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The high-energy and particle-physics division of the European Physical Society (EPS) has announced the winners of its 2017 prizes, awarded at the EPS Conference on High-Energy Physics held in Venice on 5–12 July.

The 2017 High Energy and Particle Physics Prize for an outstanding contribution to the field was awarded to Erik Heijne of Czech Technical University in Prague, Robert Klammer of the University of Hamburg and DESY, and Gerhard Lutz of the Max Planck Institute for Physics, “for their pioneering and leading roles in the LIGO observatory that led to the direct detection of gravitational waves, opening a new window to the universe”. LIGO has recently detected its third gravitational-wave event, and a global effort is mounting to build further such observatories (see p11).

Theorist Simon Cann-Huot of McGill University has won the 2017 Gribov Medal for outstanding work by a young physicist in theoretical particle physics and/or field theory, “for his groundbreaking contributions to the understanding of the analytic structure of scattering amplitudes and their relation to Wilson loops”. The Young Experimental Physical Prize for outstanding work by a young physicist, meanwhile, was won by Xin Qian of Brookhaven National Laboratory, “for his key contributions to the Daya Bay Reactor neutrino experiment that led to the measurement of the neutrino mixing angle $\theta_{13}$.

The 2017 Outreach Prize was awarded to Michael Hoch, who is a member of the CMS collaboration, “for initiatives highlighting the conceptual and physical beauty of high-energy physics, and the inspirational qualities that are common to both art and science”. Finally, the 2017 Special Prize of the EPS high-energy and particle-physics division was awarded to René Brun of CERN, “for his outstanding and original contributions to the software tools for data management, detector simulation, and analysis that have shaped particle and high-energy physics experiments for many decades”. Brun pioneered the GEANT3 detector-simulation system, co-ordinated the development of the PAW (Physics Analysis Workstation) platform, and in 1995 created the ROOT system while working for the NA49 heavy-ion experiment.

High recognition for CERN Director-General

On 20 June, CERN Director-General Fabiola Gianotti was received as a Foreign Associate of the French Academy of Sciences in Paris. Established in 1666, the Academy has 262 members, including 138 foreign associates. Also in June, she received an honorary doctorate from the University of Roma Tor Vergata and also the 2017 Tommasini Prize from the University of Roma La Sapienza, “for the innumerable contributions to particle physics that led her to play a leading role in discovering the Higgs boson as spokesperson of the ATLAS experiment and in the orientation of current and future research as DG of CERN.” The prize money will be donated to the CERN & Society Foundation for educational programmes.

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Two schools win beam time at CERN

On 13 June, CERN announced the winners of its 2017 Beamline for Schools competition. Selected from 180 team entries from 43 countries, totalling around 1500 high school students, the winners were “Charging Cavaliers” from École secondaire catholique Père-René-de-Galinée in Cambridge, Canada, and “TCO-ASA” from l’Ecole Centrale de Nantes in France. In September the teams will come to CERN to carry out their own experiments at a fully equipped CERN beamline. Charging Cavaliers, comprising 12 students, plan to search for elementary particles possessing fractional charge by observing their light emission in the same type of liquid scintillator as that used in the SND experiment at SNOLAB, Canada. Team TCO-ASA, comprising eight students, has chosen to build a Cherenkov detector at its school and wishes to test it in a real particle beam.

The first Beamline for Schools competition was launched in 2014 on the occasion of CERN’s 60th anniversary. To date, winners from the Netherlands, Greece, Italy, South Africa, Poland and the UK have performed their experiments at CERN.

2017 GÉANT Community Awards

GÉANT is a fundamental element of Europe’s e-infrastructure, delivering a high-bandwidth and high-speed fibre-optic backbone for Europe’s national research and education centres. Since 2012, the GÉANT Community Awards have honoured individuals who have contributed significant ideas, time and expertise to the development of the network. The 2017 awards were presented at the TNC17 networking conference in Linz, Austria.

