CavMag

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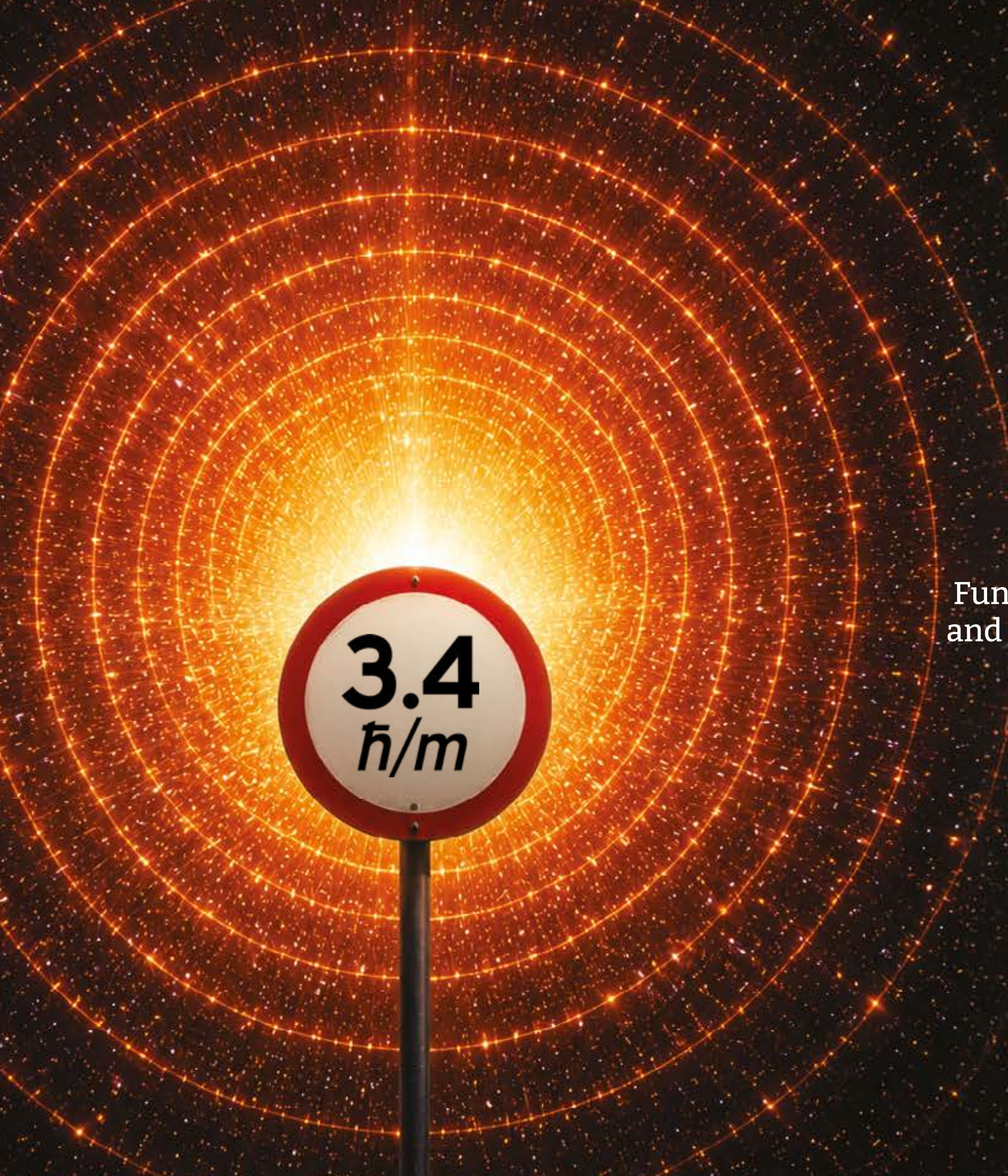
HOW FAST CAN QUANTUM COHERENCE SPREAD?



MicroBooNE rules out a sterile neutrino

Funding for particle physics and astronomy under threat

Death by black hole

ALSO INSIDE:

From neutrino physics to cancer detection

The last-ever look inside the 1974 building

UNIVERSITY OF CAMBRIDGE | Cavendish Laboratory Department of Physics

Welcome
to CavMag 35

Harry Cliff

The first half of 2026 has brought a number of exciting developments here at the Cavendish Laboratory, from the announcement of a new strategic partnership with IonQ that will bring the UK's most powerful quantum computer to the Ray Dolby Centre, to significant breakthroughs in our understanding of quantum matter, fundamental particles and ancient galaxies.

However, it has also brought challenges. At the start of the year, the Science and Technology Facilities Council announced that it expects to make deep cuts to particle, nuclear and astrophysics research in the UK, citing financial pressures and changing government priorities. These measures will devastate many of the areas in which the Cavendish is world leading, from probing the fundamental building blocks of nature at the Large Hadron Collider and neutrino experiments, to exploring the cosmos through radio astronomy and the James Webb Space Telescope. Physicists and astronomers across Cambridge have been grappling with the potential impact of these cuts while making the case, both in public and behind the scenes, for continued investment in fundamental physics, from which much of the talent and technology pipeline ultimately flows. Matt Kenzie explores the unfolding crisis and what can be done to resolve it in an opinion piece on page 5.

Meanwhile, the Cavendish continues to produce world-leading research. Christoph Eigen and Zoran Hadzibabic report on their discovery of a speed limit for the spread of quantum coherence in Bose Einstein condensates, with profound implications for our understanding of quantum matter and perhaps even cosmology. Magnus Handley gives an account of how new results from the MicroBooNE experiment have all but ruled out sterile neutrinos as an explanation for a long-standing anomaly, and Jan Scholtz, Francesco D'Eugenio and Roberto Maiolino tell the story of the supermassive black hole that snuffed out star formation in an ancient galaxy.

I would like to thank our Student Editors, Daniel Robins, Bofeng Xue and Minglei Zhang, who stepped in to produce issue 34 of CavMag while I was away on parental leave in late 2025. It was a pleasure working with such an enthusiastic and able team of young physicists, whose hard work resulted in an excellent edition of the magazine.

Finally, it was with great sadness that we learned that Peter Littlewood, internationally renowned condensed matter physicist and former Head of the Cavendish Laboratory, passed away on 15 June 2026. We extend our deepest sympathies to his family, friends, former students and colleagues. He will be greatly missed. An obituary of Peter will appear in the next edition of CavMag.

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Write to us:

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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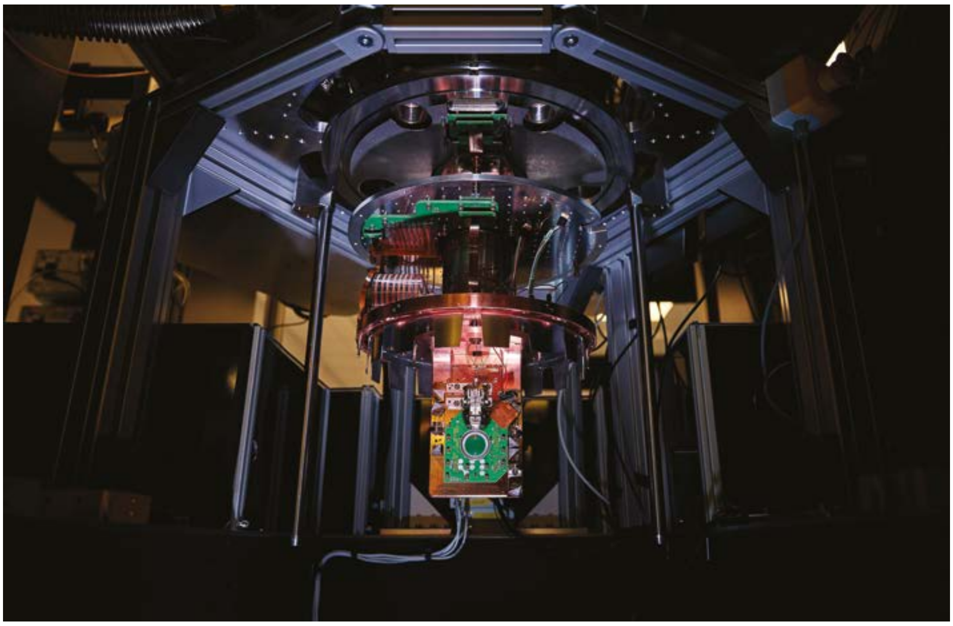
Strategic partnerships ‘supercharge’ Cambridge’s quantum research

Cambridge’s quantum research and innovation have received a major boost through two linked partnerships that will accelerate work within the laboratory and unlock broader applications.



The University has established a landmark 10-year strategic partnership with quantum technology company IonQ, its largest industrial collaboration to date. At the heart of this partnership is the new IonQ Quantum Innovation Centre, which will be based in the Cavendish Laboratory’s Ray Dolby Centre and will house the UK’s most powerful quantum computer.

The IonQ partnership will support long-term research funding for quantum science and technology at Cambridge, as well as the co-development of new quantum network nodes and sensing capabilities across the University, including a strengthening of the existing Cambridge to Bristol UK quantum network.

This is accompanied by sustained support for people and access. The partnership will fund new academic roles, postdoctoral positions and PhD students, alongside three years of access provided through Innovate UK for the National Quantum Computing Centre. This will extend use of the system beyond Cambridge to researchers and early-stage companies across the UK.

Alongside this major infrastructure and capacity investment, a second initiative addresses a more structural challenge: how Cambridge’s frontier quantum research is translated into real-world applications.

The applied quantum programme with FormationQ, an independent platform for quantum adoption and applications, also enabled by IonQ technology, focuses on the conditions needed for adoption. While advances in quantum science continue at pace, wider use remains constrained by gaps in institutional readiness, coordination and workforce capability.

The programme brings together the Cavendish Laboratory’s scientific base with FormationQ’s role as a long-term operator, building the pathways and organisational structures required to support sustained deployment.

Researchers will have access to high-fidelity quantum hardware to support applied experimentation, with an emphasis on progressing beyond laboratory demonstrations towards more robust systems.

The University of Cambridge is home to one of the largest and most successful communities of quantum scientists and technologists in the world, and the Cavendish Laboratory has long been at the heart of this research community. These developments are the next chapter in that long legacy.

Taken together, they represent a coordinated investment in infrastructure, people and research capacity, while driving the enabling work needed to translate research into practice.

ABOVE:
IonQ quantum computer. Credit: IonQ.

UKRI funds SEQUIN to probe Earth with a hybrid quantum array

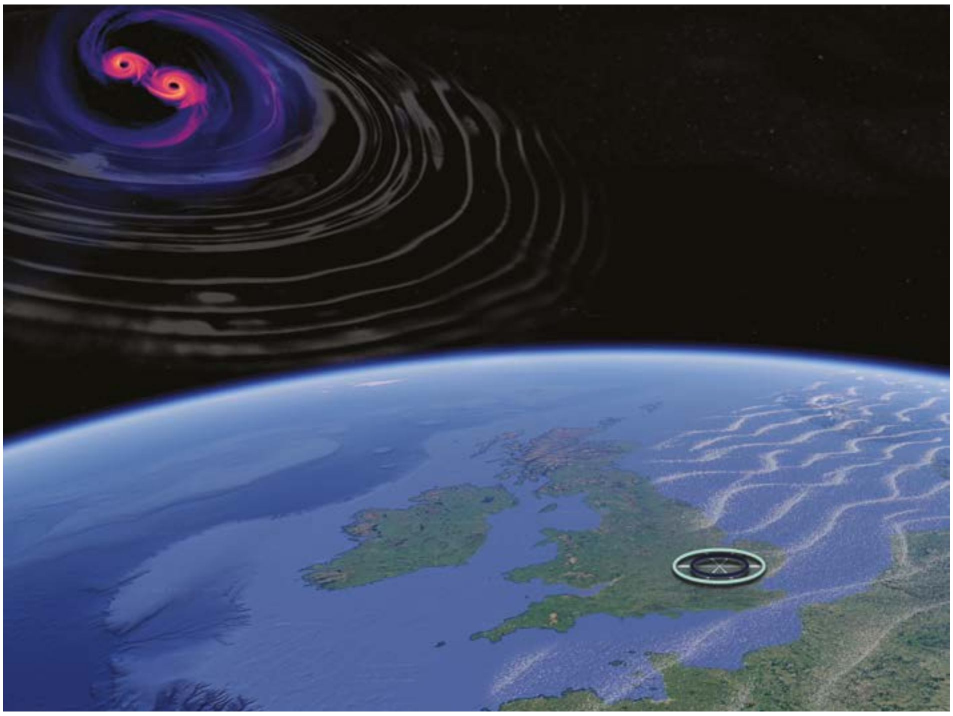
An interdisciplinary collaboration between the Many-Body Quantum Dynamics Group led by Ulrich Schneider at the Cavendish Laboratory, and the Department of Earth Sciences at the University of Oxford, has received a £1.2 million from UK Research and Innovation (UKRI) to probe Earth with a hybrid quantum array.

The project, named SEQUIN for *Sensing the Earth with a novel QUantum-classical INterferometer array,* brings together quantum sensing and seismic monitoring to improve the detection techniques of extremely faint signals, from gravitational waves in space to deep vibrations within the Earth.

Gravitational waves have transformed how we understand the universe. These ripples in spacetime originate from the most dramatic events in the cosmos, such as colliding black holes, but they are very difficult to detect. Before colliding, black holes orbit each other, producing long-lived gravitational waves that provide more information about their sources. Quantum sensors can measure these faint signals, but they can be masked by natural and human-made ground vibrations. Conversely, the Earth's free oscillations are low-frequency vibrations that occur after the planet experiences a large-magnitude earthquake, characterised by natural resonant frequencies. These vibrations are sensitive to structures deep inside the Earth and are equally difficult to detect, even using large networks of seismometers.

The SEQUIN project will tackle both these challenges through a hybrid approach.

Using real-time data from conventional seismometers alongside the ultra-sensitive capabilities of quantum sensors, SEQUIN aims to filter out environmental noise and isolate faint signals with far greater precision than either instrument could alone. This could help unmask gravitational waves in future experiments while also improving detection of long-period ground vibrations with repetition times of 100 to 1000 seconds.



Bringing together physics, quantum technology and Earth science, this project will unlock new ways to explore both the cosmos and our planet, opening the door to improved gravitational wave detection and a deeper understanding of the Earth's internal processes.

The project is further strengthened by contributions from project partners, including the United States Geological Survey (USGS), UKRI-STFC Boulby Underground Laboratory, the University of Glasgow, and the Université de Strasbourg, who will provide expertise and specialised instrumentation, specifically precise and novel seismometers, to enhance the hybrid sensing network.

ABOVE:
Illustration of hybrid array disentangling seismic waves in the Earth and gravitational waves from outer space. Credit: Jeremiah Mitchell, (GoogleData SIO, NOAA, U.S. Navy, NGA, GEBCOLandsat / CopernicusIBCAOU.S. Geological Survey GeoBasis-DE/BKG (©2009) Inst. Geogr. Nacional).

Buckets, partitions, and a quiet crisis in UK fundamental physics

Matt Kenzie

The LHCb experiment at the Large Hadron Collider at CERN. Credit: CERN.

