FROM OXFORD TO MARS

The enigma of methane on Mars

PAVING THE WAY TO A NEW GENERATION OF LIGHT SOURCES
Plasma acceleration

POWERED BY A STAR
Astronomy off the grid

THE IMPACT OF OUR RESEARCH
A new collaborative initiative with Industry

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PROUD WINNERS OF:
Paving the Way to a New Generation of Light Sources

One of the most spectacular phenomena, as we often hear from schoolchildren visiting our Physics Department, is a meteor shower – a wide glowing trail left by tiny unburned particles in the sky. Even more amazing (rare but still possible in Oxfordshire) are Aurora Borealis, the result of interaction of ‘solar wind’ – the accelerated subatomic elementary particles – with the Earth’s magnetic field.

Cosmic rays - elementary particles of tiny masses, which enter the Earth’s atmosphere with the energy of a cricket ball – are much more difficult to observe with a naked eye and even their acceleration mechanism still remains a mystery. Yet we are often asked by schoolchildren, can we create such cosmic rays in the laboratory, and if so, why would we want to do this and how would we use such scientific tools?

Following Freeman Dyson, who refuted the idea of concept-driven scientific revolution and instead argued that creation of scientific tools drives progress, we are well armed to answer these questions. We can point schoolchildren to the very tens of thousands of accelerators used in science and industry. We can describe how physicists and engineers can, in fact, compete with nature. Even though the elementary particle energies achieved in accelerators are less than a millionth of those of the most energetic space particles, we can accelerate billions and billions of subatomic elementary particles simultaneously. Moreover, we have found ways to focus the particle flux and compress it to a tiny size. For instance, one of the most ambitious modern accelerators – the Large Hadron Collider (LHC) at CERN – accelerates proton beams to an energy equivalent to that of a Boeing 747 at take-off, and this energy is concentrated within a ‘point’ less than a human hair in diameter.

Excited by the recent progress, we should also be vigilant about the next steps. The time it takes to design and build any new accelerator or collider, and the fact that their sizes and costs tend to increase, slowing down progress in recent decades, indicates that a technological revolution is required to make further progress. Back in 1940 Enrico Fermi dreamed about a giant accelerator on a stable orbit that circled the Earth. We now need to be much more responsible and ensure that every technological advance is explored and exploited before we can propose to funding agencies a collider even two or three times larger than the LHC.

Thinking about the next technological revolution in accelerators, we can recall that some plasma physicists have recently argued that the above-mentioned ultra-high-energy cosmic rays are, in fact, the result of plasma acceleration happening far away in our Galaxy. These same processes may drive the technology to create the next breakthroughs here on Earth. And even though we do not directly study cosmic rays at the John Adams Institute (JAI) for accelerator science, we are looking into this technology as a possible workhorse for next generation colliders and various other accelerators.

Conventional accelerators operate on the principle of particle acceleration in resonators, these are metal containers of a certain shape that have a limited ability to withstand strong electromagnetic fields due to possible electric breakdowns and destruction of the resonator walls. However, the wave produced in plasma, a material which is already ‘broken-down’, can create an acceleration gradient a thousand times larger, which would allow us to reduce the size of the accelerators.

PLASMA-BASED COLLIDERS: FROM CONCEPT TO REALITY

We are often asked the question: ‘when will plasma acceleration-based colliders become a reality?’ The answer is, certainly not tomorrow: the research and development roadmaps toward plasma acceleration colliders created by US and European communities extend to around 2035. With colliders in mind, here at the JAI we are strongly focused on plasma acceleration applications that have a more immediate use for society and industry: compact light sources. Our eventual goal is the creation of a compact, coherent x-ray source – a Free Electron Laser (FEL) – similar in functionality to the operating Linac Coherent Light Source (LCLS) at the Stanford Linear Accelerator Centre (SLAC) or the European XFEL being commissioned at the German Electron Synchrotron Centre (DESY, Hamburg) – but about a hundred times smaller, thanks to advantages in plasma acceleration.

Building an FEL based on plasma acceleration requires solving a number of challenges. For instance, if we scale up all the phase space dimensions, the beam accelerated by plasma looks like a sheet of A4 paper – very thin (in size) and wide (in angular and energy spread). Our dream beam, however, would have the same volume but would be round, like a hazelnut. Creating a beam with proper phase space suitable for FEL is a task we are currently working on. Another challenge we have is the limitation imposed by high power solid-state lasers needed for plasma excitation which, unfortunately, have low repetition rates (just a few Hz), and very low ‘wall plug’ efficiency. The multi-pulse plasma acceleration technology developed by our team and led by Prof Simon Hooker (JAI/Oxford) could use high-repetition-rate fibre lasers to overcome this difficulty.

While the plasma acceleration FEL is being actively developed, a compact coherent soft x-ray source based on plasma acceleration (see Fig. 1) is already possible and can actually be quite bright. In fact, it is comparable in peak brightness with the third generation synchrotron light sources. The x-rays produced by such sources have already been used in trials conducted in consultation with medical experts. For example, the team led by Prof Zulfikar Najmudin of JAI/Imperial College London (ICL), is studying microscopic bone damage caused by osteoporosis – see Fig. 2.

A BOLD NEW APPROACH TO TRAINING ACCELERATOR SCIENTISTS

Work on novel technologies such as plasma acceleration FEL and light sources requires a new approach to graduate training. The graduate course offered to JAI students is coordinated by Prof Emmanuel Tsesmelis (CERN/IFA) and combines accelerator theory and practice with plasma and laser physics, as well as real life experiences such as lectures given to students via video from the heart of the LHC/CERN control room.

The JAI graduate training is world renowned with its trademark being the students’ design project. In this project, all first-year JAI graduate students work as a team for two months to design an innovative accelerator, ensuring that all the major systems (optics, magnets, accelerator systems) are self-consistent. The projects vary each year, with recent projects ranging from a plasma accelerator for proton therapy to the electron–positron option of the Future Circular Collider.

The JAI students’ design project utilises a proven and effective hands-on approach. It allows students to master and put into practice the theoretical concepts and methods they have learnt during the previous terms’ lectures.

The JAI’s graduate training approach has been successfully applied in 2016 at the US Particle Accelerator School (USPAS) where Prof Andrei Seryi (JAU/Oxford) and Dr Aakash Sahai (JAI/ICL) taught a one-week course on ‘Unifying physics of accelerators and lasers’. Here the design project had to be completed in just one week, so detailed simulations were replaced by estimations of the parameters of the key systems.

The results of this JAI-led USPAS class exceeded our expectations; the students were able to develop a novel design of an x-ray source based on a compact storage ring of an electron beam with on-orbit and on-energy injection by a laser plasma acceleration system. Based on their successful design, the team of students were invited to present their concept at the prestigious North American Particle Accelerator Conference (NAPAC 2016) where the USPAS leadership praised their achievement.