Massimo Parovel of the Music Conservatory Giuseppe Tartini, Trieste, had the idea to enable performing artists to interact even if they are located thousands of kilometres apart, resulting in a low-latency audiovisual system called LOLA that is now being used for events and educational purposes. Husband-and-wife team Tomasz Wolniewicz and Maja Górecka-Wolniewicz of PŚNC and Nicolaus Copernicus University shared an award for their work on the edrostream Configuration Assistant Tool and other technical assistance.

Finally, Edward Short of CERN’s IT department was commended for making significant contributions through her leadership of work in the REFEDS Framework for Federated Identity, which enables incident response to be co-ordinated across federated organisations.

On 16 May the SESAME light source in Jordan was officially opened by King Abdullah II marking a new era of research in the region covering fields ranging from medicine and biology, through materials science, physics of novel healthcare, the environment and archaeology.

An intergovernmental organisation, SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) is the first regional laboratory for the Middle East and neighbouring regions. It is based around a 42 m-diameter storage ring in which electrons generate intense beams of synchrotron light for diverse user experiments. First turns of the electrons took place in January, and SESAME’s initial research programme with three beamlines will be operational this year.

CERN has played a major role in the facility, notably through the European Commission-funded CESSAMag project, which provided the magnet system for SESAME’s main ring and brought CERN’s expertise in accelerator technology to the project. The May ceremony also saw a changeover in SESAME’s organisation, with former CERN Director-General Rolf Heuer succeeding fellow former CERN Director-General Chris Llewellyn Smith as the new president of the SESAME Council. “SESAME truly embodies the spirit of scientific curiosity and collaboration that is the driving force of human progress,” said Fabiola Gianotti, Director-General of CERN at the event. “CERN and SESAME have this in common: both were established to provide a centre of scientific excellence and to foster collaboration among neighbouring countries.

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On 23 May 2017, the third edition of the High Luminosity LHC (HL-LHC) Industry Day took place in Warrington, a few minutes away from Daresbury Laboratory in the UK, at the two-day event, jointly organised by CERN and the Science and Technology Facilities Council (STFC), gathered some 200 participants from 17 European countries. Key engineers and physicists from CERN and STFC presented the technical challenges of the HL-LHC project to numerous company delegates attending the event. The face-to-face meetings arranged with the CERN engineers were also an excellent opportunity for companies to learn more about the key components of the HL-LHC upgrade and the upcoming calls for tenders. The HL-LHC will allow the LHC to achieve instantaneous luminosities a factor five larger than its nominal value, and the project’s estimated CHF950 million cost will be realised within a constant CERN budget. The HL-LHC study phase started in 2010 and the commissioning phase will finish in 2026. The upgrade is crucial not only for the full exploitation of the LHC’s physics potential, but also to enable operation of the collider beyond 2025.

More than 1.2 km of the present LHC plus associated technical infrastructure will be renewed – a challenge that can only be accomplished with the strong involvement of European industry. Since 2012, the HL-LHC has therefore organised events to connect CERN with potential industrial partners that can meet the specific technical challenges.
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The 8th International Particle Accelerator Conference (IPAC) took place in Copenhagen, Denmark, on 14–19 May, and was attended by more than 1550 participants from 34 countries. Hosted under the aegis of the European Spallation Source (ESS) and organised under the auspices of the European Physical Society (EPS) accelerator group and the International Union of Pure and Applied Physics, the event was also supported by the MAX-IV facility and Aarhus University.

Although accelerators were initially developed to understand the infinitesimal constituents of matter, they have evolved into sophisticated instruments for a wide range of fundamental and applied research. Today, particle accelerators serve society in numerous ways, ranging from medicine and energy to the arts and security. Advanced light sources are a case in point, and this technology is attracting the attention of several laboratories keen to build compact free-electron lasers. In the field of novel accelerator concepts, a new scheme to produce very low-emittance muon beams based on the interaction between a 45 GeV positron beam and a target has been devised by researchers at INFN Frascati. Finally, with increasing attention being paid to the energy efficiency of accelerators, major steps are being made in the domain of high-efficiency RF sources, where efficiencies of up to 85% were reported at this year’s IPAC event.