Read the press releases of the past year and UK science looks to be in rude health. In March 2026, UKRI announced £51.2 million for a new National Cryogenic Facility at Daresbury, principally to support the scale-up plans of the Silicon Valley quantum firm PsiQuantum. Days earlier, IonQ and the University of Cambridge announced a partnership that will site a 256-qubit quantum computer in the Ray Dolby Centre – the most powerful of its kind in the UK. The Secretary of State, Liz Kendall, can plausibly claim that British science is 'world-leading' in life sciences, AI and 'increasingly quantum'. These are real successes, and the Cavendish stands to benefit directly from several of them.

And yet, behind the bunting, something is going badly wrong. Through 2025 and into 2026, the part of UK Research and Innovation (UKRI) that funds particle physics, astronomy and the international facilities on which they depend – the Science and Technology Facilities Council (STFC) – has been quietly hollowed out. New astronomy postdoctoral funding has collapsed by close to 75% in two years. Two major international commitments – the LHCb Upgrade II at CERN and the UK contribution to the Electron-Ion Collider – have been 'deprioritised'. STFC is now under instruction to find a further 30% saving in a prioritisation exercise that no scenario on the table reverses.

Projects across particle physics and astrophysics in which the Cavendish plays leading roles, from flagship experiments at the Large Hadron Collider like LHCb and ATLAS probing the basic structure of matter, the DUNE experiment which promises to reveal the secrets of neutrinos, and a range of astronomical observatories exploring the early universe such as the Square Kilometre Array – have all been asked to model a range of scenarios, from flat cash, to 60% reductions to grants. Given these projects require long term, stable support from multiple international partners, cuts at this level not only threaten the UK's involvement in these projects, in some cases they may collapse them entirely.

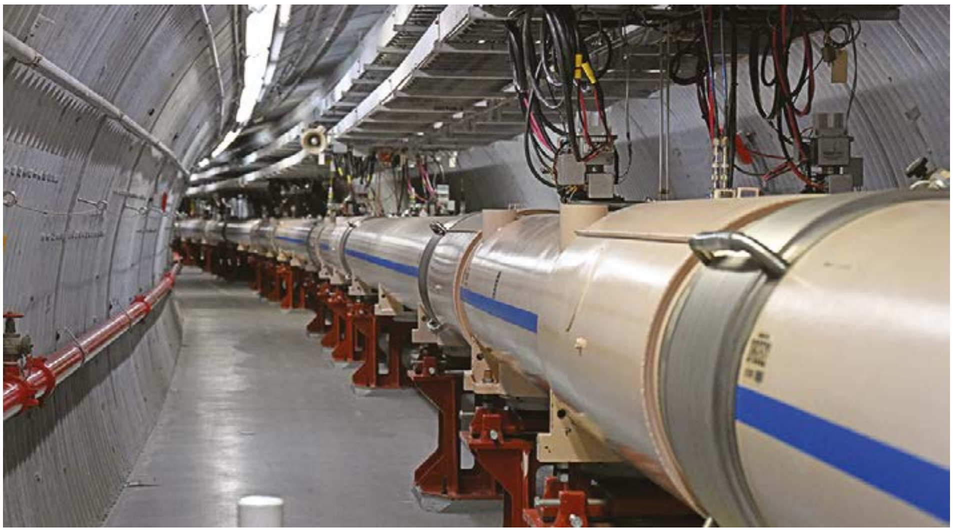
This is the result of a deliberate reform that has worked well in the abstract and badly in the specific. What follows is an appeal to those of you – many now in finance, technology and industry – who became who you are in part because of fundamental physics, and who may not yet realise how much is at stake.

The new architecture

In December 2025, before the STFC crisis became public, the Secretary of State set out a new funding framework. The UKRI envelope of around £38.6 billion is now divided into four 'buckets': roughly £14 billion for 'blue sky' curiosity-led research, £7 billion for growth, £8 billion for sovereign missions, and £7 billion for talent and infrastructure. The intent is to align research spending with declared priorities – life sciences, AI and quantum. Stated like that, it is hard to object.

But two structural problems are baked into the implementation, and they fall almost entirely on the fundamental end of physics. The first is that the headline cash settlement is only marginally larger than the last; set against inflation and the rising costs of international facilities, it is a real-terms cut to discretionary research.

The second is more subtle. The large projects that STFC oversees – accelerators, telescopes, neutron sources, satellite missions – have time horizons of twenty to thirty years and fixed running costs that lie largely outside the UK's control. After the previous STFC crisis, in 2009, Lord Drayson introduced ring-fences known as the 'Drayson partitions' between three budget streams – international subscriptions, large UK facilities and the core research programme – to prevent inflation or exchange-rate movements in the first two from quietly turning the lights off on the third. Those protections have been allowed to erode without parliamentary discussion. As Michele Dougherty, the STFC Executive Chair, told the Commons select committee in March: 'They have been eroded over time – that is clear.'



The tunnel containing the Relativistic Heavy Ion Collider at Brookhaven, which will host the Electron Ion Collider (EIC). Credit: Brookhaven National Laboratory.

What has been cut, and how

In December 2025, UKRI removed four projects from its Infrastructure Fund pipeline: the LHCb Upgrade II at CERN, the UK contribution to the Electron-Ion Collider at Brookhaven, Critical Mass UK, and the RUEDI chemical-imaging project. Each principal investigator was informed by letter on 19 December that their project 'has not been prioritised by UKRI at this time'. All four had already passed UKRI's own multi-year prioritisation process and received preliminary funding: the UK's LHCb Upgrade II commitment had been £49.4 million over ten years, of which around £5 million was already spent, and the contribution to the EIC was to have been £58.8 million over nine years, supporting seven UK universities and two national laboratories.

Three months later, UKRI announced four new Infrastructure Fund awards, headlined by £51.2 million for the National Cryogenic Facility at STFC's Daresbury Laboratory. None has been through the same length of peer review and prioritisation. The deprioritised projects were quietly removed from the UKRI Infrastructure Fund web page; the original portfolio description, which spoke of 'global leadership' and the UK as 'a partner of choice for collaboration', was replaced with wording emphasising growth. When Parliament's Science, Innovation and Technology Committee formally requested the minutes of the Infrastructure Advisory Committee meetings at which the four were deprioritised, the request was declined. The decision sits uncomfortably with the Haldane principle that individual project choices should rest with the funders, not with government.

Capability lost

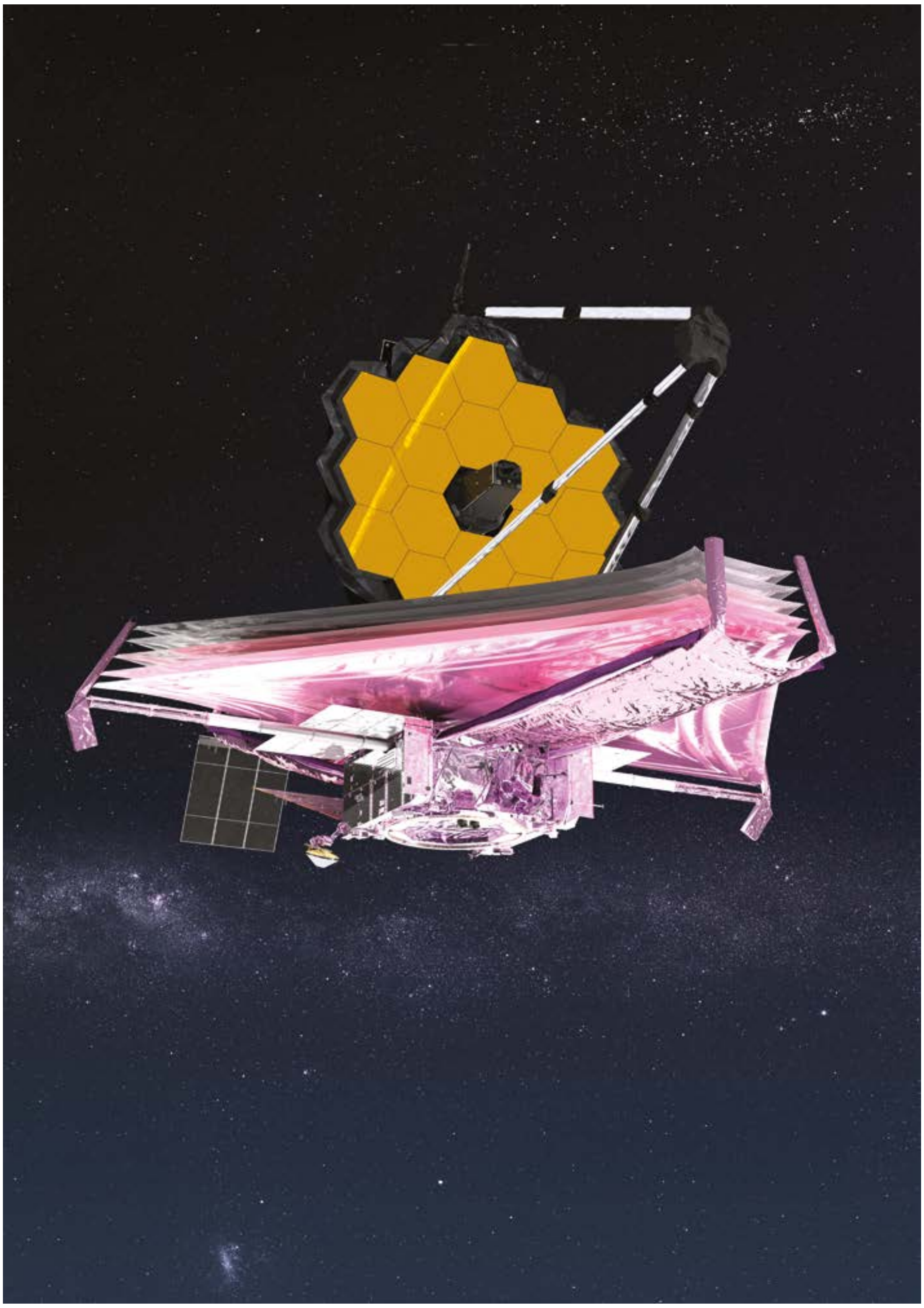
Treaty-level agreements with CERN, the European Southern Observatory and others buy the UK a seat at facilities no single nation could build alone. But a seat at the table is not the same as a research programme. To extract any actual science from these facilities – to build the detectors and instruments, train the postdocs, run the data pipelines and write the papers – requires a properly funded domestic programme. It is precisely that domestic programme that the new framework treats as discretionary, and that STFC's prioritisation exercise – aimed at a 30% reduction – now puts on the chopping block.

The numbers already tell the story. The Astronomy Grants Panel's community report, published in February 2026, records that new postdoc-years funded nationally fell from around 80 in 2024/25 to 22.5 in 2026/27 – a fall of nearly 75%. Ten of the 26 research organisations that submitted four or more Small Award proposals received nothing at all. Particle physics is on a parallel trajectory. Unlike the 2010 crisis, from which the community recovered within a year, no scenario on the table restores funding to previous levels. The LHCb spokesperson, Vincenzo Vagnoni of INFN Bologna, has described the UK's withdrawal from LHCb Upgrade II as 'a fundamental betrayal of more than two decades of scientific leadership and a blow to the foundational stability of European big science.'

The talent pipeline is the most fragile asset in the system. A discipline that loses two consecutive postdoc cohorts loses the supervisors of the next one and the lecturers of the one after that. Capability built over decades can be dismantled in a single spending review.

The Cambridge stake

Cambridge has been at the heart of every era of UK fundamental physics, from the Cavendish discoveries of the


Artist's illustration of the James Webb Space Telescope. Credit: NASA.

electron and the neutron, through cosmic microwave background work at the Mullard Radio Astronomy Observatory, to the exoplanet discoveries of our Jacksonian Professor and 2019 Nobel laureate Didier Queloz – who has himself joined more than a hundred UK planetary scientists in warning of 'long-term damage to the standing of UK science' if the proposed STFC cuts are allowed to proceed.

The current disinvestment lands directly on the Cavendish. The high-energy physics group has played a leading role in LHCb since the experiment's inception, and Upgrade II would have been the natural continuation of two decades of work. Cambridge astrophysicists, through the Kavli Institute for Cosmology and the Institute of Astronomy, are deeply embedded in the international infrastructure ecosystem the new framework relegates. And in a moment of awkward irony, the Cavendish's Professor of Experimental Particle Physics Mark Thomson – who taught a generation of Cambridge physicists and served as STFC Executive Chair from 2018 to 2024 – became Director-General of CERN in January 2026, just as the UK was withdrawing from the very upgrade his organisation needs.

Why this matters for the growth the government wants

There is a temptation to argue that fundamental physics deserves protection on its own terms – the cathedral-of-knowledge case – and to leave it there. That argument is correct, but it cedes the ground the government has chosen to fight on.

The Secretary of State has been explicit that the tests of success are jobs, turnover and venture capital. Fundamental physics scores on every one of those metrics, just not on a parliamentary-term timescale. The World Wide Web came out of a particle physics laboratory. MRI came out of nuclear magnetic resonance. The trapped-ion qubits that IonQ has just paid $1.1 billion to acquire (via Oxford Ionics) came out of decades of atomic and particle physics whose grant applications would not have survived a 'bucket 2' growth filter at the time. Quantum is the obvious example today because we can finally see the commercial endpoint. We cannot yet see the next one – which is precisely why curiosity-led research must be sustained at scale, not preserved as a rhetorical fig leaf.

Equally important is the recruitment effect. Cavendish admissions tutors know that students come to physics for the same reasons most of us did: the questions, not the applications. Particle physics and astrophysics carry a disproportionate share of that pull. Strip them out and the pipeline that feeds the industries the government most wants to grow narrows at its source.

“That leaves a gap the Cavendish community is unusually well-placed to help close – and for most alumni the most useful first step is not to write a cheque, but to raise a voice.”

The MeerKAT radio telescope in South Africa, which will form part of the Square Kilometre Array. Credit: SKAO / SARAO.

What alumni can do

The political process must run its course. The Public Accounts Committee takes evidence in June; the STFC prioritisation exercise concludes shortly after. None of the structural problems will be resolved on that timescale.

That leaves a gap the Cavendish community is unusually well-placed to help close – and for most alumni the most useful first step is not to write a cheque, but to raise a voice. If you care about the future of fundamental research at Cambridge and beyond, please consider writing to your MP – in Cambridge that is Daniel Zeichner, who has been one of the parliamentarians most active in pressing the government on these decisions – or adding your name to the open letter from industry signatories now circulating in support of UK particle physics, astronomy and nuclear physics. Alumni in industry, finance and technology carry particular weight in the latter forum: many of you perhaps credit some part of your success to a training in physics made possible by public investment in fundamental research, and saying so publicly matters more than you might think.

Philanthropic support remains welcome, of course – for postdoctoral fellowships in particle physics and astrophysics, for PhD studentships in fundamental areas, and for bridging support for early-career researchers whose grant routes have closed. But for any of the above – whether you want help drafting a letter to your MP, want to be put in touch with the industry open-letter coordinators, or wish to discuss directing philanthropic support – the Cavendish Development Programme (hod@phy.cam.ac.uk) or the author of this article (mkenzie@hep.phy.cam.ac.uk) would be glad to hear from you.

None of this is a substitute for public funding. It is a way for the alumni community to keep open the doors that policy is, for now, closing – and to ensure the next generation of physicists has somewhere to begin.

Matt Kenzie is an Associate Professor in the High Energy Physics Group, Team Leader of the LHCb group and a fellow of Clare College.

