CavMag

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CERN'S NEXT DIRECTOR-GENERAL

ENERGY MATERIALS FOR A GREENER FUTURE

THE NEW CAVENDISH MUSEUM

ALSO INSIDE:

A new era for physics
The Ray Dolby Centre opens

Quantum hub
For national security and infrastructure

UNIVERSITY OF CAMBRIDGE | Cavendish Laboratory
Department of Physics

Welcome
to CavMag 33

Harry Cliff

It has been a busy few months at the Cavendish Laboratory. We are now almost fully moved into our stunning new home, the Ray Dolby Centre, with laboratories up and running and most research groups now moved across from the 1974 estate. The café on the third floor is bustling with staff and students and a new Cavendish Museum has opened in the public wing, showcasing instruments used in many of the laboratory's most famous discoveries.

On 9 May, in beautiful spring sunshine, the building was officially opened by Dagmar Dolby, Mete Atatüre, the Head of the Cavendish, Vice-Chancellor Deborah Prentice and Lord Spencer Livermore, Financial Secretary to the Treasury and Minister for Growth. It was a moving ceremony where Dagmar spoke eloquently of need to maintain international collaboration during turbulent times, a spirit that the new Cavendish Laboratory will continue to embody.

As we reach the end of our 150th anniversary year, which culminated with the Cavendish Science Festival on 19 and 20 of June, we share some further reminiscences from our alumni community. We also report on the completed Cavendish Museum, a fantastic new resource for students, staff and the general public, where visitors can explore the fascinating history of the laboratory through artefacts, graphics and interactive media.

However, in the main, this edition looks to the future. Inside these pages you'll find an interview with Mark Thomson, the incoming Director-General of CERN, as he lays out his vision for particle physics in the coming decades as CERN plans a successor to the Large Hadron Collider. Professor Siân Dutton describes the cutting edge materials research that is helping us towards net zero, and we hear from our young researchers, as they share their hopes and aspirations for the future of their respective fields.

We are always delighted to hear from you, so please do contact us using the details opposite with your comments or suggestions. We hope you enjoy this 33rd edition of CavMag, as the Cavendish Laboratory enters a new era for its research, teaching and engagement with the public.

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Write to us:

Do you like this redesigned issue? Would you like to read more articles about our staff, or find out what other alumni are doing? We are always delighted to hear from our readers, please contact us by email, postal mail or on social media. Letters may be published in future issues. Please mark your email or letter: 'for publication'.

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Feature

CERN's next Director-General

The Cavendish's very own Mark Thomson will become Director-General of CERN at the start of 2026. In this interview, he lays out his vision for the international laboratory as European physicists prepare for life after the Large Hadron Collider.

Harry Cliff

It's rare to bump into Mark Thomson in the Cavendish Laboratory these days. After joining as a lecturer in 2000 and becoming a professor in 2008, Mark's career has increasingly taken him away from Cambridge. In 2015, he became co-spokesperson of the Deep Underground Neutrino Experiment (DUNE), the largest particle physics project ever undertaken in the USA. Then from 2018 to 2024, he served as Executive Chair of the Science and Technology Facilities Council (STFC), the UK government agency that supports science and engineering research, including particle physics and astronomy. Now, he is preparing to take on the biggest job in physics: Director-General of CERN.

Mark will come into post at a critical time for the world's leading particle physics laboratory. The European particle physics community is in the midst of developing its strategy for a future after the Large Hadron Collider, at a time when the international environment is less stable and predictable than it has been for a generation.

So, when Mark visited to the newly completed Ray Dolby Centre on a sunny day in April to give the keynote speech at an Institute of Physics conference, I took the opportunity to sit down with him to discuss his priorities as the incoming Director-General and get his view of the current state of the field. He began by responding to the oft-heard argument that particle physics has reached an impasse or dead-end following the discovery of the Higgs boson at CERN's Large Hadron Collider (LHC) in 2012.

"Sometimes, I hear these messages that high energy physics is in the doldrums. Absolutely not true!" he began emphatically. "If you look back 30 years, we've seen really big, profound discoveries – the Higgs boson, neutrino masses – every seven, eight years. That's a pretty good hit rate for fundamental discovery." This critique of particle physics, and the Large Hadron Collider in particular, stems largely from the fact that aside from the Higgs, the LHC has not revealed any new particles that might address big mysteries like dark matter or the imbalance of matter and antimatter in the universe, mysteries emphasised by the messaging around the launch of CERN's shiny new 27 kilometre, €4.6 billion collider in 2008.

But for Mark, the LHC has had an incredible impact, in particular through its epoch-defining discovery: the Higgs boson. Though predicted by the standard model as a consequence of the mechanism that gives fundamental particles mass, the Higgs is anything but standard. "The Higgs is not just another particle" Mark continued, "it is something completely different from anything we've seen before. We are starting to explore what the Higgs boson is and how it works. This is science at its most basic, science that is addressing really critical questions about the universe."

But beyond the headline-grabbing breakthroughs, Mark is keen to highlight the rich programme of research that the LHC has fostered. Colliders, like the LHC, do not just exist to discover particles, they enable a vast range of measurements of fundamental processes, testing the standard model at high precision and probing for indirect signs of 'new physics'.

Mark pointed in particular to the discoveries of tetraquarks and pentaquarks at the LHCb experiment, one of the four large detectors on the LHC ring. Such particles, made of four and five quarks, represent an extension of the quark model that explains the nature of hadrons, such as protons and neutrons. Their discovery has opened up a new sub-field of research.

Thousands of papers have been produced by the LHC experiments on everything from matter-antimatter asymmetry to quark-gluon plasmas. "The scientific output of the LHC has just been incredible, both in terms of numbers of papers and quality. And of course, the Breakthrough Prize, as of two days ago, really recognised the fact that this machine, the LHC and the experiments, has contributed so much to science."

Opposite page: Schematic map of the potential location of the Future Circular Collider at CERN, near Geneva. Credit: CERN

The ATLAS experiment at CERN's Large Hadron Collider, one of the two detectors used to discover the Higgs boson. Credit: CERN

“The real breakthrough was the Higgs, but we should not be expecting massive breakthroughs every few years. Science doesn’t work like that.”

So where does this idea that particle physics is in the ‘doldrums’, come from? “I think there was this assumption that you would switch the LHC on and suddenly you see a whole new world. I'm not sure how realistic that ever was to be honest. The real breakthrough was the Higgs, but we should not be expecting massive breakthroughs every few years. Science doesn't work like that.”

So, what of the future? When Mark’s term as Director-General begins on 1 January 2026, he will have three key tasks in his in-tray. His “number one priority” is the completion of the High-Luminosity LHC, a major upgrade of CERN’s flagship accelerator that will increase the rate at which it collides protons by a factor of ten. This will enable the LHC experiments to dramatically increase the size of their datasets, with a corresponding leap in sensitivity to a vast range of different processes, including detailed studies of the Higgs boson and searches for ever more elusive signs of physics beyond the standard model.

The civil engineering for the project began back in 2018, with the project slated for completion in 2029. One of the key challenges is constructing new magnets to focus the proton beams at the collision points, something that can only be achieved using the latest in superconducting technology. This is “very, very challenging” as Mark put it, “so I will be laser focused on getting us to that next stage of the LHC journey.”

For Mark, the potential of this upgraded LHC is enormous. “This is a massive change in capability. We're making the detectors better and the scientific community is being very imaginative and using AI to make everything we do more effective. So, you combine all of that – ten times more data, better detectors, better techniques – means we’re right at the start of the whole LHC journey, and that’s incredibly exciting. We are moving into a regime where we are exploring the unknown in a different way, much more precisely. There is a real discovery opportunity here.”

Alongside overseeing the final stages of the LHC’s major upgrade, Mark’s second priority as Director-General will be preparing CERN for a future after the LHC has powered down for the last time in the early 2040s. What comes next is the key question being wrestled with as physicists from across Europe prepare the next iteration of the European Strategy for Particle Physics, a document that will shape the field’s future trajectory.