The Copenhagen conference saw 115 companies from 16 countries present their products as part of an industrial exhibition, which was complemented by lively panel discussions on industrial careers, intellectual property and other relevant issues. In total there were 45 invited and 51 contributed oral presentations and approximately 1440 posters, with the EPS accelerator group also awarding its 2017 prizes (CERN Courier April 2017 p38). The 9th IPAC will take place in Vancouver, Canada on 29 April–4 May 2018.

Several new directions for the study of this primordial state of matter. From the Higgs sector, CMS reported on observations of Higgs decay to two particles with a significance of 4.9 standard deviations compared to SM backgrounds. Differential cross-sections for Higgs decays to two Z bosons, which test properties of the Higgs such as its spin and parity, also act as a probe of perturbative QCD, were shown by ATLAS. Throughout the conference, it was clear that precision studies of the Higgs sector are a critical element in elucidating the nature of the Higgs boson itself, as well as understanding electroweak symmetry breaking and searching for physics beyond the SM.

In addition to these highlights, a broad spectrum of results were presented. These ranged from precision studies of the SM, such as new theoretical developments in electroweak production, to numerous new search results, such as searches for low-mass dark-sector mediators from the CMS experiment and searches for supersymmetry in very high-multiplicity jet events for ATLAS. The conclusion from the conference was clear: we have learnt a tremendous amount from the Run 2 LHC data but there is still much more to come. Therefore eagerly await the newest data from the LHC to help further discriminate the SM, cast light on the nature of the Higgs, or to find an entirely new particle.

**LHC physics shines in Shanghai**

The Large Hadron Collider Physics (LHC-P) conference took place at Shanghai Jiao Tong University (SJTU) in China, on 15–20 May. One of the largest annual conferences in particle physics, the timing of LHC2017 chimed with fresh experimental results from the ALICE, ATLAS, CMS and LHCb experiments based on 13 TeV LHC data recorded during 2015–2016. The conference saw many new results presented and also offered a broad overview of the scientific findings from Run 1, based on lower-energy data.

One of the main themes of the conference was the interplay between different results from various experiments, in particular those at the LHC, and the need to continue to work closely with the theory community. One such example concerns measurements of rare massless-vector-boson (V) processes in particular: decay $V \rightarrow 4 \tau$, which is sensitive to new physics and could probe the presence of new particles through the study of the $B^0$ helicity structure. The LHCb collaboration has found several discrepancies with Standard Model (SM) expectations, including a more than three-standard-deviation discrepancy in the angular distributions of this $B^0$ decay. New results presented by ATLAS and CMS have created further tension in the situation (see diagram), and more data from LHC Run 2 and continued theoretical developments will be critical in understanding these decays. The LHCb experiment showed a surprising enhancement of strange-baryon production in proton-proton collisions (CERN Courier June 2017 p10). In nucleus–nucleus collisions, this enhancement is interpreted as a signature of the formation of a quark–gluon plasma (QGP) – the extreme state that characterised the early universe before the appearance of hadrons. The first observation of strangeness enhancement in high-multiplicity proton–proton collisions hints that the QGP also formed in collisions of smaller systems and opens new directions for the study of this extreme state.

Exploring axions and WIMPs in Greece

On 15–19 May, the historic Greek city of Thessaloniki hosted the 13th annual edition of the Patras Workshop on Axions, WIMPs and Dark Matter. The first meeting in 2005, the event has evolved into an important annual conference of the sotoparticle community, addressing questions related to dark matter and dark energy both from the experimental and theoretical sides. Related topics from neutrino or astrophysics complement the agenda. The all-time high of more than 120 scientists attended the workshop this year, indicating the ever-growing interest in the quest for dark matter and especially for axions.

As well-established dark-matter candidates, along with weakly interacting massive particles (WIMPs), axions and axion-like particles (ALPs) are a central topic of the workshop. A large number of ongoing, planned and proposed experiments cover the full axion mass range with a good-chance of detection. The most stringent experimental bounds on axion-to-photon couplings still come from “helioscopes” such as the CAST experiment (p10). New large magnets to convert axions produced in the Sun to detectable X-ray photons. New proposals discussed at the workshop aim at improving the sensitivity of experiments but also at extending their reach to dark matter axions and dark-energy candidates such as chameleons (scalar particles that change their coupling strength in response to the local matter density). Dedicated chameleon searches were presented, exploiting both their coupling strengths to dark matter, the latter using a novel opto-mechanical detector.

