

Faces & Places

APPOINTMENTS

Bassler to be next president of CERN Council

The CERN Council announced on 28 September the election of Ursula Bassler, a delegate of the Council since 2015 and a former member of the Large Hadron Collider (LHC) committee, as its 23rd president, for a period of one year (renewable twice) starting on 1 January 2019. She is currently deputy director at France's National Institute for Nuclear and Particle Physics (IN2P3 - CNRS), where she was involved, in particular, in preparing the Institute's contribution to the detector upgrades for the High Luminosity LHC (HL-LHC) and in shaping France's involvement in the European Open Science Cloud. Previously, she headed the particle-physics division at the Institute of Research into the Fundamental Laws of the Universe at the French Alternative



President-elect, Ursula Bassler.

Energies and Atomic Energy Commission (CEA) in Saclay.

"CERN as an organisation is essential to make progress in particle physics, as we need continuous, long-term efforts," said Bassler. "During the upcoming update of the European Strategy for Particle Physics, it will be important to design the vision for the future infrastructures in our field and to start laying out a path for their realisation with the CERN Member States and the global particle-physics community. I'm looking forward to working as Council president, together with the CERN directorate, the European Strategy Group and all delegations, on this challenging endeavour."

Bassler will take over from Sijbrand de Jong, who concludes his three-year term at the end of December.

Zanderighi joins Max Planck Institute for Physics as director

Giulia Zanderighi, a professor of physics at the University of Oxford in the UK and a staff member in CERN's theory department, has been appointed director of the Department of Novel Computational Techniques in Particle Phenomenology at the Max Planck Institute for Physics (MPP) in Munich, Germany. Zanderighi



New MPP director Giulia Zanderighi.

is an expert in collider phenomenology, and has received several awards for her work, including the Bessel Research Award and an ERC Consolidator Grant endowed with €1.5 million. She specialises in high-precision theoretical calculations of particle collisions at the Large Hadron Collider (LHC), specifically on fixed-order perturbative quantum chromodynamics calculations for multi-particle processes.

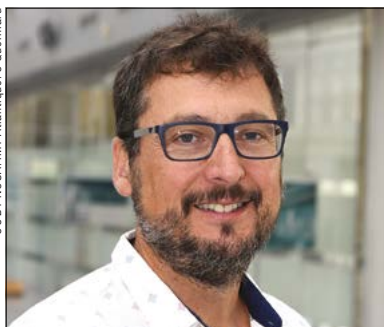
Zanderighi will take up her post at MPP on 1 January 2019, where she will co-operate with Siegfried Bethke, director of experimental high-energy physics, in connection with the ATLAS detector at the LHC.

Martínez García to lead SUBATECH laboratory

Ginés Martínez García, a member of the ALICE collaboration at CERN and leader of the Nantes ALICE group, has been appointed director of the SUBATECH research laboratory, located in Nantes, France. He started the new post on 1 September.

SUBATECH's research activities focus on nuclear physics, radiochemistry and their applications. The unit is co-operated by the Institut Mines Telecom Atlantique (IMT-Atlantique), the French National Institute for Nuclear Physics and Particle Physics (IN2P3) of CNRS and

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SUBATECH director Ginés Martínez García.

the Université de Nantes.

Martínez García has been working at SUBATECH for 20 years, leading the lab's plasma group first between 2002 and 2010 and then between 2013 and 2018. His research concerns heavy-ion physics. Martínez García worked in the PHENIX experiment at the Relativistic Heavy Ion Collider in Brookhaven between 1999 and 2004 and has been working in the ALICE experiment at CERN since 1998.

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AWARDS

Bell Burnell to donate \$3m Breakthrough Prize

Jocelyn Bell Burnell has been awarded a Special Breakthrough Prize in Fundamental Physics for her 1967 discovery of pulsars and a lifetime of inspiring leadership in the scientific community. Bell Burnell, currently a visiting professor of astrophysics at the University of Oxford and chancellor of the University of Dundee, will donate the \$3m prize money to create a fund to support greater diversity for women and people from ethnic minorities. The money will be given to the UK Institute of Physics to support graduate students from under-represented groups.

