based in the Organic Materials Innovation Centre (OMIC) under the supervision of Professor Stephen Yeates and Professor Peter Budd.

Mercy said: "I was very happy to receive the award. When I was thinking about submitting an entry I showed it to Stephen Yeates and he said 'go for it', so I did. I didn't expect anything from it - but having the work I do recognised is a good feeling."

Peter Budd, Professor of Polymer Chemistry, added: "This award is a significant achievement for Mercy, like a dream come true. She will now be able to acquire the equipment she needs, such as glassware and standard reagents to enable her to continue her research after her Commonwealth scholarship ends. This will be additionally supported by equipment donated from OMIC.

"After she has returned to Ghana, Mercy plans to maintain a strong collaboration with The University of Manchester in joint research projects. This will enable her to contribute significantly to the development of the Ghanaian chemical industry."

The L'Oréal-UNESCO regional fellowship is a competitive award given to a few selected women with potential to make great strides in the field of science. The award recognises Mercy as an individual, as well as recognising the work she is doing as regionally important in Africa. The associated grant she has received will support Mercy to continue her research in Ghana.

The University of Manchester is also helping with this endeavour by sending surplus equipment from the School of Chemistry to international partner Kwame Nkrumah University of Science and Technology (KNUST) in Ghana.

Professors Yeates and Budd have developed an MSc in Polymer Chemistry at KNUST, and from that a number of Ghanaian graduates have benefitted from a Commonwealth Split-site Scholarship programme to Manchester, including Mercy Badu.

Mercy's research at Manchester looked at the utilisation of naturally occurring biopolymers as innovative materials for the Ghanaian chemical industry.

Her work is based around vegetable fats, which have become important commodities in world trade as they have many uses. In particular she is focused on thermal properties - characterised by crystallisation or melting behaviour - which affect the processing of fats, particularly trans-fatty acids from hydrogenated oils.

"These oils increase the risks of cardiovascular disease. My research is looking at how to replace the use of hydrogenated fat with naturally occurring saturated fats.

"I arrived in Manchester with an idea I wanted to work on and a raw material that I had identified. We spent the first few months looking at what we could do - and the last six months have been dedicated to looking at how we can formulate these materials to facilitate drug delivery."

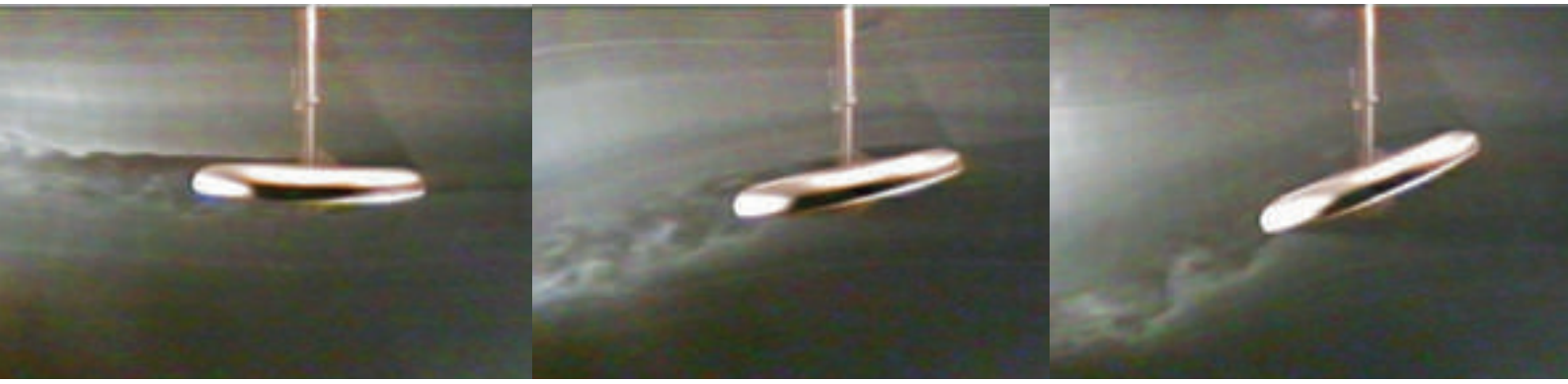
Peter Budd added: "We will be publishing a paper of a very detailed characterisation of this material very soon."

The research has also seen collaborations with the Federal University of Ceara in Brazil and that partnership will help Mercy identify more uses for her material.

Mercy returned to Ghana at the beginning of 2014 but will receive ongoing support from The University of Manchester. She will be able to submit results from her research to the Polymer Science group at Manchester for additional evaluation.

Extreme removals

Anyone who has moved house will testify it is one of the most stressful experiences in their life. So spare a thought for those colleagues involved in the precision planning to relocate highly specialist equipment from their existing locations into the new Manchester Engineering Campus Development (MECD). We talk to some of the movers and shakers behind this herculean project and find out about what is probably the biggest logistical challenge of their careers.



A wind tunnel in action: central cross-section of the flow field over a non-spinning disc-wing, with

The Manchester Engineering Campus Development project is well under way. It forms the largest single project in the University's Campus Masterplan, a ten-year £1 billion investment announced in 2012, to create a single campus with new teaching and research buildings, student facilities and major improvements to the public realm.

All four schools – Chemical Engineering and Analytical Sciences; Materials; Electrical and Electronic Engineering; Mechanical, Aerospace and Civil Engineering – who will eventually occupy the new site have already identified their current equipment, space and facility requirements working with a team of consultants.

They are now starting to think about how they would like the new campus to work. What facilities will they need? What equipment will they move? How much floor space will kit require? What kind of extra, ancillary systems do they need, such as steam, compressed air, water sprinklers or vacuum tanks? Once these questions are answered the consultants will compile all the requirements for the Manchester Engineering Campus Development (MECD). They then have to develop a conceptual design to meet all these requirements in efficient, ingenious ways. The MECD concept, expected later in 2014, will form the core for the architectural design brief.

As part of this early stage design process, each school has catalogued all its equipment and services – an inventory of 1,500 large-scale (ie bigger than benchtop) items, most of which will ultimately move to the new site.

Indeed some of this impressive and expense equipment will have to move twice. First the Materials Science Centre must be emptied ('decanted') so this old building can be demolished along with Grosvenor Halls to make space for the new construction.

Preparations are already underway to renovate space in alternative buildings, including the Morton Laboratory, The Mill and the Maths and Social Sciences Building, to host temporary labs, clean rooms, testing rigs and more. Here research will continue as normal during the construction of their new permanent homes.

Ryan Lewis, University Capital Project Manager, is currently planning this decanting phase. One of the biggest headaches is the transfer of the school's entire suite of imaging equipment out of the basement of the Materials Science Centre. "You can't move such sensitive equipment just anywhere," he explains. "Electron microscopes, for example, are highly sensitive to vibration. We have had to test a whole load of buildings to find the most suitable location."

The Henry Moseley X-ray imaging equipment will decamp further south to the new Photon Science Institute in the Alan Turing Building. Most of the School of Materials' 12 electron microscopes will end up in the Maths and Social Sciences building – shown to be least susceptible to vibrational noise.

