

Faces & Places

APPOINTMENTS

KEK and Fermilab directors reappointed

The leaders of two of the world's foremost high-energy physics laboratories have been reappointed for second terms. Director general of the KEK laboratory in Japan, Masanori Yamauchi, has been granted a second three-year term lasting until 2021, while, independently, director of Fermilab in the US, Nigel Lockyer, has been appointed for a second five-year term.

Since April 2015, Yamauchi has overseen KEK's accelerator upgrades for various facilities including the transformation of KEKB into SuperKEKB (*CERN Courier* September 2016 p32). Neutrinos have been another focus of his directorship, in particular improving the precision of neutrino-mixing measurements at the T2K experiment and supporting the next generation of long-baseline neutrino experiments. The search committee cited Yamauchi's "high international scientific rating, his ability to co-ordinate relationships both inside and outside KEK, and his vision for meeting KEK's medium-term goals" among the reasons for the appointment.

Nigel Lockyer has been at the helm



Masanori Yamauchi (left) and Nigel Lockyer remain in post.

of Fermilab since 2013, before which he was director of Canada's TRIUMF laboratory. His second term, which begins on 3 September 2018, comes as Fermilab begins building its flagship Long-Baseline Neutrino Facility (LBNF), which will send neutrinos underground from Illinois to South

Dakota for the international DUNE project. During his first term, Lockyer helped to position the US as a world leader in neutrino research, in addition to Fermilab's strong role in the Large Hadron Collider and the CMS experiment at CERN, and continuing particle-astronomy programme.

AWARDS

APS announces 2018 prizes and awards

The American Physical Society (APS) has announced the winners of its spring 2018 prizes and awards, several of which recognise contributions to high-energy particle and nuclear physics.

The W K H Panofsky Prize in Experimental Particle Physics went to Lawrence Sulak of Boston University "for novel contributions to detection techniques, including pioneering developments for massive water Cherenkov detectors that led to major advances in nucleon decay and neutrino oscillation physics". Sulak helped design and build the first massive liquid-scintillator calorimeter and large-area drift chambers, and also the forward calorimeter for the CMS detector at the LHC. Also in the experimental arena, the Henry Primakoff Award for Early-Career Particle Physics was granted to Eric Dahl of Northwestern University and Fermilab, citing his fundamental contributions to the development of



(Left to right) Lawrence Sulak, Eric Dahl, Keith Olive, Michael Dine, Ann Nelson, Alexander Wu Chao, Bradley Sherrill, Edward Shuryak, who received key awards in particle and nuclear physics. The annual American Physical Society (APS) awards take into account "scores of outstanding nominees across the spectrum of physics disciplines", recognising the most accomplished, promising and respected scientists and leaders.

KEK/FNAL

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new techniques for the direct detection of dark matter, including the use of bubble chambers and xenon time projection chambers.

The Robert R Wilson Prize for Achievement in the Physics of Particle Accelerators goes to Alexander Wu Chao of SLAC National Accelerator Laboratory “for insightful, fundamental and broad-ranging contributions to accelerator physics, including polarisation, beam–beam effects, non-linear dynamics, and collective instabilities, for tireless community leadership and for inspiring and educating generations of accelerator physicists”.

Theorist Keith Olive of the University of Minnesota has won the Hans A Bethe Prize “for outstanding contributions across a broad spectrum of fields including nuclear physics, particle physics, theoretical and observational astrophysics, and cosmology, especially Big Bang nucleosynthesis and the properties of dark matter”. The J J Sakurai Prize for theoretical particle

physics is shared between Michael Dine of the University of California in Santa Cruz and Ann Nelson of the University of Washington. The citation noted the pair’s groundbreaking explorations of physics beyond the Standard Model, including their seminal joint work on dynamical supersymmetry breaking, and for their innovative contributions to a broad range of topics – including new models of electroweak symmetry breaking, baryogenesis and solutions to the strong charge-parity problem.

In the nuclear-physics area, Bradley Sherrill of the National Superconducting Cyclotron Laboratory, located on the campus of Michigan State University (MSU), won the Tom W Bonner Prize in Nuclear Physics for his scientific leadership in the development and utilisation of instruments and techniques for discovery and exploration of exotic nuclei. The citation also recognised his role in advancing the Facility for Rare Isotope Beams, which is currently under

construction at MSU. The Herman Feshbach Prize in Theoretical Nuclear Physics, meanwhile, went to Edward Shuryak of Stony Brook University “for his pioneering contributions to the understanding of strongly interacting matter under extreme conditions, and for establishing the foundations of the theory of quark–gluon plasma and its hydrodynamical behaviour”.