Dark-matter axions are the target of “helioscopes”, which search for relic axions in the galactic halo using ultra-cold resonant microwave cavities immersed in a magnetic field. Various techniques to reach higher frequencies and to move the axion mass...
Accelerator experts meet in Copenhagen

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Although accelerators were initially developed to understand the infinitesimal constituents of matter, they have evolved into sophisticated instruments for a wide range of fundamental and applied research. Today, particle accelerators serve society in numerous ways, ranging from medicine and energy to the arts and security. Advanced light sources are a case in point, following the steady improvement in their performance in terms of brilliance and temporal characteristics. MAX-IV and the ESS, which lie just across the Öresund bridge in Sweden, are two of the most powerful instruments available to life and material scientists. Their high brilliance and intensity make them attractive for experiments on materials science, chemistry, physics and biology. The high performance of these accelerators is due to improvements in modern superconducting magnet technology, which now allows for the construction of magnets with field strengths of up to 15 T.

The conference was the interplay between different results from various experiments, in particular those at the LHC, and the need to continue to work closely with the theory community. One such example concerns measurements of rare B-meson decays and in particular the decay $\psi(2S) \rightarrow K^*\ell^+\ell^–$, which is sensitive to new physics and could probe the existence of new particles through the study of the $B^+$ helicity structure. The LHCb collaboration has found several discrepancies with Standard Model (SM) expectations, including a more than three standard-deviation discrepancy in the angular distributions of this $B^+$ decay. New results presented by ATLAS and CMS have created further tension in the situation (see diagram), and more data from LHC Run 2 and continued theoretical developments will be crucial in understanding these decays.

An exciting result from the ALICE experiment showed a surprising enhancement of strange-baryon production in proton–proton collisions (CERN Courier June 2017 p16). In nucleus–nucleus collisions, this enhancement is interpreted as a signature of the formation of a quark–gluon plasma (QGP) – the extreme state that characterised the early universe before the appearance of hadrons. The first observation of strangeness enhancement in high-multiplicity proton–proton collisions hints that the QGP may also form in collisions of smaller systems and opens new directions for the study of this primordial state of matter.

From the Higgs sector, CMS reported an observation of Higgs decays to two particles with a significance of 4.9 standard deviations compared to SM backgrounds. Differential cross-sections for Higgs decays to two Z bosons, which test properties of the Higgs such as its spin and parity and also act as a probe of perturbative QCD, were shown by ATLAS. Throughout the conference, it was clear that precision studies of the Higgs sector are a critical element in elucidating the nature of the Higgs boson itself, as well as understanding electroweak symmetry breaking and searching for physics beyond the SM.

In addition to these highlights, a broad spectrum of results were presented. These ranged from precision studies of the SM, such as new theoretical developments in electroweak production, to numerous new search results, such as searches for low-mass dark-sector mediators from the CMS experiment and searches for supersymmetry in very high-multiplicity jet events for ATLAS. The conclusion from the conference was clear: we have learnt a tremendous amount from the Run 2 LHC data but are yet to fully understand the Higgs. Therefore eagerly awaiting the newest data from the LHC to help further disentangle the SM, cast light on the nature of the Higgs, or to find an entirely new physics.

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measurement in magnetic field

Reach new heights

PT2026 NMR Precision Teslameter

The Metrolab PT2026 sets a new standard for precision magnetometers. Leveraging 30 years of expertise building the world's gold standard magnetometers, it takes magnetic field measurement to new heights, measuring higher fields with better resolution.

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lepton machines, and a new reference layout based on a 97.75 km-circumference tunnel was presented. The key feature of the FCC-hh medium-to-long term. The formidable feat of creating the first LHC -- a machine that offers significant increases in energy and luminosity compared with today’s machines – also requires new levels of global co-operation.

