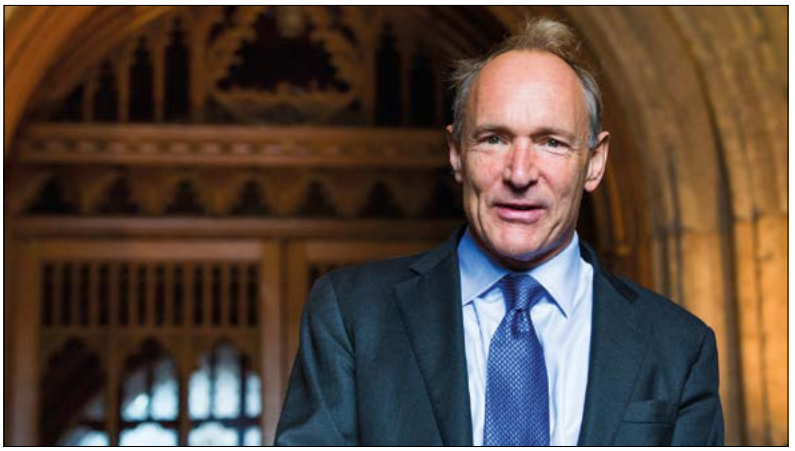
Faces & Places

AWARDS

Tim Berners-Lee receives Turing Award

On 4 April, CERN alumnus Tim Berners-Lee received the 2016 A M Turing Award for his invention of the World Wide Web, the first web browser, and the fundamental protocols and algorithms allowing the web to scale. Named in honour of British mathematician and computer scientist Alan Turing, and often referred to as the Nobel prize of computing, the annual award of $1 million is given by the Association for Computing Machinery. In 1989, while working at CERN, Berners-Lee wrote a proposal for a new information-management system for the laboratory, and by the end of the following year he had invented one of the most influential computing innovations in history – the World Wide Web. Berners-Lee is now a professor at Massachusetts Institute of Technology and the University of Oxford, and director of the World Wide Web Consortium and the World Wide Web Foundation.

Paul Clarke



Berners-Lee created the first web-serving software in open-source fashion, catalysing the web's development.

ICTP Dirac medallists 2016

The International Centre for Theoretical Physics 2016 Dirac Medal has been awarded to Nathan Seiberg of the Institute for Advanced Study in Princeton, and Mikhail Shifman and Arkady Vainshtein of the University of Minnesota. The award recognises the trio's important contributions to field theories in the non-perturbative regime and in particular for exact results obtained in supersymmetric field theories.

Nathan Seiberg (left), Mikhail Shifman (middle) and Arkady Vainshtein (right) have made important contributions to supersymmetric field theories.

Guido Altarelli Award 2017

The second edition of the Guido Altarelli Award, given to young scientists in the field of deep inelastic scattering and related subjects, was awarded to two researchers during the 2017 Deep Inelastic Scattering workshop held in Birmingham, UK, on 3 April. Maria Ubiali of Cambridge University in the UK was recognised for her theoretical contributions in the field of proton parton density functions, and in particular for her seminal contributions to the understanding of heavy-quark dynamics. Experimentalist Paolo Gunnellini of DESY, who is a member of the CMS collaboration, received the award for his innovative ideas in the study of double parton scattering and in Monte Carlo tuning.

Paolo Gunnellini and Maria Ubiali receive the prize, which was established in 2016 to honour the memory of CERN theorist Guido Altarelli.

Faces & Places

Prizes galore for IceCube members

Four members of the IceCube neutrino observatory, based at the South Pole, have independently won awards recognising their contributions to the field. Aya Ishihara of Chiba University in Japan was awarded the 37th annual Saruhashi Prize, given each year to a female scientist under the age of 50 for exceptional research accomplishments. This year's prize, presented in Tokyo on 27 May, cites Ishihara's contributions to high-energy astronomy with the IceCube detector.

Fellow IceCube collaborator Subir Sarkar of the University of Oxford, UK, and the Niels Bohr Institute in Denmark has won the 4th Homi Bhabha prize. Awarded since 2010 by the Tata Institute of Fundamental Research (TIFR) in India and the International Union of Pure and Applied Physics, the prize recognises an active scientist who has made distinguished contributions in the field of high-energy cosmic-ray and astroparticle physics over an extended academic career. Sarkar has also worked on the Pierre Auger Observatory and is a member of the Cherenkov Telescope Array collaboration.