A further 30 prizes and awards were announced by the APS, including the Dannie Heineman Prize for Mathematical Physics awarded to Barry Simon of Caltech and IBM “for his fundamental contributions to the mathematical physics of quantum mechanics, quantum field theory, and statistical mechanics, including spectral theory, phase transitions, and geometric phases, and his many books and monographs that have deeply influenced generations of researchers”. With a few exceptions, APS prizes and awards are open to all members of the scientific community in the US and abroad.

Wang, Kim and Nishikawa awarded Pontecorvo Prize

The 2017 Bruno Pontecorvo Prize, awarded by the Joint Institute for Nuclear Research (JINR) in Dubna, Russia, has been awarded to Yifang Wang of the Institute of High Energy Physics in Beijing, Soo-Bong Kim of Seoul National University in Korea and Koichiro Nishikawa of the KEK laboratory in Japan. The prize recognises the trio’s outstanding contributions to the study of neutrino-oscillation phenomena and in particular to the measurement of the θ_{13} mixing angle in the Daya Bay, RENO and T2K experiments. The Pontecorvo Prize was established in 1995 to commemorate Bruno Pontecorvo, once assistant of Enrico Fermi and often called the father of neutrino physics.



The prize ceremony at JINR on 19 September with (left to right) Koichiro Nishikawa, Soo-Bong Kim, Yifang Wang and JINR director Viktor Matveev.

ANNIVERSARIES

ISOLDE marks 50 years of physics with exotic nuclei

On 16 October, researchers working on the ISOLDE Radioactive Ion Beam facility at CERN celebrated 50 years since it received its first beam of radioactive exotic isotopes. ISOLDE initially took protons from the oldest CERN accelerator, the synchrocyclotron, and these first ISOLDE experiments focused on studying the fundamental properties of exotic nuclei.

After the shutdown of the synchrocyclotron in 1990, a new ISOLDE experimental hall was connected to the PS Booster. Since 1992, more than 1000 different exotic beams have been produced and accelerated for the more than 500 users that now come to ISOLDE each year to perform experiments in the fields of nuclear structure, nuclear astrophysics, fundamental interactions and materials research, and recently also for biochemistry and medical-applications research.

The first test of the unique ISOLDE installation at the 600 MeV synchrocyclotron in October 1967.



Diamond anniversary



Inaugurating Diamond Light Source 10 years ago (from left): The Queen, former Diamond CEO Gerd Materlik, the Duke of Edinburgh, and former Diamond chairman David Cooksey.

On 19 October, the UK's third-generation synchrotron X-ray facility, Diamond Light Source, marked 10 years since its official opening. For the past decade, Diamond's scientific output has exceeded expectations, with 6000 peer-reviewed journal articles based on user experiments across a range of disciplines published so far. Academic and industrial user visits now exceed 9000 per

year, in addition to around 60,000 visitors ranging from undergraduates to members of the public. "With these achievements in mind, all I can say is that I am humbled and proud to be at the head of such a great project, made possible by the dedication of our current and former staff, contractors and user community from academia and industry," said Diamond CEO Andrew Harrison.



On 10–11 October, the Germany Federal Ministry of Education and Research (BMBF) together with CERN held the 13th edition of the popular industry event Germany at CERN. During the two days, 37 German companies showcased their latest products and services for scientists, engineers, technicians and buyers at CERN. The annual meeting, like similar events with other Member States, allows firms to make connections and establish leads for future contracts. Pictured on the left are CERN Director-General Fabiola Gianotti and Karl Eugen Huthmacher, director-general of BMBF's Provision for the Future – Basic and Sustainability Research department, speaking with an exhibitor.

MEETINGS

Crete workshop takes stock of hadron therapy

Understanding the fundamental laws of nature is the dream of physicists and the mandate of research institutions such as CERN. Many of us, however, are often faced with the question: "Why is this useful?" Motivated by the need to enhance awareness of the benefits of fundamental research to society and to facilitate future progress, a workshop and public event titled Ions for Cancer Therapy, Space Research and Material Science took place on 28–30 August in Chania, Crete.

Participants received a comprehensive overview of the current status of particle therapy for cancer. The number of working clinical facilities, mainly using protons, is rising rapidly. Nearly all new clinics use active beam scanning to provide more conformal doses and also the possibility to modulate fields for enhanced sparing of critical healthy tissue. Experts from several of the leading European centres – including the National Centre of Oncological Hadron therapy (CNAO) in Italy, the Heidelberg Ion-Beam



Around 50 people took part in the Crete meeting on hadron therapy.