MicroBooNE rules out a sterile neutrino but mysteries remain

Nature's most elusive particle, the neutrino, remains mysterious as the MicroBooNE collaboration at Fermilab rules out a fourth flavour as the explanation for several long-standing anomalies.

Magnus Handley

For particles so small and feebly interacting, neutrinos have caused more than their fair share of headaches for particle physicists over the last century. First predicted by Wolfgang Pauli as an upsetting and 'desperate remedy' to conserve energy and momentum in beta decays, their exceptionally low interaction probability and continued identity crises have consistently forced physicists to be creative in the quest to understand their properties.

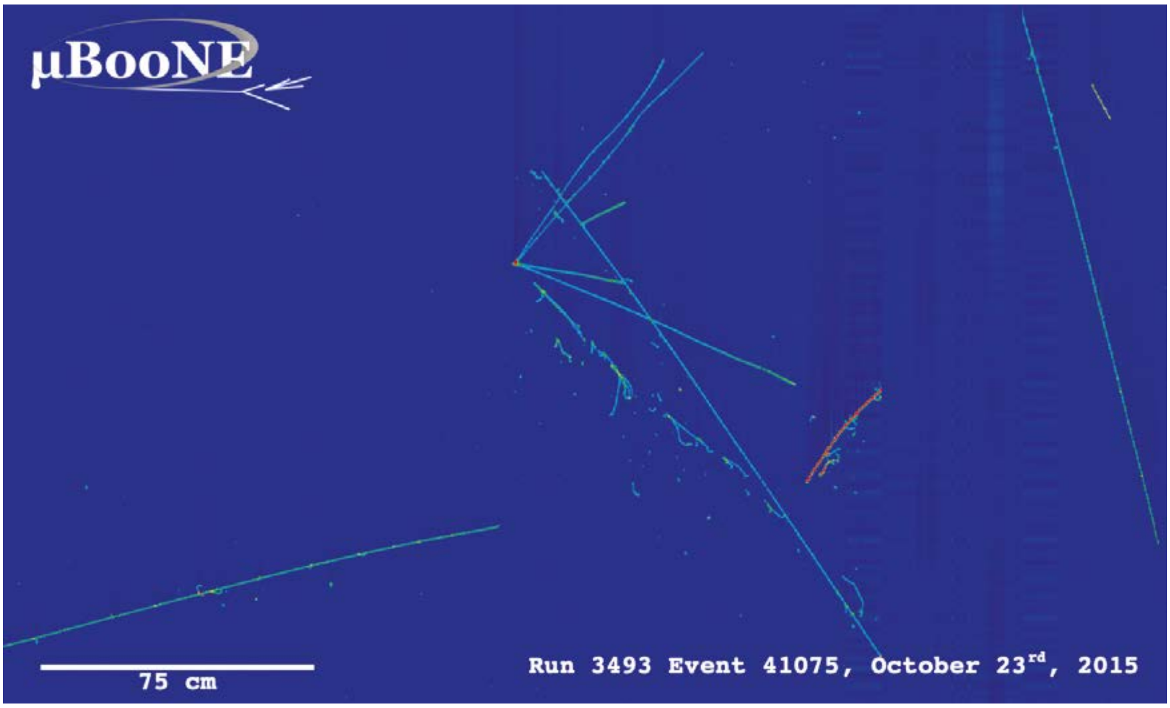
The modern understanding of neutrino physics came into focus in 1998 when the Super-Kamiokande experiment, and subsequently the Sudbury Neutrino Observatory in 2001, confirmed that the three known types or 'flavours' of neutrino – labelled electron, muon and tau – could change over time. For instance, by the time electron neutrinos created in the centre of the Sun arrive at Earth, a significant fraction will have transformed into either muon or tau neutrinos. Known as neutrino oscillation, this phenomenon solved two outstanding mysteries – the so-called 'solar' and 'atmospheric' neutrino problems – both stemming from the fact that fewer neutrinos of a certain type reached our detectors than expected. This also gave another critical piece of information, that neutrinos had mass, an unexpected property not previously predicted by the Standard Model.

At first glance, the picture seemed almost complete. Nature appeared to contain three neutrino flavours, each interacting only through the weak nuclear force and each capable of oscillating into the others over long distances because of their tiny, but non-zero, masses.

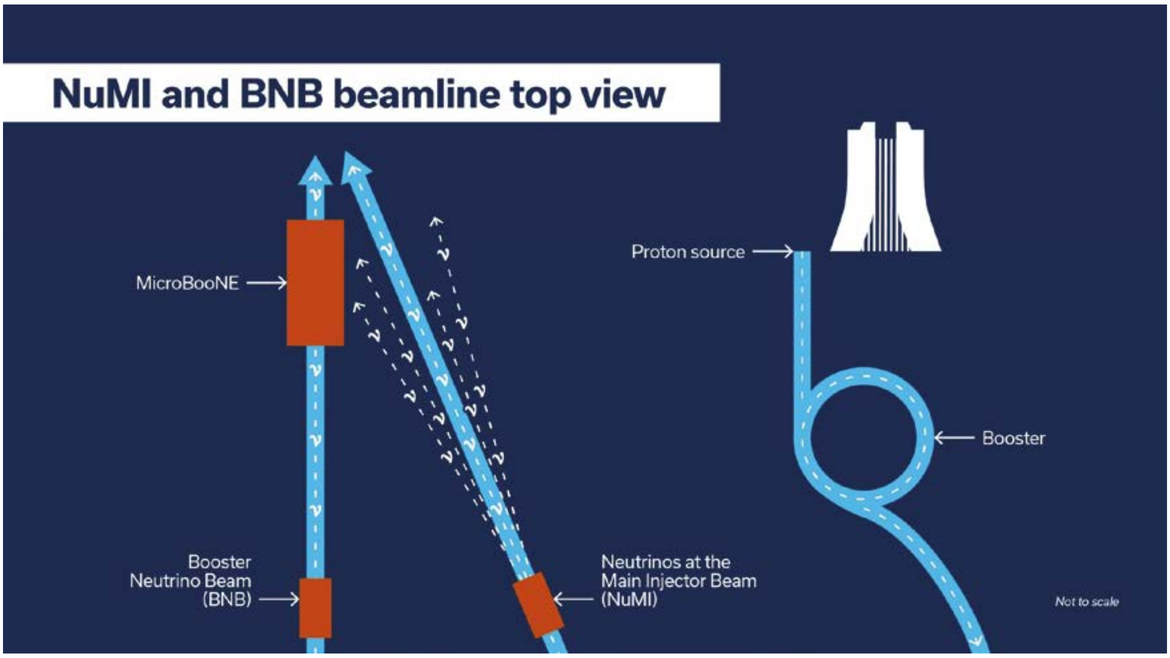
Sadly, the picture failed to stay so simple.

Several short-baseline experiments from the late 1990s onwards, most notably the LSND experiment at Los Alamos and MiniBooNE at Fermilab, reported unexplained excesses of electron-neutrino-like events at low energies. Taken together, these amounted to a six-sigma discrepancy with prediction – meaning there is around a one in 500 million chance of the results being a statistical fluke. The neutrino beams studied by these experiments start as primarily muon neutrinos, and while we know that high-energy neutrinos can change type over long distances, the detectors here were far too close to their respective sources for that transformation to occur with only the three known flavours.

So, what was going on? A popular hypothesis invoked the addition of a fourth non-interacting, or 'sterile' neutrino: providing an extra pathway for the shapeshifting between muon and electron-type neutrino flavours. While very successful detectors in many ways, the data from LSND and MiniBooNE couldn't tell us whether there



A typical event display from the MicroBooNE detector, showing a high-resolution readout of a neutrino interaction creating several daughter particles. Credit: MicroBooNE.



A schematic showing how MicroBooNE is exposed to neutrinos from both the BNB and NuMI beamlines. Credit: Fermilab.

really was a new particle, or if something else was happening which mimicked the oscillation signature. The reason was the technology used, as both LSND and MiniBooNE relied on Cherenkov light cones as their primary way of identifying particles. These cones of light are produced when a charged particle travels faster than light would through the mineral oil in the detector: a process somewhat analogous to a sonic boom. The problem with this is that it's very difficult to distinguish between the particle showers produced by an electron (such as those produced when electron neutrinos interact) and those from photons. To properly investigate the anomalies, a different detector technology was required.

MicroBooNE, a follow-on detector built to resolve these anomalies, is a Liquid Argon Time Projection Chamber (LArTPC) filled with 170 tonnes of the liquefied noble gas. When a neutrino interacts with an argon nucleus, charged particles are produced which create trails of ionisation. By applying strong electric fields, these trails are pulled to the walls of the detector, where planes of readout wires give high-resolution, almost photographic, representations of the interaction.

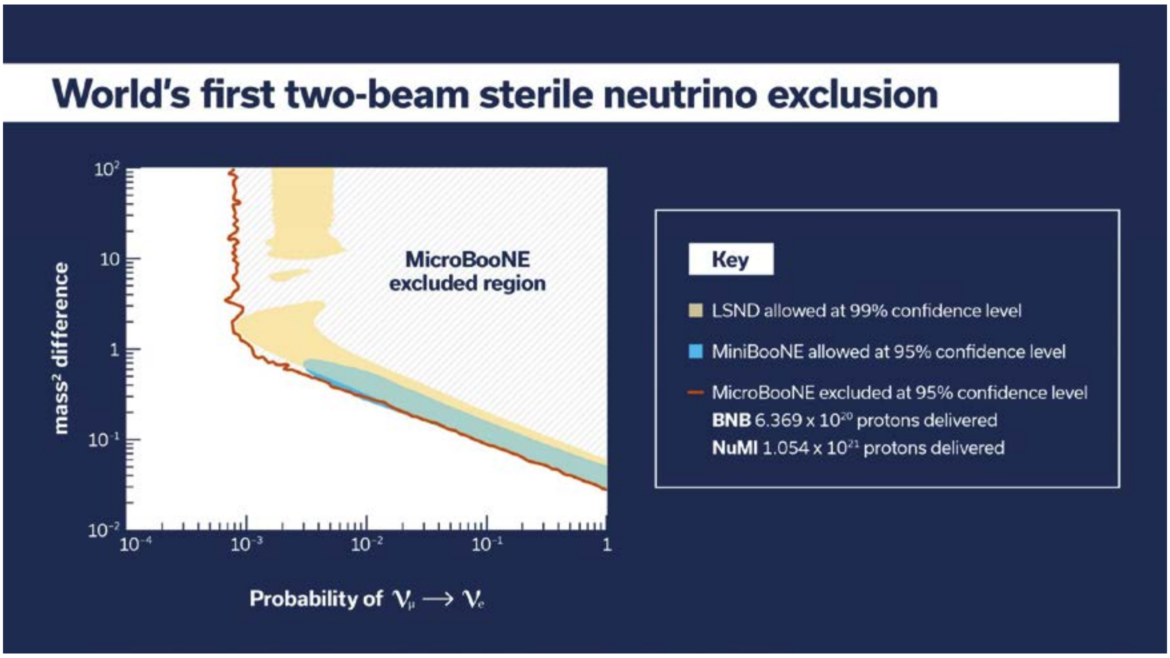
When trying to resolve electron-like showers, this has two main advantages over Cherenkov detectors. Firstly, LArTPCs are excellent calorimeters, and when photons pair-produce to create an electron-positron pair, they deposit roughly twice as much energy per unit length as when an electron creates a shower in the detector. In addition to this, photon showers are often easy to identify because they often travel a considerable distance away from the interaction point before pair production, giving a characteristic gap between the shower and interaction vertex.

The high-resolution nature of the detector readout requires more complicated processing, or 'reconstruction', to steadily build up from raw charge readout 'hits', to clusters of hits in two dimensions and eventually to three-dimensional objects which correspond as well as possible to real particles. The development of a reconstruction package known as *Pandora* has been one of the major contributions of Cambridge researchers to the MicroBooNE experiment, with extensive use across many different analyses and dataset validation efforts, as well as on other LArTPC experiments.

To best investigate the MiniBooNE excess, MicroBooNE was built in the same Booster Neutrino Beamline (BNB), at a very similar distance from the neutrino source. Even with this, neutrino oscillation physics is fickle, and if we were unlucky then there are portions of parameter space where the effect of oscillation into electron neutrinos would be cancelled out by the disappearance of the (small, but non-zero) intrinsic electron-neutrino content of the beam.

Enter MicroBooNE's secret weapon: *a second neutrino beam!* A quirk of positioning means that

"To properly investigate the anomalies, a different detector technology was required."



The final result, showing that MicroBooNE excludes almost all scenarios where the LSND and MiniBooNE results could be explained by a single sterile neutrino. Credit: Fermilab.

MicroBooNE also sees neutrinos from the main injector neutrino beamline (NuMI), but significantly off-axis, at an angle of eight degrees from the target. This means the intrinsic electron neutrino content of NuMI is much higher than that of the BNB, breaking the potential degeneracy and allowing us to probe oscillations which might otherwise have required multiple detectors to see.

When the data from both beams was analysed, no significant excess of electron-neutrino-like events was seen. In fact, MicroBooNE didn't observe anything resembling the excesses seen by MiniBooNE. The results almost entirely exclude the region of phase space where a single light sterile neutrino would have needed to sit to explain MiniBooNE – effectively shutting this down as a viable hypothesis.

Taken together, what does this all mean?

The new MicroBooNE results end a chapter in the hunt to understand these anomalies by ruling out a high-profile hypothesis, but fail to complete the story. LSND and MiniBooNE still saw more events than expected, and the community is yet to understand why. Was a Standard Model background underpredicted? Was something mismodeled that is better accounted for in modern simulation? Or is there still some new physics out there, potentially invoking a more complex phenomenological picture?

Attempts to resolve this are far from over, with continued efforts from many different experiments globally. The MicroBooNE collaboration continues to investigate its dataset, looking for hints of more complex beyond-the-standard model scenarios. Separately, other collaborations like the short-baseline neutrino (SBN) program (a collection of multiple detectors now in the Fermilab beams) will push the bounds significantly further and pave the way for next-generation experiments like DUNE: a mega-experiment currently under construction and for which Cambridge researchers continue to lead development.

Looking forward, MiniBooNE sits as a small part of a bigger puzzle, which is still some way off from being completed. Several open questions remain. Why do neutrinos have mass at all? What is the order of those masses? Do neutrinos and antineutrinos oscillate differently? This last question could help to understand the matter-antimatter asymmetry of the early universe. So as several neutrino megaprojects across the world – DUNE in the US, Hyper-Kamiokande in Japan, and JUNO in China – start to switch on over the next few years, we might soon get to know nature's shiest particle a little better.