Meanwhile, former IceCube spokesperson Christian Spiering from DESY has won the O'Ceallaigh Medal for astroparticle physics, awarded every second year by the Dublin Institute for Advanced Studies. Spiering, who led the collaboration from 2005 to 2007 and also played a key role in the Lake Baikal Neutrino Telescope, was honoured "for his outstanding contributions to cosmic-ray physics and to the newly emerging field of neutrino astronomy in particular". Both he and Sarkar will receive their awards at the 35th International Cosmic Ray Conference in Busan, South Korea, on 13 July.

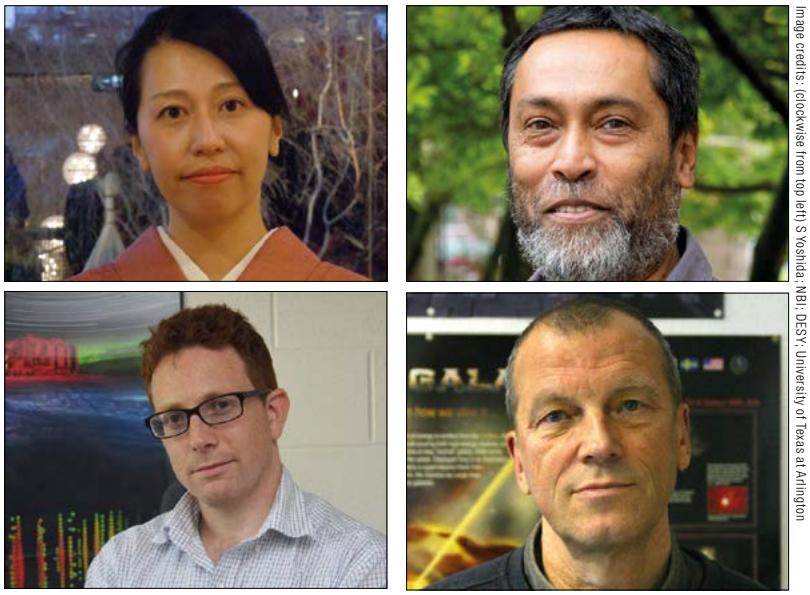


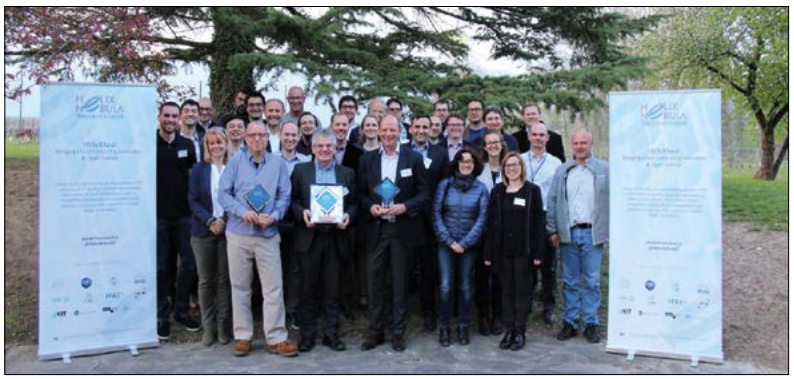
Image credits: (clockwise from top left) S Yoshida; NBI; DESY; University of Texas at Arlington

(Clockwise from top left) Aya Ishihara, Subir Sarkar, Christian Spiering and Ben Jones.

Finally, IceCube member Ben Jones of the University of Texas at Arlington has won the APS 2017 Mitsuyoshi Tanaka Dissertation Award in Experimental Particle Physics, for his thesis "Sterile Neutrinos in Cold Climates".

Firms to begin prototyping the science cloud

An awards ceremony took place at CERN on 3 April recognising companies that have won contracts to start building the prototype phase of the Helix Nebula Science Cloud (HNSciCloud). Initiated by CERN in 2016, HNSciCloud is a €5.3 million pre-commercial procurement tender driven by 10 leading research organisations and funded by the European Commission. Its aim is to establish a European cloud platform to support high-performance computing and big-data capabilities for scientific research. The April event marked the official beginning of the prototype phase, which covers the procurement of R&D services for the design, prototype development and pilot use of innovative cloud services. The three winning consortia are: T-Systems, Huawei, Cyfronet and Divia; IBM; and RHEA Group, T-Systems, Exoscale and SixSq. Each presented its plans to build the HNSciCloud prototype and the first deliverables are expected by the end of the year, after which two consortia will proceed to the pilot phase in 2018.