It is not the challenge of physically getting the equipment out of the basement that concerns Ryan the most. "We will work with the equipment manufacturers and specialist movers. The dismantling is certainly complex, although these contractors make it look easy as they dismantle, label and box everything for transportation. However, getting the

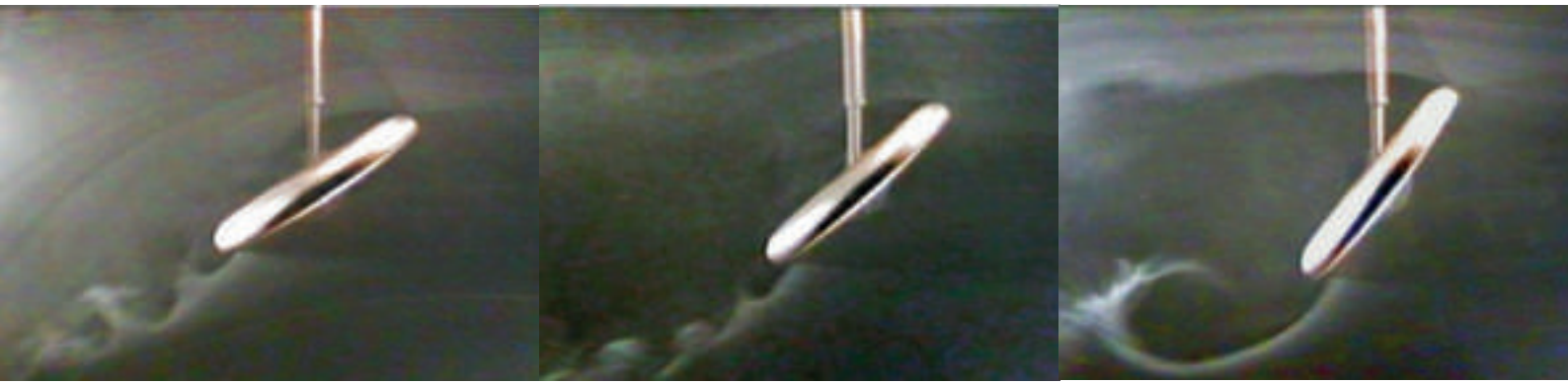
microscopes back up and running is the biggest challenge because they are so sensitive.

The Titan electron microscope, a goliath at 3m tall which comes with a roomful of peripheral devices, could take eight weeks or more to move. Ryan says that he plans to move one microscope at a time to minimise disruption and allow research to continue. "At least when it comes to moving again into the new building we'll know exactly what we are doing!" he quipped.

Gary Burns, Technical Services Manager for the School of Chemical Engineering and Analytical Sciences (CEAS) has already done his bit: CEAS moved into the new James Chadwick building in 2012. He remembers how much work went into the transfer of the 20m tall Cameron MEG Rig. "The unique rig cost about £1 million, so it had to come with us despite the high costs involved in its transfer. Of course we brought in outside specialists; they dismantled it into manageable modules, everything was labelled and packaged before being loaded onto trucks for the short journey from the Mill."

Gary says that every item of equipment requires individual consideration and attention to detail. "Actually physically dismantling and transporting is the easy bit – and we use contractors anyway. What really matters is planning and designing every step in intense detail. It is no good arriving in your new lab to discover that you need extra pipework!"

For Gary, success comes down to collaboration and communication. "There's at least one meeting every fortnight for projects like this, and that's before we get to the nitty gritty of architectural design, floor layouts and putting in services," he notes. "It is exciting to see electricians, mechanics and specialist engineers swarming over a piece of kit, cleaning it out, labelling and delicately packaging it for transport. But it is close communication as much as clever engineering that gets multimillion pound equipment out of old labs and quickly installed in new ones."



an electrically heated wire vaporised oil to create smoke, visualising the flow field when illuminated

HOW TO... MOVE A WIND TUNNEL

"We've got around 16 wind tunnels in MACE," says Mike Carroll as he unlocks a basement door in the George Begg building. "They range in size from benchtop dimensions to these."

He opens the door into a large hall, dominated by two industrial looking blue-painted steel tubes. They look a bit like four or five shipping containers – some rather shrunk in size – bolted end to end. It looks like a big job to move these out, but Mike just smiles. "Yes, but that's what moving contractors do best. You can see that the wind tunnel is quite modular, so we can dismantle it in bits that will fit through the door using a forklift – we had to enlarge the door when we first moved in. However, you can be fairly sure that when we rebuild this at the other end it probably won't be quite like this."

Mike explains that wind tunnels, like a lot of research equipment, evolve and adapt to their environment. "You construct the kit according to its environment. When we moved in here we had to turn the air intake through 90 degrees. So when we get round to designing the new home for these tunnels – and we're talking a hall the size of a football pitch – I'm sure something will change. We will be rebuilding with modifications."

Giant wind tunnels which are among some of the specialist equipment that will be relocated as part of the Manchester Engineering Campus Development

But it isn't necessarily the wind tunnel itself that poses the biggest engineering challenge. Mike opens the door to another tunnel. The experimental area is less than a metre long, and half the width. A 5cm metal model of an aircraft wing is mounted in the space. Yet this tunnel, which delivers air speeds up to Mach 5, requires an entire room of ancillary equipment: a 5m high pressuriser, a 2m long heater and two enormous vacuum tanks stacked to the roof.

"Moving the actual tunnel will be relatively straightforward," Mike suggests, "but we need to plan how we will use the new space. Will we take these rusty looking tanks with us? Can we design a central vacuum facility with our wind tunnels radiating out from it? How much floor space do we need around each tunnel for measuring equipment? Could we run tunnels simultaneously in a shared space?"

He doesn't have the answers yet – there are many meetings in his diary – and in the meantime the research must go on. "We plan for the future, but stay focused on the present. It's my job to minimise the disruption as we wait for the creation of our brand new home."

> FIND OUT MORE
www.manchester.ac.uk/aboutus/vision/

The first official movie still of Manchester graduate Benedict Cumberbatch as British computer pioneer Alan Turing in *The Imitation Game*. Image supplied by Black Bear Pictures

Manchester graduate to bring Turing to the big screen

Manchester graduate and Sherlock Holmes star Benedict Cumberbatch (Drama, 1999) is to play Alan Turing in a new film expected to hit the big screens later this year.

'The Imitation Game' focuses on the cracking of the Enigma code during World War Two, and drama graduate Cumberbatch will be play the codebreaker alongside a star-studded cast, including Keira Knightley, Charles Dance, Matthew Goode, Mark Strong and Rory Kinnear. The film is directed by Morten Tyldum and written by Graham Moore.

From 1948 until his death in 1954, polymath Alan Turing – hailed as the "father of modern computing" – worked on the world's earliest computers at The University of Manchester.

"Turing was an exceptionally talented man," said Professor Jim Miles, Head of Computer Science. "It's important to remember that although he was Deputy Director of Manchester's Royal Society Computing Machine Laboratory his appointment in Manchester was Reader in Mathematics.

"Beyond Computer Science he made important contributions to many fields including mathematics, psychology, chemistry, physics and biology."

The big screen interest in Turing coincides with him being awarded a posthumous royal pardon from the Queen and praise for his war-time contribution from the Prime Minister.

The rare pardon, awarded under the Royal Prerogative of Mercy protocol, follows a request from Justice Secretary Chris Grayling to address a "discriminatory" conviction.

Justice Secretary Chris Grayling explained the reasoning behind the pardon: "Dr Alan Turing was an exceptional man with a brilliant mind. His brilliance was put into practice during the Second World War where he was pivotal to breaking the Enigma code, helping to end the war and save thousands of lives.

"His later life was overshadowed by his conviction for homosexual activity, a sentence we would now consider unjust and discriminatory and which has now been repealed.

"Dr Turing deserves to be remembered and recognised for his fantastic contribution to the war effort and his legacy to science. A pardon from the Queen is a fitting tribute to an exceptional man."

Prime Minister David Cameron added: "Alan Turing was a remarkable man who played a key role in saving this country in World War Two."

Pioneer Alan Turing

Life on the front line as depicted by soldier-artist Walter Phythian. This drawing is on display until June 29, along with poignant war letters written by Manchester students, as part of the Aftermath exhibition at the University's John Rylands Library. www.library.manchester.ac.uk/rylands

University to mark WW1 and the Faculty's ground-breaking contribution

The University of Manchester is set to mark the 100th anniversary of the outbreak of World War One with a series of events and activities running throughout 2014.