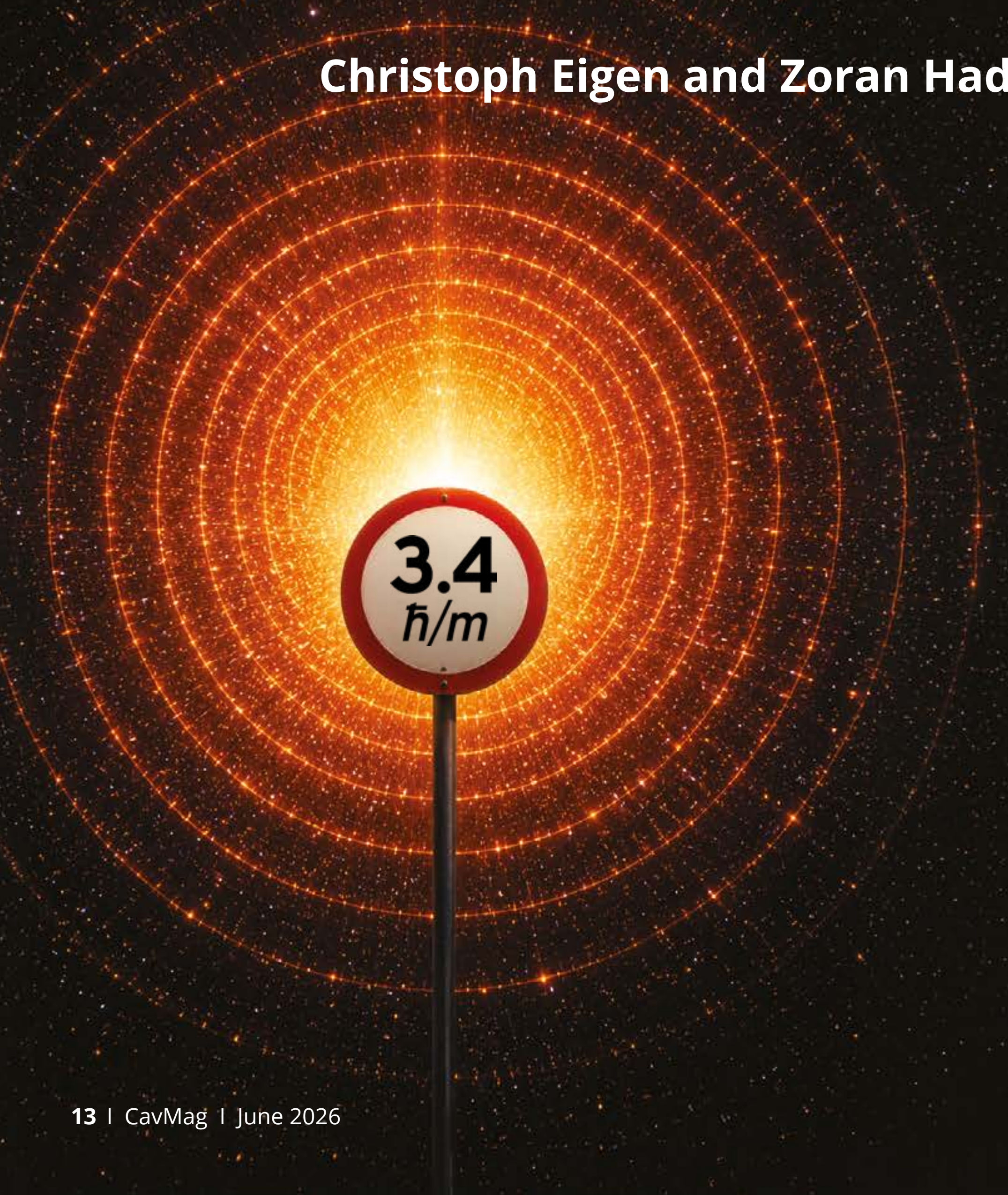
Reference:
The MicroBooNE Collaboration, 'Search for light sterile neutrinos with two neutrino beams at MicroBooNE'. Nature (2025). DOI: 10.1038/s41586-025-09757-7

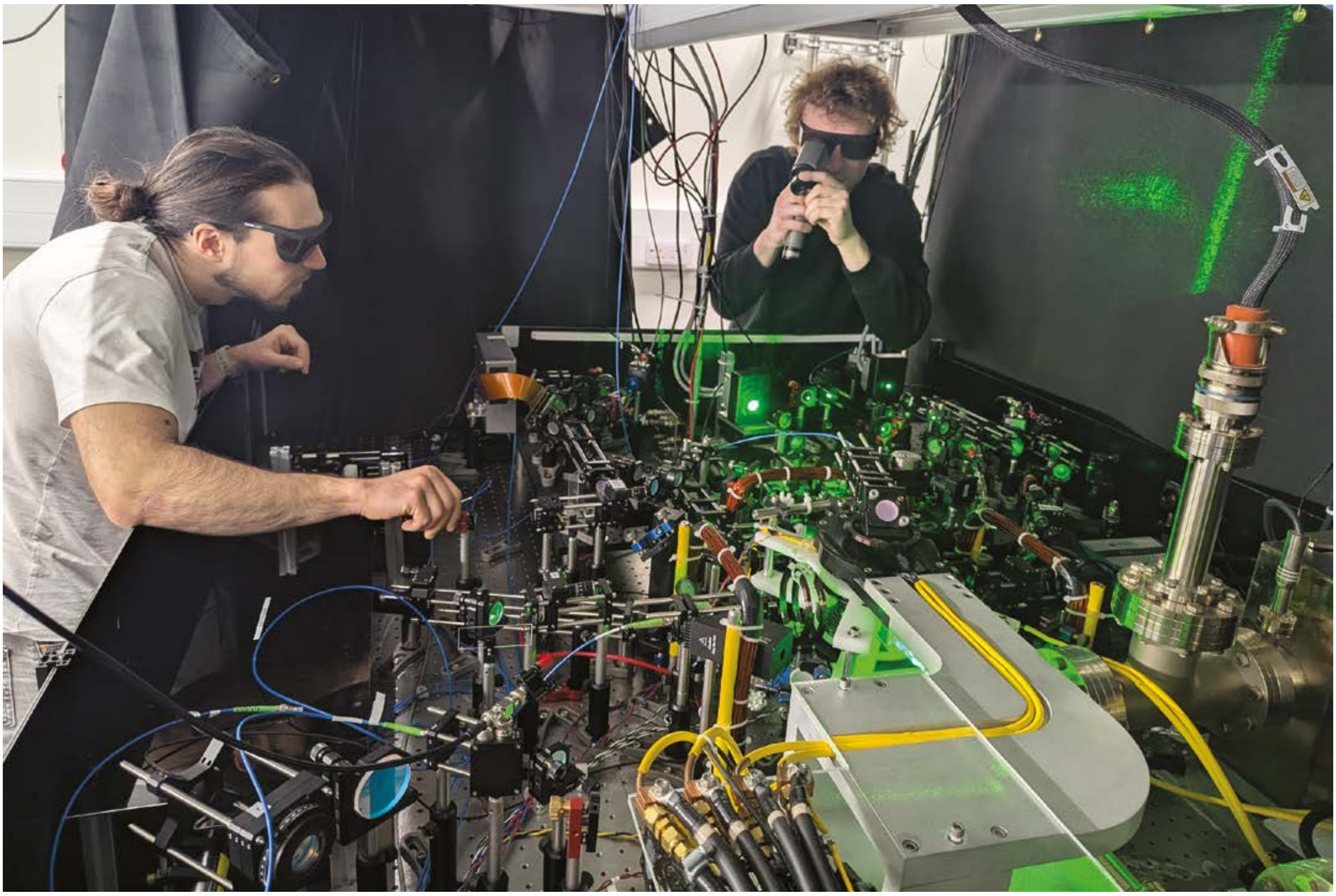
Magnus Handley is a PhD student in the High Energy Physics Group, working on the DUNE and MicroBooNE experiments.

How fast can quantum coherence spread?

Cavendish physicists have observed a fundamental rate limit for the spreading of quantum coherence, the process by which a system syncs into a single quantum state. The existence of such a limit has profound implications for disparate fields, from quantum computing to the evolution of the early universe.

Christoph Eigen and Zoran Hadzibabic





ABOVE: **Photograph of our experimental apparatus used to create homogeneous Bose gases consisting of ultracold potassium atoms, with lead authors Gevorg Martirosyan (left) and Martin Gazo (right) tweaking the setup.**

The discovery of fundamental limits on the rates of physical processes has repeatedly reshaped our understanding of nature. The speed of light constrains how quickly information can propagate through space-time, while other limits bound the rates of quantum evolution or the spreading of correlations in many-body systems. Such limits are not just curiosities: they reveal which quantities truly set the pace of a physical process, and they can have profound technological implications.

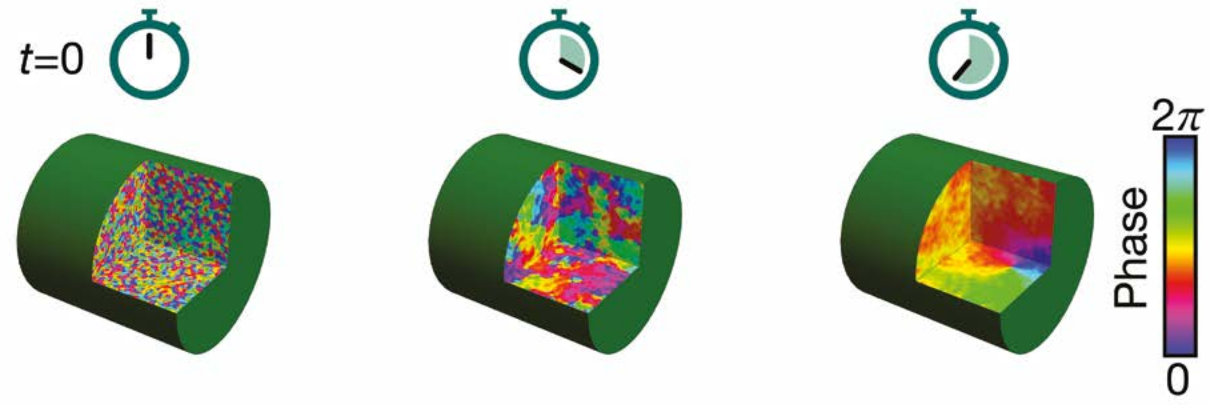
In our recent work we uncovered a new such limit: a universal limit for the rate at which coherence spreads during the formation of a Bose–Einstein condensate.

A Bose-Einstein condensate (BEC) is a state of matter that appears when an ensemble of bosons – particles that can share the same quantum state – is cooled to ultralow temperatures, typically below a millionth of a degree above absolute zero. In this regime, the particles no longer behave as independent objects. Instead, they form a unified macroscopic quantum object that behaves coherently and exhibits wave-like properties.

Since their first experimental realisation in 1995, BECs have become a routine part of ultracold-atom laboratories around the world. Yet, a foundational question has remained largely unanswered: once a condensate begins to form, how long does it take for coherence to spread across truly macroscopic length scales?

To address this question, we used our quantum-gas experiment based on ultracold potassium-39 atoms confined in optical box traps. The platform offers two key advantages. First, we can tune the interactions between the atoms with high precision, using so-called Feshbach resonances. Secondly, the box traps offer homogeneous atomic samples, providing a particularly clean setting in which to watch coherence emerge. This contrasts with more traditional harmonic traps, where the density varies across the cloud and the critical point is crossed at different times in different regions of space.

We began by preparing a gas with very low energy per particle and then drove it far from thermodynamic equilibrium using external magnetic forces. In this way, we created initial



Cartoon illustration of coherence growth during Bose-Einstein condensation. Starting from an initially disordered phase field (at t = 0), locally coherent regions emerge and grow over time, gradually establishing phase coherence across the box (which is cylindrical in our experiments). The colour scale indicates the local quantum phase from 0 to 2 π.

states that were highly disordered and incoherent, but still 'cold' enough that, in equilibrium, they should feature a sizable BEC. We then let the cloud relax in isolation, with its subsequent evolution driven only by interactions between the atoms.

To monitor the relaxation dynamics, we measured the momentum distribution of the gas at different evolution times, repeating the experiment many times under otherwise identical conditions. As the system relaxed, we observed a gradual narrowing of the momentum distribution, signalling the growth of coherence in real space.

More quantitatively, we extracted the coherence length, denoted ℓ, which characterises the distance over which different parts of the gas 'know' about one another's quantum phase. During condensate formation, coherence does not appear everywhere at once. Instead, locally coherent regions form, grow, and merge, in a process known as coarsening. We found that, after an initial transient stage, the square of the coherence length grows linearly in time. This behaviour is a hallmark of universal scaling dynamics far from equilibrium.

The most striking result emerged when we varied the microscopic details of the system, for example the strength of the interparticle interactions that drive thermalisation. As expected from decades of cold-atom intuition, stronger interactions make the condensate appear sooner: they accelerate the initial approach to local equilibrium. However, once the system enters the universal coarsening regime, the rate at which the square of the coherence length, ℓ^2, grows is always the same. Initial conditions, density, interaction strength, and even the system size, affect how the system reaches the universal regime, but not the rate at which coherence ultimately spreads. Our measurements reveal a universal limit $D = d\ell^2/dt = (3.4+0.3)\,\hbar/m$, set solely by the ratio of the reduced Planck constant ($\hbar$) and the particle mass (m). For our potassium-39 atoms, this corresponds to 5.5 μm^2 per millisecond.

This result has striking consequences for the formation of coherence over truly macroscopic distances. Since the coherence length grows only as the square root of time, extending coherence over large length scales rapidly becomes slow. At the rate we measure, it would take centuries for coherence to spread by this mechanism through a potassium cloud the size of a swimming pool. Even for particles as light as neutrons, for coherence to spread across planetary distances would take far longer than the age of the Universe.

Our work connects two complementary theoretical pictures of how order develops in a quantum fluid. In one, coherence spreads through wave-like excitations of the phase field. In the other, the growth of order is linked to the decay of a turbulent spaghetti-like tangle

“This result has striking consequences for the formation of coherence over truly macroscopic distances.”

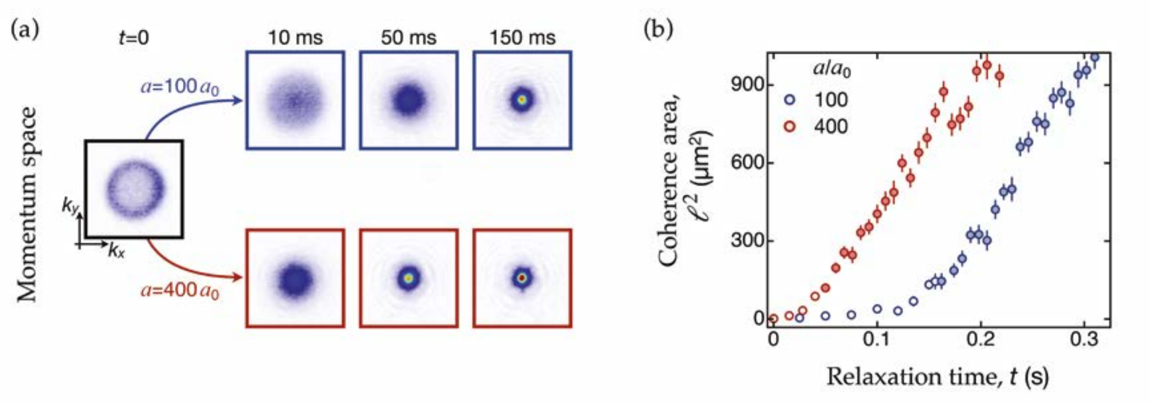
of vortex filaments. Our measurements do not yet distinguish which microscopic mechanism dominates, or whether the two are naturally intertwined. What they do show, is that the macroscopic coarsening rate is universal.