Therapy Center (HIT) in Germany and the Paul Scherrer Institute (PSI) in Switzerland – summarised their clinical and research activities. All centres are engaged in clinical trials to provide evidence on the efficacy for different tumour entities.

The history of particle therapy is a prime example of society benefiting from

basic research, as was illustrated from the perspectives of CERN and the GSI centre in Germany as early drivers of the technology. GSI pioneered carbon therapy in Europe in the 1990s with a pilot study that eventually included 440 patients. Subsequently, a number of clinical centres were opened, the HIT in Heidelberg being the first. CERN

Faces & Places

provided valuable input with its Proton-Ion Medical Machine Study (PIMMS), which was later realised in the clinical centres of CNAO and also MedAustron in Austria.

Major issues remaining in scanned particle therapy are range uncertainty, i.e. the knowledge of the exact position of Bragg peaks within the patient, and the treatment of moving targets such as in the thorax or abdomen. Both topics were addressed in

detail, showing ways to assess and safely deliver doses to lung cancer as already performed, for example, at NIRS in Japan. Several methods were presented to use particle beams for imaging. This would enable clinicians to directly image tissue stopping power instead of converting X-ray attenuation from computed tomography (CT) scans, which is one of the major sources of uncertainty. Particle imaging could also

be performed online during therapy to assess both the location of the target and to estimate range from projection images.

Proposals for future projects in Europe, Russia and the US were also presented, underlining the need for diagnostic methods together with therapy, followed by discussions about related applications for space research and dosimetry. Specific developments of detectors routinely used for physics research were also presented, highlighting projects such as Medipix and Timepix based on silicon-detector technologies (*CERN Courier* October 2017 p17). The workshop was complemented by presentations of research activities at the nearby Technical University of Crete (TUC) related to "science for health" and details on medical applications and transfer of knowledge via companies resulting from its research projects. In addition, with the goal of bringing local universities into closer contact with international organisations planning new facilities, a special session was hosted at TUC.

Strong co-operation

On the final day of the Crete meeting, a specific session was dedicated to developments of accelerators for medical and industry purposes. These included a report from the TERA foundation and the start-up firm ADAM SA in the UK, making the case for a multi-ion research facility in parallel with new compact single-ion accelerator designs for treatment.

The benefits of strong co-operation and the best use of expertise and resources were repeatedly highlighted during presentations of the future BIOMAT projects planned at GSI/FAIR (*CERN Courier* July/August 2017 p41) and JINR for biophysics and material research. The BIOMAT facility will use heavy ions for its biophysics research programme, focusing mainly on space-radiation effects and for materials research, while NICA at JINR will offer a radiobiology and materials-science programme.

The workshop facilitated a healthy flow of information and strengthened co-operation on relevant activities in the large research centres, with valuable input from existing therapy centres and proposals for future projects. The scientific workshop was preceded by a weekend of well-received public events in the old city of Chania and concluded with an open discussion. This clearly conveyed the message that, despite the main aims of large research institutes such as CERN and GSI being fundamental research, important spin-offs have a direct impact on everyday life.

● indico.cern.ch/e/ions2017

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Madagascar physics in focus

The 9th High-Energy Physics Madagascar International Conference (HEPMAD17) was held on 21–26 September at the Malagasy National Academy in Madagascar, involving around 50 participants including 10 invited speakers from abroad. The HEPHAD conference series is unique in sub-Saharan Africa and Indian Ocean countries, and the event alternates with the QCD-Montpellier series (*CERN Courier* November 2017 p39). It is part of a programme to promote high-energy physics in Madagascar, where the iHEPMAD research institute was founded in 2002 offering masters and PhD courses, and is complemented by popular seminars delivered at different Madagascan high-schools.

This year, results from experiments at the LHC were the focus of experimental talks, covering tests of the Standard Model and



Participants at the 9th HEPHAD event.

searches for new physics by ATLAS and CMS and the production of heavy quarks by ALICE. From the theory side, iHEPMAD members presented recent results on the estimate of heavy molecules and four-quark states using the QCD spectral sum-rule approach, with preliminary results on the extraction of QCD parameters such as the coupling constant and running quark masses from the masses of the $\eta_{c,b}$ mesons.