"We want to mark the diversity of the University's contribution to the war effort," explained Dr James Hopkins, the University Historian and Heritage Officer.

"Many fought on the front line and paid the ultimate sacrifice but thankfully many returned. Others from the University community had a role to play on the home front, while others passionately objected to the war and became pacifists. We want to reflect all of this in the year ahead."

James said the then Faculty of Technology – a forerunner to UMIST and The University of Manchester – itself lost 196 students, including 63 who had been members of the Manchester University Officers' Training Corps.

One survivor was 2nd Lieutenant JD Cockcroft, who returned from serving in the Royal Artillery on the Western Front to complete his BScTech and MSscTech at the Faculty. This former officer went on to work with Ernest Walton to eventually "split the atomic nucleus" and from this work Sir John Cockcroft, as he become known to the world, was awarded a Nobel Prize for Physics.

Ironically, explains historian James, the artillery shells used by young gunners like John Cockcroft were produced at a better and faster rate, thanks to the work of the original technology faculty he studied at. A new type of gas furnace pioneered in Manchester boosted the UK's munitions production and therefore helped power the national war effort.

Other innovations included a deep sea hydrophone to counter submarine threats to shipping, improvement in the fabric used by R33 and R34 airships, as well as advice on how to stretch the nation's bread supply.

"This pioneering work helped propel what would become our Faculty into one of national significance," James added. "In fact, you can trace some of the modern Faculty's world-leading reputation for applied excellence from this period of ambitious technological application."

A CAREER CUT SHORT

Scientist Henry Moseley had his promising career cut short after being killed in the Gallipoli campaign in 1915, aged 27. Just before the outbreak of the war, while working in Manchester, Moseley observed and measured the X-ray spectra of various chemical elements. Through this work he discovered a systematic relation between wavelength and atomic number, a discovery known as Moseley's Law.

Today Manchester has a world-class reputation in X-ray imaging technology which was recently recognised with a Queen's Anniversary Prize. See pages 34 and 35.

If you have any information relating to the Faculty's contribution to World War One please contact Dr Christine Twigg: **christine.twigg@manchester.ac.uk**

EPSUCCESS

Andrew Welfle

Andrew Welfle (pictured left), a PhD researcher in the Tyndall Centre for Climate Change Research has been selected as one of five students representing Manchester at the Global Young Scientists summit 2014 in Singapore, which took place in January.

Andrew's research focuses on Biomass, Resource Modelling, Bioenergy, Climate Change, Energy Policy.

The summit is an annual gathering of primarily PhD students and post-docs from all over the world, and internationally eminent science and technology leaders, with an interdisciplinary theme covering a range of subjects from chemistry, physics and medicine to mathematics, computer science and engineering. The students attend a five day programme, interacting with world-renowned scientists and peers, to discuss science and research.

Andrew said: "The GYSS is important as there are few similar events that bring together such a large number of leading scientists representing the spectrum of scientific research. Often when you are working in your research area it is too easy to lose a wider perspective of what you are doing, and be unaware what relevant research may be being carried out in other scientific disciplines. The GYSS provides a great forum for addressing this.

Charm matters in anti matter

Manchester scientists working at the European Organisation for Nuclear Research (CERN) have reported the world's most precise measurement of the difference between matter and antimatter – known as CP violation – during the decay of charm particles.

The team, pictured, which included colleagues from the universities of Oxford and Glasgow, presented their findings at the sixth International Workshop for Charm Physics hosted by The University of Manchester's School of Physics and Astronomy in September and have now submitted their publication.

Manchester scientist Dr Silvia Borghi, who presented the new result at the conference, said: "This measurement – the first to search for matter-antimatter asymmetries in charm particles with a precision of better than 0.1 per cent – is a major milestone for our group's research."

Professor Chris Parkes, co-chair of the conference, added: "This is an important topic of research at the Large Hadron Collider, as it provides a unique way to search for sources of new physics, and we were pleased to host this conference in the UK for the first time."

The event, organised by members of Manchester's High Energy Physics group who participate in CERN's Large Hadron Collider Beauty (LHCb) experiment, is the leading conference for research in particles containing charm quarks.

The LHCb collaboration contributed a range of brand-new results, one of which was obtained under the leadership of Dr Marco Gersabeck, who was also co-chair of the conference. He said: "Attracting more than 100 delegates from around the world exceeded our expectations and shows the huge interest in this field. The results from the LHCb experiment are now shaping the world's knowledge of charm physics."

New X-ray vision can reveal internal structure of objects

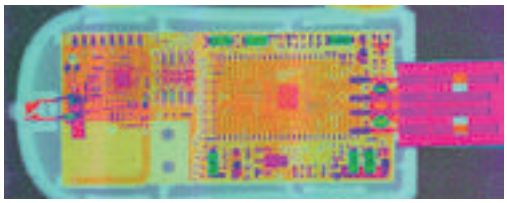
University of Manchester researchers, working with colleagues in the UK, Europe and the US, have developed a new kind of 'X-ray vision' that can peer inside an object and map a three-dimensional distribution of its nano properties in real time.

The novel imaging technique could have a wide range of applications across many disciplines, such as materials science, geology, environmental science and medical research.

Professor Robert Cernik in Manchester's School of Materials, said: "This new imaging method – termed Pair Distribution Function-Computed Tomography – represents one of the most significant developments in X-ray micro tomography for almost 30 years"

"Using this method we are able to image objects in a non-invasive manner to reveal their physical and chemical nano-properties and relate these to their distribution in three-dimensional space at the micron scale.

"Such relationships are key to understanding the properties of materials and so could be used to look at in-situ chemical reactions, probe stress-strain gradients in manufactured components, distinguish between healthy and diseased tissue, identify minerals and oil-bearing rocks or identify illicit substances or contraband in luggage."



A laboratory system for element specific hyperspectral X-ray imaging. Analyst 138 (2013) 755-759

The research, published in the journal Nature Communications, explains how the new imaging technique uses scattered X-rays to form a three-dimensional reconstruction of the image.

"When X-rays hit an object they are either transmitted, absorbed or scattered," explained Professor Cernik. "Standard X-ray tomography works by collecting the transmitted beams, rotating the sample and mathematically reconstructing a 3D image of the object. This is only a density contrast image, but by a similar method using the scattered X-rays instead we can obtain information about the structure and chemistry of the object even if it has a nanocrystalline structure.

"By using this method we are able to build a much more detailed image of the object and, for the first time, separate the nanostructure signals from the different parts of a working device to see what the atoms are doing in each location, without dismantling the object."

Manchester alumni take up the challenge

MAKING A DIFFERENCE

An award-winning scheme to encourage Manchester graduates to become school governors is proving a big success.

Since August last year, 125 Manchester alumni have signed up to the School Governors One-Stop Shop (SGOSS) initiative – along with participating University staff, this helps to make the University the country's leading recruiting organisation for school governors under the SGOSS partnership.

The partnership is part of the University's commitment to make a real difference and engage with communities. This work forms part of a core social responsibility strategy as outlined in the Manchester 2020 Vision.

Julian Skyrme, Director of Social Responsibility at the University, said he was delighted with the response from the alumni community. "Manchester alumni are an amazing resource for school leaders and young people," he said. "As successful, professional individuals across a rich range of occupational backgrounds, they have a lot to offer governing bodies in schools and young people directly."

"We are making social responsibility a distinguishing feature of all our activities, ensuring we support our current and former students to make a positive difference to young people in state school education."

Manchester is the first university to formally partner with SGOSS, a national charity whose aim is to help fill the 30,000 current vacancies for state school governors across England. School governors form the country's largest group of educational volunteers – on average each governor influences the education of around 550 children.