The FCC study envisions an accelerator complex that would push the limits of what is possible to reach the highest energies. Good progress on the next generation of colliders. The collider scenarios explored in the FCC study pose a number of technological challenges. The FCC Week 2017 witnessed a growing worldwide eagerness from the scientific and engineering communities, with participants discussing technological and manufacturing breakthroughs that could help to meet the FCC’s performance and cost goals. As the CERN director for accelerators and technology, Frédérick Bordry, remarked: “Designing and building a post-LHC accelerator should be based on the use of breakthrough technologies to provide the beam energy, intensity and brightness that are required for a future discovery machine. The ongoing FCC R&D programme is a natural extension of the High-Luminosity LHC activities and it ensures the efficient use of past investments.

The key to reaching the highest energies is the development of new superconducting magnets able to reach dipole fields of 16 Tesla twice that of the LHC.

Significant advances in superconductors, superconducting RF technologies and RF power sources are needed, as is a new beam vacuum system to meet the challenges of going to higher energies. Good progress towards the CDR has been made for other systems, including cryogenics and the supply of electricity.

FCC Week 2018 will take place in Amsterdam and will be the final meeting before the presentation of the Conceptual Design Report scheduled for the end of 2018. By then, results from the second round of the LHC should provide another crucial input needed by the global high-energy physics community to decide on the next generation of colliders.
Participants of PATRAS2017, which focuses on the low-energy, high-intensity frontier.

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The PT2026 offers unprecedented flexibility in the choice of parameters, interfacing and probe placement, as well as greatly improved tolerance of inhomogeneous fields. And with Ethernet & USB interfaces and LabVIEW software, it fits perfectly into modern laboratory environments.

Coverage to the meV region is under study, and first results on axion masses up to about 24 meV were reported by the HAYSTAC collaboration. Other projects aim at reaching even higher masses: multi-vane cavities, distributed Bragg reflectors, photonic band-gap resonators and multi-layered dielectric discs. These experiments employ cutting-edge superconducting technology and amplifiers developed for quantum-computing research.

Superconducting cavities that can achieve quality factors close to 10^10 and ultra-high field magnets (up to 25 T) are also being developed at IBS/CAPP in Korea.

On the theory side, talks ranged from axions in string theory to estimates of the axion mass using the tools of lattice QCD. Several contributions focused on the observed anomalous transparency of the universe for high-energy photons, which might be explained by processes involving ultra-light ALPs with masses in the meV region or below. Others discussed whether the current density of dark-matter axions might differ from the homogeneous canonical picture due to the presence of axion condensates, caustics and mini-clusters.

A plethora of experiments aim at the direct detection of freele WIMP-induced nuclear recoils. WIMPs are one of the prime candidates for cold dark matter that arise naturally in various theories beyond the Standard Model of particle physics. The search strategy differs slightly for low- and high-mass WIMPs, with the transition taking place at around 3 GeV/c, but all efforts rely on ultra-low backgrounds and low thresholds.

The Patras event saw detailed reports from the latest experimental and theoretical developments and upcoming projects -- a highlight being the first public presentation of new results from the XENON1T dark-matter experiment, which has set the most stringent limits on WIMP-nucleon scattering above WIMP masses of around 10 GeV/c^2 (see p10). WIMP physics can also be probed indirectly, for instance by the JUNO telescope, and by colliders such as the LHC. It is now clear that, while the simplest WIMP models are under some pressure given the non-detection so far, plenty of well-motivated parameter space remains.

There are also a number of promising fixed-target experiments looking for portals from the dark sector to the Standard Model, such as dark photons, and other subtle experiments to study the low-energy, high-intensity frontier. In this frame, the community can look forward to developments with CERN’s “Physics Beyond Colliders” initiative (CERN Courier November 2016 p28) and the US “Cosmic Vision” initiative.

Berlin meeting weighs up post-LHC machine

From 29 May to 2 June, more than 500 participants attended the 3rd Future Circular Collider (FCC) collaboration week in Berlin, Germany. The meeting heralds a new phase for the FCC collaboration, which will now start preparing a design report and cost estimates for all collider options, to be delivered by the end of 2018. The vibrant and global R&D programme of FCC paves the way for future energy and intensity-frontier colliders that could replace the LHC by the mid-2030s. Impressive progress is being made across all domains of the FCC study, and the large number of young researchers involved is highly promising for the future of the field.