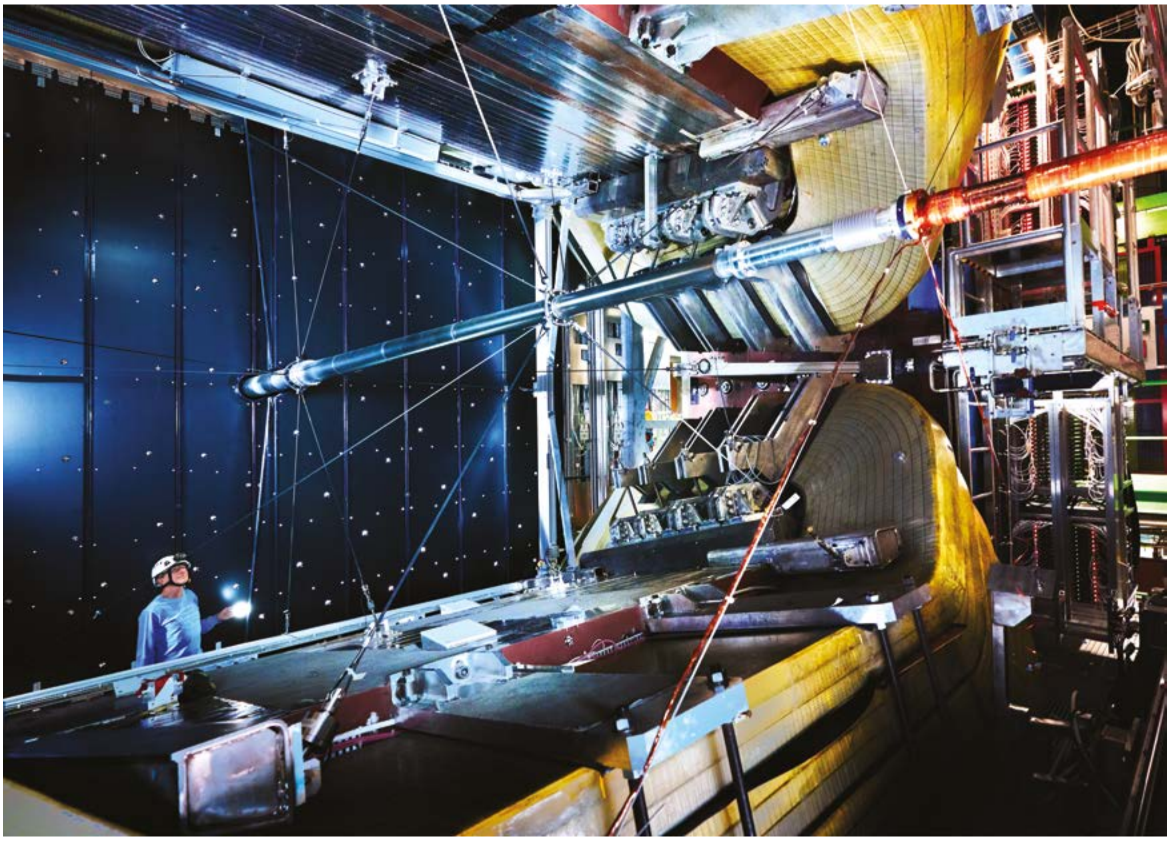
“It will be my job to turn those scientific priorities into something real,” Mark said. “That means working with CERN’s member states and other potential international partners to make what I believe would be an incredibly exciting project into a reality.”

The leading contender for CERN’s next flagship machine is the Future Circular Collider (FCC), a proposed 90 km ring that would collide electrons and positrons to produce large numbers of Higgs bosons, allowing researchers to study this bizarre particle in unprecedented detail.

The Higgs is at the centre of many of the biggest unanswered questions in modern physics.
In the standard model, the Higgs particle is a quantum excitation of the Higgs field, a universal quantum field that gives mass to the fundamental particles, like electrons and quarks, and causes the unified electroweak force to separate into the electromagnetic and weak forces.

Despite its discovery in 2012 and a host of studies since by the ATLAS and CMS experiments at the LHC, we still have only a relatively fuzzy picture of the Higgs boson. Although it currently appears consistent with the particle predicted by Peter Higgs, Françios Englert and Robert Brout in 1964, physicists can’t yet be confident that it really is the standard model Higgs boson and not some more exotic imposter. We still do not know, for instance, whether it is responsible for giving mass to the electron and the up and down quarks that make up ordinary matter. And it remains possible that the Higgs boson found at the LHC is not a fundamental particle at all, but a composite object made of as yet unknown building blocks.

What’s more, the Higgs boson is deeply connected to other mysteries in physics, including how matter came into existence during the first instant after the Big Bang, and could also act as a ‘portal’ to the unexplored dark universe, by interacting directly with dark matter particles. These opportunities and more besides, make understanding the Higgs the prime goal of particle physics in the coming decades.



The beampipe hanging inside the magnet of the LHCb experiment. Credit: CERN

For Mark, studying the Higgs is reason enough to build the next collider. "The case is very simple," he said. "The Higgs boson is a fundamental property of the universe, not just another particle. We now need to really understand what it is."

However strong the science case may be, the FCC undoubtedly presents a major financial and political challenge. The price tag – estimated at around 15 billion Swiss francs – appears daunting. But Mark is quick to point out that the cost would be spread across many years and shared between CERN's 24 member states. "It's not 15 billion now. It's 15 billion over roughly 15 years. That's an important distinction."

However, the project only becomes affordable if additional partners beyond the CERN member states are willing to contribute. One possibility is the European Union. "There have been some very positive statements at the Commission level about the value of places like CERN in terms of technology and technological supremacy." Mark pointed to the recent Draghi report on the future of European competitiveness, which highlighted underinvestment in research and development and emerging technologies as key factors holding back European productivity. CERN, he hopes, has a role to play in tackling these challenges.

Other potential partners include Japan and the United States, though with the Trump administration currently proposing 55% cuts to the National Science Foundation, it is hard to imagine Washington showing any interest in contributing to a European collider.

Indeed, the current geopolitical and economic environment is markedly less stable than it was when the LHC was approved in the 1990s. For Mark, this makes the mission of CERN – science for peace – even more vital. "CERN was created in 1954 to bring countries together to collaborate in science in a peaceful way. Given all the tensions we've seen in the world since then, it's remarkable how strong that mission has remained. I think places like CERN are even more important today."

And while he acknowledges that securing funding for the FCC will be a difficult task, Mark remains optimistic. "It won't be easy. But I do believe it's doable – if we, as a scientific community, send a clear, unified message that this is the thing we should do."

Still, not everyone agrees on what the next big step in particle physics should be. Some favour alternative projects, such as linear colliders or more exotic concepts like muon colliders and plasma wakefield accelerators. Mark, who worked on linear colliders earlier in his career, now believes that the balance of scientific benefits favours the FCC.

"If you'd asked me 20 years ago, I would've said build a linear collider and get to the Higgs really quickly. But now, we're already doing Higgs physics with the LHC. A circular collider would get

Excavation works for the High Luminosity LHC at CERN in 2023. Credit: CERN

us far more data. The science case for luminosity [the rate of collisions] outweighs the argument for going to slightly higher energy with a linear collider."

As for cutting-edge, next-generation accelerator concepts, Mark believes CERN should support R&D but remain focused. "We can't do everything. CERN is investing in promising technologies like high-field magnets, which are essential for a future hadron collider. But other developments – like plasma acceleration – are still early-stage. We need to identify potential showstoppers first and focus our efforts."

Beyond these large-scale projects, Mark's third priority as Director-General is to build a coherent long-term vision for CERN's 'beyond colliders' programme. CERN hosts a unique collection of smaller accelerators, built over the 20th and 21st centuries, which aside from providing beams of particles to the LHC, also support a broad spectrum of smaller scale experiments, from nuclear physics to antimatter studies and even climate science.

"There's a whole programme of physics we can do with CERN's infrastructure that isn't collider-based," he said. "What I'd like to do is lay out a 20–25 year plan for how we use that complex strategically, in parallel with building the next big collider." This vision would help sustain a vibrant environment for early-career scientists, who often seek more immediate scientific returns than a 30-year mega-project can offer, bridging the gap until the next big machines fire up.