The University's successful school governors programme won the 'Social Responsibility' category of the Environmental Association of Universities and Colleges (EUAC) Green Gown Award – the same project also went on to win the 'International Best Social Responsibility' category.

Find out more about this **Signature Programme** at: **www.sgoss.org.uk/sgoss-and-the-university-of-manchester.html**

GLOBAL GRADUATES

As part of an international fact-finding mission to gather careers advice from Manchester alumni, **Qualeem Hussai** (third year Electrical and Electronic Engineering) travelled to Singapore, **Taranvir Sagoo** (third year, Civil Engineering) visited Dubai, while **Robin Drinkall** (third year Chemistry with Medicinal Chemistry) went to New York. Each was supported by the University's Global Graduates programme and given the opportunity to meet alumni from a range of professions during their respective week-long meetings.

At least three quarters of students who participated in the scheme are from a widening participation background and are funded to participate by a gift from a donor with special recognition going to University governor **Paul Lee** who funded 12 of the 16 Global Graduate students. The scheme – which is administered by the Careers Service – aims to raise career aspirations and heighten cultural awareness in students. It will run again in June, with visits to New York, Dubai, Singapore and Hong Kong.

GLOBAL IMPACT AWARDS

Three students from the Faculty have received Global Impact Awards, which are funded by alumni donations to the University and are awarded by the Alumni Association Advisory Board.

To qualify for the £250 award, the students have to travel overseas and undertake voluntary work of sustainable benefit to the community. This work must also be beyond the main focus of their subject of study.

Lucy Major, third year MEng Civil Engineering, travelled to Uganda to spend a month working with charity East African Playgrounds. **Muhammed Nurul Bin Shahul Hamid**, second year BEng Mechanical Engineering, visited Turkey to work with high-school students, while **Alexander Crow**, first year BSc Electronic and Electrical Engineering, went to Kenya to construct a new classroom and kitchen at Marigat Catholic Primary School.

EPSUCCESS

IBM award for John Keane

John Keane of the School of Computer Science and the Manchester Institute of Biotechnology, Co-Director of the cross-faculty Decision and Cognitive Sciences Research Centre, has won a prestigious IBM Faculty award; one of only four in the UK. He joins 13 other researchers from around the world who each receive $10,000 to bring together their research for the benefit of curricular development.

The IBM Faculty Awards is a world-wide programme intended to foster collaboration between researchers at leading universities and those in IBM, and to promote courseware and curriculum innovation to stimulate growth in disciplines and geographies that are strategic to IBM.

The award will be used in collaboration with Dr Goran Nenadic to support research and teaching in 'big data and analytics'. In particular, the award will support technical case studies investigating the design and implementation of big data solutions to enhance postgraduate teaching.

Big data refers to large quantities of raw information generated by changing technologies and corresponding changing organisational practice. The rapidly expanding volume of complex, multi-modal data, allied to its perceived potential, impacts both analytic techniques and organisational context to utilise the analysis results. These impacts have led to the recent emergence of 'data scientist' and related activities as a hybrid role requiring mainly technical skills but also understanding of organisational context. The award will support both research and teaching in big data.

Professor Keane holds the MG Singh Chair in Data Engineering. His primary interest is data analytics and decision support for complex, multi-modal data. The work explores a range of applications from bio-medical to financial.

Launch of The Graphene Flagship: Professor Karin Markides, President and CEO of Chalmers University of Technology, Gothenburg, Sweden, Professor Jari Kinaret, Director of The Graphene Flagship, Chalmers University of Technology, Gothenburg, Sweden and Professor Konstantin Novoselov, Member of the Graphene Flagship Strategic Advisory Council, The University of Manchester,

Graphene Flagship sets sail

The Graphene Flagship has been launched as one of Europe's first ten-year, € 1bn flagships in Future and Emerging Technologies. Selected by the European Commission, its mission is to take graphene and related-layered materials from academic laboratories to society, revolutionise multiple industries and create economic growth and new jobs in Europe.

During January, a flagship sail was symbolically set jointly by Wolfgang Bosch of the European Commission, Karin Markides, President of Chalmers University of Technology, and Nokia representative Tapani Ryhänen.

The Graphene Flagship strategy is divided into two separate phases: a 30-month ramp-up phase under the seventh Framework Programme (1 October 2013 to 31 March 2016) with a total European Commission funding of €54m, and a steadystate phase under the Horizon 2020 programme, starting 1 April 2016, with expected European Commission funding of €50m per year.

Carl-Christian Buhr, member of the Cabinet of European Commission Vice-President Neelie Kroes, said: "Now, we are all in this together, the Commission and all the academic and industrial partners of The Graphene Flagship. It's is an unusually long-term commitment, and there will be challenges, let's be clear about that.

"One challenge will be to keep the agility, to get the right new partners inside, so that you can react and steer in a new direction as the context changes. Another is of course the scientific challenge. Thirdly, we need to bring in industry in such a way, that ideas are taken up in a way that leads to new products and markets. That's the whole idea of the flagship."

The consortium of Graphene Flagship initially includes 75 academic and industrial partners in 17 European countries. It focuses on the general area of communications, concentrating on ICT and on the physical transport sector, and supporting applications in the fields of energy technology and sensors.

The consortium will be expanded in the near future with another 20-30 groups, further strengthening the engineering aspects of the Graphene Flagship.

Parallel to this, work is performed among EU member states and associated nations, through an ERA-NET, to coordinate national funding initiatives on graphene, complementing Graphene Flagship funding from the European Commission. Graphene Flagship launches a range of initiatives focused on graphene dissemination within and outside the flagship.

'Tense' graphene joins forces with gold nano-antennas

Writing in Nano Letters and Physica Status Solidi Rapid Research Letters, a team led by Dr Aravind Vijayaraghavan in collaboration with Professor Stephanie Reich at Freie Universität Berlin and Professor Stefan Maier at Imperial College London, has shown that graphene can be used to investigate how light interacts with gold nanostructures of different shape, size and geometry. This could potentially increase the efficiency of solar cells and photo detectors.

This interaction, through plasmon resonance, is the same phenomenon that gives colour to the gothic stained glass rose window of Notre-Dame de Paris.

When light shines on a metal particle smaller than the wavelength of the light the electrons in the particle start to move back and forth along with the light wave, causing an increase in the electric field at the surface of the particle.

When two such particles are brought close to each other, the oscillating electrons in the two particles interact, forming an even higher electric field between the two particles, which results in a coupling between the two particles. It has proven to be difficult to experimentally observe and measure the magnitude of this coupling and resulting electric field.

Dr Vijayaraghavan's team and collaborators have shown that graphene can be placed on top of such coupled gold antennas of different shapes and, by performing Raman spectroscopy on the graphene, this coupled plasmonic system can be observed and measured.

He said: "When a sheet of graphene, just one atom thick, is placed on top of two gold particles next to each other, the graphene bends around the particles and gets stretched in the gap between the particles. When light falls on the graphene, it is scattered to different extents from the strained and unstrained parts of the graphene.

"Fortunately, the strained part of the graphene also lies in the same region as the plasmonic electric field – in the cavity in between the two dots. This allows us to compare the amount of light scattered by the plasmonic cavity and the surrounding region, and derive a quantity for the enhancement from the plasmonic antenna cavity.

"The light scattered from the strained graphene can be 1000 times brighter than the light from the surrounding graphene."

University attracts £5 million research partnership from graphene manufacturer

Bluestone Global Tech - one of the world's largest graphene manufacturers - will open its European base at The University of Manchester, and sign a £5 million collaborative agreement; a decision which could create many new jobs in the city.

The partnership will allow University academics to work closely on research projects with Bluestone to produce the next generation of graphene applications.

Graphene was first isolated at The University of Manchester by Andre Geim and Kostya Novoselov in 2004, earning them the Nobel prize for Physics in 2010.