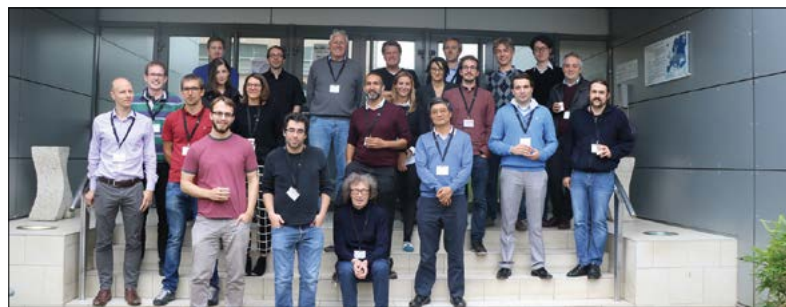
These presentations were accompanied by talks from national researchers covering climatology, technology for sustainable energies and radioprotection. The conference was also an opportunity for foreign participants to discover the natural richness and traditions, as well as the social poverty, of Madagascar. HEPHAD18 will be held in Antananarivo from 20 to 26 September 2018.

Association Gasy Maria-Mandroso

Precision electroweak discussions in Orsay

A special electroweak workshop took place in Orsay on 2–6 October with the help of the Paris-Saclay University and in co-ordination with the LHC Physics Centre (LPCC) at CERN.

With the LHC entering a new phase of precision physics studies, about 30 participants (theorists and experimentalists) were involved in lively discussions to see how uncertainties on measurements (of the W-boson mass and the Weinberg angle, for instance) could be reduced. The effort will continue within the electroweak working group of the LPCC.



Participants at the electroweak workshop at Orsay.

L. Eyraud

CAS course in advanced accelerator physics

The CERN Accelerator School (CAS) and Royal Holloway University of London (RHUL) organised a course on advanced accelerator physics held at the RHUL campus on 3–15 September. The course followed an established format with lectures in the mornings and practical courses in the afternoons. The lecture programme consisted of 38 talks, while the practical courses provided hands-on experience in beam instrumentation and diagnostics, RF-measurement techniques, and optics design and corrections. Participants selected one of the three courses and followed their chosen topic throughout the school.



S. Alden

A total of 70 students of 24 nationalities attended the course, with most participants coming from European countries, but also from Canada, China, Mexico and Russia.

Forthcoming CAS courses in 2018 will be on: beam dynamics and technologies for future colliders (Zurich, Switzerland, 21 February–6 March); beam instrumentation (Tuusula, Finland, 2–15 June); computing and simulation (Greece, November); and an introduction to accelerator physics (Romania, early autumn).

● cern.ch/schools/CAS

Faces & Places

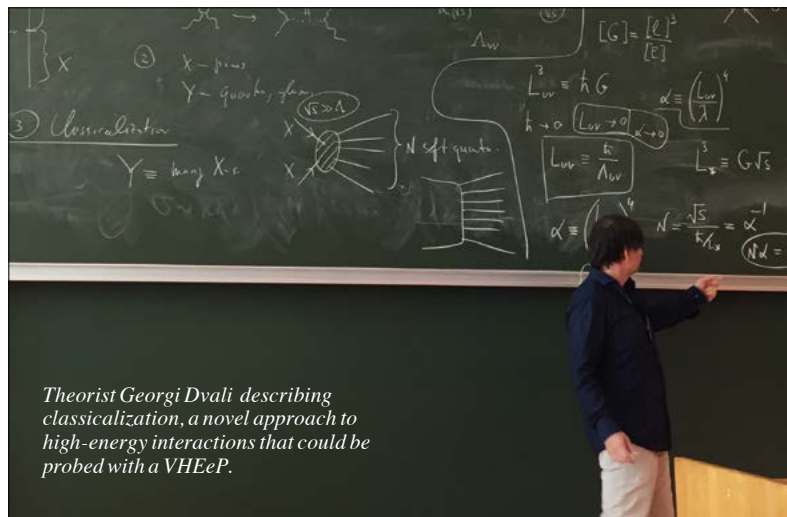
Exploring the physics case for a very-high-energy electron–proton collider

Rapid progress is being made in novel acceleration techniques (see p31). An example is the AWAKE experiment at CERN (*CERN Courier* January/February 2017 p8), which is currently in the middle of its first run demonstrating proton-driven plasma wakefield acceleration. This has inspired researchers to propose further applications of this novel acceleration scheme, among them a very-high-energy electron–proton (VHEeP) collider.