In view of the long lead times of major projects in high-energy physics, the FCC study is exploring several possible options for post-LHC circular colliders. For CERN to retain its pole position in accelerator-based particle physics as said by CERN Director-General Fabiola Gianotti in her opening address – the laboratory “must continue to play a leading role in global efforts to develop technologies and design future colliders that could replace the LHC.”

The key to reaching the highest energies is the development of new superconducting magnets able to reach dipole fields of 16 T, roughly twice that of the LHC. Significant advances in superconductors, superconducting RF technologies and RF power sources are needed, as is a new beam vacuum system to meet the challenges of going to higher energies. Good progress towards the CDR has been made for other systems, including cryogenics and the supply of electricity.

FCC Week 2018 will take place in Amsterdam and will be the final meeting before the presentation of the Conceptual Design Report scheduled for the end of 2018. By then, results from the second round of the LHC should provide another crucial input needed by the global high-energy physics community to decide on the next generation of colliders.

Through this CERN Courier supplement the August 2017 issue is available as a PDF at cerncourier.com.
Cécile DeWitt-Morette 1922–2017

Cécile DeWitt-Morette, founder of the Les Houches summer school, passed away on 8 May at the age of 94. Born in Caen, she studied in Paris after completing her bachelor degree. In 1944 her mother, sister and grandmother were killed in the Allied bombing of Caen, but in Paris she secured a job at CNRS and was awarded a PhD three years later with a thesis about meson production. She was then invited to the Institute for Advanced Study in Princeton by Robert Oppenheimer, where she met her future husband, the US physicist Bryce DeWitt (they would go on to have four daughters).

Mixing with the best of US physics made her realise the poor situation of the field in France, especially particle physics, and drove her to do something about it. Precisely at that time, a summer school was organised at the university of Michigan in Ann Arbor, and Cécile had the idea to create such an event in France. Her beautiful eyes with double-iris rings and considerable powers of persuasion, not to mention a fantastic intuition for selecting the best possible lecturers, were difficult to resist. She had a friend whose father, the architect Albert Laprade, loaned her a piece of land at La Côte des Chavants, just above the village of Les Houches in the Arve valley, among farms and cottages. Financial input soon followed thanks to her skillful negotiating tactics, and in the summer of 1951 I was one of a few candidates to attend the school for a period of three months. She had chosen fantastic professors: Léon Van Hove for quantum mechanics and Viki Weisskopf for nuclear physics, both of whom would be future Director-Generals of CERN; Res Jost for field theory; Walter Kohn (a future Nobel Prize winner) for solid-state theory; and Claude Cohen-Tannoudji. The demand for 1951 was one of a few candidates to attend the school for a period of three months. She had chosen fantastic professors: Léon Van Hove for quantum mechanics and Viki Weisskopf for nuclear physics, both of whom would be future Director-Gen
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Charles Gruhn 1935–2017

Charles Gruhn, a long-time colleague and friend for many of us at CERN and elsewhere, passed away peacefully on 24 March. Chuck, as he was known, obtained his PhD from the University of Washington, Seattle, in 1961, and throughout his professional life he worked on the development of particle detectors and their associated electronics.

Chuck started his scientific career at the Massachusetts Institute of Technology, where he worked on nuclear reactions and on studies involving alpha particles, and in 1964 he moved to Michigan State University. His development of detectors included lithium-germanium counters, silicon semiconductors and a Ge(Li) Compton spectrometer. He also performed a large variety of proton-scattering experiments.

In 1970 he took a sabbatical at the Max Planck Institute for Physics in Munich, which was working in close contact with CERN at the time. After a short period, CERN offered him an indefinite contract, which he accepted. Since Chuck was a US citizen, this was a very rare exception for a physicist who was not from a Member State. He immediately became involved in experiments at the Intersecting Storage Rings, which recorded its first proton–proton collisions in January 1971. His work on detectors was centred on silicon semiconductors and on multiwire proportional chambers within the group of Georges Charpak. His main topic in physics was the search for fractionally charged particles indicating a signal for free quarks.

Chuck left CERN to work for three years at the University of Texas at Austin, successively. Bryce died in 2004 just as he was about to receive the Einstein Prize from the American Physical Society.