Following the research and training principles outlined above, the JAI is determined to bring its basic research to industrial, medical and societal applications in the near future. We hope that our research will help to design compact sources of synchrotron radiation that are based on synergy between lasers and new accelerators. We believe that these sources will be able to revolutionise the world of accelerator physics and its applications, as has happened with the invention of visible-light lasers, which spurred science and industry in the 20th century. In particular, the development of very compact sources of x-ray pulses, that can be an inspiring piece of evidence that enables us to overcome the ‘valley of death’ between basic science and technological applications. JAI looks forward to meet some of the recently declared goals of the UK Industrial Strategy.
FROM OXFORD TO MARS

The Oxford Physics Department has an illustrious history of sending scientific instrumentation to other planets. But on Mars, we’ve had more than our fair share of reminders of the high risks of planetary exploration. The Atmospheric, Oceanic and Planetary Physics (AOPP) sub-department’s first interplanetary foray was nearly four decades ago in 1978 when an Oxford-designed infrared radiometer was sent to Venus aboard NASA’s Pioneer Venus Orbiter. This has led to further successes: AOPP-built equipment is currently operating in orbit around Saturn, the Moon, Earth and Mars. Mars has proved the most challenging to reach: operating in orbit around Saturn, the Moon, Earth and Mars. Mars has proved the most challenging to reach: operating in orbit around Saturn, the Moon, Earth and Mars. Mars has proved the most challenging to reach: operating in orbit around Saturn, the Moon, Earth and Mars.

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More difficult than orbiting Mars, though, is landing on the planet. Mars is arguably one of the most difficult places to land in the solar system. Its variable atmosphere, with dust storms and occasional winds, leads to far greater unpredictability than one would find at an airless body like the Moon. On the other hand, its atmosphere is 50 times less dense than that of the Earth, meaning that parachutes are relatively ineffectual and airbags or rocket-powered landing systems are needed for the last portion of the descent. Due to the distance of Mars from Earth, the whole entry, descent and landing sequence must be autonomous because the two-way radio communication delay is longer than the 6-7 minute descent to the surface.

LANDING ON MARS: FROM BEAGLE 2 TO THE TRACE GAS ORBITER

Few people in Oxford can be more acutely aware of the dangers of landing on Mars than I am. For my DPhil project here in AOPP, I built a Mars wind sensor for the UK’s Beagle 2 lander in 2003, on Christmas day 2003 (12 days after my successful viva defence). Beagle 2 apparently reached the surface of Mars intact, but then failed to communicate. We succeeded in getting an almost identical wind sensor to be included on Europe’s Schiaparelli Mars lander in 2016 – so on 19 October 2016, I was at the European Spacecraft Operations Centre waiting for Schiaparelli to land. We watched the radio signal from the lander, as monitored by an Indian radio telescope array, as it approached the Martian surface, but the signal suddenly disappeared when the lander reached the surface. A subsequent investigation revealed that the lander’s guidance system had concluded that it was on the surface and so it shut off its thrusters – but that this had happened when it was still 3.7km above the ground, so it went into freefall, hitting the surface 17 seconds later. The lander was never heard from again.

The news from Mars that day was not all bad, though. First of all, the Schiaparelli lander transmitted information throughout its descent, so almost all of the flight systems – from heat shields to parachutes – have been verified. This will increase the chances of success for future missions. But more importantly, Schiaparelli was carried to Mars by a much bigger spacecraft called the Trace Gas Orbiter (TGO); that same day, while Schiaparelli made its ill-fated descent through the atmosphere, the TGO successfully conducted a rocket firing to insert it into orbit around Mars. And the TGO’s investigations promise to be very interesting indeed.

THE ENIGMA OF METHANE ON MARS: AN INDICATOR OF LIFE?

Back in 2003, three independent research groups announced the discovery of methane in Mars’ atmosphere. The amounts of methane detected were frustratingly variable and faint, with reported abundances of only 0-100 parts per billion. However, this was of immediate interest, because of the possibility of biological sources. There are abiotic ways of generating methane – notably, through reactions of water with olivine or similar rocks – but most of these require liquid water which is itself of great interest for hunters of extra-terrestrial biology (exobiology). Subsequent observations often yielded only upper limits on atmospheric methane abundances, but sometimes also revealed continent-sized plumes of elevated methane levels. This defies our current understanding of Martian atmospheric chemistry, which cannot yet explain either how the methane is created in such great quantities nor how it is destroyed; in the jargon of atmospheric chemistry, we need to identify the sources and sinks of atmospheric methane.

INVESTIGATING THE MARTIAN ATMOSPHERE

The TGO is designed to follow up on these observations. Its main observation mode is spectroscopy of sunsets and sunrises (solar occultation). The sun provides a bright source of photons and the limb-viewing geometry provides a long atmospheric path length. So this method allows extremely sensitive detection of trace atmospheric constituents in absorption spectrometry. The TGO will be able to detect not only methane at abundances down to a few parts per trillion, but also related organic and halogen species, to reveal the chemical cycles which govern their variability. Although the TGO’s instruments weren’t built in Oxford, AOPP scientists will be involved in interpreting its measurements, analysing the raw spectra and incorporating this information into atmospheric circulation models, to help identify sources and sinks for the different trace species.

Many of those sources and sinks are expected to be underground, so that is where the next generation of Mars exploration craft will be searching. Oxford’s next chance to get instrumentation to the surface of Mars will come next year when NASA’s InSight mission will launch, carrying innovative micro-seismometers manufactured at Imperial College and packaged and calibrated in Oxford. This will be followed in 2020 by the second half of ESA’s ExoMars programme – a rover which will be able to drill two metres below the surface, to reach subsurface areas where organic materials are more easily preserved. Here at AOPP, we will be hoping that these missions land successfully.
Both of these two activities – engaging young people in developing countries in science as well as gaining unique spectroscopic data streams for astrophysics research – are manifestly not possible when there is no power, or following a particularly egregious electricity spike that destroys the instrumentation. Just over a year ago, a sympathetic donor (who prefers to remain anonymous) offered the funds to build a solar farm at the school observatory. Since then, 1 and 2 colleagues from the AAO, Steven Lee and Chris McCowage, used this generous resource to design, install and commission a ‘solar system’ that would allow the perils of the local mains grid.

The main energy costs in running an observatory are the cooling of the CCD cameras to minimise noise on the detectors, powering the control PC and operating the mount on which the telescope holds, tracks and guides. On the school roof, a few metres away from the observatory, two sets of photovoltaic panels were installed, Pavo and Vela, which each comprise six square metres in four panels cabled in series and then in parallel so that the electricity can be transmitted at a high voltage, thus minimising the thickness of the cables needed. The harvested current is then fed through charge regulators into four battery banks, named Aldebaran, Bellatrix, Canopus and a Draconis (all star names). These are comprised of 48 readily available lead acid 2V battery cells configured to provide 24V and collectively store 2,000 amp hours (Ah). This amount was designed to be well above the maximum we are ever likely to draw in the observatory, so that the battery life can be preserved. The observatory itself was converted to run entirely on DC electricity, rather than using lossy inverters to turn DC electricity from the batteries into AC and then turn it back into DC electricity with manufacturers’ power packs incurring further losses. The supply of DC electricity from the batteries provides clean, noise-free power feeding our devices – particularly important for the cameras collecting the precious data from distant places across the Galaxy. Powering up each device is controlled remotely via IP switches specifically designed for DC control so that, thanks to the internet, everything in the observatory can be conveniently monitored from rainy Oxford. Not only does the solar farm enable safe, ongoing measurements for astrophysics research, it also enables the schoolchildren to use the telescope for themselves. More profoundly still, these children living in their school in rural India learn something of the galaxies and stars in the same sky as their fellow students across the galaxy. 