Simulations show that electrons can be accelerated up to energies in the TeV region over a length of only a kilometre using the AWAKE scheme. The VHEeP collider would use one of the LHC proton beams to drive a wakefield and accelerate electrons to an energy of 3 TeV over a distance less than 4 km, then collide the electron beam with the LHC's other proton beam to yield electron–proton collisions at a centre-of-mass energy of 9 TeV – 30 times higher than the only other electron–proton collider, HERA at DESY. Other applications of the AWAKE scheme with electron beams up to 100 GeV are being considered as part of the Physics Beyond Colliders study at CERN (*CERN Courier* November 2016 p28).

Of course, it's very early days for AWAKE. Currently the scheme offers instantaneous luminosities for VHEeP of just $10^{28} - 10^{29} \text{ cm}^{-2} \text{ s}^{-1}$, mainly due to the need to refill the proton bunches in the LHC once they have been used as wakefield drivers. Various schemes are being considered to increase the luminosity, but for now the physics case of a VHEeP collider with very high energy but moderate luminosities is being considered. Motivated by these ideas, a workshop called Prospects for a very high energy ep and eA collider took place on 1–2 June at the Max Planck Institute for Physics in Munich to discuss the VHEeP physics case.

Electron–proton scattering can be characterised by the variables Q^2 (the squared four-momentum of the exchanged boson) and x (the fraction of the proton's momentum carried by the struck parton), the reaches of which are extended by a factor 1000 to high Q^2 and to low x . The energy dependence of hadronic cross-sections at high energies, such as the total photon–proton cross-section, which has synergy with cosmic-ray physics, can be measured and QCD and the structure of matter better understood in a region where the effects are



Theorist Georgi Dvali describing classicalization, a novel approach to high-energy interactions that could be probed with a VHEeP.

completely unknown. With values of x down to 10^{-8} expected for $Q^2 \geq 1 \text{ GeV}^2$, effects of saturation of the structure of the proton will be observed and searches at high Q^2 for physics beyond the Standard Model will be possible, most significantly the increased sensitivity to the production of leptoquarks.

Deepening knowledge

A major theme of the workshop and physics focus for VHEeP is a deeper understanding of QCD and hadronic cross-sections at the highest energies and lowest values of x . Theoretical expectations show that saturation of the structure of the proton will be observed at VHEeP and will also be at a scale where QCD calculations are perturbative. This is particularly true in eA collisions with a higher density of gluons, where a saturation scale of around 20 GeV^2 is expected – a value where the cross-section at VHEeP is also expected to be large.

The physics at low x is also important for understanding cosmic-ray production at high energies where the rate of production of neutrinos at the TeV scale and above strongly depends on the gluon density down to values of x as low as 10^{-9} , as well as the total charm-production cross-section. The complementary nature of low- x physics and total cross-sections also has links to our understanding of gravity, for instance via the AdS/CFT duality and novel theories

that VHEeP could probe. The needs of polarisation and eA physics were discussed, as was HERA data at low x and the status of Monte Carlo simulations for ep and eA physics.

Overall the workshop highlighted how the extra energy reach at VHEeP would deepen our knowledge of the fundamental structure of matter and lead to a new way of understanding QCD. It could also help address big questions in physics such as the confinement of quarks and understanding black holes or new theories that attempt to explain all particle interactions.

The workshop ended with a discussion on how VHEeP could fit in to the global particle-physics landscape, specifically with current planned and possible ep and eA physics experiments. The proposed Electron Ion Collider in the US, LHeC at CERN and VHEeP have much in common, but also significant differences. There is much complementarity between the low-energy, high-luminosity polarised physics, such as the 3D mapping of the proton, and the physics at high energy, such as saturation. The different communities should therefore work to put forward a roadmap outlining a rich physics programme of electron–proton and electron–ion interactions, which will then serve as strong input to the European Strategy for Particle Physics in the next couple of years.

Faces & Places

VISITS

S Bennett/CERN



Cong Tac Pham, deputy minister for science and technology, Socialist Republic of Vietnam, visited CERN on 3 October, during which he passed by the ISOLDE experimental hall and ATLAS experiment and signed the guestbook.



On 19 October, **Toril Nagelhus Hernes**, pro-rector for innovation at the Norwegian University of Science and Technology (NTNU), signed a collaboration agreement with CERN director for accelerators and technology Frédéric Bordry (pictured). NTNU and CERN have worked closely together for many years, and the new agreement will bring collaboration between the two institutions closer.

S Bennett/CERN

J Ordian/CERN



Blaženka Divjak, minister of science and education, Republic of Croatia, visited CERN on 24 October. She took in the CERN Control Centre, ALICE and S'Cool LAB, and discussed Croatia's application for associate membership of CERN. She is pictured signing the guestbook with director of international relations Charlotte Warakulle and Director-General Fabiola Gianotti.