The implications reach well beyond ultracold atoms. Far-from-equilibrium ordering appears in many areas of physics, from superfluids and magnets to quark-gluon plasmas and early-universe cosmology. Ultracold gases provide a uniquely clean and tunable platform for studying these questions, because interactions, density, geometry, and dimensionality can all be controlled precisely. Our experiment offers a quantitative benchmark for theories of universality far from equilibrium: the search for simple laws governing the evolution of complex many-body systems.

Looking forwards, a major challenge is to determine how general this limit is. Similar measurements in lower-dimensional gases, strongly interacting systems, mixtures, driven systems, or lattice geometries could reveal whether analogous bounds govern the growth of coherence in other forms of quantum matter. Direct probes of vortices and other phase defects are underway, and could help clarify the microscopic mechanism behind the observed coarsening.

There are also practical implications. Many quantum technologies rely on producing and maintaining coherence over large distances or across many degrees of freedom. Our work shows that, at least when coherence is generated by relaxation in an isolated system, its growth is subject to an intrinsic many-body constraint. This is relevant not only for engineered quantum systems, but also for large natural quantum systems, including neutron stars and possible dark-matter candidates.

Reference:
Martirosyan et al., *‘A universal speed limit for spreading of coherence.’ Nature (2025). DOI:* 10.1038/s41586-025-09735-z



Uncovering a universal limit on the rate at which coherence can spread. (a) Momentum-space snapshots of a relaxing gas for two interaction strengths differing by a factor of four. As coherence develops, the broad incoherent distribution narrows into a sharp central peak. In line with decades of ultracold-atom intuition, stronger interactions do accelerate the early relaxation, bringing the gas into the coherent regime sooner. (b) However, the evolution of the extracted coherence area ℓ^2 reveals two distinct stages of the dynamics: the initial, non-universal regime that depends on the interaction strength (open symbols), and the coarsening regime in which ℓ^2 grows linearly, and at essentially the same rate in both cases.

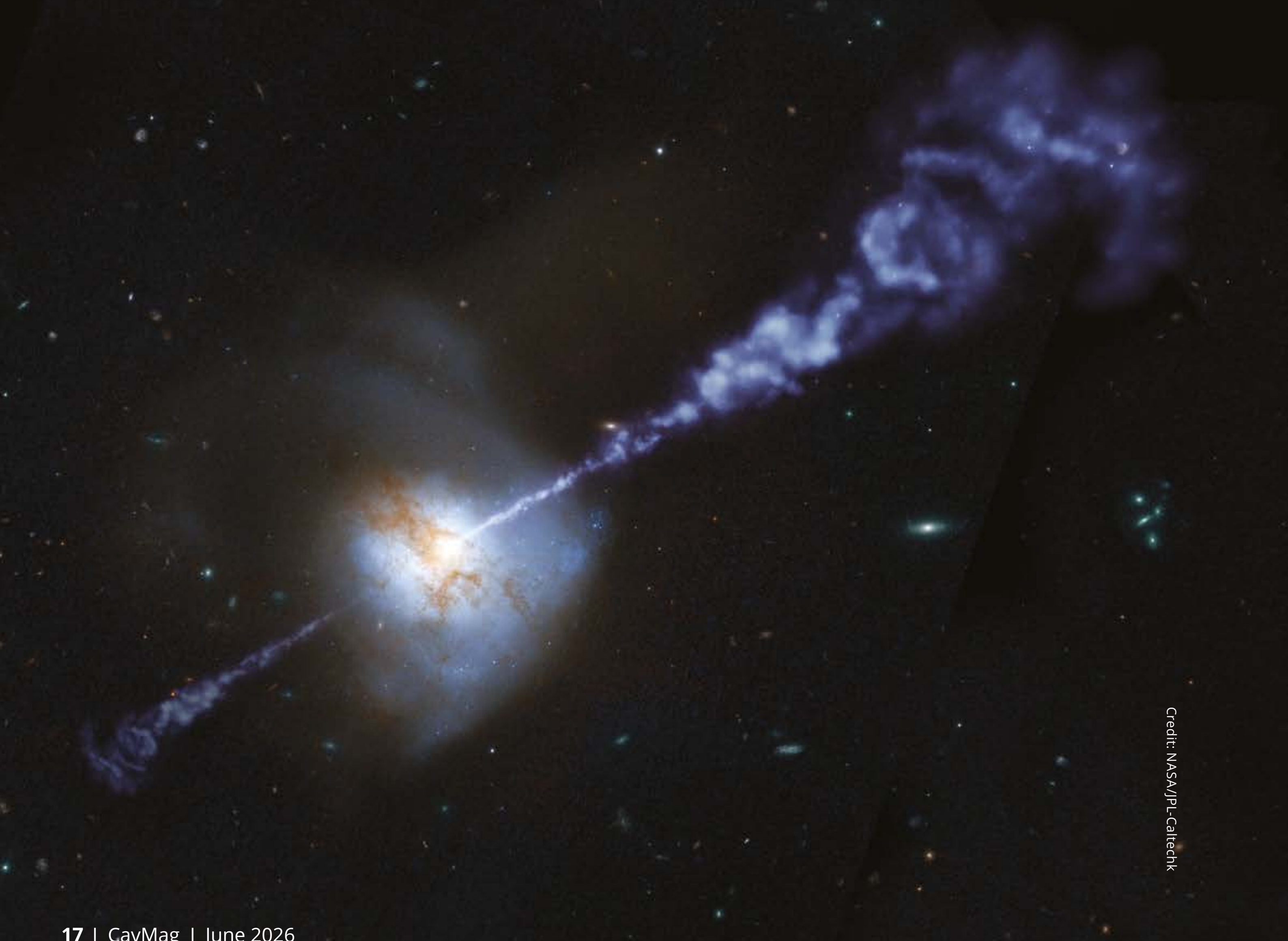
Christoph Eigen is Assistant Research Professor in the Quantum Gases and Collective Phenomena Group.

Zoran Hadzibabic is Professor of Physics and head of the Quantum Gases and Collective Phenomena Group.

Death by black hole

Cavendish astronomers have spotted one of the oldest 'dead' galaxies and found that a growing supermassive black hole can slowly starve a galaxy of the raw material needed for star formation. Their discovery challenges our understanding of galaxy evolution.

Jan Scholtz, Francesco D'Eugenio, Roberto Maiolino



Credit: NASA/JPL-Caltechk

Black holes capture everyone's attention, often being portrayed as cosmic villains that swallow everything in their path. However, most of the time, black holes are inactive and isolated, rarely interacting with their surroundings. One special class are so-called supermassive black holes, which are found at the centres of most galaxies in the local universe.

These giants have masses ranging from millions to billions of times that of the Sun, accounting for between 0.1% and 0.5% of the total mass of their host galaxy. At the centre of our own Milky Way sits a black hole with a mass of four million suns, a discovery that won Andrea Ghez and Reinhard Genzel the Nobel Prize in Physics in 2020.

Evidence that growing supermassive black holes influence their galaxies is a tantalising puzzle

As these black holes grow, they release enormous amounts of energy across the electromagnetic spectrum – from radio waves to gamma rays – equivalent to ten times the gravitational potential energy of the galaxy. This energy either heats up the gas within the galaxy or, through radiation pressure, drives powerful winds blasting at speeds of up to a few thousand kilometres per second. This process is predicted to remove gas from the galaxy, which is the fuel for forming new stars. Yet each growth episode only lasts up to 10 million years at a time.

Growing supermassive black holes – also known as Active Galactic Nuclei, or AGN – are key ingredients in theoretical simulations of galaxy formation, ensuring that galaxies do not grow too massive through injection of energy into a galaxy's gas supply or its removal through outflows. The entire process of stopping formation of new stars in galaxy is often referred to as galaxy quenching. However, despite years of research, astronomers have yet to find direct evidence of this effect.

Probing 'dead' Pablo's Galaxy with cutting-edge instruments

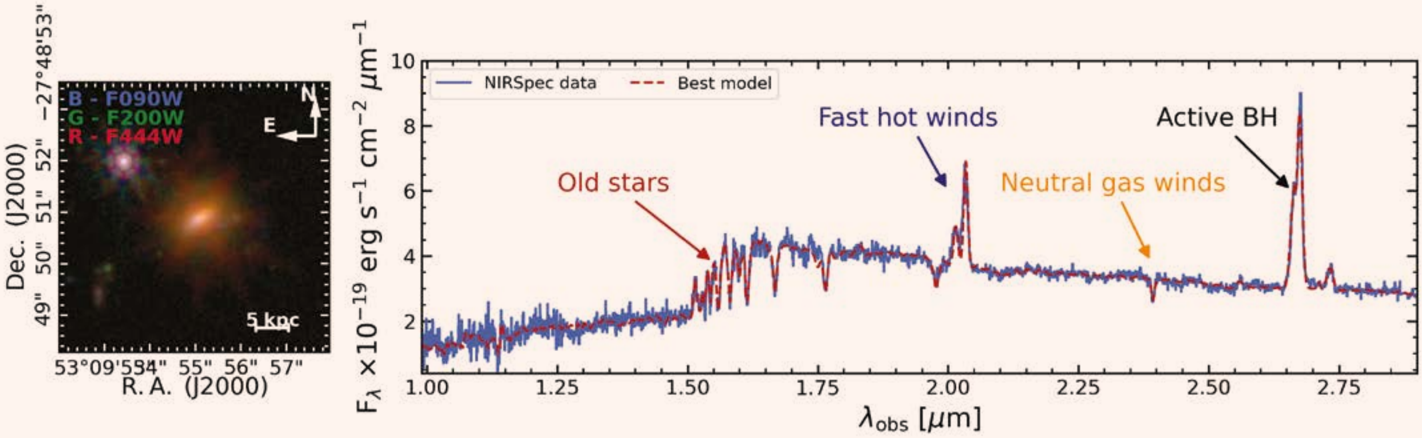
The launch of the James Webb Space Telescope (JWST) has made this problem of quenching galaxies even more challenging. We are now discovering even more 'dead' galaxies – those that are no longer forming new stars – that existed only a few billion years after the Big Bang. This suggests galaxies need far less time to grow to their final size and die than previously thought.

One such galaxy, called GS-10578 but nicknamed 'Pablo's Galaxy' after the astronomer who first observed it in detail, is unusually massive for such an early period in the universe. It has a mass of about 200 billion solar masses, and most of its stars formed between 12.5 and 11.5 billion years ago. Pablo's Galaxy appears to have lived fast and died young; it stopped forming new stars despite its relatively young age due to an almost total absence of the cold gas that stars need to form.

Based on previous work also published in *Nature Astronomy*, the galaxy appears to be a calm, rotating disk. This indicates that it did not experience any major disruptive mergers with other galaxies. Since we can rule out a traumatic past for Pablo's Galaxy, its lack of fresh gas must be due to the galaxy's own evolution.

We used data from the James Webb Space Telescope and the Atacama Large Millimeter Array (ALMA) to study this galaxy in the early universe, roughly three billion years after the Big Bang, or ten billion years ago.

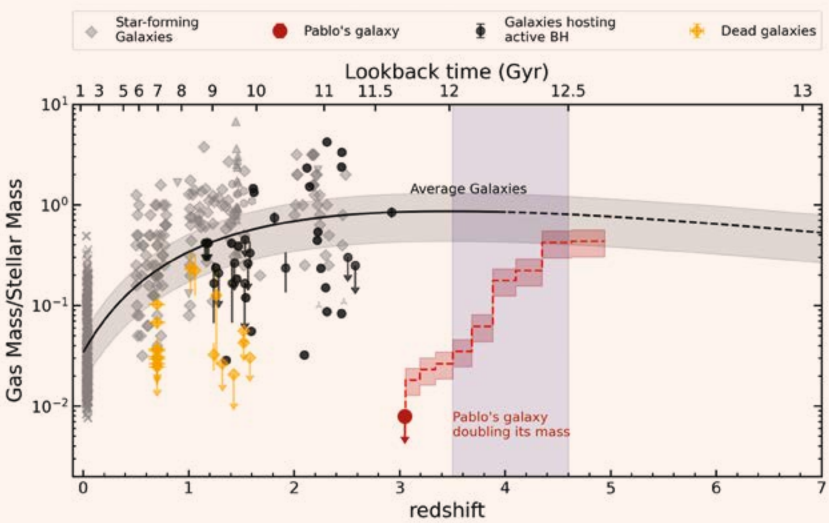
The imagery from the Near Infrared Camera (NIRCam) and the spectrum from the Near Infrared Spectrograph (NIRSpec) provide excellent insight into the galaxy. An image of Pablo's galaxy and its spectrum can be seen below. From this data, we can learn that the galaxy hosts an actively growing black hole, old stars and fast winds. Furthermore, the data provided precise measurements of its star formation history – effectively mapping out exactly when the galaxy formed its stars – while the ALMA observations measured the galaxy's gas supply.



JWST/NIRCam image and NIRSpec spectrum of Pablo's galaxy. The NIRSpec data provide us with excellent insight into the nature of the galaxy.

Starvation effect observed from supermassive black hole activity

A careful combination of the ALMA and JWST data revealed that the galaxy's black hole is the main culprit behind this missing gas. Despite undertaking the longest ALMA observations ever conducted on this kind of distant, dead galaxy – spanning over 7 hours using over 50 antennae – we found no evidence for carbon monoxide, a key indicator for the cold molecular hydrogen required for star formation. (It is extremely challenging to detect cold molecular hydrogen at temperatures below -240°C, so we often target other molecules, such as carbon monoxide which commonly occurs in molecular hydrogen clouds but is much easier to detect.)



Comparison of Gas fraction (gas mass/stellar mass) against redshift.

By reconstructing the galaxy's star-formation history and gas content, our team concluded that the galaxy evolved with a 'net-zero inflow', meaning fresh gas never refilled its reservoir from the intergalactic medium. Rather than blowing away all its gas in a single cataclysmic event, the galaxy suffered death by a thousand cuts. The black hole repeatedly heated or expelled incoming material over multiple cycles, preventing the galaxy from replenishing itself with fresh gas and slowly strangling star formation. This breakthrough result, reported in the journal *Nature Astronomy* (the second *Nature Astronomy* article on this galaxy by the Cavendish team), explains why observing the direct impact of black hole growth on galaxy evolution has traditionally been so challenging. Each black hole growth episode does very little damage, but cumulatively, they are catastrophic to the galaxy.

Additionally, JWST spectroscopy revealed powerful winds of neutral gas streaming out from the galaxy's supermassive black hole at 400 kilometres per second, stripping away 60 solar masses of gas every year. These numbers suggest the galaxy's remaining fuel will be depleted in as little as 16 to 220 million years – far faster than the billion-year timescale typical for similar galaxies.

“Each black hole growth episode does very little damage, but cumulatively, they are catastrophic to the galaxy.”

The phenomena may be more common than previously thought

Although Pablo’s Galaxy stopped forming stars 400 million years ago, its black hole can currently be observed in a new active growth episode. This means the current black hole activity and the observed gas outbursts did not cause the initial shutdown; instead, repeated past episodes likely kept the fuel from returning – a process known as the ’maintenance feedback mode’.

The findings help explain a growing population of massive, surprisingly old-looking galaxies observed by Webb in the early Universe. Before Webb, these were unheard of. Now we know they’re more common than we thought – and this starvation effect may be why they live fast and die young.