A Special Breakthrough Prize in Fundamental Physics can be awarded by the selection committee at any time in recognition of an extraordinary scientific achievement, and in addition to the regular



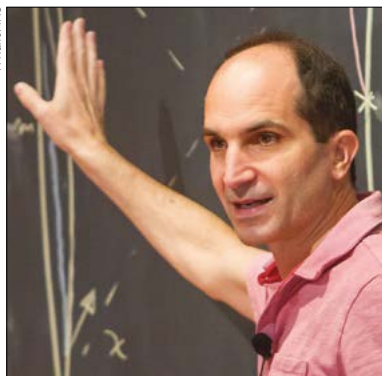
Prize winner Jocelyn Bell Burnell.

Breakthrough prizes awarded through the annual nomination process. "Jocelyn Bell Burnell's discovery of pulsars will always stand as one of the great surprises in the history of astronomy," said Edward Witten, the chair of the selection committee. "Until that moment, no one had any real idea how neutron stars could be observed, if indeed they existed. Suddenly it turned out that nature has provided an incredibly precise way to observe these objects, something that has led to many later advances."

Bell Burnell is the fourth to be awarded the special prize. Previous winners are the late Stephen Hawking, seven CERN scientists whose leadership led to the discovery of the Higgs boson, and the LIGO and Virgo collaborations for the detection of gravitational waves.

Prange award goes to Juan Maldacena

Juan Maldacena of the Institute for Advanced Study in Princeton, US, is the 2018 recipient of the Richard E Prange Prize and Lectureship in Condensed Matter Theory and Related Areas. Maldacena is recognised for his 1997 theoretical discovery of a deep connection between gauge theories and quantum gravity. Known as AdS/CFT duality, the connection is one of most important theoretical physics results of



Prange award recipient Juan Maldacena.

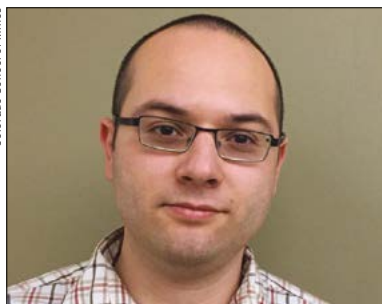
the past 30 years, and has remained a topic of great fundamental interest in particle physics, string theory, gravity, nuclear physics and condensed-matter physics. With more than 10,000 citations, the paper describing the result is among the most cited papers in all of science over the past 20 years.

Established by the University of Maryland (UMD), the prize, which carries a \$10,000 honorarium, honours the late Richard E Prange, whose distinguished career at UMD spanned four decades. Previous winners include Philip W Anderson, David Gross and Frank Wilczek.

Global Neutrino Network dissertation prize announced

Gary Binder from the Colorado School of Mines and Lew Classen from the University of Münster have won the 2018 Global Neutrino Network (GNN) dissertation prize. The annual award distinguishes young researchers who have written an outstanding thesis and contributed significantly to GNN, an association of major neutrino telescopes such as IceCube dedicated to increasing communication between the experiments.

Primary criteria of the selection are the scientific quality, the didactics and the form of the thesis. Binder was recognised for his thesis "Measurements of the flavour composition and inelasticity distribution of high-energy neutrino interactions in IceCube", which he conducted at the



GNN award winners for 2018: Gary Binder (left) and Lew Classen (right).

University of California at Berkeley. Classen won with a thesis titled "The mDOM – a multi-PMT digital optical module for



the IceCube-Gen2 neutrino telescope", which was completed at the University of Erlangen-Nürnberg.