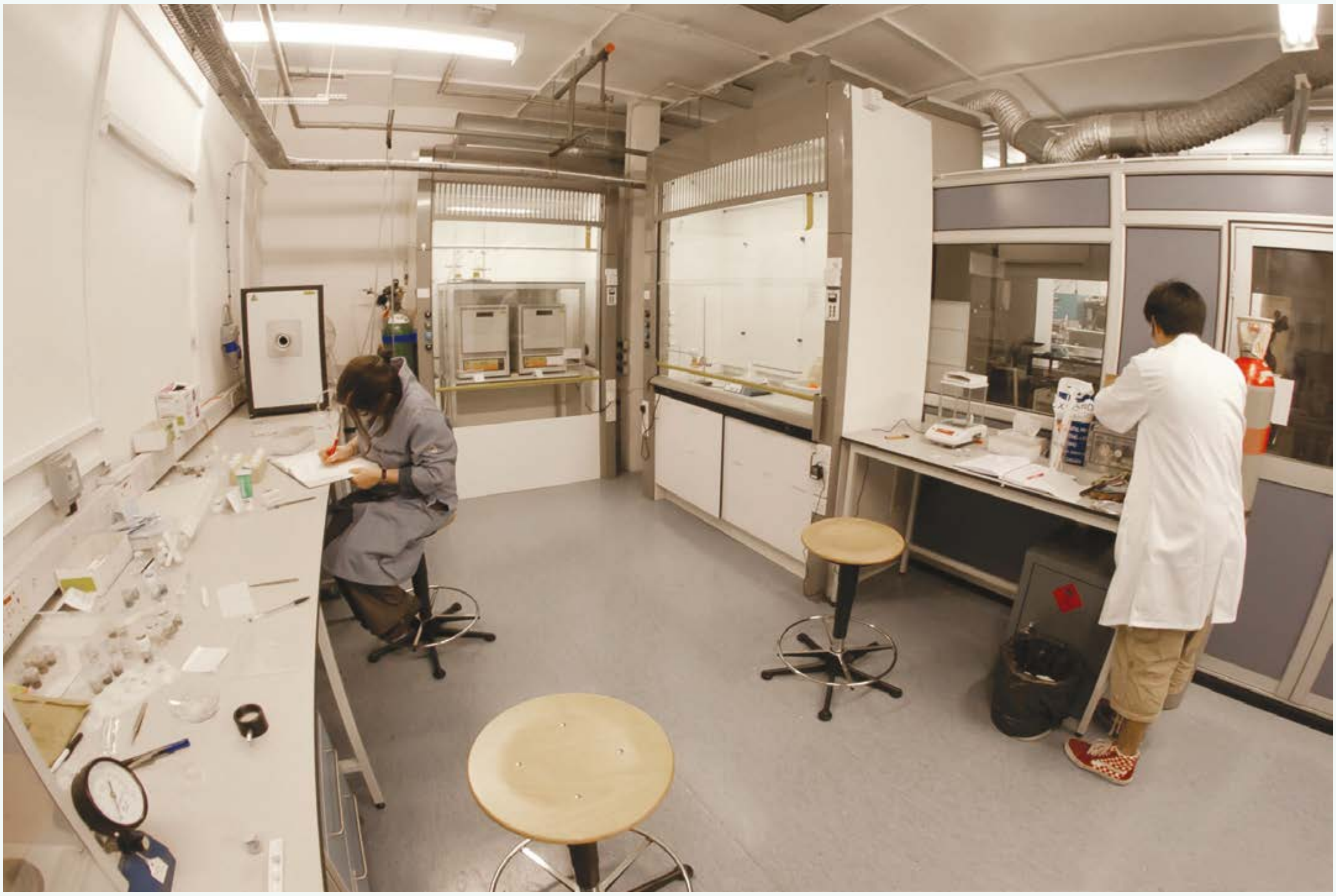
Ultimately, Mark's vision for CERN is one of balance: advancing toward new frontiers, while preserving the diverse, inclusive, and collaborative spirit that has made the laboratory a global beacon of scientific progress. "We're at an incredibly exciting moment," he concluded. "Yes, the next steps are big and difficult. But we've got a great plan, and there's only one CERN in the world. It's vital for European science – and for global science – that we keep it at the forefront."

Flags of the member states flying outside CERN. Credit: CERN

New materials for the energy transition

Researchers in the Functional Energy Materials Group led by Siân Dutton are working to develop, understand and optimise materials to support the energy transition.

Siân Dutton



The Energy Materials lab.

As we move towards net-zero emissions we need to reconsider how we generate, store, transport and use energy. At the heart of all these applications are the materials and devices which enable us to move towards greener technologies. At the Cavendish, together with the wider Cambridge community, we are developing materials and devices for the energy transition, including energy efficient computing, energy generation, transmission and storage. This not only includes research within our Energy Materials research theme but also two new graduate courses focused on this highly interdisciplinary area.

I lead, the Functional Energy Materials (FEM) group, an interdisciplinary team working at the interface between physics, chemistry and materials. We focus on developing and understanding materials for next generation energy devices including rechargeable batteries, low temperature cooling, and optoelectronic materials. The group uses a wide range of measurement techniques to explore the interplay between structure and a material's properties in complex oxide systems. We are interested in developing materials for next-generation, beyond-lithium-ion batteries.

Recently, we have explored the role of the Jahn-Teller electronic transition in nickel (Ni^{3+}) oxides in layered sodium-transition metal oxides, which are of interest as next-generation battery materials. The energy lowering Jahn-Teller transition lifts the degeneracy of partially occupied bands in a material and reduces the symmetry of the transition metal site. In $NaNiO_2$, the local Jahn-Teller distortion is ordered throughout the structure resulting in symmetry lowering, which is suppressed on heating above 500 Kelvin. Jahn-Teller transitions are also observed in other technologically relevant materials including undoped high temperature cuprate superconductors and manganese oxides with 'colossal magnetoresistance', which is when the electrical conductivity of a material changes dramatically when placed in a magnetic field. Such materials could be used in developing magnetic memory devices.

Our initial focus was on understanding the nature of the high temperature transition in $NaNiO_2$. Through experiments at several international facilities – the Spallation Neutron Source in the USA, the ISIS Pulsed Neutron and Muon Source in the UK, the European Synchrotron Radiation Facility in France and the Diamond Lightsource in the UK – we studied this as a function of both temperature and pressure. Our work resulted in the first observation of a displacive rather than an order-disorder Jahn-Teller transition and we have subsequently demonstrated similar behaviour in the lithium-containing analogue, $LiNiO_2$, a parent system for many next-generation lithium-ion batteries.

Using our knowledge of $NaNiO_2$ we explored the structures formed when $NaNiO_2$ is cycled in a battery. On removing sodium ions (i.e. charging in a battery) the presence of the Jahn-Teller distortion gives rise to complex structures in the Na_xNiO_2 phases which limit reversibility and enhance degradation. The Na_xNiO_2 structures were first reported in the 1980s, however their exact structures had not been fully determined due to their complex nature caused by the combination of Na vacancy, Ni charge and Jahn-Teller ordering. Using high-intensity, high-resolution and low noise measurements we have successfully determined the structure of the de-sodiated phases. In all phases we find complex combinations of Ni charge ordering, Jahn-Teller distortions and Na vacancy ordering.

Using tools developed in our work on $NaNiO_2$, we can show that whilst the Jahn-Teller distortion is suppressed in Na_xNiO_2 the Ni sites still retain some Jahn-Teller characteristics which give rise to the complex phase diagram not observed in other layered transition metal oxides. In ongoing work, we are exploring how we can use our understanding of Na_xNiO_2 to minimise degradation and improve battery performance.

A long-standing project in the Functional Energy Materials group is exploiting divalent batteries, which have the advantage of driving two electrons through the external circuit for every ion transported across the battery. At the turn of the century, divalent magnesium-ion batteries were demonstrated to reversibly cycle multiple times, albeit at much lower operating voltages and capacities than commercial lithium-ion batteries. Since then, there have been extensive reports of both higher voltage and higher capacities in magnesium-ion systems. Our work in this area has shown that the promising electrochemical performance often arises from degradation,

Below and opposite: containers of materials used in experiments.

“Our work combining physics, chemistry, and materials science allows us to understand the processes occurring in energy materials.”

rather than magnesium-ion transport, highlighting the need for detailed post-cycling studies in magnesium batteries.

In addition to batteries, we are also interested in developing alternatives to cryogenic gases. Helium gas is typically used for cooling to very low temperatures. However, helium is a biproduct of natural gas extraction and in recent years there have been shortages in supply. In addition to allowing for low temperature physics experiments, helium is used to cool the superconducting magnets in magnetic resonance imaging (MRI) scanners and high energy particle accelerators, as well as in many quantum computing applications that require cooling to low temperatures. In this area we focus on magnetic cooling using changes in the ‘magnetocaloric effect’, changes in temperature driven by changing spin configurations on application of a magnetic field. To optimise performance, we use geometrically frustrated magnetic systems with lanthanide ions to maximise the entropy available and the accessible temperatures for cooling.

Collaborating with Mike Zhitomirsky (CEA, Grenoble) and Claudio Castelnovo (TCM, Cavendish), we have experimentally verified the theoretically predicted enhancement of the magnetic cooling rate for some geometries of magnetic lattices, whilst also showing that the best materials for low temperature cooling will be those with the weakest magnetic interactions. In complementary experimental work we have been able to demonstrate free spin (weakly interacting) dominated magnetocaloric effect in gadolinium (Gd^{3+}) containing dense double perovskites. Following on from our initial reports, we are now exploiting the chemical diversity of double perovskites to tune the magnetic and magnetocaloric properties.

Our work combining physics, chemistry, and materials science allows us to understand the processes occurring in energy materials. Using facilities both in Cambridge and elsewhere we can build a detailed understanding of the relationship between structure and properties in materials relevant for the energy transition.

Advanced Materials for the Energy Transition

Graduate Programmes in Energy Materials – first cohorts welcomed in October 2025

MPhil. in Advanced Materials for the Energy Transition (AMET) is an 11 month programme run by the Department of Materials Science and Metallurgy, Department of Physics and Department of Chemistry co-directed by Chiara Ciccarelli, Alexander Forse and Xavier Moya. In addition to taught courses students will complete a life cycle analysis module and an extended research project.

To find out more visit: **amet.masters.cam.ac.uk**

The Sustainable Energy Materials Innovations (SEM) PhD Programme, co-directed by Siân Dutton and Sam Stranks, is a 3.5 year interdisciplinary PhD programme across Physical Science and offering PhD training in energy materials required to deliver net zero by 2050. The course will provide diverse training in the design and discovery, development, scale-up, life-cycle analysis, and systems integration of advanced energy materials and devices in areas strongly guided by the needs of the ‘net-zero’ industry. PhD projects are co-supervised by at least two supervisors from different disciplines, and most will include collaboration with an industry partner.

Find out more at: **phy.cam.ac.uk/study/postgraduate/programmes/phd-in-sustainable-energy-materials-innovations**

Building the new

Cavendish Museum

Since the mid 20th century, the Cavendish Laboratory has held a collection of scientific instruments and archival material that embodies the extraordinary history of the laboratory. A beautifully designed new Cavendish Museum has just opened in the Ray Dolby Centre.