SOLAR ENERGY FOR A GLOBAL PROJECT

But by design there is an important educational spin-off as well. If a single observatory can be successful in rural India, then with appropriate support, an observatory could be set up anywhere in the world. But by design there is an important educational spin-off as well. If a single observatory can be successful in rural India, then with appropriate support, an observatory could be set up anywhere in the world. A second observatory, the Global Jet Watch Observatory in rural southern India, is one of the five Global Jet Watch observatories (www.globaljetwatch.net). These five telescopes are distributed in longitude around the world so there is always one of them in darkness, which is an essential prerequisite for optical astronomy. This enables a unique programme in the study of black hole systems in our Galaxy.

These black hole systems can now be monitored around the clock, in a way that is simply not possible from a single observatory at a fixed longitude. They are exotic and dynamic phenomena that actually change on timescales of hours and days, so to keep the watch going we need a round-the-clock network of telescopes. We are investigating how matter behaves close to black holes; how, even in space, our black hole understanding applies. The observatory can be conveniently driven from the cameras collecting the precious data from distant places across the Galaxy. Powering up each device is controlled remotely via IP switches specifically designed for DC control so that, thanks to the internet, everything in the observatory can be conveniently monitored from rainy Oxford. Not only does the solar farm enable safe, ongoing measurements for astrophysics research, it also enables the schoolchildren to use the telescope for themselves. More profoundly still, these children living in their school in rural India learn something of the galaxies and stars in the same sky as their fellow students across the galaxy.
The pink episode has reminded me of the late Dr Michael Grace who was once kind enough to admit me to Christ Church and Physics. He had various artefacts to probe the intuition of entrance candidates; one of these was a chunk of germanium which has very interesting optical properties as the angle of incidence changes. The feedback we get about the Newsletter often remarks on how fascinating people’s memories of their time in the Department are. If you have any interesting reminiscences about the place and the people, please put pen to paper.

The last Newsletter was the final one edited by Professor Fabian Essler. I think he has done a wonderful job and would like to thank him for all his efforts. The new editor is Professor Dimitra Rigopoulou who would be delighted to hear from you through newsletter@physics.ox.ac.uk.

We are well on the way in our campaign to establish the Oxford Physics Endowment for Graduate students (OXPEG), which is planned ultimately to support 25 graduate scholarships for outstanding young physicists from around the world. The fund currently stands at about £1.1m confirmed. A big thank you to everyone who responded to my email in January; contributions as a result of that are still coming in. As I said at the last Morning of Theoretical Physics event, on the whole, physicists do jobs that do not lead to enormous personal wealth; but there are a lot of us, about 11,000 in total and 9,000 plus for whom the Department has contact information. Even small contributions count; if all 9,000 of us give £50 every year that already amounts to nearly half a million pounds per annum. Of course, I hope that those who can will contribute more, and I understand that some will not be able to manage anything, but acting together we can make a difference.

Brexit continues to be a major preoccupation for us, as for everyone else in the UK. The Article 50 Act not only triggered the departure of the UK from the EU but also the end of our membership of Euratom, the European Atomic Energy Community. This unanticipated effect of Brexit is doubtless only the first surprise; fortunately, some other organisations crucial to us, such as CERN, ESOF and ESA, are entirely independent of EU structures and thus definitely will not be affected. Euratom has many functions but from our point of view its importance is mainly in coordinating research into fusion and fusion plasmas, the latter in particular being a topic in which Oxford Physics leads the world. Euratom is responsible for running the Joint European Torus (JET) at Culham, for example, and almost all funding for this research area is channelled through it. We do not know how the Government plans to unpick the situation. It is certainly no one’s intention that UK research cease or be substantially damaged in such a major science and technology field but the potential for damage right now is considerable and we are working hard to get the way ahead clarified as soon as possible.

It has taken only seven months for the structure of the Beecroft Building to emerge from the huge hole in the ground and reach its maximum height, and, amazingly, right now we are still on schedule. The frame was completed in February and a brief baring out ceremony was held on a wet and windy day; the final concrete was somewhat unexpectedly shovelled into place by the Vice Chancellor, Adrian Beecroft and yours truly. Since then the cladding has been proceeding apace and most of it is now on. Some people claim that the light coloured metallic part of the cladding is pink while others vehemently deny this. In fact, it is not pink but copper; although in certain lighting conditions I think it definitely appears pink. Second year electromagnetism and the scattering of light off metals is responsible, the effect itself will fade as the copper ages.

Brexit continues to be a major preoccupation for us, as for everyone else in the UK. The Article 50 Act not only triggered the departure of the UK from the EU but also the end of our membership of Euratom, the European Atomic Energy Community. The leptons are particles that feel only the electromagnetic and weak nuclear forces, the electroweak interaction in the language of the Standard Model. The lightest charged leptons are the electron and its antiparticle the positron. They have two heavier analogues; the muons whose mass is about 207 times greater, and the tau whose mass is about 3,477 times greater. No one knows why the masses of these particles differ so much, nor indeed why there are three different families at all, but it is a clear tenet of the Standard Model that the strengths of their interaction with the electroweak forces are the same – this is what is meant by lepton universality. However, the new LHCb results show that some 8% of tau neutrinos (transient particles created in collisions at the Large Hadron Collider) prefer to decay to electron-positron pairs than to muon anti-muon pairs, collisions at the Large Hadron Collider) prefer to decay to electron-positron pairs than to muon anti-muon pairs, showing that lepton universality is not true. In turn this means that there have to be further, as yet undiscovered, particles which are not yet so tight that the effect could not disappear by a factor of about 1.5. The errors on this measurement are by lepton universality. However, the new LHCb results show that some 8% of tau neutrinos (transient particles created in collisions at the Large Hadron Collider) prefer to decay to electron-positron pairs than to muon anti-muon pairs, showing that lepton universality is not true. In turn this means that there have to be further, as yet undiscovered, particles which are not yet so tight that the effect could not disappear by a factor of about 1.5. The errors on this measurement are...
GREENLIGHT FOR GIRLS

How do we get more girls to study – and keep on studying – science subjects? This question is important for so many different reasons, from the supply and demand of skilled people for the tech sector to the fact that, by whitening down the numbers from half the population, we must be missing out on some serious science talent. The disproportion between the genders is particularly obvious in physics, and sets in early. Although at GCSE the balance is pretty equal (after all, studying science is generally compulsory), girls make up only 20% of those who continue with physics post-16, and that ratio between men and women in physics never really recovers. In general, the work of Oxford Women in Physics Society focuses on supporting those who have made it to university or beyond, and although this is vital work, it is a support mechanism and not a solution – only one in five of those studying physics at university is female, so most of the crucial choices have already been made. But perhaps this is something we can change.

SCIENCE CAN BE FOR ANYONE

Clearly we need to engage girls early, before they start to make decisions about what subjects to keep, if we are to stop this loss of talent. This idea is at the heart of the work of greenlight for girls, an international organisation devoted to engaging girls with STEM subjects: science, technology, engineering and maths. Last month, Oxford Women in Physics Society teamed up with greenlight for girls to bring a ‘pig day’ to Oxford – the first of its kind here, and only the third greenlight for girls event in the UK.