Architecture prize for former artists in residence

Architects Matias del Campo and Sandra Manninger, who were artists in residence at CERN in 2016 through the Arts at CERN project with support from the Department of Arts of the Federal Chancellery of Austria, have received the prestigious 2018 Studio Prize by the American Institute of Architects (AIA). Del Campo, Manninger, along with thesis students of the Taubman College of Architecture + Urban Planning at the University of Michigan in the US, were recognised for their ideas for a new visitor centre at CERN for the proposed Future Circular Collider (FCC).

The AIA Studio Prize recognises thoughtful, innovative and ethical projects at accredited architecture schools in the US and Canada, and awards a cash sum of \$25,000. Del Campo and colleagues' studio was selected by this year's jury as one of the most compelling studios in US architectural education today.

In one of the studio's ideas for the visitor centre (pictured), students Sung-Su Kim, Yongjoon Kim and Nathan Wesseldyk looked at pattern "as a means of understanding and conveying how multiple complex systems can be overlaid to find moments of interaction".



One of the ideas for a visitor centre for FCC. (Image credit: Sung-Su Kim, Yongjoon Kim, Nathan Wesseldyk, Taubman College of Architecture + Urban Planning.)

EVENTS

New entrance welcomes the world to CERN

On 28 September, CERN, the État de Genève and the Commune de Meyrin inaugurated the "Esplanade des Particules", an open space focused on welcoming visitors and the public to the European lab. This large public space, which connects CERN's reception building to the Globe of Science and Innovation, was designed with pedestrians and sustainable transport in mind. According to landscape architects Studio Paolo Bürgi of Ticino, "The esplanade puts everything on the same level, like a slab resting on the ground, with the aim of marking out a completely new space. A simple surface, enriched by brass inserts, evokes the vectorial shape of a magnetic field."

During the ceremony, the flags of CERN's 22 Member States were raised on the new esplanade for the first time. CERN's new official address is now 1 Esplanade des Particules.

"The Esplanade des Particules is the crowning achievement of the very fruitful collaboration between CERN, the État de Genève and the Commune de Meyrin,



The newly inaugurated Esplanade des Particules.

and symbolises CERN's desire to become ever more open to the world," said Fabiola Gianotti, CERN Director-General. "It will also form a magnificent setting for the

construction of the Science Gateway, a new centre for communicating science to the general public and for encounters between CERN's scientists and visitors."

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MEETINGS

Particle physics meets astrophysics and gravity

The 7th International Conference on New Frontiers in Physics (ICNFP 2018) took place on 4–12 July in Kolymbari, Crete, Greece, bringing together about 250 participants.

The opening talk was given by Slava Mukhanov and was dedicated to Stephen Hawking. To mention some of the five special sessions featured, the memorial session of Lev Lipatov, a leading figure worldwide in the high-energy behaviour of quantum field theory (see *CERN Courier* January/February 2018 p50), the session on quantum chromodynamics and the round table on the future of fundamental physics chaired by Albert de Roeck, saw a high number of attendees.

Alongside the main conference sessions, there were 10 workshops. Among these, the one on heavy neutral leptons highlighted novel mechanisms for producing sterile-neutrino dark matter and prospects for future searches of such dark matter with the next generation of space-based X-ray telescopes, including Spektr-RG, Hitomi and Athena+.

The workshop on instrumentation and methods in high-energy physics focused on the latest developments and the performance of complex detector systems, including triggering, data acquisition and signal-control systems, with an emphasis on large-scale facilities in nuclear physics, particle physics and astrophysics. This programme attracted many participants and led to the exchange of scientific information between different physics communities.

The workshop on new physics paradigms after the Higgs-boson and gravitational-wave discoveries provided an opportunity both to review results from searches for gravitational waves and to show plans for future precision measurements of Standard Model parameters at the LHC.

The workshop also featured several theory talks covering a wide range of subjects, including the implementation of supersymmetry breaking in string theory, new developments in early-universe cosmology and beyond-Standard Model physics. ICNFP 2018 also saw the first workshop on frontiers in gravitation, astrophysics and cosmology, which strengthened the Asian presence at ICNFP, gathering many participants from the Asia Pacific region.