Harry Cliff

Model of the double helix structure of DNA.

As an undergraduate, I would often stop to gawk at some of the extraordinary scientific instruments on display in the Cavendish Museum, housed on a long corridor on the first floor of the Bragg Building. In a short stretch of cabinets, you could find the cathode ray tube used to discover the electron, Wilson's cloud chamber that first made the tracks of subatomic particles visible and the small brass tube that Chadwick used to discover the neutron.

These remarkable items are all part of the Cavendish Collection, which was first assembled after the Second World War when Lawrence Bragg, then Cavendish Professor, put out a request for important items that might be hidden in various corners of the laboratory on Free School Lane. Since then, the collection has grown in fits and starts, as new items from the postwar history of the laboratory were added to the display over the subsequent decades.

It is no exaggeration to say that this is one of the most significant collections of scientific apparatus anywhere in the world, especially when it comes to the history of physics in the 19th and 20th centuries. This point became even clearer to me after working with historic collections during my seven-year spell as a half-time exhibition curator at the Science Museum in London.

Now, the Cavendish Museum has been redisplayed in the stunning setting of the Ray Dolby Centre. Last year, I had the privilege of taking on responsibility for the collection from Malcolm Longair, who has spent many years preserving, researching, cataloguing and enhancing the collection. As the new curator, I faced the exciting, if slightly daunting task of creating a display fit for the Cavendish Laboratory's new home, which unlike the previous museum would be open to the public without appointment, five days a week.

Early on, the Department took the decision to provide a significant budget for the new exhibition. As Mete Atatüre put it, you don't want to scrimp on something that is relatively cheap (at least compared to the Ray Dolby Centre) and very visible (located in the public wing). This enabled us to appoint an experienced team of museum professionals, supported by a number of university staff, who all gave their time generously to bring the new display into being.

A display of historic apparatus in the Austin Wing of the original Cavendish Laboratory on Free School Lane.

After inviting several design firms to interview, we appointed London architecture studio Drinkall Dean, who have worked extensively with national institutions, including the British Museum, the Science Museum and the V&A. Lead designer Angela Drinkall put together a multi-talented team including graphic designer Helen Lyon from Studio HB, and Clay Interactive, specialists in digital and interactive museum displays.

The design they produced was crisp and modern, with showcases in white powder coated steel and crystal clear low-iron glass, that almost disappear and draw the eye to the objects. The showcases themselves were manufactured by Yorkshire-based company Glasshaus, whose installation team worked tirelessly for four weeks in the Ray Dolby Centre to assemble the showcases and plinths.

Completed ahead of the official opening of the Ray Dolby Centre on the 9th May, the museum includes six large free-standing showcases that focus on specific discoveries, instruments or people, five interactive touchscreens with reams of deeper content, three plinths displaying some of the larger objects from the Cavendish Collection and two monumental wall cases, which explore themes from the Cavendish Laboratory's research.

Above:
The Ray Dolby showcase, positioned in front of a large sculpture inspired by the circuitry from the Spectral Recording system, Dolby's final analogue invention.

These are spread throughout the public wing of the Ray Dolby Centre, with the majority on the first and ground floors.

The first thing you see when entering the building is a showcase dedicated to the life and work of Ray Dolby. Among the items donated by the Dolby family are his original unbound PhD dissertation on X-ray microanalysis at the Cavendish Laboratory, and several iterations of the noise reduction technology he invented at Dolby Laboratories. Complementing these more technical items are pieces that speak to his love of music, which inspired his work on noise reduction, including his clarinet and sheet music. Suspended above the case is a *Star Wars* movie poster, which was one of the first feature films to use Dolby noise reduction.

The case also features a built-in touchscreen with an interactive timeline of Ray Dolby's life, researched and written by Cavendish astrophysicist, Charlie Walker and designed by Clay Interactive. The piece incorporates a number of film and audio recordings, including interviews with Ray and an early guitar demo of the noise reduction system that Dolby Labs used to promote their technology to music studios in the 1960s. One particularly touching moment during the official opening of the Ray Dolby Centre was when one of Dolby's grandchildren told her grandmother that listening to the interview with Ray was the first time she had heard her grandfather's voice. He had died the year she was born, in 2013.

Walking further into the public wing you encounter two large tank cases, one containing the iconic DNA model made by the MRC laboratory shortly after Crick and Watson determined the structure of DNA in 1953. The other contains a helium liquefier invented by

Pyotr Kapista to supply the Cavendish with liquid helium in the 1930s.

Around the corner is the largest collection of objects in the exhibition, two huge wall cases running the length of the corridor that passes behind the stage of the Ray Dolby Auditorium. These are subdivided into themes, the first telling the story of the origins of the Cavendish Laboratory in the late 19th century, including a section of the first transatlantic cable, an innovation that demonstrated the utility of physics to industry. Nearby, you will find a plinth with the famous experiment that James Clerk Maxwell, the first Cavendish Professor, used to measure the viscosity of gases, which was carefully restored by Sean Geraghty from the workshops team.

Also in this area of the museum is a large wall-mounted touchscreen that allows visitors to browse through the extensive photographic archive, including over a century of annual research student photographs, and countless other images of scientific equipment, laboratory life and lesser-known figures from the Cavendish's history. High energy physics PhD student Ella Wood did a huge amount of work for this screen, researching and writing pages of material about some of the less well known Cavendish scientists and technicians, many of them women, who contributed enormously to its success.

Within these cases you can find items that speak to the Cavendish's pioneering work in nuclear physics, X-ray crystallography, electron microscopy, low temperature physics and astrophysics. Highlights include part of the accelerator built by Cockcroft and Walton in 1930 in their quest to split the atom, Lawrence Bragg's original X-ray spectrometer and Brian Pippard's model of the Fermi surface of copper. At the end of the corridor is another freestanding

Centre:
Dagmar Dolby, wife of Ray, listening to an audio recording in the exhibition at the Ray Dolby Centre official opening.

Right:
Kaptisa's helium liquefier on display in the Ray Dolby Centre.

Feature

case that explores the observation of pulsars by Tony Hewish and Jocelyn Bell, including Hewish's pulsar model and another interactive touchscreen with a timeline of the months leading up to their momentous discovery.

Many of the objects in the museum were sympathetically and delicately mounted by expert museum mount maker Colin John Lindley, who spent several days in Cambridge in total; first measuring and examining each object before they were moved to the Ray Dolby Centre and then returning at the end of April with his handmade mounts to install each object individually. Working with Colin and his colleague and partner Kate Silverston over several days as we installed the collection was a real joy.

A particularly nervous moment came when we mounted one of J. J. Thomson's original cathode ray tubes, used in the discovery of the electron in 1897. The delicate glass tube has not been on display for over a decade, as it was deemed too valuable and fragile for the aged wooden cabinets in the old museum. Now it can be viewed in a single showcase exploring the Cavendish's contribution to understanding the inner structure of the atom, alongside a later version of Rutherford's Manchester experiment that discovered the proton, and Chadwick's neutron discovery experiment, which have also not been displayed for over two decades. It is truly remarkable to find instruments that contributed

Anticlockwise from top:

Former Head of Department and Collection Curator, Malcolm Longair and Sean Geraghty with Maxwell's viscosity of gases experiment.

The photo archive touchscreen and bust of James Clerk Maxwell at the start of the main museum displays.

Colin John Lindley carefully installing Thomson's e/m tube in the 'Atom' showcase on the ground floor of the Ray Dolby Centre.

to the discovery of all three of the subatomic components of the atom in a single case, at a single laboratory.

It has been exciting to see staff, students and visitors pause to engage with the displays over the past few weeks. One of the unexpected consequences of the Museum appearing in the public wing is that it has given the building an identity. Beautiful as the Ray Dolby Centre is, it is not immediately obvious on entering that you are in a laboratory. You might equally be in an elegant corporate office. But as soon as you see the double helix of DNA you can be in no doubt that you are in a scientific building, and more still, the Cavendish Laboratory, reborn for the 21st century. In the coming months and years, we plan to augment these displays with new objects reflecting the Cavendish's cutting-edge research, so that the Museum becomes a living representation of the laboratory's past, present and future.

I'd like to finish by thanking the many people who I have had the pleasure to work with on this project, which has occupied larger and smaller parts of many people's working lives for the past year. I'm particularly grateful to Angela Drinkall for marshalling the team so effectively, to Helen Lyon for her dedication to producing the highest quality graphics and to Adrian Ward for delivering beautiful new digital content right up to the line as we laid the tracks in front of the train. Special mention also goes to David Hunt and Debbie Carminati, who provided invaluable project management support throughout, at a time when they were also extremely busy with the move into the Ray Dolby Centre itself. The new Cavendish Museum is the result of this collective effort.

I hope, in the coming months, you will drop in to explore these remarkable objects, displayed afresh in the Cavendish Laboratory's new home.

The Cavendish Museum is open to the public without appointment in the Ray Dolby Centre, Monday to Friday, 8am to 5pm.