A Purcell

Award winners and participants at the ceremony, which marks the official beginning of the prototype phase of the pre-commercial procurement process for the Helix Nebula Science Cloud.

CONFERENCES

Beam gymnastics in Sicily

The CERN Accelerator School (CAS) organised a specialised course devoted to beam injection, extraction and transfer in Erice, Sicily, from 10 to 19 March. The course was held in the Ettore Majorana Foundation and Centre, and was attended by 72 participants from 25 countries including China, Iran, Russia and the US.

The intensive programme comprised 32 lectures and two seminars, with 10 hours of case studies allowing students to apply their knowledge to real problems. Following introductory talks on electromagnetism, relativity and the basics of beam dynamics, different injection and extraction schemes were presented. Detailed lectures about the special magnetic and electrostatic elements for the case of lepton and hadron beams followed. State-of-the-art kicker and septa designs were discussed, as were issues related to stripping-injection and resonant extraction as used in medical settings. An overview of optics measurements in storage rings and non-periodic structures completed the programme, with talks about the production of secondary and radioactive beams and exotic injection methods.

The next CAS course, focusing on advanced accelerator physics, will take place at Royal Holloway University in the UK from 3–15 September. Later in the year, CAS is participating in a joint venture in collaboration with the accelerator schools of the US, Japan and Russia. This school is devoted to RF technologies and will be held in Japan from 16–26 October. Looking further ahead, schools are currently planned in 2018 on accelerator physics at the introductory level, on future colliders and on beam instrumentation and diagnostics. See https://www.cern.ch/schools/CAS.

(Above) Participants at the CAS event, which was devoted to beam injection, extraction and transfer.

Faces & Places

Testing gravity in Vancouver

Around 100 participants from 15 countries attended the 2017 Testing Gravity Conference at the Simon Fraser University, Harbour Centre, in Vancouver, Canada, on 25 to 28 January. The conference, the second such meeting following the success of the 2015 event, brought together experts exploring new ways to test general relativity (GR).

GR, and its Newtonian limit, work very well in most circumstances. But gaps in our understanding appear when the theory is applied to extremely small distances, where quantum mechanics reigns, or extremely large distances, when we try to describe the universe. Advancing technologies across all areas of physics open up opportunities for testing gravity in new ways, thus helping to fill these gaps.

The conference brought together renowned cosmologists, astrophysicists, and atomic, nuclear and particle physicists to share their specific approaches to test GR and to explore ways to address long-standing mysteries, such as the unexplained nature of dark matter and dark energy. Among the actively discussed topics were the breakthrough discovery in February 2016 of gravitational waves by the LIGO observatory, which has opened up exciting opportunities for testing GR in detail (*CERN Courier* January/February 2017 p34), and the growing interest in gravity tests among the CERN physics community – specifically regarding attempting to measure the gravitational force on antihydrogen with three experiments at CERN's Antiproton Decelerator (*CERN Courier* January/February 2017 p39).

A Frolov/SFU

Testing Gravity is a new conference series held every two years.

Among other highlights there were fascinating talks from pioneers in their fields, including cosmologist Misao Sasaki, one of the fathers of inflationary theory; Eric Adelberger, a leader in gravity tests at short distances; and Frans Pretorius, who created the first successful computer simulations of black-hole collisions.

This is an exciting time for the field of gravity research. The LIGO–Virgo collaboration is expected to detect many more gravitational-wave events from binary black holes and neutron stars. Meanwhile, a new generation of cosmological probes currently under development, such as Euclid, LSST and SKA, are stimulating theoretical research in their respective domains (*CERN Courier* May 2017 p19). We are already looking forward to the next Testing Gravity in Vancouver in 2019.

Visits

L Mottet

On 12 April, CERN hosted the seven-member high-level group of scientific advisers to the European Commission, which provides independent scientific advice on specific policy issues. Led by former CERN Director-General Rolf Heuer, the group toured ATLAS and the AMS Payload Operations Control Centre.

S Bennett/CERN

On 18 April, Czech minister of health **Miloslav Ludvik** visited CERN, during which he toured the ALICE experiment and signed the guestbook with head of Member State relations Pippa Wells.