For the second time in the ICNFP series, a workshop on quantum information and quantum foundations took place, with the aim of promoting discussions and collaborations between theorists and experimentalists working on these topics.



The ICNFP 2018 participants.

Yakir Aharonov gave a keynote lecture on novel conceptual and practical applications of so-called weak values and weak measurements, showing that they lead to many interesting hitherto-unnoticed phenomena. The latter include, for instance, a “separation” of a particle from its physical variables (such as its spin), emergent correlations between remote parties defying fundamental classical concepts, and a completely top-down hierarchical structure in quantum mechanics, which stands in contrast to the concept of reductionism. As exemplified in the talk of Avshalom Elitzur, the latter could be explained using self-cancelling pairs of positive and negative weak values.

Sandu Popescu, Pawel Horodecki, Marek Czachor and Eliahu Cohen presented many new phenomena involving quantum nonlocality in space and time, which open new avenues for extensive research. Ebrahim Karimi discussed various applications of structured quantum waves carrying orbital angular momentum (either photons or massive particles) and also discussed how to manipulate the topology of optical polarisation knots. Onur Hosten emphasised the importance of cold atoms for quantum metrology.

The workshop also featured many excellent talks discussing the intriguing relations between quantum information and condensed-matter physics or quantum optics. Some connections with quantum gravity, based on entanglement, complexity and quantum thermodynamics, were also discussed. Another topic presented was the comparison between the role of spin and polarisation in high-energy physics and quantum optics. In both of these fields, one should consider the total angular momentum, not the spin alone, and helicity is a very helpful concept in both, too.

Future accelerator facilities such as the

low-energy heavy-ion accelerator centres FAIR in Darmstadt, Germany, and NICA at the Joint Institute for Nuclear Research in Dubna, Russia, were also discussed, particularly in the workshop on physics at FAIR-NICA-SPS-BES/RHIC accelerator facilities. Here new ideas as well as overview talks on current and future experiments on the formation and exploration of baryon-rich matter in heavy-ion collisions were presented.

The MoEDAL collaboration at CERN, which searches for highly ionising messengers of new physics such as magnetic monopoles, organised a mini-workshop on highly ionising avatars of new physics. The workshop provided a forum for experimentalists and phenomenologists to meet, discuss and expand this discovery frontier. The latest results from the ATLAS, CMS, MoEDAL and IceCube experiments were presented, and some important developments in theory and phenomenology were introduced for the first time. Highlights of the workshop included monopole production via photon fusion at colliders, searches for heavy neutral leptons and other long-lived particles at the LHC, regularised Kalb–Ramond monopoles with finite energy, and monopole detection techniques using solid-state and Timepix detectors.

Finally, on the education and outreach front, Despina Hatzifotiadou gave LHC “masterclasses” in collaboration with EKFE (the laboratory centre for physical sciences) to 30 high-school students and teachers, who had the opportunity to analyse data from the ALICE experiment and “observe” strangeness enhancement in relativistic heavy-ion collisions.

The next ICNFP conference will take place on 21–30 August 2019 in Kolymbari, Crete, Greece.

● *Laressa Bravina, Dmitry Gorbunov and Sonia Kabana.*

ROOT's renovation takes centre stage at Sarajevo meeting



The participants of the ROOT workshop held in Bosnia and Herzegovina.

The 11th ROOT Users' Workshop was held on 10–13 September in Sarajevo, Bosnia and Herzegovina, at the Academy of Science and Arts: an exceptional setting that also provided an opportunity to involve Bosnia and Herzegovina in CERN's activities.

The SoFTware Development for Experiments group in the experimental physics department at CERN drives the development of ROOT, a modular software toolkit for processing, analysing and visualising scientific data. ROOT is also a means to read and write data: LHC experiments alone produced about 1 exabyte of data stored in the ROOT file format.