Left: **A section of the large wall cases, displaying objects from X-ray crystallography, electron microscopy and low temperature physics.**

Right: **The Atom showcase, containing instruments used in the discovery of the electron, proton and neutron. An interactive touchscreen explores the wider contributions of Cavendish researchers to understanding the structure of the atom.**

Your Cavendish memories

We asked you to share your recollections of your time at the Cavendish Laboratory, and received dozens of submissions, some of which were published in our last issue. Here is a futher non-exhaustive selection.

Fitzwilliam is quite a way from Free School Lane but not so far from the West Cambridge site. After three years commuting through town, the move was very welcome.

In my final year (Experimental and Theoretical Physics), I took Malcolm Longair's course on "The Origin Of Cosmic Rays". It was, by a long way, the course I enjoyed most in all three years but, sadly, it was also the shortest being scheduled at the beginning of Finals Term. The quietness of the "New Cavendish" library afforded a rare opportunity in three years of hectic study; to sit back and think. I came up with my "take" on the question Malcolm's course posed.

When asked, during a supervision, I told Malcolm what my thinking there had led me to. On hearing it, he became very excited and told me "If you write that in the exams, you'll get a lot of marks". Curiously enough, the question appeared in the exams so I repeated what I'd said in writing. Equally curiously, not "a lot of marks" seemed to materialise from it as I ended up in the 3rd Class, which ended my hopes of a postgraduate career in radio astronomy at Aberystwyth. It seems, though, that I was destined for the space programme, as my following career led me to being involved in the Rosetta mission in 2014, which saw two landings on solar system bodies.

Leslie Baldwin (Fitzwilliam, 1971)

I did Natural Sciences from 1964 to 67, in the old Cavendish, and remember the lecture theatre well. I had an awful lot of lectures on those hard wooden benches.

There were 100 of us, and there was only 1 other girl. Some mornings we had 4 hours on the trot in that room, with only a couple of minutes between each. So, we took it in turns to miss one lecture and go for a cup of coffee and then copy someone else's notes. Mind you it was always fascinating, and I remember one lecture where we taught how to build an atomic bomb. The lecturer produced two bits of what he said was Uranium. He put them down 2 feet apart, and then, empty handed, squashed his hands together, saying that if he did this with the Uranium it would get hot and explode. We all cowered back, but ever since I have wondered if this really was Uranium.

I was the first in my family to go to University. My father had a scholarship to Cambridge, but his parents wouldn't let him go! All those drinking parties! So he joined the Post Office and did his degree and Ph.D in the evenings. I always felt that if I could, I ought to do what he hadn't been allowed to.

Virginia Thorne

I was at the end of my research on electron microscopy of irradiated germanium and used to stay at the Lab until very late up to 3 a.m. Alone in such a huge new laboratory, waiting for the preparation of specimens to be used at the microscope, I felt an unforgettable very peculiar sensation difficult to describe. To work at a so distant location was only possible because I had a car. When hungry, I ate biscuits with a glass of water.

Carlos A. Ferreira Lima (Darwin, 1975)

Prof. Sir Neville Mott at the inauguration of his portrait in the new lab.

With colleagues in the New Cavendish. from left to right, Pratibha Gai (now Dame Pratibha), Kamal Hossain, myself and John (surname forgotten).

Shall think of the Cavendish - as so very often I do! Brian Pippard's glorious lectures; the vast kindness of Dr Edward Shire when I had messed up my Finals; and a small roomful of electronics folk in the Austin Wing (one I recall, attempting at that moment, unsuccessfully, to tidy up the table with his wire-cutters) quietly saying to one another, "It simply can't be that fast!" It so happened that it was!

Richard Blackie

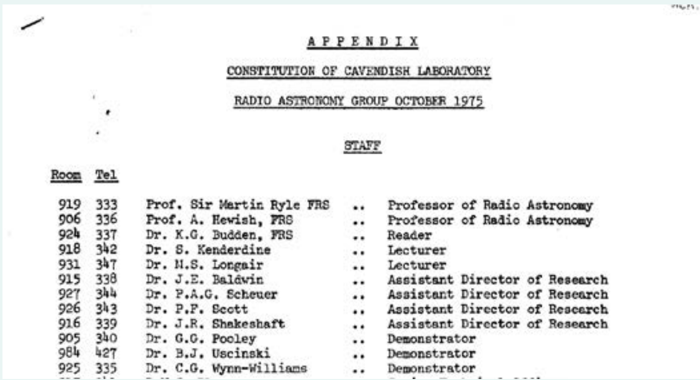
Radio Astronomy Holding Point

I applied to be a doctoral research student at the Cavendish in 1974. I was invited for an interview with Professor Sir Martin Ryle. Feeling nervous, I entered his large corner office on the upper floor and noticed an aeronautical chart laid out on his desk. I had an interest in aviation, and he had worked on airborne radar during World War II. He put me at ease and explained that he was countering a proposal to place a holding point for aircraft over Cambridge; he feared the radio altimeters, etc. would interfere with the radio telescopes. It seems Professor Ryle recognised my knowledge of aeronautical radio systems, and this helped me secure a sought-after place at the Cavendish.

I spent three years at the "new" Rutherford building of the Cavendish Laboratory from 1975 to 1978. I used the Half-Mile Radio Telescope at Lord's Bridge to observe the outer parts of M33 and several irregular galaxies on the hydrogen line. The Radio Astronomy group in the Cavendish had a unique culture: the checklist for the telescope was "The Co-Pilot's Guide to the Half-Mile Radio Telescope"; To summon someone in the group, we used a Morse key and transmitted a pre-allocated callsign from a corner of the corridor. If you heard your callsign in a mid-tone, you went to the key; but if the tone was high, it meant go to Martin's office, and if the tone was low, it meant go outside the engineering labs on the ground floor. There was a special call summoning for coffee in the morning, and tea in the afternoon, where interesting technical discussions took place. The radio telescopes at Lord's Bridge had the same Morse keys. We sometimes used an old moped with a rusty fuel tank to get there, and my Ford Cortina was thoroughly checked to ensure it did not produce interference. There was a WW2 Würzburg radar dish to help triangulate terrestrial interference, possibly from a sparky washing machine in a nearby village. There is no holding point above the radio telescopes.

Michael Reakes (Radio Astronomy group, 1975-78)

Talking about the telescopes during an open day.



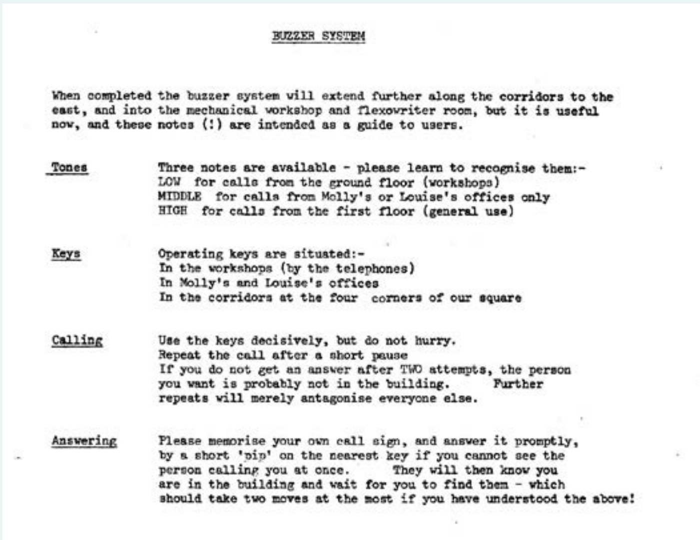
APPENDIX

CONSTITUTION OF CAVENDISH LABORATORY

RADIO ASTRONOMY GROUP OCTOBER 1975

STAFF

Room	Tel			
919	333	Prof. Sir Martin Ryle FRS	..	Professor of Radio Astronomy
906	336	Prof. A. Hewish, FRS	..	Professor of Radio Astronomy
924	337	Dr. K.G. Budden, FRS	..	Reader
918	342	Dr. S. Kenderdine	..	Lecturer
931	347	Dr. M.S. Longair	..	Lecturer
915	338	Dr. J.E. Baldwin	..	Assistant Director of Research
927	344	Dr. P.A.G. Scheuer	..	Assistant Director of Research
926	343	Dr. P.F. Scott	..	Assistant Director of Research
916	339	Dr. J.R. Shakeshaft	..	Assistant Director of Research
905	340	Dr. G.G. Pooley	..	Demonstrator
984	427	Dr. B.J. Uscinski	..	Demonstrator
925	335	Dr. C.G. Wynn-Williams	..	Demonstrator



BUZZER SYSTEM

When completed the buzzer system will extend further along the corridors to the east, and into the mechanical workshop and flexowriter room, but it is useful now, and these notes (!) are intended as a guide to users.

Tones — Three notes are available - please learn to recognise them:-
LOW for calls from the ground floor (workshops)
MIDDLE for calls from Molly's or Louise's offices only
HIGH for calls from the first floor (general use)

Keys — Operating keys are situated:-
In the workshops (by the telephones)
In Molly's and Louise's offices
In the corridors at the four corners of our square

Calling — Use the keys decisively, but do not hurry.
Repeat the call after a short pause
If you do not get an answer after TWO attempts, the person you want is probably not in the building. Further repeats will merely antagonise everyone else.