I met Cécile for the last time at IHES in 2011 where she was made an Officier De la Légion d’Honneur. On 7 May, the day before she died, I understand that she was delighted to learn that the anti-European candidate as president of France, Marine Le Pen, had been defeated.

● André Martin.
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Mixing with the best of US physics made her realise the poor situation of the field in France, especially particle physics, and drove her to do something about it. Precisely at that time, a summer school was organised at the university of Michigan in Ann Arbor, and Cécile had the idea to create such an event in France. Her beautiful eyes with double-iris rings and considerable powers of persuasion, not to mention a fantastic intuition for selecting the leading physicists, were difficult to resist. She had a friend whose father, the architect Albert Laprade, loaned her a piece of land at La Côte des Chavants, just above the village of Les Houches in the Arve valley, among farms and cottages. Financial input soon followed thanks to her skilful negotiating tactics, and in the summer of 1951 she was one of a few candidates to attend the school for a period of three months. She had chosen fantastic professors: Léon Van Hove for quantum mechanics and Viki Weisskopf for nuclear physics, both of whom would be future Director-Generals of CERN. Res Jost for field theory; Walter Kohn (a future Nobel Prize winner) for solid state physics; plus seminars by giants such as Wolfgang Pauli. We worked very hard, except for some excursions in the mountains, and learnt a lot.

The Les Houches school, of which Cécile remained director for 22 years, continued to be a complete success. Many of its students and some teachers received the Nobel prize, the Wolf prize or the Fields Medal. Among them were Pierre Gilles De Gennes and Claude Cohen-Tannoudji. The demand for basic courses dissipated over the years, but the school became a place for high-level specialised topics, and continues to be so.

Cécile also played an important role in founding the Institut des Hautes Études Scientifiques (IHES) in Bures sur Yvette, and did important work on functional integration, also collaborating with her mathematical-physicist husband. They were professors at the University of North Carolina at Chapel Hill and at the University of Texas at Austin, successively. Bryce died in 2004 just as he was about to receive the Einstein Prize from the American Physical Society.

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Gerhard Lutz 1939–2017

One of the pioneers of silicon radiation detectors, Gerhard Lutz, passed away in Vienna on 28 April. He will be remembered for numerous inventions that shaped the field of silicon detectors, his deep insight into detector physics and analysis methods, his role as mentor of many young scientists, and his modest and charming personality.

Gerhard Lutz was born in Klagenfurt, Austria, in 1939. He studied physics at the Technical University of Vienna and obtained his PhD from the University of Hamburg under Willibald Jentschke, the founder of DESY and later a Director-General of CERN. His thesis concerned the coherent bremsstrahlung and pair production on diamond crystals using the DESY synchrotron, and demonstrated the production of GeV photons with a polarisation in excess of 70%. In 1967 he moved to Northeastern University in Boston and contributed to a spectrometer experiment at Brookhaven, which had aimed to follow up on spectacular results reported earlier by the “CERN missing mass spectrometer”. The splitting of the $\Lambda$ resonance and the observation of narrow high-mass resonances. Based on high-quality data and a painstaking analysis, he showed that the CERN results were incorrect.

In 1972, Lutz took a position at MPI-Munich and initiated a precision measurement of the reaction $\pi^+ p \rightarrow \pi^- \pi^+ n$. He organised and ran the experiment, wrote the event-reconstruction software and developed the complex mathematical formalism necessary to interpret the results — marking a milestone contributions to the design and operation of the time projection chamber, including the role of tracking in relativistic heavy-ion experiments.

His principal scientific interest during the later years of his career was the study of binary stars. He developed methods for their observation, photography and analysis at home with private telescopes, recording real data once a year at the International Amateur Observatory on the Gamsberg in Namibia, Chuck’s observations found many acknowledgments due to their high-level professionalism.

Besides the many achievements in his brilliant scientific career, we would like to recall his fine personal qualities. Above all, his greatest quality was perhaps that he was simply a nice person. Our deepest sympathy goes to his wife Ute, their children and families.

His friends and colleagues.

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His friends and colleagues.