S Bennett/CERN

Minister for higher education and science in Denmark **Søren Pind** visited CERN on 25 April, touring the synchrocyclotron, the Antiproton Decelerator, ALICE and ATLAS. Here he is pictured (centre) meeting ATLAS spokesperson Karl Jakobs.

S Bennett/CERN

Dr **Viktoras Pranckietis** MP and speaker of the Seimas, Republic of Lithuania, visited CERN on 26 April, taking in CMS, ISOLDE and MEDICIS. He signed the guestbook with senior adviser for Lithuania Tadeusz Kurtyka (left) and director for finance and human resources Martin Steinacher.

Letters

Two loops in context

The article "The two-loop explosion" (*CERN Courier* April 2017 p18) summarises the current status of precision theory predictions for scattering processes at the LHC, driven by the impressive performance of the LHC experiments. While this is a new situation at CERN, it is not without precedent at a hadron collider. In fact, it had already been apparent in the late 1990s at the electron–proton collider HERA, then operated at DESY, that two- and even three-loop computations in QCD were needed to match the high accuracy of the data. Since then the theory community has made steady advances by achieving two-loop predictions also for electron–positron collisions and, in some cases, pushing as far as the five-loop level.

This progress is based on a number of developments. Factorisation of physics from different length scales has been used systematically to establish effective theories in the soft and collinear limits, helping to organise the sometimes tedious process of cancelling infrared divergences in physical cross-sections. Deeper insight into the analytical structure of scattering amplitudes and new research in mathematics on iterated integrals, hyper-logarithms and periods have also revealed the algebraic structure encoded in Feynman diagrams. Finally, there has been constant progress in computer algebra as the key technology in multi-loop calculations. The computational challenge to set up and solve large systems of equations, even of terabyte size, can be overcome with symbolic manipulation systems such as FORM. It is only during recent years that suitable open-source software and relatively inexpensive hardware have become widely available.

Thus, continuous efforts and investments in theory research during the past decades are bearing fruit, allowing theory predictions in 2017 to indeed match the precision required by many LHC measurements.

● *Sven-Olaf Moch, University of Hamburg.*

OBITUARIES

Pierre Binétruy 1955–2017

One of the most brilliant theorists of his time, Pierre Binétruy, passed away on 1 April. Binétruy received his doctorate on gauge theories in 1980 under the direction of Mary K Gaillard, and held several positions including a CERN fellowship and postdocs in the US. In 1986, he was recruited as a researcher at LAPP in Annecy-le-Vieux and, four years later, he moved to the University of Paris XI. Since 2003 he was a professor at Paris Diderot University. He helped to found the Astroparticle and Cosmology Laboratory (APC) in 2005 and was its director until 2013. We also owe to him the involvement of the APC in space sciences, Earth sciences, and the realisation of the importance of data science.

Binétruy's research interests evolved from high-energy physics (notably supersymmetry) to cosmology and gravitation, and in particular the intersection between the primordial universe and fundamental theories. His recent interests included inflation models, dark energy and gravitational-wave cosmological backgrounds. During his prolific career, he published seminal papers that approached 1000 citations each and received several awards, including the Thibaud Prize and the Paul Langevin Award.

But he will also be remembered for his spirit and courage. He knew that it was necessary not only to seek scientific truth

Binétruy's research interests included supersymmetry, cosmology and gravitation.

but also to have the courage to prepare the community for the scientific goals that this truth demands and to fight to defend them. Older members of IN2P3 remember the extraordinary intellectual atmosphere that animated the Supersymmetry Research Group, which he proposed and directed from 1997 to 2004, transforming it into an unprecedented crossroads for experimenters and theorists. By that time, when the detection of gravitational waves was for many a distant dream, he also had the intuition to involve France in the field of gravitational-wave detection via the LISA Pathfinder programme – a scientific choice to which he devoted great dynamism right up to his death.

Binétruy was also an inspiration to hundreds of students. Through the MOOC Gravity project, which he developed in collaboration with George Smoot, his courses reached tens of thousands of students. He viewed MOOC not just as a simple way to improve the visibility of the university, but as a revolution in the way knowledge is diffused. In parallel with these activities, Binétruy found time to be president of the Fundamental Physics Advisory Group (2008–2010) and the Fundamental Physics Roadmap Committee (2009–2010) of ESA; the French consortium of the LISA space mission; the theory division of the French Physical Society (1995–2003); and the theory section of CNRS (2005–2008). He was also a member of the IN2P3 Scientific Committee (1996–2000) and numerous other panels.