Thousands of high-energy physicists use ROOT daily to produce scientific results. For the ROOT team, this is a big responsibility, especially considering the challenges Run 3 at the LHC and the High Luminosity LHC (HL-LHC) pose to all of us. Luckily, we can rely on a lively user community, whose contribution is so useful that, periodically, a ROOT users' workshop is organised. The event's objective is to gather together the ROOT community of users and developers to collect criticism, praise and suggestions: a unique occasion to shape the future of the ROOT project.

More than 100 people attended this year's workshop, a 30% increase from 2015, making the event a success. What's more, the diversity of the attendees – students, analysis physicists, software experts and framework developers – brought different levels of expertise to the event. The workshop featured 69 contributions as well as engaging discussions. Software companies participated, with three invited contributions: Peter Müßig from SAP presented OpenUI5, the core of the SAP javascript framework that will be used for ROOT's graphical user interface; Chandler Carruth from Google

discussed ways to make large-scale software projects written in C++, the language for number-crunching code in high-energy and nuclear physics (HENP), simpler, faster and safer; and Sylvain Corlay from Quantstack showed novel ways to tackle numerical analysis with multidimensional array expressions. These speakers said they enjoyed the workshop and plan to come to CERN to extend the collaboration.

ROOT's renovation was the workshop's main theme. To be at the bleeding edge of software technology, ROOT – which has been the cornerstone of virtually all HENP software stacks for two decades – is undergoing an intense upgrade of its key components. This effort represents an exciting time for physicists and software developers. In the event, ROOT users expressed their appreciation of the effort to make it easier to use and faster on modern computer architectures, with the sole objective of reducing the time interval between data delivery and the presentation of plots.

In particular, the spotlight was on the modernisation of the I/O subsystem, crucial for the future LHC physics programme; ROOT's parallelisation, a prerequisite to face Run 3 and HL-LHC analyses; as well as on new graphics, multivariate tools and an interface to the Python language, which are all elements of prime importance for scientists' everyday work.

The participants' feedback was enthusiastic, the atmosphere was positive, and the criticism received was constructive and fruitful for the ROOT team. We thank the participating physicists and computer scientists: we appreciated your engagement and are looking forward to organising the next ROOT workshop.

• Danilo Piparo for the ROOT team.

Ultra High Performance Silicon Drift Detector

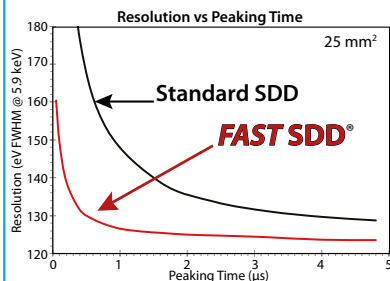
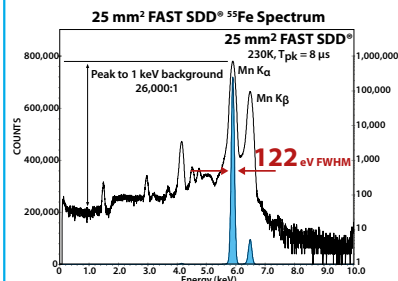
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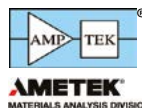


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OBITUARIES

Burton Richter 1931–2018

Burton Richter, a major figure in particle physics who shared the Nobel Prize for the co-discovery of the J/ψ meson, passed away on 18 July in Palo Alto, California, at the age of 87.

Born in Brooklyn, New York, in 1931, Richter's love of science began with the nightly blackouts during World War II, which revealed an unparalleled view of the night sky.

He studied physics at the Massachusetts Institute of Technology (MIT), where he was introduced to the electron–positron system by Martin Deutsch, who was conducting classical positronium experiments. He wrote his thesis on the quadratic Zeeman effect in hydrogen and completed his PhD in 1956 on the photoproduction of pi-mesons from hydrogen.