The Department was filled with 100 local girls aged between 11 and 14 for a day of hands-on science and technology workshops, aimed at girls aged between 11 and 14. The girls were given tours of the college library and laboratories, and were introduced to physics and astronomy with hands-on science activities. The day ended with a talk by a particle physicist, and a Q&A session with scientists from across the UK.

At midday, everyone headed to Pembroke College for lunch in their beautiful Hall. For many of the girls, seeing inside an Oxford college was a totally new experience, and some Pembroke undergraduates kindly gave tours of the college. Lunch was followed by a Q&A session. The panel consisted of Cesca Webb, a Pembroke physics undergraduate; Professor Daniela Bortoletto, a particle physicist; Melissa Rancourt, an engineer and founder of greenlight for girls; Emma Parker, a trainer clinical scientist in radiotherapy physics at the Churchill Hospital, and Merritt Moore, a DPhil student and professional ballet dancer. Questions ranged from how to pick up coding skills to balancing physics work with other interests, prompted by props that the panelists had brought including a dosimeter, a weekly planner and pointe shoes!

GOING OUT WITH A BANG!

The grand finale was provided by the enthralling Accelerate! show, a whistle-stop tour of accelerator physics via liquid nitrogen, 40,000 volts, beach balls and very loud explosions. In the capable hands of Dr Kirsty Duffy and Joe Hitchen, this was the perfect culmination of everything the day was about – bringing accurate science to life through interactivity, involvement and, above all, fun.

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Giving to Physics

Oxford Physics is one of the largest and most eminent Physics departments in Europe. Oxford physicists are probing new ways to harness solar energy, modelling the earth’s atmosphere to predict future climate, exploring the potential of quantum physics to revolutionise information technologies and executing calculations that reveal the fundamental structure of space and time. They participate in many large-scale international physics projects — including the Large Hadron Collider, European Extremely Large Telescope and Square Kilometre Array.

Oxford Physics has a strong tradition of public engagement as an integral part of the University’s vision to embed high-quality and innovative public engagement as an integral part of the University’s vision to embed high-quality and innovative public engagement as an integral part of the University’s vision. The Outreach team, in collaboration with the Department of Physics, programmes and support researchers with public engagement, as well as providing funding for research and events. Activities such as Stargazing Outreach and other showcase events also provide central opportunities for researchers to engage the public with their own research projects. We are very pleased to have our efforts acknowledged and hope to continue to develop this area to allow even more people to engage with, and hopefully be inspired by, our research.

The 12 winning entries, from a total of 84, received recognition for their achievements in an awards ceremony at Meriton College.

In 2016 the Department was recognised for its work in this area in the first ever Vice-Chancellor’s Public Engagement with Research Awards. The awards are part of the University’s vision to embed high-quality and innovative public engagement as an integral part of research culture and practice at Oxford. The Vice-Chancellor said: ‘I am delighted to introduce these awards to recognise and celebrate excellence in Public Engagement with Research from across the University.

The community with less tradition of attending events from the USA, obtain information about leaving a gift in your will and more information on tax-efficient giving.

Donors who give £1,000 or more to Oxford Physics are eligible to become a member of The Henry Moseley Society. For further information about this or to support Oxford Physics, please contact Val Crowder: email alumni@physics.ox.ac.uk.

Please note that all donations will be held as expendable endowment in the OXPEG fund, which has been established for the purposes of supporting graduate scholarships in the Department of Physics.

To make a gift, visit www.campaign.ox.ac.uk/physics.

The Department has a strong tradition of providing engaging space-themed activities for schools and the public, we run popular lectures, school telescope evenings and stalls at local festivals as well as an annual Stargazing open day.

The events consisted of activities for parents, teenagers and younger children including planetarium shows, talks, model satellite building workshops and hands-on stalls. In Cowley we gathered crowds in the shopping centre with a dry ice show and held workshops and shows in disused offices above the shops. We tested a number of new activities in the Barton neighbouring centre including an interactive team game entitled Commanding Curiosity, where participants took the role of scientists at mission control, directing the actions of the Mars rover, Curiosity, to complete a series of challenges. Participants also had the opportunity to watch an immersive 360 degree video which let them join Dr Colin Wilson in a planetary observing trip using some of the world’s best telescopes situated in Hawaii.

There was a great amount of support from the events from staff and the Department and we were pleased to have a total of 560 participants across both venues. Evaluation data from the event was successful in engaging members of the public from a variety of socio-economic backgrounds, many of whom had previously taken part in a university event. We were also pleased to see some familiar faces who were happy to return to the new venues to take part in our activities. The partnerships formed within the community were also a success and we hope the way for future events and engagement.

AWARD WINNING OUTREACH

The Department of Physics has a highly active outreach programme which has engaged more than 40,000 schoolchildren across the UK in activities including research talks, workshops, shows, festival stalls, tours and competitions. This is in addition to hosting the extremely successful Zooniverse citizen science project, which has worldwide reach and impact.

In 2016 the Department was recognised for its work in this area in the first ever Vice-Chancellor’s Public Engagement with Research Awards. The awards are supported by the University of Oxford’s RCUK Catalyst Seed Fund, which aims to improve institutional support for Public Engagement with Research.

It has been exciting and reassuring to see the myriad ways in which people have engaged with the extraordinary research happening at Oxford. The Department was recognised in the award category for ‘Building Capacity’ for encouraging, facilitating and supporting high quality Public Engagement with what it supports. This work includes having a central outreach team to facilitate a series of successful outreach programmes and support researchers with public engagement, as well as providing funding for research and events. Activities such as Stargazing Outreach and other showcase events also provide central opportunities for researchers to engage the public with their own research projects. We are very pleased to have our efforts acknowledged and hope to continue to develop this area to allow even more people to engage with, and hopefully be inspired by, our research.

The 12 winning entries, from a total of 84, received recognition for their achievements in an awards ceremony at Meriton College.

The Department was recognised in the award category for ‘Building Capacity’ for encouraging, facilitating and supporting high quality Public Engagement with Research. The Department was recognised in the award category for ‘Building Capacity’ for encouraging, facilitating and supporting high quality Public Engagement with Research. The Department was recognised in the award category for ‘Building Capacity’ for encouraging, facilitating and supporting high quality Public Engagement with Research. The Department was recognised in the award category for ‘Building Capacity’ for encouraging, facilitating and supporting high quality Public Engagement with Research.

Lena Shams, Sian Tedaldi and Catherine Hayer from the Physics Outreach Team collect the award on behalf of the Department.
THE FUTURE OF PARTICLE PHYSICS

The inaugural Particle Physics Christmas Lecture

The inaugural Particle Physics Christmas Lecture was held on 3 December 2016 in the Denys Wilkinson Building. The lecture was delivered by Prof John Womersley. John is the Director of the European Spallation Source in Lund, Sweden. Until October 2016 he was Chief Executive of the Science and Technology Facilities Council (STFC), the UK funding agency for particle physics, nuclear physics and astronomy, large scale science facilities and national laboratories. John earned a DPhil from Oxford and is a visiting professor here.

The event was sold out. Eighty alumni, spanning matriculation from the early 1960s to 2016, had the opportunity to hear John give an engaging talk on the status of our understanding of the nature of the universe - from the Higgs boson to detecting gravitational waves and, in particular, what we don’t know; that the particles and forces we understand in ever greater detail make up only a small fraction of what’s in the cosmos, and that our theoretical prejudices about what remains to be discovered may be very wrong. Looking to the new generation experiments at accelerators underground, and studying the large-scale structure of the universe, will answer these questions and raise others. This is why it is essential that the UK remains at the forefront of research of this kind and how it contributes more broadly to society.