Work has begun on the £61m National Graphene Institute (NGI), funded by the Engineering and Physical Sciences Research Council and the European Regional Development Fund, which will provide a centre for industry and University academics to work side by side on emerging graphene applications. The deal with Bluestone marks the first strategic partnership of the NGI.

The University has more than 100 scientists and engineers working on graphene and other 2D materials, across all disciplines providing the expertise and critical mass Bluestone and other industrial partners require.

Bluestone, who currently have laboratories in New York and Taiwan, are leading the emerging graphene market, providing mass production of high-quality 2D materials to enable the commercialisation of many graphene-enhanced applications such as advanced displays, flexible electronics, energy storage materials, and cosmetics.

In addition to providing the material for research projects, Bluestone will initially open a pre-production facility and offices at the University to partner with a few leading consumer companies, before setting up larger European headquarters and a pilot production plant within Manchester.

Bluestone joins Graphene Industries and 2D-Tech, the University spin-out companies supplying graphene and other 2D materials around the world, in a group of graphene manufacturers based at the University.

Dr Chung Ping Lai, Chief Executive Officer for Bluestone Global Tech, said: "The link with The University of Manchester and the National Graphene Institute is integral to our strategy of working with our customers to bring products and processes from the lab to the workplace. With our long-term commitment and co-operation with the University, BGT will have access to a critical mass of world-class research talent, facilities and resources and we are very excited to be located at the home of graphene."

STOP PRESS ...

Sir Andre Geim and Sir Kostya Novoselov have been awarded the Freedom of the City of Manchester.

The freedom of the city is the highest honour Manchester can bestow and recognises the pioneering work undertaken by Sir Andre and Sir Kostya, who won the Nobel prize in 2010 for their work on graphene.

In their resolution, council leaders also recognised the importance of the University to the growth and regeneration of the city.

Queen awards Regius professorship to School of Physics and Astronomy

Professor Andre Geim has become the inaugural Regius professor at the University; one of only two such awards at Manchester in the past 100 years. Regius professorships are bestowed by the Queen in recognition of exceptionally high quality of teaching and research. A total of 12 Regius professorships were awarded by the Queen to mark her Diamond Jubilee.

Professor Geim received the 2010 Nobel prize, alongside Konstantin Novoselov, for his work on the novel material graphene. He said: "The Regius professorship reflects the tradition of exceptionally strong physics at The University of Manchester. I am most honoured to play a role as the current figurehead for this century-long effort. I would like to express my deep appreciation to the University and School leadership for their efforts in gaining this hallmark."

The School of Physics and Astronomy is one of the world's principal physics departments with more than 1,000 students, and carries out innovative research projects in physics, astrophysics and astronomy, as well as significant public engagement activities. The School boasts world-leading staff in all areas of modern physics and has produced nine of the 25 Nobel prize winners associated with The University of Manchester, two of whom are among the current staff.

Professor Stephen Watts, Head of the School of Physics and Astronomy, said: "Physics at Manchester has a proud tradition, starting with Rutherford and the discovery of the atomic nucleus, to the recent discovery of graphene. "

Professor Colin Bailey, Vice-President and Dean of the University's Faculty of Engineering and Physical Sciences, added: "I am particularly delighted that Andre has agreed to accept the inaugural Regius Professor of Physics. His passion for scientific research and education, together with its impact on society and the economy, is truly inspirational."

A celebratory event was held at the University in October, and Professor Geim received the Queen's Warrant at the University's Foundation Day lecture.

Cutting-edge nuclear research facility opens in Cumbria

The University's recently opened Dalton Cumbrian Facility on the Westlakes Science and Technology Park, near Whitehaven

The University of Manchester's Dalton Nuclear Institute has opened its Cumbrian research facility on the Westlakes Science and Technology Park near Whitehaven.

The Dalton Cumbrian Facility (DCF) is a new research base established with an initial £20 million joint investment by the University and the Nuclear Decommissioning Authority (NDA). It will strengthen world-leading academic research in nuclear energy in West Cumbria.

Now a core component of the new National Nuclear User Facility, part of the Government's Nuclear Industrial Strategy, the DCF is designed to complement and significantly expand the nuclear research and education capability of the UK's nuclear R&D sector.

The Facility is adding to the growing research, education and skills infrastructure in West Cumbria, key elements in the Britain's Energy Coast programme designed to deliver diverse and sustained economic wellbeing for the area. The overall aims of the DCF are the delivery of world-leading nuclear research and the transfer of knowledge to industry.

Research will focus primarily on the areas of radiation science and nuclear engineering decommissioning. The facility is fully equipped following delivery and commissioning of a particle accelerator, and has detailed computer modelling capability and large-scale experimental laboratories. These include extensive irradiation facilities and associated analytical and inspection equipment, to provide a comprehensive research environment.

Through the DCF, the University has pioneered unique academic access in an agreement with the NDA to the National Nuclear Laboratory (NNL)'s extensive R&D and engineering facilities at the Central Laboratory, on the Sellafield site, and at Workington. This access, available to wider UK academia, is vital to support full lifecycle development and deployment of innovative technologies.

Adrian Simper, the NDA's Director of Strategy and Technology said: "The NDA has always believed that a world class nuclear research centre is a key component for the success of the decommissioning mission, recognised by our significant investment in the Dalton Cumbria Facility"

"Locating the DCF here in West Cumbria provides a unique combination of a world class research facility with appropriate staff and equipment, able to work collaboratively with the likes of the National Nuclear Laboratory, close to the Sellafield site that presents us with the most significant decommissioning and radiological challenges.

"More broadly the DCF and its links with NNL add to existing investments such as Energus and the Construction Skills Centre, to provide West Cumbria with probably an unrivalled network of research, education and training infrastructure that brings benefits to the decommissioning mission, the nuclear industry as a whole and the local economy and community."

> FIND OUT MORE
www.dalton.manchester.ac.uk
+44 (0) 161 275 4263
dalton@manchester.ac.uk

Professor Andrew Sherry (left), Director of the Dalton Nuclear Institute with Rt Hon Michael Fallon and AMEC's Tom Jones

Dalton Nuclear Institute and AMEC – creating a North West global centre of excellence

AMEC and The University of Manchester's Dalton Nuclear Institute have announced a long-term strategic partnership. The collaboration will see both parties working collaboratively to create a global centre of excellence for reactor engineering and nuclear skills in the North West.

The partnership will allow the University to build on its track record of innovative research and development projects and broaden the services both parties offer to respective customers. This will include Reactor Technology Development; a project that will take technology developments from the Dalton Nuclear Institute and put them into industry application through AMEC.

Rt Hon Michael Fallon, UK Minister of State for Energy, announced the partnership: "I am delighted to announce the launch of this partnership. The UK nuclear sector is second to none and it is critical that the UK continues to showcase its expertise and skills around the world.

"This partnership supports strong collaboration between industry and academia, one of the cornerstones of the Nuclear Industrial Strategy, and will support the UK in exporting its skills and expertise overseas ensuring that we keep our rightful place as the leader in the nuclear sector."

Professor Andrew Sherry, Director of the Dalton Nuclear Institute said: "Our relationship with AMEC has developed over the last decade. There is great scope to combine academic and industrial capability for skills development and technology. Jointly we can offer an even better service to our respective customers in the domestic and international markets."

Clive White, President of AMEC's Clean Energy – Europe business, added: "There are many benefits in extending what is already established as a highly successful partnership. Through academia and industry joining together, in support of the UK's Nuclear Industry Strategy, the UK will effectively export its nuclear skills and capabilities into the international marketplace."

PARTNERSHIP OBJECTIVES

- Establish the North West as a globally-recognised centre of excellence for reactor engineering within the nuclear industry.
- Create a recognised hub for customers to receive independent, expert advice working on world-leading projects.
- Support the delivery of the Nuclear Industry Strategy, helping to meet the future people capability requirements for future and existing UK nuclear requirements.