That year, Richter moved to Stanford University's high-energy physics laboratory as a research associate. In 1960, he became an assistant professor of physics, then associate professor in 1963 and professor in 1967. During this time, Richter married his wife, Laurose, and had two children, Elizabeth and Matthew. By 1970, Richter's talents in experimental particle physics and accelerator physics led to the Stanford Positron-Electron Asymmetric Ring (SPEAR) at the Stanford Linear Accelerator Center (SLAC). It included a groundbreaking type of general-purpose detector that has been used in particle colliders ever since, and it would eventually produce his biggest discovery.

After Richter secured funding for SPEAR in 1970, it took him just 27 months to build the accelerator, at a cost of \$6 million. Experiments commenced in 1973 and, famously, in November 1974, SPEAR flushed out what the SLAC team dubbed the “psi” meson – a bound state of two charm quarks. Simultaneously, at Brookhaven National Laboratory on the other side of the continent, Sam Ting and his group had spotted the same resonance, which they christened the “J”. Just two years later, Richter and Ting shared the 1976 Nobel Prize in Physics for their pioneering discovery of the J/ψ , which proved the existence of a fourth type of quark (charm). It was a major step towards the establishment of the Standard Model of particle physics.

Before he received the Nobel Prize, in 1975 Richter began a sabbatical year at CERN, during which he pursued an experiment at CERN's Intersecting Storage Rings (ISR) – the world's first hadron collider. He was



Richter was an expert in accelerator and experimental physics.

hosted by Pierre Darriulat and worked on adding a muon spectrometer arm to the R702 experiment. Richter also worked out the general energy-scaling laws for high-energy electron–positron colliding-beam storage rings, looking specifically at the parameters of a collider with a centre-of-mass energy in the range 100–200 GeV, arguing that such a machine would be required to better understand the relationship between the weak and electromagnetic interactions: “That study turned into the first-order design of the 27 km-circumference LEP project at CERN that was so brilliantly brought into being by the CERN staff in the 1980s,” he wrote in his Nobel biography.

His influential paper “Very High Energy Electron–Positron Colliding Beams for the Study of the Weak Interactions” (*Nucl. Instrum. Methods* **136** 47) was followed by two detailed studies: one concerning the physics, published in November 1976 as CERN Yellow Report 76-18, of which Burt was a co-author, and an accelerator study headed by Kjell Johnsen. “Burt’s paper and his personal advocacy of high-energy electron–positron collision triggered interest at CERN, and had a powerful impact on the development of the Laboratory, also paving the way for the LHC and the discovery of the Higgs boson,” says CERN’s John Ellis.

In 1978, along with others at SLAC, Richter began to investigate the possibility

of turning the 3.2 km linear accelerator at SLAC into a linear electron–positron collider. Construction of the SLAC Linear Collider (SLC) began in 1983, and Richter became director of SLAC the following year, until stepping down in 1999. During that time, he oversaw the construction of the SLC, the only linear electron–positron collider yet to be built, and led the way to other machines for photon science. While SLAC director, Richter also initiated interregional collaborations with DESY in Germany and KEK in Japan, and was a proponent of bringing into existence a high-energy linear collider as a global collaboration.

“Perhaps his greatest contribution as director was, in the 1990s, designing a future for SLAC that would look very different from the past,” said Stanford Provost Persis Drell, who served as SLAC director from 2007 to 2012. “He recognised that pursuing an X-ray free-electron laser at SLAC could be used to provide a revolutionary science opportunity to the photon science community, who use X-rays as their tool for discovery. This vision became the Linac Coherent Light Source. Burt recognised that outstanding science needed to drive the future of the institution, and he did not flinch from designing that future.”