Answering — Please memorise your own call sign, and answer it promptly, by a short 'pip' on the nearest key if you cannot see the person calling you at once. They will then know you are in the building and wait for you to find them - which should take two moves at the most if you have understood the above!

The Radio Astronomy buzzer system user guide and directory – 1974-75

New era of physics research begins with official opening of the Ray Dolby Centre

The Ray Dolby Centre, our state-of-the-art new home and major asset for the University, the city and the country, was officially opened at a ceremony in Cambridge on 9th May by Dagmar Dolby, Vice-Chancellor Professor Deborah Prentice, Professor Mete Atatüre, Head of the Cavendish Laboratory, and Lord Spencer Livermore, Financial Secretary to the Treasury and Minister for Growth.

The Dolby Family cut the ribbon, officially opening the Ray Dolby Centre on Friday 9 May. Credit: Nordin Catic.

Named in recognition of a generous £85 million donation from the estate of Cambridge alumnus and sound pioneer Ray Dolby, along with £75 million support from the UK government through the Engineering and Physical Sciences Research Council (EPSRC), the Ray Dolby Centre stands as a testament to Dolby's enduring legacy and commitment to scientific innovation.

The new facility – which features 173 laboratories, lecture halls, learning and collaborative spaces, workshops, cleanrooms and offices – is set to revolutionise physics research and education at Cambridge, and boost innovation in key areas such as semiconductors, quantum communications, new methods of disease detection, and large-scale energy generation and storage.

Links to the past

Designed to match the most exacting standards of current research and teaching, the new building is in part inspired by the original Cavendish Laboratory's ethos – to provide an environment that fosters creativity and collaboration.

Professor Mete Atatüre, Head of the Cavendish Laboratory, says a space of this kind is essential to enable researchers to make scientific breakthroughs. "The work that has had the greatest scientific impact on society – including huge discoveries at the Cavendish – didn't happen just because they had the biggest building or the most expensive equipment, it happened because they created the right space for people to think outside the box, to be able to ask the right questions."

"We've designed the Centre with humans in mind – the way they operate, the way they work, the way they create curiosity in each other – to originate new ideas," Prof Atatüre said.

Access to the general public – another key feature of the original Victorian laboratory – is also a big part of the new building. Unlike many other scientific laboratories, much of the building is open to the public, including a café space, outreach and exhibition spaces organised around six courtyards.

"We're working to address society's challenges – the energy crisis, healthcare, future technology – so of course that means involving the public," explains Atatüre. "The old Cavendish on Free School Lane had a 'front of house', where the public came in to see demonstrations of electricity, magnetism, and other research of the time, and a 'back of house', where the research happened. They were communicating with the public about what they were doing, what science is, and it's one of the first places where that happened. So in the same spirit, people will be able to come into the Ray Dolby Centre's public wing for events, into the big auditorium and the lecture halls, and hear directly from Cambridge scientists."

Redefining the future of UK physics research

The opening ceremony celebrates the transformative potential of the Centre for both the University and the nation.

The Ray Dolby Centre will serve as a national hub for physics, hosting CORDE, the Collaborative R&D Environment for Physics. This EPSRC's National Facility will foster collaboration between industry and university researchers, and engage the wider community in ground-breaking scientific endeavours.

The future of physics in the eye of the next generation

Sarah Sibug Torres
PhD Student in the NanoPhotonics group

As a researcher in the field of surface-enhanced Raman spectroscopy (SERS), I'm excited about the future of SERS as it transforms from a laboratory tool into a powerful, real-world sensing platform, especially in clinical diagnostics. Looking ahead, advances in physics and materials science will continue to deliver scalable, precision plasmonic nanostructures; engineering will drive the development of low-cost, portable instruments; chemistry will unlock new ways to control molecular interactions at the nanoscale; and machine learning will help decode complex spectra. These interdisciplinary developments are paving the way for accessible, sensitive, and reliable sensors that bring early disease detection and molecular diagnostics closer to reality.

Niamh Mulholland
PhD Student in the Quantum Optical Materials and Systems group

What excites me most about the future of research in my field is the open landscape of possibilities. My work focuses on diamond tin-vacancies for quantum communication, with the goal of realising scalable, multi-node quantum networks. What's thrilling is that the field is still wide open – no single qubit platform has yet emerged as the definitive solution. Whether through solid-state systems like silicon vacancies or atom-based approaches such as neutral atoms, each path has its unique advantages and associated challenges. Being at the forefront of this race, with the potential to shape which technology ultimately prevails, makes this an incredibly dynamic and inspiring time for quantum research.

Katie-Lou White
PhD Student in the Bohndiek Lab

Our group develops optical imaging techniques for detecting early cancer. One project uses targeted multispectral imaging to enhance subtle colour changes between benign tissue and precancerous disease in Barrett's Oesophagus. We have two clinical trials ongoing; one uses short wave infrared to probe the optical properties of excised tissue, while the other uses a customised multispectral endoscope in volunteers with Barrett's.

The Cambridge ecosystem of University, Industry, Hospitals and public engagement makes such trials possible. We're excited about the new OASIS Hub, which hopes to connect and nurture similar ecosystems across the UK, thereby empowering clinical translation of imaging technologies.

Lola Danhaive
PhD Student in the Galaxy Formation and Evolution group

With the arrival of the James Webb Space Telescope (JWST), launched on Christmas day in 2021, every field in astrophysics was revolutionised, from the study of exoplanets in our own Milky Way to the study of the very first galaxies billions of light years away. We are now able to trace the evolution of galaxies from their formation to their entire evolution across cosmic time. I am especially looking forward to the search for the very first stars, called Population III stars, which have yet to be found, and more generally to the testing of theoretical models which will define our view of the Universe for the coming decades.

Yunzhou Deng
Marie Skłodowska-Curie fellow in the Rao/Optoelectronics group

What excites me most is to work somewhere over the rainbow – creating and manipulating infrared light using optoelectronic devices. We're tackling the challenge of electroluminescence in the telecommunications band, a spectral region far beyond human vision, yet an optical highway for bioimaging, depth sensing, and data transfer. The Ray Dolby Centre, new home of the Cavendish, is an ideal environment to move beyond conventional materials, explore new mechanisms, and develop advanced spectroscopic tools to better understand and control light emission. Ultimately, we aim to develop light sources with small device footprint and low power consumption.

Anna Mullin
PhD Student in the High Energy Physics group

I enjoy our confrontation with surprise in nature, where we belong but are mostly strangers to the mechanics of the smallest scales. We have learned to predict phenomena more precisely than we could have imagined in the past, yet we will never experience this physics first-hand. The search can seem unyielding and physics uncompromising, but we continue to discover clues that link scales from quantum mechanics to cosmology, wrapping our questions up in the same set of mysteries. I am excited to uncover hidden symmetries may describe the world just beyond our reach.

A celebration of 150 Years: alumni return en masse to the Cavendish

Last January, we had the pleasure to welcome 400 alumni back to Cambridge for our 150th anniversary alumni reunion.

It was wonderful to reconnect and celebrate the past, present, and future of the Cavendish with our vibrant community, ranging from former students who graduated from the Old Cavendish on Free School Lane in the 1950s to the young children of more recent graduates.

With insightful talks from academics and early career researchers, engaging hands-on activities, lab tours and a preview of the not-yet-opened Ray Dolby Centre, the day provided an incredibly enriching experience, finishing on a high note with a special dinner at Peterhouse, where alumni fondly reminisced about their time at both the Old Cavendish and West Cambridge sites.

It was a pleasure to see so many of our guests reconnecting with old friends, former colleagues and supervisors, and to hear about everyone's journeys since their time at the Cavendish.

We are blessed to have such a wonderful alumni community, and we look forward to welcoming more of you at the next reunion (provisionally scheduled for January 2027).

We have selected a few photos to give you a flavour of the day. You can explore the whole album here:

Photo credit: Vivian Perez/Chris Brock


isaac
Physics You work it out
a free interactive tool
used by thousands of schools
to develop STEM problem solving skills
Teacher Support

‘Think like a scientist’ and other highlights from the outreach team

Since moving into the Ray Dolby Centre, the Cavendish outreach team has been busy engaging students from across the country in science through various activities. From building bridges at the Cambridge Physics Experience to launching Mars Rovers in the Ray Dolby Centre, it is all about making science fun and accessible. Nicki Humphry-Baker, Cavendish Outreach Officer, highlights some key events from earlier this year, and what to look forward to in the next few months.

Nicki Humphry-Baker

In January, the outreach team was among the first to move into the Ray Dolby Centre, alongside the Isaac Physics group. The corridors were quiet at first, but it’s been a pleasure to watch the building come to life as more teams have joined us.

Despite the move, we continued to deliver our core events, including the Cambridge Physics Experience and the Cambridge Physics Centre Lectures. Our first event in the new Cavendish Laboratory was the final public lecture of the 2024-25 series in March, delivered by Professor Trevor Cox. Fittingly, he spoke about room acoustics—how architectural design affects sound—in the state-of-the-art Ray Dolby Auditorium. Students attending the talk were not only engaged by the content but also thrilled by the new surroundings.