On 26 October representatives of the Austrian, Swiss and German Science Foundations came to CERN, in part to discuss opportunities for future projects. Pictured left to right (with CERN director for research and computing Eckhard Elsen second from left) are the current presidents of the Austrian, Swiss and German foundations: **Klement Tockner**, **Matthias Egger** and **Peter Strohschneider**, respectively.

J Ordian/CERN

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OBITUARIES

Henri Desportes 1933–2017

It is with great sadness that we announce the death of Henri Desportes, at the age of 84, on 24 September in the village of Gif sur Yvette, France. He was the head of the CEA Saclay department STCM until his retirement in the mid 1990s. Since the 1960s he was a pioneer of applied superconductivity and rapidly became an internationally recognised expert in the development of numerous accelerator and detector magnet systems for high-energy physics.

In particular, Desportes contributed to the creation of the first superconducting magnets for many experimental programmes, including: polarised targets (HERA, installed at CERN and then in Protvino); the 15 foot bubble chamber at Argonne National Laboratory in the US; the magnet of the CERN hybrid spectrometer bubble chamber in 1972; the first thin-walled solenoid, CELLO, in 1978 at DESY; and the solenoid for the ALEPH experiment at LEP in 1986.



His early participation in the genesis and design of the large magnets for the CMS and ATLAS detectors for the LHC should also not be forgotten.

Desportes supervised numerous work at Saclay on the development of innovative superconducting magnets with a wide

Desportes was an expert in magnets for experiments.

range of scientific, technical and medical applications. He was the main initiator of new techniques using helium indirect cooling, the stabilisation of superconductor by aluminium co-extrusion and externally supported coils. Henri worked on all of these subjects with some of the great names in physics. It is partly thanks to him that Saclay has been involved in most of the magnets for large detectors built in Europe since the early 1970s. For this work he received a prestigious IEEE Council on Superconductivity Award in 2002.

We will remember his courtesy, his humour and his unfailing involvement in these flagship projects that have contributed greatly to physics experiments and to several fundamental discoveries.

● Antoine Daël.

Patrick Fleury 1935–2017

Experimental particle physicist Patrick Fleury passed away on 14 September. After graduating from France's prestigious Ecole Polytechnique, he first encountered particle physics during a traineeship at Berkeley. On his return, he quickly became a prominent figure in the field of bubble chambers. Appointed by Bernard Gregory, he operated the DBC 81 chamber at CERN, which was built at Saclay in collaboration with the Polytechnique and Orsay. He studied the use of deuterium in the chamber, which received beam from the Proton Synchrotron (PS), and led a study group concerning the f_0 spin and the "g" meson. He was also in charge of the construction of CERN's separated M5 beam, a high-quality beam from the PS.

Quite rightly, Fleury always underlined the crucial role played by the Polytechnique and its leading bubble-chamber experts, first and foremost Louis Leprince-Ringuet, in the development of particle physics at CERN, from its inception to the modern day. Due to Bernard Gregory's involvement at CERN, Fleury effectively ran Polytechnique's laboratory (LPNHE-X) from 1973 to 1975, before taking on the role officially until 1984, a period that included its move to Palaiseau. On the new site, he and Charles Gregory



Fleury transitioned to astroparticle physics during his career.

built up a technical group capable of building large-scale facilities, and established a strong electronics team and an IT team. Fleury also set up the "solar unit" that would later become a major laboratory, the PICM.

Over the years, Fleury played a major and often pioneering role in several fields of physics at IN2P3 with the support of its director, the late Jean Yoccoz (*CERN Courier* April 2017 p43), as well as in very-large-scale integration (VLSI) and massive computation, founding the Centre

de Calcul Vectoriel pour la Recherche in Palaiseau and installing a CRAY supercomputer there. Fleury then steered his laboratory towards the use of electronic detectors and, from 1968 onwards, oversaw their introduction at CERN, working with Arne Lundby's group (with Pierre Lehmann) and then becoming involved in the physics of the Omega spectrometer, and later in the DELPHI experiment at LEP.

Following his time at the head of LPNHE-X and a stint at Stanford, he led experiments at Saclay's Saturne accelerator, before deciding to take his career in a different direction, moving towards what would later be known as astroparticle physics, where he contributed to the establishment of major areas of study. Before Stanford, he had already helped found the Fréjus underground laboratory, on the suggestion of André Rousset, before IN2P3 and the CEA took it over.