Looking ahead, the Cambridge team has been awarded an additional 6.5 hours of JWST observation time using the Mid-Infrared Instrument (MIRI) to observe Pablo’s galaxy. These new observations will target warmer hydrogen gas, revealing more about the exact mechanisms through which its supermassive black hole halts star formation. Concurrently, the team is expanding a number of target sources with similar high-quality ALMA and JWST observations, which will soon reveal just how common this starvation phenomenon is across the universe.

Photo of the ALMA observatory. Credit: eso.org/public/unitedkingdom/products/mountedimages/mounted_0200.

Jan Scholtz is a postdoctoral researcher at the Kavli Institute for Cosmology.

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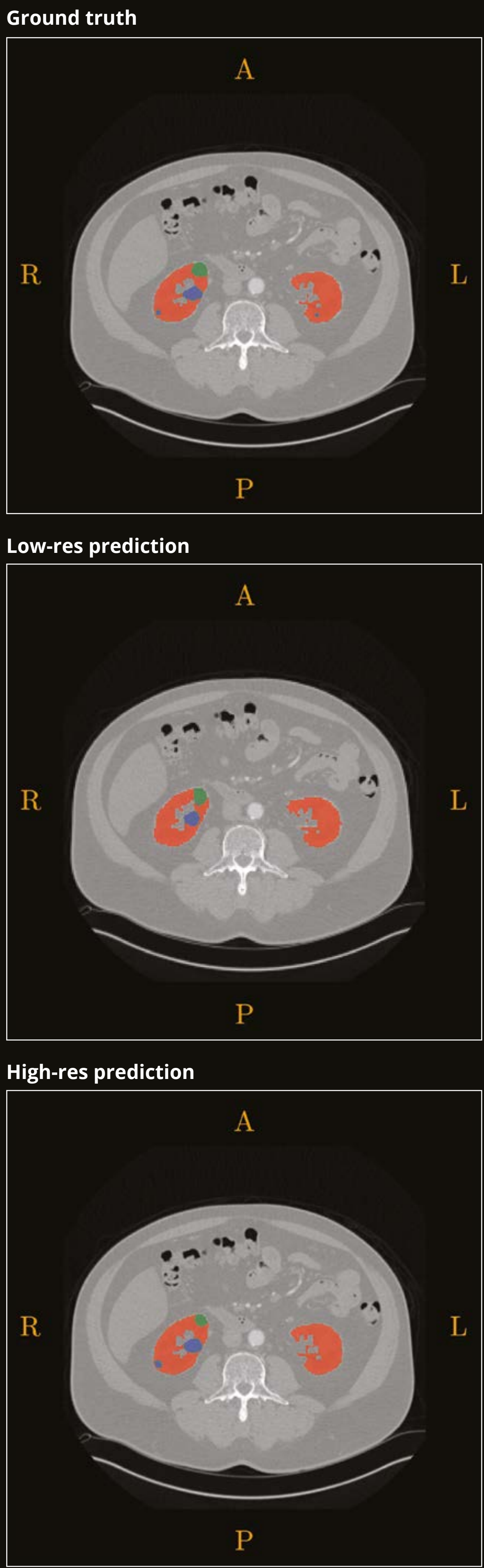
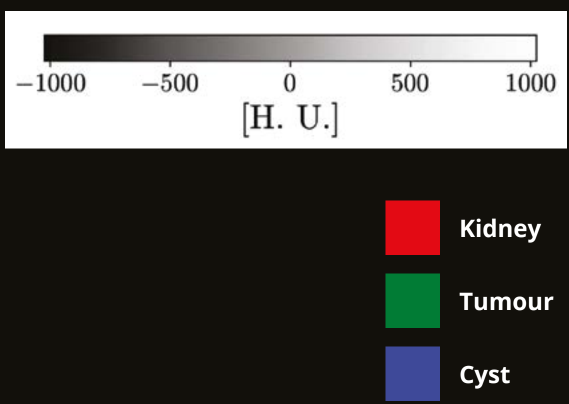
Roberto Maiolino is Professor of Experimental Astrophysics at the Cavendish Laboratory and the Kavli Institute for Cosmology.

From neutrino physics to cancer detection

Lorena Escudero Sánchez
and Leigh Whitehead





It's not uncommon for developments in particle physics to make their way into medicine. Positron emission tomography (PET), cyclotrons used to generate diagnostic isotopes or hadron therapy, are well-known examples of revolutionary technologies that originated in our quest to understand how matter works. And this transfer of technology is not limited to just hardware: the latest breakthrough technology, Artificial Intelligence (AI), which is actively developed in particle physics, is also finding applications in other fields.

This time it was thanks to the work of our team of neutrino physicists (past and present), from University of Cambridge, ETH Zurich and University of Cincinnati. We decided to apply a new type of neural network from the reconstruction of neutrino events in liquid argon time-project chambers (TPCs) – used to detect neutrinos at experiments including MicroBooNE and DUNE – to finding tumours in radiological imaging.

Submanifold sparse convolutional neural networks (SSCNs) are a type of image processing algorithm that has found popularity in neutrino experiments due to the typical sparsity of data, where typically only ~1% of readout channels record a signal from an interaction. Standard convolutional neural networks (CNNs), whilst very powerful to identify whether a photograph contains, for instance, a cat or a dog, are inefficient when applied to such sparse images as they perform operations on regions that are all zero-valued ('empty'). Instead, SSCNs use significantly less memory and take much less processing time for the same level of accuracy.

And these advantages can be particularly helpful to enable the deployment of AI tools in clinical environments with limited computational resources, speeding up image analysis while contributing to lower energy consumption during both training and deployment. In this study, we applied SSCNs to computed tomography (CT) imaging, one of the most common image modalities used worldwide for cancer diagnosis and treatment monitoring. Although CT images are not naturally sparse, this imaging modality is a suitable use case for SSCNs. This is possible since the intensities stored in voxels in CT are described by the scale of Hounsfield Units (H.U.) that represents radiodensity, such that different values are indicative of different tissue types.

The first step of our method was 'voxel sparsification', followed by a two-stage 3D segmentation method in which SSCNs were deployed. In the first stage, a low-resolution sparse network was used to identify a region of interest, a process that in principle can be used in a standalone way for lesion detection. In the second stage, a high-resolution sparse network performed refined semantic segmentation within the region of interest, providing the very precise delineation of organs and tumours needed for further downstream measurements and analysis, which is key to enabling precision medicine and personalised treatments.

As a proof-of-concept, we applied this novel method to the segmentation of kidneys and renal tumours, using only publicly available datasets from the KiTS (Kidney Tumour Segmentation) challenge. The performance we obtained, measured in terms of 'Dice similarity coefficient', a metric of overlap between prediction and ground truth widely used in medical segmentation tasks, is competitive with the approaches in the top leaderboard of the latest KiTS challenge, achieving 95.8% for kidney + masses, 85.7% for tumours + cysts, and 80.3% for tumours alone. Crucially, compared to an equivalent dense implementation of the same architecture (UNet), our proposed sparse approach achieves up to a 60% reduction in inference time and up to a 75% reduction in VRAM (video random-access memory) usage across both the CPU and GPU configurations tested.

This study, now published open access in Nature Scientific Reports, provides strong motivation for the application of our SSCN technique to other use cases, and to continue building bridges between particle physics and clinical medicine.

Reference:
Alonso-Monsalve, S., Whitehead, L.H., Aurisano, A. and L. Escudero Sanchez, 'Submanifold sparse convolutional networks for automated 3D segmentation of kidneys and kidney tumours in computed tomography.' Sci Rep (2026). DOI:10.1038/s41598-026-51801-7

OPPOSITE:
Example scan showing very good agreement between the high-resolution prediction (bottom) and low-resolution prediction (centre), and the expert radiologist segmentation (top) of the kidneys, tumours and cysts.

Lorena Escudero Sánchez is a Principal Research Data Scientist at RAND Europe, an affiliated lecturer at the Department of Physics and a visiting researcher at the Department of Radiology.

Leigh Whitehead is a research professor in the High Energy Physics Group working on the DUNE and ProtoDUNE experiments.

The last-ever look inside the Cavendish Laboratory's 1974 building

Former site of the University's physics department being demolished

Mićo Tatalović

The first time I encounter Cavendish 2, the recently abandoned site of the Cavendish Laboratory at the University of Cambridge, it's by mistake. It's October 2025, and I get off the university bus at the West Hub stop looking for the lab where I'm supposed to start my media fellowship. The fellowship is funded by the European Molecular Biology Organization to allow science journalists to further their scientific education. I'm excited to start my 3-month residency at the lab, learning how we can better report the exciting research in the field of exoplanets and astrobiology, and specifically the search for life on other planets.

But I get a bit turned around and head off in the wrong direction, at least wrong at this point in time. I quickly see a building with the big sign reading 'Cavendish Laboratory', but it looks abandoned, with a large skip parked outside. I soon realise this is the old site, moved out of a few weeks earlier, and eventually find the lab's new building just up the road.

The prestigious Cavendish Laboratory, with its 36 Nobel Prize winners, has an iconic status in the history of science. The university's physics department was initially based in central Cambridge where Francis Crick and James Watson famously determined the double-helix structure of the DNA molecule, and where monumental discoveries including the electron and neutron were made, and where new technologies were developed such as the mass spectrograph and X-ray crystallography, which in turn allowed for new discoveries in chemistry and biology.

The lab moved to the outskirts of Cambridge in 1974, 100 years after its foundation, having outgrown its overcrowded site on Free School Lane in central Cambridge. Physics had changed dramatically by the mid-1970s, with the emergence of 'big-science' such as radio astronomy and particle physics, and there was a need for new large-scale facilities which would enable international collaboration.

The new building in West Cambridge was constructed as a maze of interconnected blocks, with new blocks added when more space was needed. It was home to generations of physicists and many thousands of students over its 50-year lifespan. But 'Cavendish 2', as it became known, originally built to last just 25 years, would eventually show its age and could no longer meet the needs of 21st century physics and an ever-expanding department.

So, in October last year the lab completed its move to the larger, bright and airy custom-built Ray Dolby Centre just up the road on JJ Thomson Avenue. The latest site is much roomier and has space to accommodate more

ABOVE: **Discarded equipment in Cavendish 2.**
TOP: **Chemistry Growth lab in the Microelectronics Reseach Centre (MRC).**

ABOVE: **HEP Cleanroom in the Rutherford building.** BELOW: **Empty shelves in the Rayleigh Library.**

researchers in custom-designed spaces required for modern physics.

Mete Atatüre, Head of the Cavendish Laboratory said: ‘For generations of physicists, the Cavendish Laboratory’s Cambridge West buildings were where careers began, ideas took shape and discoveries were made.

‘It’s where the spirit of collaboration, curiosity and excellence that has shaped the Cavendish since its birth more than 150 years ago continued to flourish, fostering the journeys of countless students, researchers and staff who worked there.

‘That heritage moved with us to the Ray Dolby Centre, a purpose-built new home for modern research and teaching. As we open this new chapter of our long history, we’re proud to carry the Cavendish legacy forward for the next generations.’

The old building is being razed this summer, once chemical and asbestos decontamination has been completed. The University’s estates division says this ‘will be designed to limit disruption, including noise and vibration, as far

as possible’ in the busy area of the Cambridge West Innovation District.

After demolition, the site will host a cycle route until new plans are developed for its future.

I was sorry to see the site closed temporarily, but happy to hear it will reopen as a cycling/walking route soon. During my fellowship, I often walked to the new lab via the old building, enjoying its picturesque park with lovely pond and trees in fall colours.

One day, I noticed signs on bike racks warning those still left behind of the imminent closure of the site to the public and the removal of any remaining bikes left there before demolition. I realised this was my last chance to see Cavendish 2 and witness this historic place before it disappears for good.

Luckily, Vanessa Bismuth, the lab’s Head of Communications and Events was kind enough to organise a visit to the site – now under lock and key – at the end of my fellowship, just days before it was shut down for good in February and handed over to third-party contractors. Vanessa and a colleague were there to guide me through the abandoned site.

As we approached, a few bikes were still clinging to the racks alongside a sign warning that they would soon be disposed of if unclaimed. Nearby, grey filing cabinets sat outside waiting to be moved. A giant half-filled skip welcomed us at the main entrance.

ABOVE: **Surface Physics lab (left) and office space (right) in the Mott building.** BELOW: **A cleanroom in the MRC.**

We passed through the empty reception and signed in. An alarm unexpectedly went off. A couple more alarms would sound at random during out visit, while lights flickered or failed to illuminate various dark corridors. Some parts of the buildings were wet, with water dripping from the ceilings, and for safety reasons we were not allowed to visit a couple of areas with leaks. The building was clearly on its last legs.

Several walls had been cut open, leaving gaping holes in the sides of old laboratories to allow the removal of specialised equipment like large optical tables that were too big to fit through the door.

The silence, the empty library, and a still glowing 'lecture in progress' sign in a long-abandoned lecture theatre lent an eerie feeling to the visit.

That feeling continued in areas that looked largely untouched by the move: the central café and some offices, still adorned with books, pictures and monitors, white boards filled with equations, and discarded lab coats.

While it sometimes looked like the laboratory had been abandoned in a rush, in reality the move was planned carefully and took 11 months to complete. Around 180 truckloads with a capacity of 18 tonnes were needed to move 107,500 cubic feet of research equipment, crates and furniture belonging to the lab's 31 research teams. This included specialised equipment including 47 cryostats, 98 optical tables, and various molecular beam epitaxy and electron beam lithography systems, as well as a cryogenics facility, the teaching laboratories, and the Cavendish Museum collection.

Most of the old equipment left by researchers was donated to schools and charities, with remaining materials destined for the skip.

Following the move to the new, upscale, state-of-the-art Ray Dolby Centre, it's unlikely that the old building will be missed, except perhaps for its use of the picturesque park and pond. A sooty barbecue left in one of the corridors and half-empty liquor bottles on the windowsill perhaps testify to the good times that were had there. Farewell, Cavendish 2.

Mićo Tatalović is a freelance journalist based in London. He was the first Maria Leptin/EMBO Science Journalism in residence at the Cavendish Laboratory from October to December 2025.

Your letters

On Margaret Hamilton and Authorship

Dear Editors,

Many people have heard of Margaret Hamilton, the computer scientist. She led the team that wrote the software for the Apollo programme, enabling astronauts to travel to the moon and return safely. However, few people know that before this celebrated role in the Apollo programme, she played a central but largely hidden role in a different field: the early development of chaos theory. In the 1960s, Hamilton worked with Ed Lorenz at MIT, writing software to predict the weather. Without her contributions, and those of other research assistants in Lorenz's group (especially Ellen Gille née Fetter), those papers could not have been written. Today, such contributions would almost certainly merit authorship. At the time, however, they were recognised only through acknowledgements [e.g. 1, 2].

We cannot change the past, but we can and should acknowledge past injustices.

In an article in the December issue of *CavMag*, a Cavendish alumnus reminisced about his time in the Cavendish Radio Astronomy group. Past efforts to uncover the hallmarks of rotation in a particular galaxy were unsuccessful. He then recounts that a "lady" provided some code she had developed. With this program, the faint fingerprint of rotation could at last be uncovered. He failed to acknowledge the name of the scientist whose computer program was central to uncovering rotation in this galaxy. He also did not acknowledge her in the single-author paper in question.