Our Cambridge Physics Experience days for secondary school students have continued to gain a lot of interest from across the country, with schools from as far afield as Manchester attending for the day. In March, we held our first outreach event in the new outreach space in the Ray Dolbe Centre. Students designed their own Mars rovers which were then launched from halfway up the atrium stairs. The new facilities worked brilliantly and will enable us to welcome even more students to future events.

This year, we also collaborated with Dr Sam Gregson—better known as the Bad Boy of Science—to deliver a science communication workshop for PhD students and researchers. Sam shared his personal journey into science communication and the insights he has gained along the way. While visiting the Cavendish, he also gave three spectacular talks to local secondary schools, using the discovery of the Higgs boson to explore the scientific method. He wrapped up with a public lecture at the Cambridge Physics Centre attended by over 200 students and community members. His interactive style kept all ages engaged and excited, offering a great example of how to make science memorable and accessible.

We joined another new collaboration this year. The Cambridge Admissions Office have setup a hub in Rochdale. As part of this initiative, we partnered with The Ogden Trust and the Rochdale Development Agency to pilot a new programme, *Think Like a Scientist*, for upper primary school pupils. The six-month programme, launched in January, features monthly sessions designed to foster critical thinking, observational skills, and scientific reasoning. Thirty-five students from seven local schools took part. Each session focused on a step in the scientific method, supported by discussions about important traits such as curiosity, open-mindedness, and patience.

The groups were tasked with developing their own research question design experiments to explore them. My favourite question was “How can we stop the playing field getting so muddy so that we can go and play on it?” Another explored optimal locations for renewable energy sources in a bid to promote solar panels for their school. The final session will take place on 28th June at Rochdale Football Stadium, where students will proudly present their findings to parents and carers. As summer approaches, we’re preparing for a packed season of residentials and major events. A highlight will be the 40th anniversary of the Physics at Work programme in September, which has been running since 1985. With 25 exhibitors already confirmed—the highest number since before the pandemic—we’ll be celebrating in style, taking over the entire Ray Dolby Centre and continuing the tradition in our new home.

The Bad Boy of Science Sam Gregson making science memorable and accessible.

Jacob Butler demonstrating the Mars rover's movements to secondary school students during a Cambridge Physics Experience day.

On behalf of the Outreach Team, I would like to thank anyone who has donated towards our programme. Without your support we would not be able to run such a broad range of activities. I would like to leave you with a quote from a teacher about my colleague, Dr Steve Martin, at one of our recent events:

"The 1-1 attention you provided, alongside the clarity of your explanations and links to real-world situations, really allowed students to engage wholeheartedly with the session. Your calm and approachable manner also made them feel very at ease in a situation where many of them would have felt rather outside of their comfort zone."

If you would like to make a donation towards our activities, please follow this link.

Primary school children from Rochdale making observations about the different types of lichen they saw on trees.

News in brief

Funding news

New quantum hub to support national security and critical infrastructure

A new quantum technology hub has been launched to ensure that the UK benefits from resilient position, navigation and timing (PNT) advancements, supporting national security and critical infrastructure. The Quantum Enabled Position, Navigation & Timing (QEPNT) hub brings together leading researchers from UK universities and institutions, including the University of Cambridge, with **Louise Hirst** and **Dave Ellis** from the Cavendish Laboratory, and **Luca Sapienza** from the Department of Engineering.

Critical UK sectors like energy, finance, communications and transport rely on the accuracy of the signals from global positioning satellites (GPS), which are vulnerable to interference and jamming, risking the loss of a billion pounds per day to UK economy. The QEPNT hub aims to tackle this by creating high performance, low size and low-cost quantum technologies.

The hub, funded by a £106 million investment as part of the UK National Quantum Technology Programme, will develop atomic clocks and LiDAR sensors, which use light to measure range, and create smaller, lighter quantum-enabled devices for applications in sectors including roads, railways and underground transport, where they could help improve navigation systems by replacing current GPS positioning technologies.

Cold storage: transforming data storage for quantum computers

Chiara Ciccarelli and her group at the Cavendish Laboratory have been awarded a €2.1 million (£1.75 million) Consolidator Grant from the European Research Council for their project PICaSSO (Picosecond superconductivity-driven spin-torques) which aims to push extraordinary characteristic of magnets to its very limit.

Quantum computing promises unparalleled speed and accuracy, yet its data storage remains fleeting, lasting just milliseconds, and works only close to –273 degrees Celsius. Quantum computers are built with superconductors, materials that conduct electricity perfectly without any energy loss but only when they are cooled to very low temperatures, close to absolute zero. Despite advancements, so far nobody has worked out an efficient way to give quantum computers a magnetic memory that doesn't involve heat. Magnets, however, have long proven exceptional for storing data reliably and cheaply for decades without losing information.

Now, Ciccarelli and her group aims to solve this challenge with PICaSSO. The project aims to push this extraordinary characteristic of magnets to its very limit and will investigate one of the biggest conundrums facing the next great tech leap forward: why can't quantum computers have a memory?

High energy physics researchers celebrate Breakthrough Prize recognition

The High Energy Physics group at the Cavendish Laboratory has been recognised through its long-standing involvement in the ATLAS and LHCb experiments at CERN, both honoured with the 2025 Breakthrough Prize in Fundamental Physics. The award celebrates the achievements of researchers contributing to publications based on Run 2 data from the Large Hadron Collider, released between 2015 and July 2024.

The prize acknowledges detailed studies of the properties of the Higgs boson, rare decay processes, matter-antimatter asymmetries, and new strongly interacting particles, advancing our understanding of the universe's fundamental constituents.

The $3 million prize is allocated to the ATLAS, CMS, ALICE and LHCb collaborations, with $1 million awarded to ATLAS and $500,000 to LHCb. All prize funds have been donated to the CERN & Society Foundation to support doctoral student research at CERN, providing early-career scientists from member institutes including University of Cambridge with invaluable experience at the frontier of particle physics.

Awards and recognition

Mete Atatüre awarded the 2024 Rahmi M. Koç Medal of Science

Congratulations to **Mete Atatüre** for being awarded the 2024 Rahmi M. Koç Medal of Science in recognition for his outstanding work in quantum optics and quantum technologies. His research has significantly advanced our understanding of various materials platforms for quantum systems, particularly in the areas of quantum networks and quantum sensors, through the interactions of matter and light.

Established in 2016, the Koç University Rahmi M. Koç Medal of Science was created to foster a lasting legacy of excellence and recognise the achievements of exceptional individuals of Turkish origin.

Ashleigh Ruane reached the *STEM for Britain* finals

PhD student **Ashleigh Ruane** (Nanophotonics group) reached the finals of the prestigious STEM for Britain competition last March. Ashleigh's research is based on developing plasmonic nanopores, as a collaboration between Nanophotonics, the Keyser Lab, and Optofluidics. The basic premise is that both chemical information (from SERS) and physical properties (size, shape etc.) of biological molecules can be useful for identifying biomarkers of disease. The device Ashleigh is developing would utilise both of these techniques simultaneously. In particular, the device is considerably easier and cheaper to fabricate, and more stable than existing methodologies.

The **STEM for Britain** competition showcases innovative research from early-career scientists, providing a platform to present their work to members of the parliament and policymakers.

Congratulations to Karolina Wresilo, winner of the US National Lab Research SLAM

High Energy Physics PhD Student **Karolina Wresilo** achieved a remarkable victory, winning the 2025 National Lab Research SLAM in the *Scientific Discovery* category. Competing against 17 contestants from U.S. Department of Energy National Laboratories, Karolina's presentation stood out among six finalists in her category.

Her winning talk focused on DUNE and MicroBooNE, demonstrating how neutrinos could help unlock the origins of the Universe. This achievement follows her success at the Fermilab SLAM, reinforcing her ability to communicate groundbreaking research with clarity and passion.

Karolina Wresilo with her award

Emeritus Professor Valerie Gibson named IOP 2024 Honorary Fellow

Valerie Gibson has been named one of the Institute of Physics (IOP) 2024 Honorary Fellows. This prestigious recognition honours individuals who have made exceptional contributions to physics.

Gibson has been recognised for her key discoveries in particle physics, her advocacy for women in science, and her contributions to public engagement. She has played a pivotal role in major experiments designed to understand why our universe is made of matter and not antimatter.

Beyond research, Gibson has been instrumental in promoting equity, diversity, and inclusion, particularly at the University of Cambridge, where she worked to address recruitment and promotion biases as well as the gender pay gap. As chair of the IOP's Juno panel, she further championed gender equality in physics.

Research news

Spinning, twisted light could power next-generation electronics

Researchers have advanced a decades-old challenge in the field of organic semiconductors, opening new possibilities for the future of electronics.

The study was co-led by Richard Friend at the Cavendish Laboratory, along with researchers from Eindhoven University of Technology. They have created an organic semiconductor that forces electrons to move in a spiral pattern, which could improve the efficiency of OLED displays in television and smartphone screens, or power next-generation computing technologies such as spintronics and quantum computing.

The semiconductor they developed emits circularly polarised light, meaning the light carries information about the 'handedness' of electrons. The internal structure of most inorganic semiconductors, like silicon, is symmetrical, meaning electrons move through them without any preferred direction.