Above all, Fleury played a fundamental role in the emergence of ground-based gamma-ray astronomy, both in France and internationally, through the ARTEMIS, CAT, CELESTE and HESS projects, as well as in IN2P3's involvement in NASA's FERMI gamma-ray satellite. Alongside

Eric Paré, he designed CAT, France's first Cherenkov imaging telescope and a prototype for the international HESS project. From 1992 onwards, Fleury, a true visionary, launched a series of colloquia on gamma-ray astronomy, which ultimately united all the teams working in the field, including those of MAGIC (La Palma) and VERITAS (Arizona), around the Cherenkov Telescope

Array observatory.

Finally, as chair of the scientific-evaluation committee of Virgo, he played a key role in IN2P3's involvement in the field of gravitational waves. The committee's report was presented in 1990, the result of hard work and many visits to the international laboratories and agencies involved. Its favourable verdict was a deciding factor in

the minister Hubert Curien's approval of the project in France.

Patrick Fleury was an exceptional scientist, a clear-sighted, passionate and visionary project developer with immense intellectual and moral strength and profound humanity, who always strove to support and instil confidence in his colleagues.

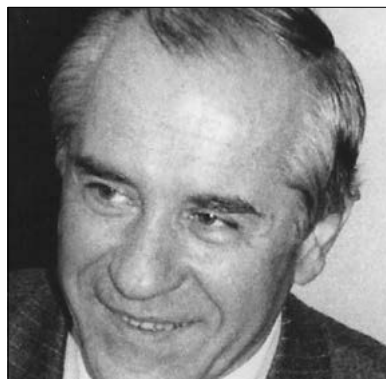
● *His colleagues and friends.*

Sergei Matinyan 1931–2017

Renowned Armenian theorist Sergei Matinyan died on 8 September in Durham, North Carolina, aged 86. He was noted for founding now well-known scientific centres: the first high-energy theoretical physics laboratory in Georgia, and a broad-coverage theory laboratory in Yerevan.

Born in Tbilisi, Georgia, and graduating from Tbilisi University in 1954, Matinyan started his scientific career at the Institute of Theoretical and Experimental Physics, Moscow, working on helium superfluidity under Lev Landau. His work on K-meson oscillations carried out later in Tbilisi was an essential step in the field. In the 1960s Matinyan studied strong interactions via complex momentum (Regge) theory, and developed the asymptotic theory of interaction of hadrons with nuclei at very high energies.

An essential phase of his career began in 1970 when he moved to Yerevan, Armenia, to become the deputy of Artem Alikhanian, the founder and then director of the Yerevan Physics Institute. There he went on to head



Armenian theoretical physicist Sergei Matinyan.

the department of theoretical physics and lectured in Yerevan State University on quantum electrodynamics and the weak interactions. Important work around that time, in 1977, was the investigation of the ground state in non-Abelian Yang–Mills

theory, where the presence of a gauge field condensate was demonstrated for the first time.

In the 1990s while at Duke University he summarised his research in the monograph *Chaos and Gauge Field Theory*, 1994, with Biro and Muller. He was elected to the National Academy of Sciences of Armenia in 1990.

Matinyan was an outstanding mentor and was particularly efficient in attracting gifted students. He supervised more than 30 PhD students in Georgia and Armenia, and his seminars were known for their depth in science and democracy of spirit. Matinyan was instrumental in organising the Soviet–US workshops on gauge theories in Yerevan held in 1983 and 1988, attended by a number of major figures. These conferences were essential events under the conditions of the Iron Curtain.

Sergei Matinyan's outstanding legacy will be remembered by his former students and colleagues.

● *Ara Ioannisian.*

Gary Steigman 1941–2017

Gary Steigman played a pivotal role in the development of modern cosmology, particularly the application of particle physics and nuclear physics to cosmological questions. He died on 9 April of complications following a fall.

Born on 23 February 1941, Gary grew up in the Bronx, New York. He received his undergraduate degree from the City University of New York in 1961 and his PhD in 1968 from New York University under the supervision of Mal Ruderman. He joined the Institute of Theoretical Astronomy (now the Institute of Astronomy) in Cambridge as a visiting fellow in 1968 and became a research fellow at Caltech in 1970. Gary joined the faculty of Yale University in 1972,



Steigman helped bring cosmology and particle physics closer.

leaving Yale for the Bartol Institute at the University of Delaware in 1978 and was then recruited to Ohio State in 1986.