After a delicious lunch the audience reconvened for a panel session which provided an opportunity to follow up on the lecture. The panellists were Oxford Professors John Wheater (HoD), Daniela Bortoletto, Subir Sarkar, David Wark and John Womersley.

Visits to the special exhibition ‘New Eyes on the Universe’ celebrating the 2015 Nobel Prize led by Prof Steve Biller and David Wark, were conducted during lunch and after the panel session. The format was very positively received and there were many requests to repeat the event in 2017.

A recording of the 2016 lecture is available here: http://media.podcasts.ox.ac.uk/physics/general/2016-1204_xmas_physics_womersley_1.mp4

This year’s lecture will be held on 2 December 2017.

Dr Karenowska will be our speaker at this year’s Alumni Garden Party

Dr Alekzey Karenowska is a magnetician in the Condensed Matter group in the Department. She is also a fellow of Magdalen College and Director of Technology at the Oxford Institute of Digital Archaeology (IDA - www.digitalarchaeology.org.uk).

Through her work at IDA, Alexy has taken a replica of the Triangular Arch of Palmyra to various locations around the world, like Trafalgar Square in London, Dubai and Florence.

Dr Karenowska (far right) will be our guest speaker at this year’s Garden Party in June. See below for more details.

FORTHCOMING EVENTS

THE HENRY MOSLEY SOCIETY SPECIAL EVENT

9 June This year the HAMS will be visiting JET at Culham for a guided tour followed by dinner at a local restaurant. This event is for Henry Mosley members only. If you’d like to know more about the Society and how to join, visit: www.campaign.ox.ac.uk/document/doc/id=1012

STAFF AND FRIENDS OF PHYSICS BBQ

23 June For the second year, we will host the formal and fun event, a BBQ at University Parks where friends and family of staff and students are welcome. Alumni, as always, are welcome to attend.

PHYSICS ALUMNI GARDEN PARTY

25 June Prof John Wheater, Head of Department, will host this event at Rhodes House. This year, Dr Alexy Karenowska (see article above) will give a talk on her work at IDA, and Director of Technology at the Oxford Institute for Digital Archaeology.

PHYSICS CHRISTMAS CAROLS

15 November TBC

TBC

THE PARTICLE PHYSICS CHRISTMAS LECTURE

2 December

INDUSTRY DAY

Date TBC See article on page 7. If you are interested in taking part, please contact Dr Phillip Tait (phillip.tait@physics.ox.ac.uk).

DEPARTMENT NEWS & EVENTS

Collaboration with Science North Canada

Old mates reunited: small world! Graham Sillman (one of our fantastic technicians, right) has worked at SNO lab in the past. He helped Science North’s technician Don Greco (left) to set up the special exhibition in the DWB last autumn. This was the same exhibition some of you saw at Canada House in autumn. This was the same exhibition in the DWB last autumn.

PHYSICS WORLD’S CHOICE FOR THE 2016 BOOK OF THE YEAR

Why String Theory? by Joseph Conlon

Abstract, mathematically complex and (so far) unsupported by direct experimental evidence, string theory attracts plenty of criticism. Yet it remains an incredibly active area of research, presents a possible way to unify the fundamental forces of nature and is the subject of this year’s Physics World’s Book of the Year, Why String Theory? by Joseph Conlon.

SPECIAL EVENT

SCIENCE NORTH CANADA COLLABORATION WITH

New Physics Newsletter Editor

We welcome Professor Dimitra Rigopoulou as the new editor of the Physics Newsletter. Prof Rigopoulou can be contacted at newsletter@physics.ox.ac.uk.

Did you know?

As physics alumni you are welcome to visit us during term time, and attend one of the excellent colloquiums of the series? They are normally held on Friday afternoons, and are followed by free coffee and biscuits. www.physics.ox.ac.uk/events

Keep an eye on our website for:

MORNING OF THEORETICAL PHYSICS

October TBC

PHYSICS ALUMNI AT THE ROYAL SOCIETY

November TBC hosted by AOPP

THE HINZTE LECTURE

15 November

THE PARTICLE PHYSICS CHRISTMAS LECTURE

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To keep up to date and book your place at our events, please visit www.physics.ox.ac.uk/events. We update the list all the time, so please check regularly!

If you have any questions about the events, contact Val Crowder: alumni@physics.ox.ac.uk

OPT IN TO KEEP READING

Advance notice – in a few months, the new Data Protection laws will come into place, which means we will not be able to contact you, send you this newsletter or keep in touch unless you OPT IN. We will have more information in the next issue, but please, in the meantime, bear this in mind if you are contacted by your College or central office.

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If your business or company would like to sponsor an event (UK or abroad), or you have an idea for a venue or event, please get in touch. We are always looking for new ideas to offer our alumni community. Write to alumni@physics.ox.ac.uk for new ideas to offer our Outreach Resources, please get in touch with Dr Sian Tedaldi: sian.tedaldi@physics.ox.ac.uk.

OUTREACH RESOURCES
If you work with schools or at an organisation that could benefit from our Outreach Resources, please get in touch with Dr Sian Tedaldi: sian.tedaldi@physics.ox.ac.uk.

DEPARTMENT NEWS & EVENTS

PHYSICS AT OXFORD & CAMBRIDGE CLUB
Dr Sam Vinko gave a wonderful talk to Physics Alumni and Guests at the Oxford & Cambridge Club last March. His talk was titled ‘From stars to proteins: unveiling material response in intense x-ray fields’. Guests’ feedback has been fantastic; they really enjoyed the occasion. This annual event is always very popular; it is great to meet new people every time. Thank you to Dr James Dodd, physics alumnus and member of the Club, for inviting us to host the event in this wonderful venue once again.

Left: Prof John Wheeler talks with alumni at the Oxford & Cambridge Club
Right: Dr Sam Vinko

BEECROFT BUILDING TOPPING OUT EVENT
Above: Dr Bella Wheater, Prof John Wheater, Mr Adrian Beecroft, Mr Liam Cummings (Business Unit Leader, Laing O’Rourke), Mr Rob Cooper (Project Leader, Laing O’Rourke), Prof Louise Richardson (Vice-Chancellor). Far left: Mr Martin Lueck (alumnus) talks to the Vice-Chancellor and Liesl Elder (Chief Development Officer UD). Right: Prof Wheeler, Prof Richardson (VC) and Mr Adrian Beecroft.

OXFORD PHYSICS EXPLORING THE PLANETS – AN EVENT AT THE ROYAL SOCIETY
Following a climate-themed event last year, 11 November 2016 saw a Physics alumni event held at the Royal Society: ‘Oxford Physics exploring the planets’. This provided a great opportunity for present researchers to meet with alumni and present some of the latest research in the Department in this exciting field. The first talk was given by Dr Colin Wilson, on the ExoMars mission which had just reached Mars a few weeks previously (see page 4). Dr Kerri Donaldson-Huynh then discussed work going on in the planetary spectroscopy lab, including characterisation of real moon rocks returned by Apollo astronauts, and preparations for upcoming asteroid missions.