Lutz made numerous seminal contributions in the field of silicon detectors in the understanding of exclusive hadronic reactions. In the late 1970s the CERN-Munich Group expanded into the ACCMOR collaboration, which pioneered the use of high-precision silicon tracking detectors. Together with Josef Kemmer and Robert Klanner, he developed silicon microstrip detectors using planar technology and built the vertex telescope for the CERN fixed-target experiments NA11 and NA32. The achieved precision of this device ($5 \mu m$), its ability to operate reliably in a high-intensity beam and identify charm particles against a huge background of hadronic events, unleashed the success story of silicon detectors. Today, practically all high-energy physics experiments rely on this technology.

Lutz’s contributions in the field of silicon detectors are numerous: the understanding of detector instabilities due to surface effects; the development of double-sided silicon-strip detectors; the concept of fully depleted p+CCDs based on the principle of secondary depletion; the realisation of novel concepts for silicon sensors with intrinsic gain; and the invention of the DePFET detector-amplifier structure. His developments found their way into many experiments outside particle physics, in particular in astrophysics and X-ray science, and also industry. Lutz co-founded the Max-Planck-Institut Halbleiterlabor (HLL) semiconductor laboratory in 1992, the research company PNSensor in 2002, and the instrumentation company PNDetector in 2007. Until the very end he contributed to the success of both companies with his sharp mind and inventions, while his guidance, inspiration and ideas have been essential for the success of semiconductor developers in the Munich area.

Those who had the opportunity to work with Gerhard Lutz appreciated his gentle and quiet way, his competence and deep insight. His scientific standards were very high and he detested superficial statements. His unconventional and original ideas inspired many colleagues and students, and his book Semiconductor Radiation Detectors has become a classic in the field. Gerhard Lutz’s innovative and influential work was honoured by the 1996 Röntgen Award, the 2011 Radiation Instrumentation Outstanding Achievement Award, and the 2017 High Energy Physics Prize of the European Physical Society (see p47).

His friends and colleagues.
years at the Los Alamos National Laboratory in the US, where he carried out further studies on silicon semiconductor detectors and worked on the development of liquid ionisation chambers. He also received a US patent for his development of laser-beam alignment systems. In 1978 he moved to the Lawrence Berkeley Laboratory (LBL) in California, where he was a professor until his retirement in 1992. LBL was deeply involved in CERN experiments and this allowed Chuck to spend most of his time at CERN, continuing to work on the Spill Field Magnet experiment at the ISR. After the closure of the ISR, he participated in CERN’s heavy-ion programme in the search for the quark–gluon plasma with the NA36 experiment. He made major contributions to the design and operation of the time projection chamber, including the role of tracking in relativistic heavy-ion experiments.

After his retirement from LBL in 1992, Chuck became a consultant for the ATLAS experiment under a contract with the MPI Munich. He was the first to study the characteristics of single proportional drift tubes, to be produced later on in hundreds of thousands to form the ATLAS Muon Spectrometer, and was our main adviser during the development and testing of the first prototype chambers at the MPI. Although suffering from heart problems, Chuck stayed active for many years to come. His main remedy against health problems was extensive hiking on the Jura mountains.

In 1972, Lutz took a position at MPI-Munich and initiated a collaboration with Gerhard Lutz, a former colleague from his days at the University of Hamburg. Together they set out to develop a new type of silicon detector, which they called “the CERN missing mass spectrometer”. The detector would consist of an array of silicon sensors that could measure the energy deposition of charged particles in the detector. This would allow for the identification of particles that had not been detected, which would be important for understanding the hadronic interactions. The detector would be mounted on a high-intensity beam and identify charm reactions. In the late 1970s the CERN–London Group expanded into the ACCMOR collaboration, which pioneered the use of high-resolution silicon detectors. Together with Josef Kemmer and Robert Klauser, he developed silicon microstrip detectors using planar technology and built the vertex telescope for the CERN fixed-target experiments NA11 and NA32. The achieved precision of this device (5 µm), its ability to operate reliably in a high-intensity beam and identify charm particles against a huge background of hadronic events, unleashed the success story of silicon detectors. Today, practically all high-energy physics experiments rely on this technology.

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