EPSUCCESS

Dr Nick Smith awarded prestigious Royal Society Fellowship

National Nuclear Laboratory (NNL) Research Fellow Dr Nick Smith has been awarded a four-year Industry Fellowship by the Royal Society. Fellowships are awarded to scientists for work on a collaborative project with an academic organisation.

Dr Smith's primary focus is fundamental and applied research into remote 2D and 3D, laser-based characterisation techniques in the nuclear industry. The research has significant potential in helping to solve key characterisation challenges faced by the nuclear industry.

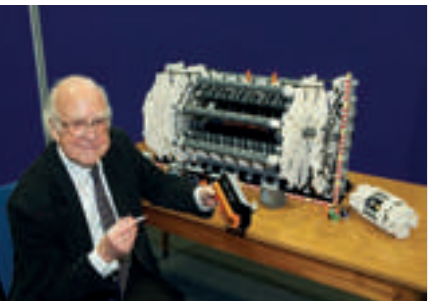
His research has already seen close collaboration between NNL and The University of Manchester's School of Earth, Atmospheric and Environmental Sciences and the Laser Processing Group, and future research will involve work at NNL's Workington Laboratory and the University's Dalton Cumbrian Facility (DCF).

A Chartered Geologist and Fellow of the Geological Society, Dr Smith is NNL's lead geologist and 3D geoscientific and remote sensing/characterisation expert. He holds visiting research/teaching roles at three UK universities and holds membership of the European Federation of Geologists and the European Geosciences Union.

Dr Smith said: "I consider the award of this fellowship a huge honour both personally and for the National Nuclear Laboratory. It will further raise the profile of NNL's research collaborations and I very much look forward to working with the University and the Royal Society over the next four years."

Professor Andrew Sherry, Director of The University of Manchester's Dalton Nuclear Institute, added: "This provides an outstanding opportunity to show the benefits of how industry and academia can work effectively together to drive innovation within the nuclear sector".

Bobby Charlton and Peter Higgs among honorary degree recipients



Manchester football hero and a recent Nobel Prize winner Sir Bobby Charlton and Professor Peter Higgs recently received honorary degrees from the University.

Professor Peter Higgs, the scientist who gave his name to the Higgs-boson particle, was awarded the Nobel Prize in 2013. His work in the 1960s was dedicated to theorising the Higgs-boson particle. Professor Higgs posited in 1964 that subatomic particles gained mass by way of a particle that has since been called the Higgs-boson.

Forty-nine years later in 2012 the Large Hadron Collider discovered the theoretical particle, helping to explain how the building blocks of the universe have mass.

His theory of the missing boson drove physics research for decades. In July of last year at the European Organization for Nuclear Research, CERN, results were presented which confirmed Peter Higgs' idea and heralded the start of the next chapter to study in detail the properties of this new particle.

Sir Bobby Charlton is probably best known for his outstanding record as a footballer for Manchester United and England.

He burst onto the scene as a flag-bearer for the 'Busby Babes' and went on to form part of United's fabled 'Holy Trinity' alongside George Best and Denis Law.

His achievements since his football career ended have been immense, often for benefit of the City of Manchester, as well as further afield. Sir Bobby is a member of the Laureus Academy which uses the power of sport to help tackle pressing social challenges through the Laureus Sport for Good Foundation projects.

In 2011, he founded the 'Find a Better Way' charity to develop new technology to accelerate the detection and removal of landmines globally, working with The University of Manchester and other partners in the North West.

Honorary degrees were also conferred upon **Frances O'Grady** (Politics and Modern History, 1980), first female General Secretary of the TUC, and Nobel Prize-winning chemist **Professor Mario Molina**.

Professor Mario Molina is a Professor at the University of California. In the 1970s he drew attention to the threat to the ozone layer from industrial chlorofluorocarbon (CFC) gases. He has received many honorary degrees, as well as numerous awards for his scientific work, including the 1995 Nobel Prize in Chemistry.

New Years Honours for EPS

Three colleagues from the Faculty of Engineering and Physical Sciences have been given awards in the 2014 New Year's Honours list in recognition of their achievements and service.

Lenox Green, a postgraduate office administrator at the School of Maths, has been awarded an OBE for his voluntary work to help youngsters, families and homeless people in Manchester. Twenty years ago Lenox and wife Heather re-mortgaged their home to set up the Rainbow Christian Centre in Hulme. The centre offers a range of activities, support and inspiration for the local community - including helping families with housing, benefits, education, court appearances, family liaison and providing a weekly food bank.

Professor Carole Anne Goble, at the School of Computer Science, has been made a CBE for her services to science. Carole is a leading authority on the semantic web, also known as Linked Data - a means of enriching the web with knowledge. She has worked on the computational and technical underpinning of scientific disciplines, particularly life sciences, systems biology and biodiversity, and has had an impact on bioinformatics, e-Science, open science and applied computer science.

Professor Douglas Kell, at the School of Chemistry and the Manchester Institute of Biotechnology, has been awarded a CBE for his services to science and research. Douglas is a leading figure in the field of systems biology, the multidisciplinary approach to tackling complex biological problems using theory, computer modelling and experimentation. This work is revolutionising how bioscientists think and work - and will make the outputs of their work both more useful, and easier to apply in industry and policymaking.

Sustainable partnership agreed between University and Unilever

The University of Manchester and Unilever have agreed to a long-term strategic partnership, making Manchester a key partner for the consumer goods company's research across a number of specific fields in science.

The University of Manchester joins a small number of strategic academic partners as the company works towards fulfilling its ambitions of growing the business while reducing its environmental impact.

Unilever has agreed that its role will be to support some of the University's research across all four of its faculties in areas such as sustainable consumption, process engineering, biophysics and systems biology, as well as aspects of inflammation, toxicology and hair biology.

Professor Luke Georghiou, Vice-President for Research and Innovation at The University of Manchester, said: "Unilever recognise that access to university research can give its organisation a new vantage point. Strategic alliances of this nature are helping to put innovation and research at the heart of economic growth in the UK.

"Unilever will benefit by gaining intellectual insights from world-leading researchers. The University will benefit from the commercial insight that can inform and direct our research in the future and generate real-world impact."

Professor Jim Crilly, Senior Vice President, Unilever Strategic Science Group, added: At Unilever we believe that to continue to be successful we need to collaborate with the very best partners to access new ideas and technologies to create superior and sustainable products. The University, with its history of leading scientific achievements and its future ambitions, makes it an obvious choice for Unilever. The diversity of research fields that we will be exploring together is testimony to the range and depth of expertise to be found at the University and to our mutual interests in key areas of research."

The landmark agreement has the potential to translate cutting-edge science into solutions for sustainable products of the future accessed by billions of consumers across the globe.

£100,000 agreement to extend ties with Brazil

The University has signed a co-operation agreement with Brazil's leading scientific research funding agency to promote research links between the UK and São Paulo.

The agreement with FAPESP (São Paulo Research Foundation) will last for five years, and will make it easier for UK researchers and their contemporaries in Brazil's top-ranked universities to work together. The University and FAPESP will contribute £50,000 to fund calls for proposals across a range of science disciplines.

FAPESP already has similar cooperation agreements with 13 UK universities and all the UK Research Councils.

FAPESP President, Professor Lafer, said: "Researchers at Brazilian universities sponsored by FAPESP are already working very closely with experts from The University of Manchester to study the way Amazonia affects global climate change. We now look forward to fruitful cooperation on a much wider wide range of scientific disciplines."

Professor Colin Bailey, Vice-President of the University and Dean of the Faculty of Engineering and Physical Sciences added: "We are particularly pleased to sign this agreement with FAPESP, which will continue to support and grow our research links with the state of São Paulo".