Telescopes are invaluable for studying objects we can’t get spacecrafts to. Professor Patrick Irwin described a series of observations charting the changing weather patterns and chemical compositions of Neptune and Uranus. Professor Neil Bowles then outlined how small satellites are now within the reach of university groups like our own; his group provided a small 4kg infrared radiometer which is currently orbiting Earth on the UK’s TechDemoSat-1 satellite, and are developing plans for a small Earth-observing ‘cubesat’ which would be only 6 litres in volume. Finally, Halley Professor Ray Pierrehumbert further expanded the horizons of the event to consider the vast variety of different planets being discovered in orbit around other stars and the correspondingly great array of climates they must exhibit, from star-like atmospheres with metallic clouds to completely ice-covered planets. Several current students and postdocs attended the event, all enjoyed the opportunity to meet and chat with alumni. We look forward to running a similar event later this year.

Above: Dr Bella Wheater, Prof John Wheater, Mr Adrian Beecroft, Mr Liam Cummings (Business Unit Leader, Laing O’Rourke), Mr Rob Cooper (Project Leader, Laing O’Rourke), Prof Louise Richardson (Vice-Chancellor). Far left: Mr Martin Lueck (alumnus) talks to the Vice-Chancellor and Liesl Elder (Chief Development Officer UD). Right: Prof Wheeler, Prof Richardson (VC) and Mr Adrian Beecroft.

OXFORD researchers and alumni discuss planetary exploration at the Royal Society, London

If you have a story, a memory or a photo to share? Would you like to be featured in the next ‘Alumni Story’? We’d love to hear from you! We are always looking for material to share with our alumni and physics community. Please write to Val Crowder: alumni@physics.ox.ac.uk.

IOP PHYSICS JUNO AWARD

Oxford Physics was awarded Juno Champion status by the Institute of Physics at the IOP awards ceremony on 29 November 2017. Champion status recognises the excellent practice within the Department of embedding the Juno principles of promoting gender equality.

Nicola Blackwood visits Physics

Dr Matthew Levy (Royal Society Governmental Pair), organized a Poster Symposium in the Department on 2 December 2016 for Ms Nicola Blackwood, MP, Minister for Public Health and Innovations, and earlier Chair of the Commons Science and Technology Select Committee. The event, entitled ‘Science & Innovation Session’, was intended to exhibit selected topical areas of science and innovation undertaken in Departmental and Collegiate environs as well as entrepreneurial eco-systems facilitated by the University. More than 25 posters were displayed on the day, and members of staff had an opportunity to talk to our guest, who asked lots of questions and was genuinely interested in all the research.

Ms Blackwood talking to Prof Pauls Radaelli and Prof Roger Davies during her visit to Physics.
Princess Maria Elettra Marconi, daughter of Guglielmo Marconi, visited the Department of Physics and Oxford

In March, Prof Paolo Radaelli and Dr Alexy Karezowska hosted a visit from the daughter of Guglielmo Marconi, pioneer in long-distance radio transmission, developer of Marconi’s law and radio telegraph systems. Among many other things, they visited the ODP lab in Physics and the Museum of the History of Science, where a specially commissioned portrait of her father was unveiled, to be displayed next to his original artefacts.

Centre for Applied Superconductivity Open for Business

For an idea in physics to have real-world impact, you need an unbroken chain stretching from physics, through materials discovery and development, and right along to industry. Joining up these disparate areas in the field of superconductors research is the aim of a new Centre for Applied Superconductivity (CfAS), a collaborative effort between local industrial companies and Oxford University’s Departments of Materials and Physics. Funding has been provided through the Oxfordshire Local Enterprise Partnership (OxLEP) and has led to the creation of new laboratories within both University departments. Much of the UK’s strength in applications of superconductivity is based within a 20 mile radius around Oxford. The origin of this geographical concentration of expertise can be traced back to the research work performed in the Clarendon Laboratory more than 50 years ago that was spun out into companies such as Oxford Instruments. The new Centre’s aims are to research new superconducting products and processes; to provide world-leading problem solving expertise for industry; and to train new generations of technicians and scientists for the growing number of Oxfordshire companies working in this increasingly important technology field. CFAS was formally launched on 27 February 2017 at an event attended by the Secretary of State for Defence, Sir Michael Fallon (who was in Oxford to announce members of a Defence Innovation Advisory Panel) and Nigel Tillipe, Chief Executive of OxLEP. The new laboratories in Physics have been completely refurbished and are equipped with state-of-the-art equipment, including a new 16 Tesla physical property measurement system (partly funded by Oxford’s John Fell fund), which will be used to study newly developed superconductors. »

Women in Physics

The proportion of female physicists at both undergraduate and postgraduate level is at an all time high, with around 20-25% female students. In comparison to other fields of science and mathematics, the fraction of women in physics remains significantly lower, and is comparable to the uptake of the subject at Sixth Form. Beyond the doctorate level, the proportion, encouragingly, remains roughly constant to lecturer level; however, despite an upward trend in the proportion of female professors, this figure is currently only 1 in 10. As illustrated by several studies on the subject, many diverse and interwoven reasons are thought to contribute to the decline, ranging from increased career responsibilities, to unconscious biases. Certainly at school level, there is evidence that gender stereotypes play a role, with the school environment being shown to affect subject choices for both female and male students.

The Physics Department is committed to promoting gender equality, as demonstrated by the award of Juno Champion status last year and the Athena Swan Silver Award in 2015. The Oxford Women in Physics Society (OxWiP) was set up to provide additional support for women, and those who identify as women, above and beyond that provided centrally by the Department. One of the Society’s key goals is to provide access to role models in an environment where the number of female scientists at the most senior levels is still only around 10%. The Society runs a mentoring scheme both for undergraduate women, who are paired with a physicist in the year above, and for postgraduate students and researchers. As well as the formal mentoring scheme, a key goal of the events we run is to increase interaction between female physicists at all levels, allowing peer support and informal mentoring to occur naturally, and providing a welcoming environment for new members of the Department.

The Society has existed for four years and now has a regular programme of events throughout the year. In Michaelmas term, more than 50 people attended our Welcome event, a record high, showing the continued interest of members of the Department in supporting diversity within physics. At the end of term we were delighted to host Professor Athene Donald (Cambridge), a leading soft matter physicist, Master of Churchill College and a vocal advocate for issues concerning women in science. Over tea and cake, the discussion ranged from gendered language in reference letters, to the importance of including everyone in the conversation about gender equality, not just women. The term also included a Christmas lunch and a banquet dinner hosted at Christ Church, which was attended by 45 people ranging from undergraduates to staff, a true testament of the strength of the Society. In Trinity Term we also had a packed programme, including a fortnightly tea sessions, a dinner at Merton College and a special celebration for International Women’s Day on 8 March. International Women’s Day provided a perfect backdrop for the Society to celebrate the ever-increasing diversity of physics and to highlight the significant number of women now following a career in this fascinating science. »

To find out more, please see our website or join our Facebook group.

www.physics.ox.ac.uk/equality-and-diversity/women-in-physics-society


Left: Women in Physics dinner at Christ Church

Sir Martin Wood visits the new CFAS laboratory

Far right: Dr Amir Haghighirad talks to Sir Martin Wood. Left: Sir and Lady Wood visiting the CfAS lab – a continuation of his pioneering work in the Department of Physics.