When he stepped down as SLAC director, Richter focused on public policy issues in science and energy, for which he received the prestigious 2007 Philip Hauge Abelson Prize from the American Association for the Advancement of Science. In 2010, he published *Beyond Smoke and Mirrors: Climate Change and Energy in the 21st Century*, an apolitical layperson’s exploration of the facts of climate and energy. Among his many accolades, Richter received the US National Medal of Science, the nation’s highest scientific honour, in 2014; the Enrico Fermi Award in 2012; and the Ernest Orlando Lawrence Award in 1976.

“In my career I have met no one who has made more fundamental contributions in electron–positron and electron–electron colliders, in the precision instrumentation used in colliders and in experimental physics,” says Ting. “After we received the Nobel Prize together in 1976, I met him many times and we became good friends. My wife, Susan, and I are going to miss him deeply.”

● His friends and colleagues at CERN, with additional input from Stanford News Service.

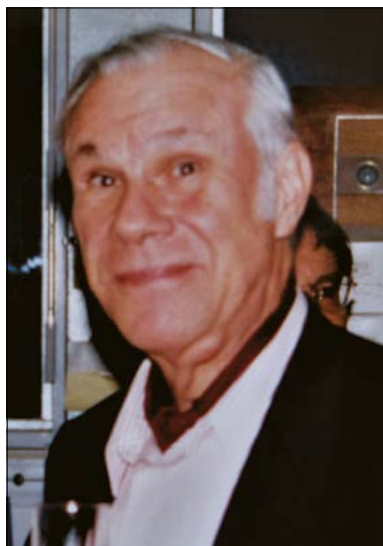
Georges Dôme 1928–2018

Georges Dôme, who had a long, productive and distinguished career at CERN dedicated to the study of accelerating radio-frequency (RF) structures and their interaction with particle beams, passed away on 27 June.

A physicist and mathematician, Dôme arrived at CERN in the early 1960s from the École Royale Militaire, Brussels, via the SLAC National Accelerator Laboratory in the US, where for 18 months he attacked the problems that would be his lifelong interest. His initial work at CERN concerned the theoretical studies of accelerating RF structures for the 300 GeV linac project, in the process contributing to the development of numerical computations of magnetic-field distributions.

With the advent of the Super Proton Synchrotron (SPS) project, he joined the team of Clemens Zettler, who was responsible for building the accelerating systems of the new machine. Georges derived the formulae to describe and use the accelerating structures, which are still the workhorse of the SPS machine today. He was in charge of the detailed measurements of the structures, specified the precision machining of the many drift tubes to fix the central operating frequency of the structures, and also identified and measured the higher-order frequency modes whose impedance can destroy the particle beams. Different antennas and probes were then designed to render these modes harmless.

Georges also designed the structure of the SPS higher-harmonic cavity, another component necessary in the struggle to stabilise the beams of ever increasing



Physicist and mathematician Georges Dôme had a distinguished career at CERN.

intensity. His work has been essential in ensuring that the high-intensity beams for the LHC and the SPS fixed-target experimental programme are available and that the future LHC Injectors Upgrade (LIU) project is possible.

The SPS is a very versatile machine and its RF group has had to study and solve many varied problems to follow the different requirements. Georges made important contributions on many occasions, for example to the studies of particle diffusion due to RF noise, which

was critical for beam lifetime in the proton–antiproton collider.

In the 1990s, Georges was asked by Vittorio Vaccaro from the University of Naples in Italy to review a paper on the coupling impedance of a circular iris, a subject that had long interested Georges. This triggered 20 pages of Georges' closely spaced, small-character calculations and a fruitful collaboration on wakefields and impedance with members of the University of Naples.

Georges studied a subject in depth and was a precise and meticulous mathematician with a strong love for Bessel functions. He was always willing to go over a piece of work for his colleagues, but this could be a daunting prospect. It would come back annotated in blue pencil, every inherent inaccuracy revealed by his rigorous, uncompromising approach. This, of course, was splendid – you knew it was now perfect – and his unfailing good humour and willingness to help made this process very easy.