Professor Celso Lafer, President of FAPESP, with Professor Colin Bailey

EPS PEOPLE

Perdita Barran welcomed to Manchester Institute of Biotechnology (MIB)

Perdita Barran joins MIB as the current Chair of Mass Spectrometry and Director of the Michael Barber Collaborative Centre for Mass Spectrometry at The University of Manchester. She graduated from Manchester University with a degree in Chemistry with Industrial Experience, after which she completed her PhD in Chemical Physics at Sussex University, under the supervision of Professors Tony Stace and Sir Harry Kroto.

She has held posts at the University of California Santa Barbara and the University of Edinburgh, where she helped to establish a Centre of Proteomics (SIRCAMS).

Dr Barran was awarded an EPSRC Advanced Research Fellowship in 2003 to study the structure and dynamics of model peptides and proteins in the gas phase. The Barran group has developed IM-MS instrumentation to investigate changes in protein conformation and aim to understand biological systems using mass spectrometry based techniques in conjunction with collaboration with biologists and biomedical research groups.

In 2009 in recognition of her achievements she was awarded the inaugural Joseph Black award by the RSC Analytical Division. She is also an Editor of the International Journal of Mass Spectroscopy.

EPSUCCESS

Science Council recognition for Professor Jon Lloyd

Professor Jon Lloyd has been recognised by the Science Council in a list of the UK's 100 leading practising scientists.

Jon, who is Professor of Geomicrobiology in the Faculty's School of Earth, Atmospheric and Environmental Sciences, Director of the Williamson Research Centre and an affiliate of the Research Centre for Radwaste Disposal, was cited in the 'Developer/Translational' category. He was recognized for his work at the interface between biology and geology, including current capacity building research funded by a prestigious Royal Society Industrial Fellowship.

Via part-time secondment to the National Nuclear Lab, Jon is also building a unique programme of research that addresses the widespread impact of microbial life on the nuclear fuel cycle, from nuclear plant operation, through to contaminated land remediation, decommissioning and radwaste disposal.

Regarding the Science Council's recognition, Jon said: "I am delighted that the interfacial work that we do has been recognised, something at which I think Manchester really excels."

Royal award recognises contribution to UK plc

The University of Manchester's world-leading imaging techniques to support the UK's strategic development in advanced materials and manufacturing has been honoured with a Queen's Anniversary Prize – one of the most prestigious awards in higher education.

Manchester is at the forefront in developing new techniques for the 3D imaging of structures and defects in materials, and interpreting the state of stress, microstructure and damage in engineering materials and components.

This is coupled with the University's knowledge and expertise to develop reliable models based on these imaging results to allow the development of engineered life-extending treatments and to accelerate the safe adoption of new manufacturing processes.

To date the University has supported a wide network of 90 companies and 35 institutions providing unique insights into materials behaviour and failure, enabling innovation and direct impact to UK plc.

The Queen's Anniversary Prizes are administered by the Royal Anniversary Trust and presented every two years to reward innovative work of outstanding quality within the higher and further education sector.

Professor Colin Bailey, Vice-President of the University and Dean of the Faculty of Engineering and Physical Sciences, said: "The University, and its staff across a range of disciplines, has become the world-leader in the development of X-ray imaging techniques and their application.

"The techniques support the development of advanced materials and manufacturing across a range of industrial sectors which is critical to the UK's economic growth, as well as addressing global challenges. The Queen's Anniversary Prize is a great honour, highlighting the excellent work carried out by our staff."

Professor Dame Nancy Rothwell, the University's President and Vice Chancellor, added: "The Queen's Anniversary Prizes reward excellence in work of outstanding importance and quality in higher and further education, so this honour is a real testament to the cutting-edge research in imaging techniques being carried out here in Manchester."

CASE STUDY: X-ray technology

X-ray technology is being used by researchers at the University of Manchester to help make air travel safer – by aiding the intelligent design of aeronautical composite materials.

The team from MXIF (Manchester X-ray Imaging Facility) is looking at the tolerance to impacts of composite materials that make up the panels on new Airbus or Boeing aircraft such as the A350 and the Dreamliner used by airlines across the world.

"Theories explaining how damage to metal panels occurs due to impacts are well established, but how modern composite material behave in similar situations is less well understood", says Professor Phil Withers, MXIF Director and Professor of Materials Science based in the University's world-leading Faculty of Engineering and Physical Sciences.

"Therefore we are using X-rays to 'see' the damage caused by impacts. These include low energy impacts such as, for example, a spanner being accidently dropped onto an aircraft panel during routine maintenance as well as high velocity impacts occurring in flight, for example by hail stones.

"Such impacts can be barely visible to the naked eye. This is because composite materials show little damage on the surface but this could be masking more serious problems underneath," said Professor Withers.

The use of X-ray technology, explained Professor Withers, is invaluable because it allows us to see below the surface in 3D to reveal what is really happening to the composite fabric following an impact.

Manchester hosts one of the most extensive X-ray computed tomography (CT) imaging facilities in the world. This allows the team to collect 3D images for precise analysis, in the same way as medical specialists use CT scanning to create realistic images of the inner body to reveal injury or disease.

In addition, because X-ray imaging is non-destructive, it means researchers can track how damage may develop in situ over time.

University

helping intelligent design of materials for safer aircraft

X-ray image of a novel 3D woven composite which make up the panels on new Airbus or Boeing aircraft such as the Dreamliner, below

The fibres are rendered semi transparent to see the damage (artificially coloured).

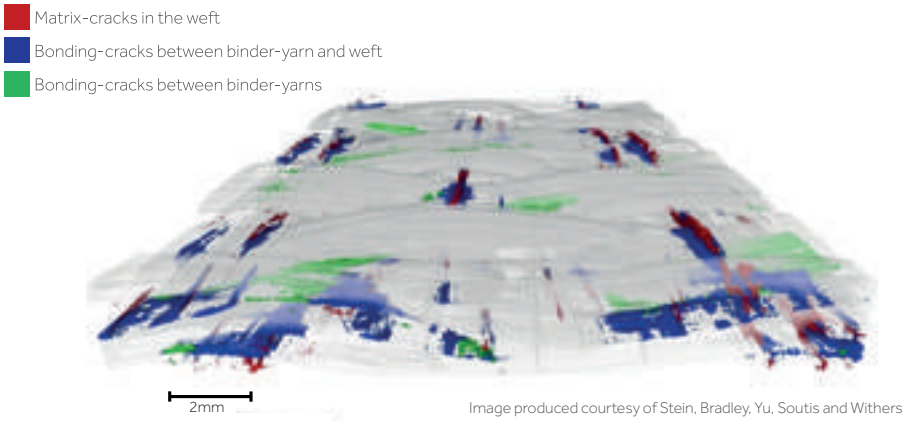


Image produced courtesy of Stein, Bradley, Yu, Soutis and Withers

The Manchester team are comparing the architecture of both conventional 2D and novel 3D composite materials. Two dimensional composites are made up of flat sheets each containing fibres in a single orientation bonded together by glue.

Such 2D laminates are therefore incredibly strong but the layers are prone to delamination on impact in comparison to 3D materials. These include interwoven carbon fibres that bind all the layers together.

This research is feeding directly into industry, explained Professor Withers, because of the strong relationships with the University and the cluster of high-tech material manufacturers based in the North West of the UK through the National Composites Certification and Evaluation Facility In Manchester.

"This research will certainly help accelerate the development of novel materials that are even smarter in application, so helping to boost safety and performance" added Professor Withers.

EPSUCCESS

Researcher wins world's top award

James Allan, a Senior Research Fellow in SEAES and a member of the National Centre for Atmospheric Sciences, has been awarded the 2013 Smoluchowski Prize by the German Aerosol Society GAeF at the European Aerosol Conference in Prague.