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are needed. DUNE, for instance, is a future long baseline neutrino experiment. What are the current challenges in this field?

I am currently working on measuring the neutrino oscillation cross section with the liquid argon (LAr) detectors. This measurement is fundamental to our understanding of neutrino oscillations and is also crucial for future neutrino experiments. This will be the first ever neutrino oscillation cross section measurement on argon in the 1 GeV energy range. This is extremely important for the next generation of LAr neutrino detectors that will operate in the same energy range, since cross section uncertainties are one of the dominant systematics for these experiments.

What are your plans in the future? I’d love to continue being a physicist and doing research. I like neutrino physics but also believe that changing field at some point can be of great benefit instead of dedicating all your research to the same topic. I’d also love to continue doing science outreach, I believe it is an important part of being a physicist.

Can you share the main positives of being a physics student at Oxford? One of the main positives is that we have the opportunity to work with, and talk to, many experts in our field. Being at Oxford also means working with a number of international students. This is important as it improves the exchange of ideas, it allows you to be more open-minded and to have better human relations. Also, many tools that improve our skills and increase our understanding are available to students.

But there are also others that are not directly related to physics, like the cure for cancer and illnesses like Alzheimer’s disease.

What scientific breakthrough would you like to see in your lifetime? There are many of them! Of course I’m biased but I would really like to see the neutrino mass problem solved – I’m rooting for Majorana-like neutrinos!

For further information visit the App website venu.physics.ox.ac.uk. Here you will find links to download from the App Store and Google Play. Images and background information are available at: venu.physics.ox.ac.uk/downloads.html

Launch event images and press release: venu.physics.ox.ac.uk/marco-del-tutto.html if you are interested in contacting the developer, email Marco at marco.delutto@physics.ox.ac.uk

Below: Marco explaining VENu

Tells us a bit about your background… I was born and raised in Rome, Italy, a city that I love and really miss. I got my Bachelor’s and Master’s degrees at the University of Rome Sapienza. I spent time at Fermilab, a laboratory in the USA, as a summer student and for my Master’s thesis. I am now reading for a DPhil in Particle Physics, working on the MicroBooNE experiment with Dr Rosanne Guenette as my supervisor.

When/how did you decide to become a physicist? When I was a kid I was attracted by how electrical and mechanical equipment works. So my first thought was to become an engineer. But then I realised that I was mostly fascinated by the basic principles which govern natural phenomena. This happened towards the end of high school, when I decided to study physics.

Why do you think it is important to study physics? Physics addresses questions of how nature works. From a philosophical point of view this is crucial if we want to better understand the world we live in. At the same time, research in physics quite often results in technological breakthroughs and innovations.

Can you explain the work you do? I am currently working on measuring the neutrino interaction cross section with the liquid argon (LAr) detectors. This measurement is fundamental to our understanding of neutrino oscillations and is also crucial for future neutrino experiments. This will be the first ever neutrino oscillation cross section measurement on argon in the 1 GeV energy range. This is extremely important for the next generation of LAr neutrino detectors that will operate in the same energy range, since cross section uncertainties are one of the dominant systematics for these experiments.

What are the current challenges in this field? Neutrinos have a very low probability to interact. We have overcome this either by building large detectors or, by having an intense neutrino beam, like we have at Fermilab.

To further study neutrino oscillations and solve the mass hierarchy problem, longer baselines are needed. DUNE, for instance, is a future long baseline experiment which will use the technology already developed and optimized by MicroBooNE.

We also need much higher track resolution in order to study nuclear effects in the liquid argon when neutrinos interact. This is why the MicroBooNE detector is a Liquid Argon Time Projection Chamber: this kind of detector offers exquisite image resolution.

What do you think are the main positives of being a physics student at Oxford? One of the main positives is that we have the opportunity to work with, and talk to, many experts in our field. Being at Oxford also means working with a number of international students. This is important as it improves the exchange of ideas, it allows you to be more open-minded and to have better human relations. Also, many tools that improve our skills and increase our understanding are available to students.

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Below: Marco explaining VENu

I read with interest Prof Terence Meaden’s memories of the Clarendon in the Autumn 2016 edition of the Department of Physics Newsletter, but my own recollections differ from his in a number of instances.

First, he mentions that Nicholas Kurti did not speak perfect English. In fact, Nicholas spoke English fluently and ably quickly and with a fairly strong accent. He was my supervisor, and when I was writing my DPhil thesis, although I thought that I was reasonably proficient in English, Nicholas suggested a number of amendments that improved the grammatical construction of the work. He also spoke French and German very well. Further, he was a wonderful, generous gentleman.

Secondly, after the retirement of Lord Cherwell, Sir Francis Simon was appointed Dr Lucy’s Professor of Experimental Philosophy and Head in 1956 but unfortunately died shortly afterwards. It was then that Bertrum Blaney was appointed to the position.

Thirdly, Prof Meaden mentions that Martin Wood was “already experimenting with superconducting magnets” in 1957. This seems a little early. There had been some pioneering work on superconducting magnets in the United States when I started my graduate studies in 1959. In the next year, S Hauser reported the use of niobium wire to produce solenoids giving fields in the range of 4.5 to 5 T (Rev. Sci. Instr. 30, 509). After reading Hauser’s paper, I wound a solenoid of niobium for use in our nuclear orientation electromagnets that were used to magnetically saturate our specimens and that hampered the detection of gamma-rays from the samples. Later, we used molybdenum-rhenium alloy coils that had a larger critical field. In the nuclear cooling group, Bob March and Orest Synko also started to use superconducting magnets in thermal switches between the paramagnetic and nuclear cooling stages. The area of high-field superconductors grew over this short period, 1960-62, culminating in the development of niobium-titanium and niobium-tin magnets. Martin Wood was Senior Research Officer in charge of magnets and was foremost expert in the design of high-field, water-cooled copper solenoids. He realised the huge potential of superconducting magnets in scientific applications and also started to experiment with them in this period. He went on to build the first commercial magnets at Oxford Instruments.

I do agree with Prof Meaden that this was a memorable and exciting period to be in the Clarendon laboratory.

With best wishes,

Professor Emeritus

University of British Columbia

LETTER TO THE EDITOR

Professor Michael Kosterlitz

IMAGE CREDIT: N. ELMEHED.

Department of Physics Newsletter | Spring 2017

Michael Kosterlitz, who read for his DPhil at Brasenose College between 1966 and 1969, has been named a Nobel Laureate for his pioneering work to help reveal the secrets of exotic phases of matter.

Professor Kosterlitz, now of Brown University, USA, shared half the prize with Professor Duncan Haldane of Princeton University, USA, with the other half going to Professor David Thouless of the University of Washington, USA.

The Royal Swedish Academy of Sciences cited the three scientists’ theoretical discoveries of topological phase transitions and topological phases of matter.

Topology is a branch of mathematics that deals with the idea that some things can be smoothly deformed into each other, whereas other things cannot without something disruptive happening along the way. For example, a soccer ball can be smoothly deformed into a rugby ball, but not into a coffee cup, because there would be some distinct moment when the handle of the cup has to be closed up.

The Academy said: “This year’s Laureates opened the door to an unknown world where matter can assume strange states. They have used advanced mathematical methods to study unusual phases of matter, such as superconductors, superfluids or thin magnetic films. Thanks to their pioneering work, the hunt is now on for new and exotic phases of matter.”