Scientists make 'odd' objects that adapt and move without a brain

Inspired by how brainless lifeforms such as starfish and slime moulds move around, physicists have constructed 'odd' objects that autonomously roll, crawl and wiggle over unpredictable terrain, including uphill and over obstacles placed in their way. This solves a key problem of robotic locomotion.

An international team of physicists from the University of Amsterdam, the University of Chicago and the University of Cambridge (Anton Souslov, TCM) showcased a series of 'odd' objects – each a type of so-called 'active metamaterial' – that are remarkably good at moving across any terrain they encounter. Each object is made from the same motorised building blocks, which can sense forces and exert them on one another. The research has recently been published in *Nature,* and confirms recent theoretical predictions dubbed 'odd elasticity'.

Exciting moments on the edge

For the first time, researchers have demonstrated that phosphorene nanoribbons (PNRs) exhibit both magnetic and semiconducting properties at room temperature. The research was led by **Arjun Ashoka**, Junior Research Fellow at Trinity College, in collaboration with international colleagues. The study establishes PNRs as a unique class of low-dimensional materials that challenges conventional views on magnetic semiconductors and could provide a stepping stone to unlocking new quantum technologies.

News in brief

Scientists have long suspected that phosphorene nanoribbons (PNRs) – thin pieces of black phosphorus, only a few nanometres wide – might exhibit unique magnetic and semiconducting properties but proving this has been difficult. In a recent study published in *Nature*, researchers focused on exploring the potential for magnetic and semiconducting characteristics of these nanoribbons. Using techniques such as ultrafast magneto-optical spectroscopy and electron paramagnetic resonance they were able to demonstrate the magnetic behaviour of PNRs at room temperature and show how these magnetic properties can interact with light.

Departmental news

New! Discover Cambridge through physics

As part of our 150th anniversary celebrations, a new 75-minute audio walking tour is now available, offering a fascinating journey through Cambridge's lanes and cloisters into the rich history of physics discoveries.

Starting at Newton's apple tree, the tour takes listeners through key locations, uncovering sites where major scientific advances were made. Along the way, Cambridge physicists share insights into both historic breakthroughs and the pioneering research shaping the future of physics.

The free tour is available on the VoiceMap App or following this link: **voicemap.me/tour/cambridge/the-cambridge-physics-walking-tour**

Welcome to our new digital home!

We're delighted to announce that the new Cavendish website is now live at **phy.cam.ac.uk**. This new digital home aims to reflect and extend the inspiring environment of our new physical home – the Ray Dolby Centre – for our virtual visitors from around the world.

Scott Lectures 2025: new frontier of quantum computing and quantum information

In March, we had the honour of welcoming **Mikhail Lukin** from Harvard University for the relaunch of the Scott Lectures. Lukin delivered a series of three exceptional talks on new frontier of quantum computing and quantum information to an engaged audience in packed lecture rooms.

Since 1930, the Scott Lectures have featured Nobel Prize winners and other eminent speakers, serving as the crown jewel of our seminar and colloquium activities for scientific dissemination and discussion.

One of the Scott Lectures in progress in the Ray Dolby Auditorium

Farewell to...

Saba Alai, the Cavendish Laboratory's Health and Safety Manager, retired from her post in February after nearly ten years of dedicated service to the Department of Physics.

As the community came together to celebrate the occasion, Mete Atatüre, Head of Department, said. "Her dedication has been instrumental in maintaining a safe working environment over the years, allowing physicists to focus on their research work without worry."

Saba Alai's goodbye to the Cavendish in the Café of the Ray Dolby Centre in February

In her poignant farewell speech, Saba reflected on her time at the Cavendish, and shared, in her distinctive humour, how she often described her role at the Cavendish as "stopping physicists from blowing themselves up."

We also said farewell to **Melanie Tribble** in March after 33 years of dedicated service in the Semiconductor Cleanroom. Over the years, she's seen the cleanroom expanded twice and the users grow to around 60, including staff from other university groups and from industry. After a couple of senior research staff left in early 2010s, Melanie took over managing the cleanroom.

We extend our heartfelt thanks to Saba and Melanie for their incredible contributions and wish them all the best for the future!

Melanie Tribble's farewell event.

Final physics practicals in the Bragg Building

In March, first-year undergraduate students had their last ever physics practical lab session in the Bragg's teaching labs. With about 400 students a year, around 20,000 students have attended a practical session within these walls over the past 50 years. A definite moment for posterity!

The last physics practical classes in the Bragg Building.

Professional services appointments

Scott Archer – Facilities Assistant
Aissa Agouzal – Facilities Assistant
Paul Crisp – Purchasing Administrator
Ren Isaksen – Facilities Coordinator
Elliott Lucas – Postgraduate Administrator
Serrita McAuley – Nanofabrication Facility Technician
Kathryn Robinson – Events Coordinator
David Sawford – Research Laboratory Coordinator - Cryostat Hall
Stuart Snell – Reception Lead
Eve Stupart – Events Manager

Alumni news

Cavendish alumnus Sandi Setiawan publishes book on black holes and geometric algebra

Sandi Setiawan, an alumnus of the Cavendish Laboratory and Clare Hall, has recently published his PhD thesis as a book, *Applications of Geometric Algebra to Black Holes and Hawking Radiation*. The book presents a novel approach to some of the most complex and fascinating problems in theoretical physics. Completed during his time at the Cavendish, Sandi's research bridges the disciplines of mathematics and cosmology. His research explores the applications of geometric algebra in the study of black holes and Hawking radiation, offering a fresh perspective on some of the most enigmatic phenomena in the universe. The book, which can be purchased on Amazon, delves into the framework of Gauge Theory Gravity, bringing clarity and structure to complex gravitational systems.

Originally from Indonesia, Sandi's passion for physics took him from early studies in the subject to a PhD at the Cavendish Laboratory, then into banking, and now back to cosmology.

Transforming cancer care with astrophysics AI

Matthew Griffiths, a former PhD student at the Cavendish Laboratory, is the co-founder and CTO of Concr, whose mission is to aid patients, clinicians, and drug developers in understanding the efficacy and mechanisms of different treatments, and to help develop treatment plans suited to each individual patient.

"The uncertainty of knowing whether a treatment will be effective for a cancer patient is one of the cruellest and most damaging aspects of the disease," Griffith said.

Building on his work in astrophysics, the Concr team have built cutting-edge technology that integrates oncology research and clinical data to simulate cancer biology, enabling precise therapeutic predictions with minimal diagnostic input.

Congratulations to WISE award finalist Isobel Houghton

We're proud to celebrate **Isobel Houghton**, who was one of the finalists for the Outstanding Woman in Engineering Award at this year's WISE Awards. From studying natural sciences and quantum physics at the Cavendish Laboratory to leading innovation as a Chief Engineer, Isobel's journey is inspiring. The WISE Awards celebrate women driving change in STEM. The Cavendish has been cheering Isobel on as she paves the way and inspires the next generation of women in STEM and physics.

CavMag goes digital

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Read every feature article, every news bite and every interview in an immersive, interactive and truly accessible digital environment. We have designed this new digital version of our magazine to be fully responsive, which means our stories can be enjoyed on all devices and screen sizes.

We are accompanying this launch with a new Alumni e-newsletter, which will be sent to you around the same time as CavMag arrives in your mailbox, to highlight some of the exciting articles included in the newest issues.

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To opt out of receiving the print edition and/or be sent an email when the latest edition is available online, please visit **alumni.cam.ac.uk/update**

Tell us what you think

We will continue developing this platform over the coming year to improve it even further for our next issue in the autumn. If you have any feedback, please get in touch to let us know what you think at **cavmag@phy.cam.ac.uk**

How you can contribute

Online giving

The University's Office for Development and Alumni Relations (CUDAR) has made it easier to make donations online to the Department and to two of our special programmes. If you wish to make a donation to the Department, please go to: **campaign.cam.ac.uk/giving/physics**

If you wish to support the graduate student programme, please go to: **campaign.cam.ac.uk/giving/physics/graduate-support**

If you wish to support our outreach activities, please go to: **campaign.cam.ac.uk/giving/physics/outreach**

If you would like your gift to be applied to some other specific aspect of the Development Programme, please contact the Head of Department.

A gift in your will

One very effective way of contributing to the long-term development of the Laboratory's programme is through the provision of a legacy in one's will. This has the beneficial effect that legacies are exempt from tax and so reduce liability for inheritance tax. The University provides advice about how legacies can be written into one's will. Go to: **campaign.cam.ac.uk/how-to-give** and at the bottom of the page there is a pdf file entitled **A Gift in Your Will.**

It is important that, if you wish to support the Cavendish, or some specific aspect of our development programme, your intentions should be spelled out explicitly in your will. We can suggest suitable forms of words to match your intentions. Please contact Samantha Stokes (**departmental.administrator@phy.cam.ac.uk**) who can provide confidential advice.

If you would like to discuss how you might contribute to the Cavendish's Development Programme, please contact Mete Atatüre (**hod@phy.cam.ac.uk**), who will be very pleased to talk to you confidentially.

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