CavMag should name those whose intellectual contributions make science possible. But questions of authorship remain difficult. It can be particularly challenging for early career researchers to navigate these questions, given unwritten discipline-specific rules and persistent power imbalances. Furthermore, certain areas of research, such as software development and data collection, have always been undervalued. How should we decide who has done enough to merit authorship?

The University of Cambridge authorship guidelines requires anyone who has made a "significant contribution" to be listed as an author. This inevitably leaves room for interpretation, whereby more junior scientists (for example, research assistants, placement students, or others) are excluded.

What, then, to recommend going forward? Firstly, we should promote early and transparent discussions about authorship, including author order, to ensure that authorship is an accurate reflection of research contributions. Secondly, early career scientists should speak about authorship with their colleagues to contextualise their own experiences and better understand the unwritten rules. And finally, the Cavendish Laboratory should set a higher bar: clearer, discipline-specific authorship standards will ensure that contributions are properly recognised at the time they are made.

It is tempting to frame Margaret Hamilton's experience, and that of our unknown female scientist, as relics of a different era. However, the dynamics that excluded them from authorship are still present today. If we treat these stories as historical curiosities rather than warnings, we risk repeating them.

Dr Hannah Christensen
(Pembroke, 2006–2010)

[1.] E. B. Kraus and E. N. Lorenz, 1961: A numerical study of the effect of vertical stability on monsoonal and zonal circulations. Changes of Climate, UNESCO, Belgium, pp. 361-372.

[2] E. N. Lorenz, 1963: Deterministic nonperiodic flow. *J. Atmos. Sci.,* **20,** 130-141.

Note from the Editors

Dr Hannah Christensen raises excellent points in her letter regarding a recollection by a Cavendish alum that was published in *CavMag 34*. Unfortunately, the author was unable to recall the name of the scientist in question and while we have identified a few potential candidates, the available records do not allow us to determine her identity with any certainty. In the next issue of *CavMag*, we plan to publish a longer piece on the work of women in the Cavendish during the 20th century, with particular focus on the under-acknowledged contributions from technicians, research assistants and graduate students.

Douglas Martin Astill (1949 – 2025)

We are remembering Doug Astill as a highly valued colleague, mentor and friend whose kindness, patience and resourcefulness left a lasting impression on those who knew him. Alongside reflections from his daughter Lucy, this obituary brings together tributes from former coworkers who recall his ingenuity in solving problems and the generosity with which he shared his knowledge and supported others.

On 14 July 2025, Douglas Martin Astill passed away aged 75, at Chesterfield Royal Hospital, in the presence of his loving wife.

Doug was born in 1949 in Nottingham (UK). He spent his childhood and teenage years attending Nottingham High School, exploring the caves of the nearby Peak District, and taking apart and putting back together his toys in the family's box room-turned-workshop.

Doug left Nottingham to study Natural Sciences at Peterhouse, Cambridge in 1967. During this time, he also took up motorcycling and diving, which allowed him to travel across the world.

His extensive career included a stint working on the Teide Observatory in Tenerife and at various Cambridge physics institutions, including the ion probe unit, the Institute of Astronomy, Schlumberger, and Astrocam. He eventually joined the Cavendish Laboratory where he worked for 30 years until his retirement. He also found time to serve as a parish councillor, practice yoga, and read a vast quantity of books.

Doug retired to the Peak District, where he continued to nurture his sense of scientific curiosity both outdoors and at his workbench, an enthusiasm he has passed down the generations. Doug is survived by his wife Clare, daughters Helen and Lucy, and grandsons Archie and Kit.

Donations in Doug's memory can be made to the Bhopal Medical Appeal, a cause Doug supported since the Bhopal Disaster in 1984.

Lucy Astill

Many of my former colleagues and students interacted very well with Doug. He was a key person at the Interdisciplinary Research Centre in Superconductivity (IRC), often being the first point of contact for younger postdocs and research students, helping then use the advanced equipment there and generally keeping the show on the road.

When the senior scientists moved back to their home departments, Physics, Chemistry, Earth Sciences, Materials Science and Engineering in 2004, Doug played a very important part in keeping some of the equipment available and in maintaining the IRC's laudable interdisciplinary ethos. He was unusually conscientious, calm and approachable. One of his many strengths was keeping very good notes and writing out instructions for the use of important equipment such as the Quantum Design Squid magnetometer and the Inel X-ray powder diffraction machine the Mott building, as well as servicing them and many other pieces of vital equipment such as vacuum pumps and PCs for data-logging when needed.

I think that he may have suffered from ill-health in his later years at work, but typically, he soldiered on regardless.

John Cooper
Emeritus Professor of Quantum Matter

I first knew Doug as a student, when he was one of those people who always seemed willing to help. He was extraordinarily knowledgeable, patient, and approachable, and no matter how busy he was, he always found time to support students and researchers with their experiments and equipment.

Later, when I became a Senior Technical Officer myself in a role that evolved from Doug's, I came to appreciate another side of him. Inheriting some of the materials, records, and documentation he had assembled gave me a real insight into the care, organisation, and professionalism he brought to his work. Everything was thoughtfully curated and meticulously maintained, reflecting the same conscientious and dependable character that so many colleagues remember.

What impressed me most was that his contribution did not end when he left. The systems, knowledge, and culture he helped establish continued to support researchers for many years afterwards. As I developed in my own career, I often found myself drawing on the standards he had set and the example he had provided.

Doug's influence extended far beyond the equipment he maintained or the facilities he supported. Through his patience, generosity, and dedication to helping others succeed, he helped shape the experiences and careers of many students, researchers, and technical staff. I count myself among them.

Cheng Liu
Research Laboratory Manager at the Department of Physics.

ABOVE: **Doug Astill at Anglesey Abbey circa 2004.**

An interview with
Lucy Oswald

Lucy Oswald joined the Cavendish in January as our new Assistant Professor in Data-Driven Radio Astronomy. Her research focuses on pulsars, the enigmatic neutron stars famously discovered in Cambridge by Dame Jocelyn Bell Burnell. Lucy is building on that legacy and forging a path for future generations.

Lucy inside Murriyang, the 64-metre Parkes radio telescope in New South Wales, Australia.

Can you tell us who you are and what you work on?
I'm an Assistant Professor in Data-Driven Radio Astronomy at the University of Cambridge. And the clue to what I work on is in the two parts of that title: the data-driven side and the radio astronomy side. I study pulsars, which are neutron stars that emit beams of radio waves. They were discovered over half a century ago, and we still don't really understand how or why they produce those beams.

Part of my work is about studying that emission directly, by observing as many pulsars as possible and looking for trends in their behaviour. The other part is using pulsars as tools, because their radio waves travel through the Milky Way and interact with things like dust, plasma and magnetic fields. That lets us build up maps of parts of the galaxy that we otherwise wouldn't be able to see. It's a lot of detective work, and it's a lot of fun.

What first drew you to astrophysics, and why pulsars specifically?
I think it was a combination of things. One was just the excitement of astrophysics: the big open questions, trying to understand space and the extremes of what's possible. The other was that as I studied physics, I realised that what I really enjoyed was the computational side: playing with data, extracting trends, looking at statistics.

Those two things came together quite naturally in astrophysics. I did some undergraduate projects on galaxies, but I actually came to pulsars almost by chance, during a PhD interview. We ended up discussing a pulsar paper, and I found the conversation so interesting that I ended up asking if my interviewer was offering a PhD project.

The pulsar research field is so dynamic and there is such a wide range of things you can investigate with them – there will be a connection to just about every area of physics you can think of! I barely knew about pulsars during my undergraduate degree, but once that opportunity appeared, I thought, *right, this is the thing for me*, and I've never regretted it.

What does 'big data' look like in pulsar astronomy?
I feel quite privileged actually, because I've seen this growth happen in real time. In my first PhD project I studied one pulsar. Then it became two, then 84, then around 300. Now I'm part of a project called the Thousand Pulsar Array, where we monitor hundreds of pulsars every single month.

The data are big in lots of different ways. We're looking at many pulsars, we're observing them repeatedly over time, and within each observation you have huge numbers of individual pulses. Each pulse can look different, and then on top of that you're observing across many radio frequencies.

So it's not just the quantity of data, it's also the number of dimensions of that data set, which means that there are many different avenues to explore.

What's the research question you're most obsessed with right now?
The big questions I'm currently trying to answer are: *Why is pulsar radio emission time-variable, and how does the pulsar magnetic field evolve over its lifetime?* I'm particularly interested in using the polarisation of pulsar radio emission to answer these questions, because it gives you direct information about the magnetic fields around the neutron star, which makes it an exciting diagnostic tool.

Advancing our understanding of pulsar physics enables us to push the boundaries of the laws of physics at the extremes – densities, magnetic fields, temperatures – and it also affects how well we can use pulsars as tools, for things like studying the Galaxy or even searching for gravitational waves.

How would you describe the current landscape for women in astrophysics?
There's still a gender imbalance, although astrophysics is generally more balanced than some other areas of physics. I've always found it a welcoming and friendly environment, and I've never really felt that being a woman was an issue day-to-day personally. But I try not to comment on generalities based on my own personal experiences – it's much more instructive to consider large-scale trends and notice which people are absent from the community.

The biggest change for me recently has been having a child and taking maternity leave. Research timelines don't stop, and that can be challenging. I was fortunate to have lots of support and flexibility, but I never fully left work, even though I was officially on maternity leave. I'm very aware that this can have wider systemic effects, particularly for early-career researchers, and that this is going to predominantly impact women. This is not specific to astrophysics or even physics, it's a wider research issue.

ABOVE: **Lucy outside Murriyang, the 64-metre Parkes radio telescope in New South Wales, Australia.** BELOW: **Lucy in front of the Lovell telescope at Jodrell Bank Centre for Astrophysics.**

Have mentors or role models made a decisive difference for you?
Absolutely. My PhD supervisor, Aris Karastergiou, and a close collaborator, Simon Johnston, were incredibly supportive. Early on, they made it clear that no question was a silly question, which gave me the confidence to explore ideas properly.

I'd also mention Professor Dame Jocelyn Bell Burnell. I was very lucky to get to know her during my PhD, and she's been a fantastic source of advice, perspective and common sense. She's an extraordinary role model.

To conclude, what would you say to a girl who loves space but doesn't feel she belongs in physics?
Physics, and especially astrophysics, is often seen as very technical or very mathematical, and of course maths is part of it. But at its heart, it's incredibly creative. You're thinking about possibilities, asking *what if*, coming up with ideas about how the universe might work.

If you're excited and curious, that's what matters. You don't have to fit a stereotype. Most people in the field are there simply because they're fascinated by the questions.

The Cambridge Festival comes to the Ray Dolby Centre

March saw us open our doors for the first Cambridge Festival events hosted in the Ray Dolby Centre where, as part of the university-wide festival, we welcomed the public in for a day of talks, demonstrations, and hands-on activities. Saturday 21 March was the West Cambridge day, and we collaborated with departments across the West Cambridge Innovation District to ensure attendees were aware of the wide range of events on offer. The Cavendish's day opened with a talk from the inimitable Dave Ansell, of Sciansell, in which he provided a long-overdue update to Faraday's famous 'Chemical History of a Candle' talks. Audiences learnt about the science behind modern lighting systems via a series of fires, sparks, and carefully controlled explosions. In the afternoon, audiences went head-to-head with Sam Gregson, the 'Bad Boy of Science', and our own High Energy Physics (HEP) research group in a series of challenges based around the cutting-edge particle physics being done at CERN. Despite a plethora of PhDs and a Professor – Tina Potter – making up the High Energy Physics (HEP) team, strength of numbers triumphed and the audience won the competition. For our final talk, Sam Grimshaw joined us from next door to show how the Whittle Laboratory is developing the technology that will underpin carbon zero aircraft propulsion systems. Alongside this lofty aim, he demonstrated how the science used to design and test jet engines has lifted the veil on the art of swing bowling in cricket.

Parallel with our esteemed speakers, we ran the East Anglia heat of the national 3 Minute Wonder competition. Growing from a local competition first held 14 years ago, 3 Minute Wonder tasks early career researchers with explaining their work to a general audience in only three minutes, using one slide and as many props as they like. This year's winner was Daniel L Robins, a PhD student from the Kavli Institute for Cosmology's REACH project, with his talk 'Unveiling Cosmic Dawn'. The national final was held on 27 May at the Royal Institution in London and, despite a strong showing from Daniel, the competition was won by Tara Ryan, from the University of Limerick and representing Ireland.

Hands-on activities and direct engagement with researchers are cornerstones of our engagement activities, and we were delighted to have representatives from the Vision Lab and HEP research group take part this year. Visitors to the Vision Lab exhibit were shown a variety of ways in which imaging and light technologies

are being used to identify tumours and assist other healthcare issues, and how the team are working to ensure these technologies work well for all skin tones. Continuing the theme of viewing the invisible, the HEP group set up a cloud chamber and their muon detector. This allowed visitors to see the subatomic particles that pass around (and through) us and learn about the work high energy physicists are doing to understand the fundamental building blocks of the cosmos. Elsewhere, visitors used their understanding of forces to build bridges and self-supporting structures using some of the Outreach Office's practical kit, and Will Hay, Chief Technician from the Department of Engineering, brought his camera obscura and made full use of the Ray Dolby Centre's views over Cambridge to practically demonstrate the fundamentals of optics. The ever-popular planetarium from the Mark Rutherford School was housed in our first-year undergraduate labs, giving those lucky enough to secure tickets a peek into the teaching wing.

Following the public activities of the weekend, we welcomed students from local schools into the department for the Festival's schools days. These days aim to bring researchers and students together to encourage young people to pursue higher education and research careers through curriculum-relevant talks, workshops, and activities. Over two days, more than 1000 students visited the Departments of Computer Science, Material Science and Metallurgy, Physics and the Veterinary School. The Ray Dolby Auditorium hosted the largest lectures, attended by nearly 400 students, and we welcomed over 300 students over the two days into the nearby seminar rooms for hands-on physics activities based around the physics curriculum.

March also saw the last of this academic year's Outreach programmes. The Cambridge Physics Experience finished with a week of Year 7 events that welcomed around 200 students from around the UK into the Department, who used their understanding of curriculum physics to develop the most effective mission to Mars. This required that they design the wheels and suspension system for a lego rover, effectively cushion an accelerometer to reduce the force it expriences, and design an aerodynamic shell for their lander. This marks the end of another year of our activities for Year 7, 9, and 12 students, and bookings will open soon for the 2026/27 programme. Preparations are well underway for this September's Physics at Work event, when we hope to build on the success of last year and bring another 2000 students face-to-face with those working in physics-related careers to show them what is possible with further study in physics.