“The three Laureates’ use of topological concepts in physics was decisive for their discoveries. Topology is a branch of mathematics that describes properties that only change step-wise. In the early 1970s, Michael Kosterlitz and David Thouless overturned the then current theory that superconductivity or superfluidity could not occur in thin layers. They demonstrated that superconductivity could occur at low temperatures and also explained the mechanism, phase transition, that makes superconductivity disappear at higher temperatures.”

Frank Close, Professor of Physics at Oxford University and a Fellow of Exeter College, Oxford, shared an office with Prof Kosterlitz when they were studying for their DPhil in Oxford in the late 1960s. He recalled: ‘Mike was at that time working in theoretical particle physics from Monday to Thursday, but on Friday he would disappear and head off in his car to the Scottish mountains for the weekend. Mike was an avid climber, and to reduce the likelihood of falling off a rock-face he had a wrist strengthener, which he would squeeze in his left fist while writing with a pen in his right hand (those were the days when people actually wrote on paper rather than typed on laptops). Whenever he paused for thought, he would put down the pen and transfer the wrist strengthener to his right fist to help reduce the likelihood of falling off a rock-face.

‘After he left Oxford he moved into condensed matter physics and did his great work on what became known as Kosterlitz-Thouless vortices. And he kept climbing. I am delighted that he has reached the top of another mountain.’

WWW.OX.AC.UK/NEWS/2016-10-04-OXFORD-ALUMNUS-SHARES-THE-2016-NOBEL-PRIZE IN PHYSICS

OXFORD ALUMNUS SHARES THE 2016 NOBEL PRIZE IN PHYSICS

Professor Emeritus

University of British Columbia

With best wishes,

Professor Emeritus

University of British Columbia
A somewhat varied career: started as a lawyer, became a physicist, ended as an artist.

In 1944, having only just turned seventeen, I entered Merton to read Law. In those days, a third of the first year law course consisted of Roman law studied in Latin. Nevertheless, after two terms I passed Law Mod, much to my surprise as I had spent more time sailing on the river than studying law. It was still wartime, and I joined the Oxford University Naval Division, which prepared us for service in the Navy. Part of our training was on the hox on a whaler which had a destroyer’s bridge mounted on it. It was so top-heavy that if one altered course by more than a few points it was liable to capsize!

I then joined the Royal Navy. At the initial interviewing board I was told that, as I had an elementary qualification in law, I was clearly suitable to be a radio and radar maintenance instructor! I was sent on an admirable course by more than a few points it was liable to capsize!

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On leaving Oxford I was recruited into the Services Electronics Research Laboratory (SERL) to build a low temperature laboratory and initiated low temperature research. The research consisted of developing new techniques for obtaining, controlling and measuring low temperatures, and our research at these temperatures concentrated on superconductivity. Later, I became Dean of the Faculty of the Technology of Manchester University and served a term as Vice Principal of UMIST.

FROM SCIENCE TO ART

In addition to my interest in physics, I had always had an interest in art, attending evening classes in drawing and sculpture, and I decided that before I went senile I would like to do this properly. I took slightly early retirement and at the age of sixty-three enrolled as an undergraduate fine art student at Manchester Polytechnic (now MUMU). The experiences of an elderly ex-physics professor in a class of 20-year-old art students could make an article in itself. At the end of the four year course, specialising in sculpture, I graduated and I now practice as a professional artist, mainly involved in sculpture.

I am, of course, often asked how different do I find life as an artist compared to that of a scientist. My answer, which usually surprises, is that I do not find that much difference. As an academic scientist, I was not told what to do but was expected to think up my own ideas. The same goes for an artist.

I now practice as a professional sculptor and artist. Does my scientific background show in my sculpture and other art work? No. I do not think so. Except that, you should try a different approach; but I am not complaining, this is the way art is.

Examples of my art work can be seen on the websites of The Royal British Sculptors Society and the Stockport Art Guild.
We hope you enjoyed reading this issue of the Physics Department’s newsletter. To contact the newsletter editor, Prof Dimitra Rigopoulou, please email newsletter@physics.ox.ac.uk. For latest news on developments at the Oxford Physics Department, see www.physics.ox.ac.uk/about-us. To contact the alumni office, email alumni@physics.ox.ac.uk. For events and lectures, www.physics.ox.ac.uk/events.

We are pleased to announce the following COMINGS, GOINGS & AWARDS...

**IN REMEMBRANCE**

It is with great sorrow that we mourn EDMUND ‘TED’ WILSON, who died on 3 November 2016 after a short illness. Ted was born on 18 March 1938 in Liverpool, the son of school teacher John Wesley Wilson and nurse Anna Wilson. He was a great accelerator physicist and an inspired and inspiring teacher. He was an engaging and entertaining companion, being one of those people who, while being quite serious about everything, never takes themselves too seriously; he lived life to the full, doing as much good as he could along the way. Ted is survived by his wife Monika, his three sons, Martin, Alexander and Nicholas and five grandchildren. Our thoughts are with them. He will be greatly missed.

**AWARDS**

PROF ROGER DAVIES will become President of the European Astronomical Society with effect from July 2017.

DR HANNAH CHRISTENSEN was a runner up for the Lloyds Science of Risk Peter Taylor Prize.

PROF CHRIS DAMERELL was awarded the 2016 Glenn Knoll Radiation Instrumentation Outstanding Achievement Award by the IEEE Nuclear and Plasma Science Society.

PROF ACHILLEFS KAPANIDIS has won an MPLS Impact Award in recognition of his research that led to the development of the Nanoimager; a compact, robust, easy-to-use high-resolution fluorescence microscope based on detecting single molecules.

PROF MYLES ALLEN received the MPLS Lifetime Award in recognition of his work engaging the public and advancing public understanding of anthropomorphic climate change and its links to extreme weather. Prof Allen has pioneered the use of ‘citizen science’ through public-participation computer modelling experiments under the climateprediction.net and weather@home initiatives.

DR JOEL SPRATT received the 2016 Arthur Cooke Prize for distinguished work by a first year research student in Condensed Matter Physics.

PROF SUBIR SARKAR was awarded the 2017 IUPAP-TIFR Homi Bhabha Medal and Prize for his distinguished contributions in high energy cosmic ray physics and astro-particle physics.

**COMINGS...**

PROF STEVE COWLEY Professorial Research Fellow | Theory

DR RICK HAMILTON Senior Research Assistant | CMP

DR IAN HEYWOOD Hintze Research Fellow | Astro

DR DAVID JENNINGS Royal Society Fellow | ALP

MRS GALE LOCKWOOD Interconnect Operations Manager | Particle

PROF BRIAN SMITH Programme Leader | ALP

DR MIKA VESTERINEN STFC Ernest Rutherford Fellow | Particle

**GOINGS...**

DR PATRICK BAIRD Head of Graduate Studies | ALP

PROF JOHN COBB Research Reader | Particle

DR IGOR MEKHOV EPSRC Career Acceleration Fellow | ALP

DR JUAN ROJO STFC Rutherford Fellow | Theory

DR SONIA TRIGUEROS Post Doctoral Research Assistant | CMP

DR BOB WATKINS Research Assistant | AOPP

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