The award, named after the physicist Marian Smoluchowski (1872-1917), recognises significant research contribution to aerosol science and is given to a young researcher, under 40 years of age, who has made the greatest impact on their chosen research field.

James studied for his undergraduate degree in Physics at Manchester, after which he took a PhD in atmospheric aerosol measurement in the University's Centre for Atmospheric Science, graduating in 2004.

Professor Hugh Coe, Head of the School of Earth, Atmospheric and Environmental Sciences, said: "Having been an undergraduate, postgraduate and research scientist here, he is truly a product of The University of Manchester and has developed into a world leader.

"Aerosol particles in the atmosphere are extremely important as they affect climate and harm human health through decreasing air quality. To understand and quantify these impacts we need to understand how such particles behave and quantitatively predict their lifecycle.

"James has been at the forefront of using new technologies to advance our understanding of such processes over the last decade and has been influential in the development of methods now widely adopted across the globe. This award is a huge recognition of his achievements."

Speed networking

The School of Mechanical, Aerospace and Civil Engineering recently hosted two speed networking events for its current students and recent graduates.

The events saw a total of 17 alumni return to campus representing an array of career destinations including Jaguar Land Rover, Rolls-Royce, Morgan Sindall, the British Army and REACT Engineering.

Speed networking events are a great opportunity for alumni to share their university and career experiences with current students. Alumni speak to small groups of students for ten minutes, discussing their career and answering questions. After ten minutes, the students rotate round to the next alumnus. The evening finishes with informal networking for students to continue networking and asking questions.

The events, organised by the Division of Development and Alumni Relations in partnership with the MACE Student Experience Manager, Rachel Bailey, offered students the opportunity to build their confidence networking with professionals and gain a real insight into the world of work and variety of careers available to them.

Rachel Bailey from MACE said: "The feedback from the students was fantastic; they really valued the opportunity to speak to alumni in small groups and find out what they do day to day and how they got to where they are today. They also noted that being in a group meant that the dreaded 'networking' was a lot less intimidating!"

Both events were a great success, with a total of 76 students attending, and there was a great buzz in the room.

Student feedback was very positive, with 100% of students who attended saying they now felt motivated to start taking action about their career, and 98% saying they would recommend the event to other students. Students also commented on just how insightful and useful the event proved to be.

The event wouldn't have been a success without the enthusiastic alumni that volunteered to share their advice.

William Shaw graduated from MEng Civil and Structural Engineering in 2001 and is the Chief Engineer at Black & Veatch Ltd: "12 years after graduation I made my first return to campus and it was really great to feel like I was adding an extra dimension to the great educational experience that I had myself. Both the students and the alumni seemed educated by the process and it also gave me an opportunity to increase awareness of Black & Veatch."

Jamie Holmes, Operations Director at Xoomworks Ltd and 1990 BEng Mechanical Engineering graduate, added: "There's no point keeping over 20 years of work experience bottled up in your head – students need this knowledge to help them make informed decisions about their future – and what a great, relaxed and informal event this was."

> FIND OUT MORE

If you would like more information about speed networking events or how you can contribute to student experience, employability, or recruitment activity please contact: Rosie Haynes, rosie.haynes@manchester.ac.uk

Students celebrate SET award success

University of Manchester students scooped three top awards at the 2013 SET (Science, Engineering and Technology) Student of the Year Awards in September.

Record numbers of entries were received this year and judges paid tribute to the exceptional quality of the work.

Laura Howarth-Kirke, a graduate of the School of Computer Science, won the award for the Best Computer Science Student for her project, 'Learning and Recognising Human Gestures using the Microsoft Kinect'. Laura was the highest scoring winner overall, and she also received the BP SET Student of the Year honour.

Laura's success meant that the award for the Lecturer of the Year went to **Dr Gavin Brown** in the School of Computer Science, who supervised her final year project.

Using the Microsoft Kinect device, Laura built a software interface capable of recognising human gestures for the purposes of controlling media devices like TVs.

However, the project went beyond what is available on the high street, using 'machine learning' techniques to automatically learn new personalised gestures from the user.

Manchester named European City of Science for 2016

Manchester has been selected to host the EuroScience Open Forum (ESOF) as part of its status as European City of Science in 2016.

The main aims of ESOF are to showcase the latest advances in science and technology, promote a dialogue on the role of science and technology in society and public policy, and stimulate and provoke public interest, excitement and debate about science and technology. The 2016 forum will be themed around breakthroughs in science, and the conditions needed for a city to capitalise on its scientific knowledge.

The Forum is Europe's largest general scientific conference, and is expected to attract around 4,500 delegates to Manchester.

Professor Luke Georghiou, Vice-President for Research and Innovation at The University of Manchester, was jointly responsible for the team that prepared the successful the bid to host ESOF 2016, alongside the City authorities.

He said: "With Manchester's unique tradition in technology, industry, engineering, science and innovation we are sure that we can offer a superb environment for delegates from all over the world.

"We are looking forward to work together with EuroScience to make Manchester 2016 a worthy successor to Dublin 2012 and Copenhagen 2014, and we are grateful for the support from the Department of Business, Innovation and Skills."

Dr Gail Cardew, chairperson of the ESOF Supervisory Board, said: "For a city to be awarded ESOF is to effectively give them the title of European City of Science. The city becomes a focal point for a discussion about science, not just among scientists but with the whole city.

"Manchester's tradition of world class research together with engaging the public provides a perfect backdrop for ESOF, and we look forward to developing a strong and exciting programme with the senior team at Manchester."

The EuroScience Open Forum will be hosted in Manchester from July 22-27, 2016.

> FIND OUT MORE www.esof.eu

Laura has now secured a prestigious place on the BBC's 'Future Media' graduate scheme, developing similar technologies.

Dr Brown said: "When Laura was awarded the Best Computer Science Student prize I was extremely happy, but when her name was called out as the overall SET Student of the Year, I was ecstatic, and even more so when I had to get up to receive my award. Laura is now creating the future of your TV technology, working at the BBC. Here at Manchester, we're all very proud of her."

Manchester students also shortlisted for the SET awards were Michael O'Connor, for best Chemical Engineering Student, and James Roscow, for best Materials Student Award.

Joseph Northwood, a Masters student last year in the School of Electrical and Electronic Engineering, who won the ARM award for the Best Electronic Engineering Student for the ARTEMIS (Autonomous Robotic Technology Enabling Minimally Invasive Surgery) Project.

The ARTEMIS Project, led by Joseph, was a collaborative project involving a team of seven MEng undergraduate students in the School of the Electrical and Electronic Engineering at Manchester and a team of five MEng undergraduate students in the School of Mechanical Engineering at the University of Leeds.

Minimally Invasive Surgery, also known as keyhole surgery, has significantly reduced patient trauma and recovery times, but post-operative infection still remains a significant problem affecting around 14% of patients at a cost of £930m in the UK alone. The ARTEMIS project investigated the feasibility of developing swallowable autonomous robots capable of performing minimally invasive surgical procedures.

The project explored the key technological challenges required to deliver such robotic systems, and demonstrated the feasibility of the approach using a 6:1 scaled surgical capsule and an actuated physical model of the upper gastrointestinal tract.

Other Manchester students involved in the ARTEMIS project were Maria McKavanagh, Martin Schuster, Roberto Fernandez Bautista, Sertunc Tuncel, John Waymont and Stephen Alderman, and the Manchester project was supervised by Dr Danielle George and Mr Peter Green.

External Relations
Faculty of Engineering and
Physical Sciences
The University of Manchester
B13 Sackville Street Building
Manchester
M13 9PL
United Kingdom

+44 (0)161 306 4045
www.eps.manchester.ac.uk
EPSFaculty@manchester.ac.uk

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