More information about our programmes can be found here: https://outreach.phy.cam.ac.uk

Our work relies on generous donations of all amounts, if you would like to contribute to our activities, please do so here: https://outreach.phy.cam.ac.uk/donations

News in brief

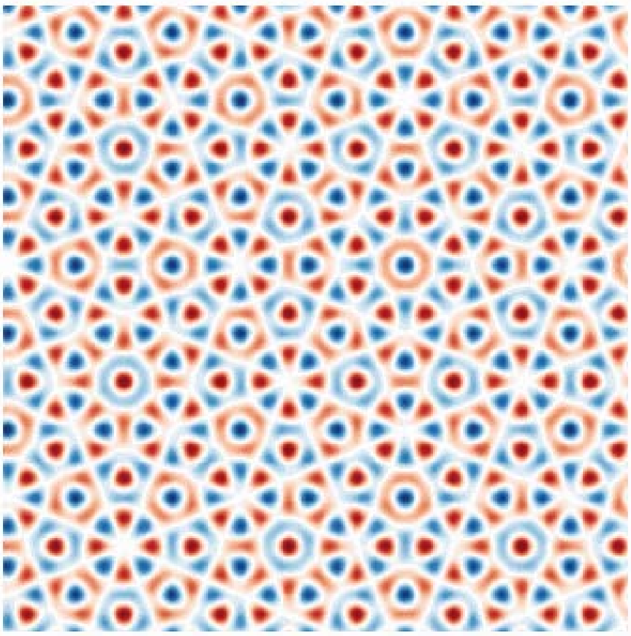
Research news

Fibre twist creates a new pathway for light

Researchers from Cambridge, Bath and international partners have developed a new optical fibre that keeps light on course even through bends, twists or structural imperfections. Published in *Nature Photonics*, the work introduces a controlled twist during fibre fabrication that creates topologically protected pathways, causing light to flow around defects rather than scatter from them. The result is far more robust signal transmission, with potential applications in high-speed communications, precision sensing and quantum technologies. **Anton Souslov** of the Cavendish Laboratory was among the co-authors.

Analytical breakthrough sheds new light on quasicrystals

Researchers at the Cavendish Laboratory have answered a longstanding question about quasicrystals – extraordinary materials whose atoms form ordered but never-repeating patterns, found in everything from meteorites to the debris of the first atomic bomb test. A new theoretical study, published with an Editors' suggestion in *Physical Review B*, shows for the first time how true energy gaps can arise in quasicrystals, bringing our understanding of these materials meaningfully closer to that of ordinary periodic crystals. The work, led by PhD student **Emmanuel Gottlob** in **Ulrich Schneider's Many-body Quantum Dynamics group**, provides analytical tools capable of making exact predictions valid in the infinite-size limit – a significant step forward for both theory and future experiments.



Repeated 8-fold optical quasicrystal.
Credit: Emmanuel Gottlob

Topological excitons open new frontier in organic semiconductors

Researchers at the Cavendish Laboratory, working with colleagues from Cambridge's Department of Materials Science and the University of Manchester, have discovered a new class of topological excitons in organic semiconductors – and shown that their inherent topology significantly enhances how they move through a material. Published across two papers in *Nature Communications*, the work builds on the topological tradition associated with former Cavendish Laboratory members Kosterlitz, Thouless and Haldane, whose Nobel Prize-winning insights now underpin everything from superconductors to quantum computers. The new findings suggest that the chemical structure of organic semiconductors can be tuned to control this topology, with promising implications for more efficient solar cells, LEDs and other optoelectronic devices.

Nu Quantum opens state-of-the-art trapped-ion qubit networking lab in Cambridge

Nu Quantum, a spin-out from the Cavendish Laboratory has opened a new state-of-the-art trapped-ion networking laboratory in Cambridge, their first dedicated industrial R&D facility for distributed quantum computing in the UK and Europe.

Mete Atatüre, Head of the Cavendish Laboratory and Founding Advisor at Nu Quantum, highlighted the significance of industry-led research in keeping the UK at the forefront of quantum science and technology. He noted that quantum interconnection remains a critical bottleneck, and the new testbed will help push the limits of networked quantum systems at industrially relevant scales.

Atomic-scale contamination found to impact performance of wafer-scale 2D Materials

Chenyang Zhao, Sam Lambrick, Ke Wang, Shaoliang Guan, Aleksandar Radić, David Ward, and Boyao Liu from the Surface Physics group, led by **Andy Jardine** at the Cavendish Laboratory - have used the CORDE Atom Scattering facility to uncover how even trace levels of contamination can alter the behaviour of atomically thin materials. A new study published in *Advanced Functional Materials* demonstrates how scanning helium microscopy can detect sub-monolayer contamination across wafer-scale 2D materials, revealing contamination invisible to conventional techniques.

The work shows that tiny amounts of adventitious carbon are enough to disrupt atomic-scale order on MoS_2 surfaces, potentially affecting the performance, reliability and reproducibility of next-generation 2D-material devices. The research was carried out in part at CORDE, supporting access to advanced characterisation capabilities at the Cavendish Laboratory.

Awards and recognition

Nicola Marzari wins 2025 Feynman Theory Prize for Nanotechnology

Nicola Marzari has been awarded the 2025 Feynman Prize in Theory, recognising his contributions to nanotechnology.

Marzari has been honoured 'for developing the theoretical and computational infrastructure that underpins modern atomically precise materials discovery', and receives this award alongside Nobel laureate Ben L. Feringa from the University of Groningen.

A leading figure in materials modelling, he was appointed Cavendish Professor of Physics in September 2025. His research is dedicated to the development and application of electronic-structure simulations to understand, predict, and design the properties and performance of novel materials and devices.

Congratulations to our three 2026 Research Culture Nominees!

Many congratulations to our three Cavendish colleagues, **Sinah Legner, Oliwia Zawadzka and Sarah Bohndiek**, for their nomination in the Research Culture Celebration, for their contributions to building and sustaining a positive and supportive Research Culture at the University of Cambridge. As Vice-Chancellor Professor Deborah Prentice said in her remarks: 'A healthy research culture underpins academic excellence: it is not a luxury or an add-on.'

The Research Culture Celebration event was the culmination of a two-week Research Culture Festival at the University of Cambridge.

Ray Dolby Centre wins regional architecture award

Alumni who have visited the Cavendish's new home will not be surprised to hear that the Ray Dolby Centre has won the Best New Building category at the Greater Cambridge Design and Construction Awards 2026, with a further highly commended for engineering-led design. Opened in May 2025, the building drew warm praise from judges, who described it as 'stunning' and an exemplar of function-led design – one that meets the exacting demands of cutting-edge research, from clean rooms to vibration-free zones, while remaining genuinely welcoming to visitors. Those who haven't yet made the trip to West Cambridge will find plenty of reason to do so.

Department news

Marcos Guimarães, new Associate Professor in the Physics of Energy Materials

We are pleased to welcome **Marcos Guimarães** to the Cavendish Laboratory as our new Associate Professor in the Physics of Energy Materials. Marcos joins us from the University of Groningen (NL) where his group has been established since 2019, having previously held positions at Cornell University and Eindhoven University of Technology.

His research examines how charge, light, spin and magnetism interact in quantum and van der Waals materials at the nanoscale, with the aim of advancing more energy-efficient approaches to future information technologies.

Marcos will be sharing his time with University of Groningen until the end of 2027 when he will be moving to Cambridge full time.

Save the date for the next Cavendish Alumni Reunion

Following the 150th anniversary alumni reunion in January 2025, we are looking forward to the next gathering at the Ray Dolby Centre on **Friday 29 January 2027**. Please mark your calendars for this special event.

Full details will be shared as the date approaches. We look forward to welcoming you back and celebrating together once again!

News in brief

Scott Lectures 2026 with Stuart Parkin

In February, we were honoured to welcome **Stuart Parkin** as our Scott Lecturer for 2026, continuing the tradition of our flagship colloquium series that has been running since 1930.

This marked Parkin's second time giving the Scott Lectures, following his inaugural appearance in 1996. He is the only scientist to have been invited twice, a testament to the impact and breadth of his work.

Parkin, a pioneer and global leader in spintronic materials and devices, impressed packed rooms with a trio of talks on spintronics and its role in advancing massive data-memory storage. If you missed the series, don't worry. The first two lectures are available on replay on the Cavendish YouTube channel, simply type 'Scott Lectures' in the search bar.

New partnership with Uzbekistan university

The Cavendish Laboratory has signed its first formal academic agreement with a university in Uzbekistan, establishing the BMU-Cavendish Development Initiative with British Management University (BMU) in Tashkent. The partnership opens the door to student and faculty exchange, joint research in areas including materials for AI and sustainable futures, and teaching and capacity-building collaborations.

It is the first agreement of its kind between the University of Cambridge and an Uzbek institution. The partnership benefits from the leadership of **Siddharth S. Saxena**, whose distinguished academic career bridges the Cavendish Laboratory and Central Asia, as he brings decades of engagement with Uzbekistan's scientific and educational landscape to this historic collaboration, which was formalised during a visit to the Cavendish by BMU students and staff, representatives from the Uzbekistan Embassy, and the Cambridge Central Asia Forum.

The occasion was marked by a visit to the Cavendish Laboratory by students and staff from BMU, representatives from the Embassy of Uzbekistan in London, and the Cambridge Central Asia Forum, Jesus College.

Graduate Student Conference 2025

The first Graduate Student Conference took place at the Ray Dolby Centre in December 2025. With nearly 200 registered attendees, over 50 posters presented, six student talks and one keynote talk, it proved to be an excellent day for the dissemination of scientific research and networking amongst the Cavendish Community.

Highlights included a keynote speech by Oxford physicist Ard Louis and an award ceremony recognising student excellence. **Rituparno Chowdhury** received the Abdus Salam Prize, while **Angelica Lola Danhaive** and **Skyla White** earned Cavendish PhD Prizes. **Ella Wood** took the Cavendish Contribution Prize, and the Best Poster Prize was shared by **William Brilliant, Zory Davoyan, and Aneesh Agarwal**. Huge congratulations to all winners.

Rituparno Chowdhury, winner of the Abdus Salam Prize. Credit: Vivian Perez

PhD Student Noam Mouelle secures fourth Boat Race victory

Noam Mouelle, PhD student at the Cavendish Laboratory, was competing his fourth Boat Race as a member of the Cambridge Men's Blue Boat in April. Having already contributed to three consecutive victories, Noam made it a remarkable fourth win on the 6.8 km Championship Course from Putney to Mortlake.

Noam is a PhD student with the High Energy Physics Group, part of the National Atom Interferometry Observatory and Network, using Ultra Cold Atom Technologies to investigate dark matter.

Richard Saunders (1953–2026)

The Cavendish has lost a valued colleague with the passing of Richard Saunders, who joined the Radio Astronomy Group in 1978 and spent his career making significant contributions to radio astronomy and observational cosmology. His most celebrated achievement was leading the upgrade of the 5-km telescope at Lord's Bridge into the world's first dedicated

Sunyaev–Zeldovich instrument, which in 1993 produced the first-ever image of the SZ effect – work recognised with the William Hopkins Prize of the Cambridge Philosophical Society. He went on to contribute to several landmark CMB experiments and remained a dedicated mentor to research students until retirement. He is greatly missed by colleagues, collaborators, and former students.

Mark Smith celebrates 35 Years of Service

Mark Smith, Undergraduate Laboratory Technician at the Cavendish, was recently recognised for 35 years of dedicated service to the University, marking a career that has spanned multiple departments and technical specialisms.

He first joined in December 1990 as a trainee technician in the Department of Chemistry, supporting undergraduate teaching laboratories, stores, and later working in David King's surface science research group. Mark later joined the Department of Materials Science & Metallurgy, developing expertise in materials preparation and microscopy, before moving to the Cavendish Laboratory in 2001 as an undergraduate teaching technician, where he has remained ever since. Throughout his career, he has worked alongside valued colleagues and contributed to teaching and research support.

Many congratulations to Mark for reaching this impressive milestone.

Farewell to...

Peter Sims retired in April after seven years of dedicated service to the Department's IT Services. We wish him all the very best for a happy and well-deserved retirement.

Professional Services appointments

- **Nolan Chandler** – Stores/Yard Assistant
- **Jonathan Cheng** – Finance Administrator
- **Eike Friedrich** – Electronics Design Engineer
- **Vanessa Hansen** – Postgraduate Administrator (maternity cover)
- **Kamaldeep** – Facilities Assistant
- **Suzanne Maton** – Purchasing Assistant
- **Himal Widooshaka Muwanwella** – Research Laboratory Technician
- **Joanne Roberts** – Programme Coordinator for Impulse
- **Lina Zvaginyte-Bagocien**e – Course Administrator

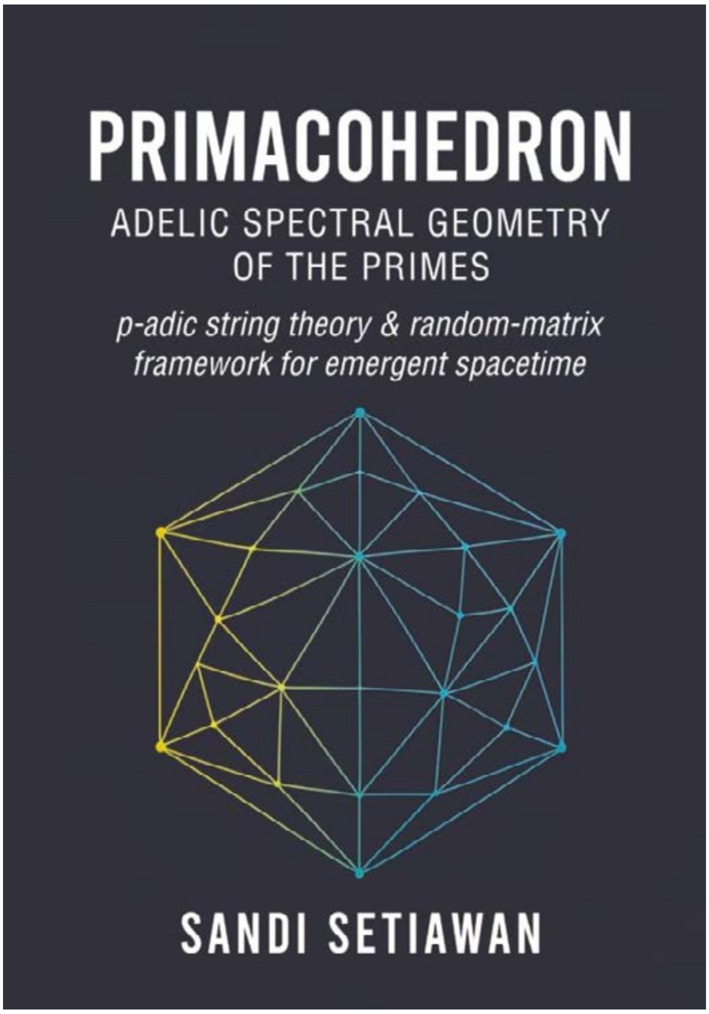
Alumni news

New book on prime numbers and the structure of spacetime

Cavendish Astrophysics alumnus (1997–2000) and Life Member of Clare Hall **Sandi Setiawan** has recently published a new book titled *Primacohedron: Adelic Spectral Geometry of the Primes* (Amazon, 2026).

The book explores a bold and interdisciplinary idea at the intersection of number theory, geometry, and theoretical physics. Rather than treating prime numbers as purely abstract objects, *Primacohedron* presents a framework in which primes function as fundamental oscillators shaping time, curvature, and information. In this vision, spacetime itself emerges as a coherent spectral structure rooted in arithmetic.

Primacohedron contributes to ongoing conversations across mathematics and physics about the deep relationship between arithmetic structure and the fabric of the universe.



CavMag goes digital

To reduce our environmental impact, we are moving to one printed issue per year while keeping our regular publishing rhythm of two issues per year. The autumn 2026 issue of CavMag will be digital only, available as a PDF and on its digital home at...

cavmag.phy.cam.ac.uk

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.

Stay in the loop

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 (**hoo@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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