Gary was ubiquitous on the cosmology conference circuit, so much so that he often referred to himself as the “TWA professor of physics”. Beginning in 1972, Gary spent 23 summers at the Aspen Center for Physics, where he served as a trustee (1978–1983), a member of the Advisory Board (1983–1998), and a long-time organiser of astrophysics workshops. Visitors to Aspen will remember Holly, Gary's Great Pyrenees dog (pictured) and a fixture on Gary's travels.

Gary's contributions to cosmology span nearly half a century, beginning with his 1968 PhD dissertation, in which he showed that ➤

Faces & Places

matter–antimatter symmetric cosmologies were untenable: the universe must have an excess of baryons over antibaryons. This work was published in *Nature*, and Gary followed up with an influential article in the *Annual Review of Astronomy and Astrophysics* in 1976. While this conclusion seems obvious now, it was certainly not obvious in the late 1960s; at that time a symmetric universe could have been considered more natural. The origin of the observed baryon excess remains undetermined to this day, but Gary's results subsequently underpinned the research field of baryogenesis.

This work was followed in 1977 by Gary's influential primordial nucleosynthesis limit on the number of neutrino species, in collaboration with Jim Gunn and David Schramm. At the time this paper was written there were only weak experimental limits on the number of generations in the Standard Model; Gary's work demonstrated that this number must be less than or equal to seven, a result later confirmed by SLC and LEP measurements of the Z width. This paper represents one of the first attempts to use cosmology to constrain particle physics, an area that blossomed in the 1980s following

Gary's pioneering work.

Gary received first prize in the 1980 Gravity Research Foundation essay competition for his paper with David Schramm exploring a universe dominated by massive neutrinos, one of the earliest proposals for a nonbaryonic universe. Later, Gary's 1984 paper with Mike Turner and Lawrence Krauss raised the possibility of a cosmological constant to allow for a flat universe.

He went on to pursue his most significant area of research: primordial nucleosynthesis. Following early work by Peebles and Wagoner, Fowler and Hoyle in the 1960s, an improved understanding of chemical evolution and better observational limits allowed primordial nucleosynthesis to become the first true area of precision cosmology in the 1980s. With long-time collaborators David Schramm, Mike Turner, Keith Olive and Terry Walker, Gary's work in this field followed two major thrusts: deriving accurate estimates of the baryon density of the universe, and constraining particle properties. A series of major papers in the 1980s and 1990s provided the gold standard for the prediction of the baryon density of the universe, a prediction spectacularly

confirmed by later CMB measurements.

More recently, Gary renewed an earlier interest in relic particle abundances. Among his later papers were a series of improved calculations of these abundances, along with new constraints on fractionally charged relic particles and several important papers on dark radiation.

In 1986, Gary came to Ohio State University to develop a research centre in cosmology that spanned both the physics and astronomy departments. His efforts yielded what is today the Ohio State Center for Cosmology and AstroParticle Physics, encompassing almost 30 faculty members in both departments and more than 15 postdocs.

Gary was a collaborator, a mentor and a good friend. He found his true companion in Sueli Viegas, his wife and fellow astronomer. Gary deserves much of the credit for bringing together the fields of cosmology and nuclear/particle physics, an area of work that became enormously productive in the years following Gary's pioneering efforts. Gary blazed a trail for others to follow, and he will be missed by all of us.

● Robert Scherrer, John Beacom, Keith Olive, Michael Turner and Terry Walker.

Beamline for Schools: a successful story continues

You haven't heard of [Beamline for Schools](#) lately? Probably because we have been very busy in September. The winners of this year's edition have been at CERN to conduct their experiments.

The winning team from Italy has tested its self-designed and self-constructed Cherenkov detector while the Canadian team was looking for hypothetical exotic particles carrying a fractional charge. Have a look at <http://cern.ch/go/Cg6P> if you want to know more and get inspired for [BL4S edition 2018](#)!

Get even more inspired by two videos that have been produced by members of the Canadian team:

<https://www.youtube.com/watch?v=gl3ay1EgGt8>

https://www.youtube.com/watch?v=gF3BES_fyQ0&t

Winning BL4S has been an incredible experience for both the students and their teachers. Both teams have been received by the officials of their home town and have given interviews on national TV and radio stations. When we asked them how they would describe their experience the two words that were used by most of them were "life changing".

BL4S 2018 is in the starting blocks. Do not miss your life changing experience by participating in the competition. [Pre-register](#) now and [submit your proposal](#) by 31 March 2018!



Join the adventure here: cern.ch/bl4s