Georges was a fine mentor, looking after his students and both his younger, and older, colleagues. His body of work, supplemented by the excellent RF lectures he gave at the CERN accelerator schools, is a reference for accelerator physicists, and he continued this work for many years after his retirement. He was also a lifelong friend of and supporter of the CERN library.

Georges was in every way a gentleman, quiet and courteous, always interesting to talk to – a good person to find at a gathering. We will miss him.

● *His friends and colleagues.*

Hans Paar 1944–2018

Hans Paar, emeritus professor of physics at the University of California, San Diego (UCSD), passed away on 17 June after a short illness. Paar was initially trained at Delft University of Technology in his native country of the Netherlands. This engineering background served him well throughout his career, allowing him to take on important tasks in the design, construction and testing of equipment in all the particle-physics experiments he participated in.

Paar started his particle-physics career at Columbia University in the US, where he worked with Leon Lederman on one of the first experiments at Fermilab (E70). After completing his PhD thesis on this project, he relocated to Europe to work as a CERN fellow with another Nobel Laureate, Jack Steinberger, on WA1, the first experiment with the high-energy neutrino beam of the newly commissioned Super Proton Synchrotron (SPS).

In 1978, Paar joined a team at NIKHEF,

the Dutch National Institute for Subatomic Physics, that worked on the TPC/2 γ experiment at the SLAC National Accelerator Laboratory in the US, and he quickly became one of the leaders of the collaboration that carried out this experiment. His visibility at SLAC led to an offer from the UCSD, which he then joined as a faculty member in 1986 and where he remained for the rest of his career.

Paar was an internationally recognised

Faces & Places

physicist. He studied the properties of the bottom quark at electron–positron colliders since the early 1990s, first as a member of the CLEO collaboration (Cornell) and later the BaBar collaboration (SLAC). He also made essential contributions to the design and construction of novel types of calorimeters, in the

context of the SPACAL and DREAM projects at CERN.

Later in Paar's career, his research interests included observational cosmology. Paar and his colleagues set out to detect the B-mode polarisation of the cosmic microwave background radiation to address one of the most fundamental

problems in astrophysics – the inflation of the early universe. Paar made crucial contributions to the realisation of this project, named POLARBEAR, which is carried out at high altitude in the Atacama Desert in Chile. Not only did he provide expert leadership, design and analysis skills, he also secured a \$600,000 private donation, which helped enable the fabrication of the telescope.

Paar cared deeply about education and creating a nurturing, motivating environment for students. He was instrumental in modernising the UCSD's

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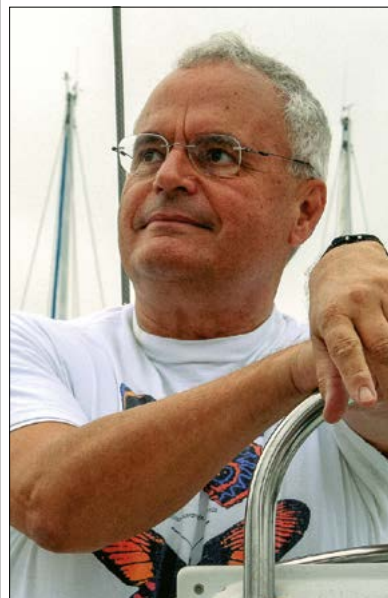
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Emeritus professor Hans Paar.

curriculum on quantum mechanics at all levels and authored the textbook *An Introduction to Advanced Quantum Physics*. As part of the UCSD Research Experience for Undergraduates programme, he gave a "Physics of Sailing" course consisting of lectures on the physics of the sport, followed by a full day of sailing on San Diego Bay.

Hans had many interests outside of physics. He was also a devoted husband, (step)father and a very good friend to many. He was a gifted piano player and a serious model-train enthusiast. He helped to create an atmosphere of creative thought and friendliness within every group he was part of. Our thoughts go to his wife Kim, his daughter Suzanne and his stepsons Eric and Alain. We all owe Hans for many happy memories.

● His friends and colleagues.