Alongside his scientific activities, which he pursued with enthusiasm and unfailing rigor, Binétruy had a deep appreciation and knowledge of broader culture. He had a profound knowledge of the arts, where he was the driving force behind several interactions between art and science. As one of his eminent colleagues said of him: "Pierre was one of those very exceptional people who was at the top of the game and, at the same time, a remarkably pleasant colleague."

● *Stavros Katsanevas.*

Gösta Ekspong 1922–2017

Our mentor, colleague and close friend Gösta Ekspong passed away peacefully on 24 February at the age of 95. His life as a particle physicist covered the nuclear-emulsion epoch, the bubble-chamber years, experiments at CERN's Large Electron–Positron (LEP) and Super Proton Synchrotron colliders. In his retirement he closely followed the results from the LHC, in particular the search for the Higgs boson.

In 1950 Ekspong was working with Cecil Powell's group in Bristol, UK, which had become a world-leading centre for cosmic-ray emulsion work. In a brilliant experiment with Hooper and King he identified the decay $\pi^0 \rightarrow \gamma\gamma$. By observing e^+e^- pairs from the conversion of the photons close to cosmic-ray interactions, it was

Ekspong once served as Sweden's delegate to CERN Council.

possible to determine the mass of the π^0 and set an upper limit for its lifetime.

Ekspong obtained his doctorate at Uppsala University, Sweden, in 1955, and immediately took up a postdoc position in Emilio Segré's group at Berkeley where he was involved in the discovery of the antiproton at the Bevatron. Scanning emulsions one evening, he found the first evidence for an annihilation interaction in an emulsion, and on the 50th anniversary of the discovery of the antiproton he was invited to Berkeley to talk about the discovery.

Ekspong was appointed to the first chair in particle physics in Sweden, at Stockholm University, in 1960. There he founded a large particle-physics group that over the years made important contributions to many experiments with data mostly from CERN. He strongly supported the use of CERN, where he was a member and chair of the Emulsion

Committee in the early 1960s and a member of the Scientific Policy Committee from 1969 to 1975. He was Swedish delegate to CERN Council for many years and was a catalyst for the development of Swedish particle physics. He was elected to the Royal Swedish Academy of Sciences in 1969 and was a member of its Nobel Committee for physics from 1975 to 1988, chairing the committee from 1987 to 1988.

His deep knowledge of statistics allowed Ekspong to clarify general features of high-energy interactions. Data from CERN's Proton Synchrotron and bubble chambers had suggested that the multiplicity distributions of charged particles obeyed so-called "KNO" scaling, but this relationship was found not to be valid in later collider data recorded at higher energies with the UA5 experiment. In a discovery reported and discussed by him at many conferences, Ekspong showed that the distributions instead followed a negative binomial distribution.

In the early studies of physics possibilities at the planned LEP collider, Ekspong also made a convincing contribution to the search strategy for observing the Higgs boson by carefully examining the experimental mass resolution. This strategy was later employed by the LEP experiments to exclude the Higgs mass up to about 115 GeV. He also took part in the technical development of one of the LEP experiments, DELPHI.

Gösta Ekspong inspired many with his lectures, discussions, and stories about Nobel-prize discoveries. In many articles in Swedish he made physics available and understandable for the general public.

● *Per Carlson and Sven-Olof Holmgren.*

Gareth Hughes 1943–2017

Gareth Hughes joined the high-energy physics group at Lancaster University in 1970, following his undergraduate and postgraduate studies at Oxford University. He was born in Wales and was a proud supporter of the Welsh Rugby Union team, although he had never played the game. He used to say that he was among the few Welshmen who never played rugby, who could not sing and who did not like leeks. Ironically, he died on the feast day of St David, the patron saint of Wales.

Following his appointment in Lancaster, Gareth played a central role in the work of the Manchester–Lancaster experiment (dubbed "Mancaster") at Daresbury Laboratory to study the electro-production of nucleon resonances (by which the components of the nucleon are converted to more highly energetic states). He subsequently went on to work on the JADE experiment at DESY, the ALEPH and then ATLAS experiments at CERN – all of which have been key in establishing the Standard Model of particle physics.

Gareth's main strength was computing. In the 1990s, as well as being a member of the CERN Central Computing Committee, he was chairman of the committee that produced the policy on computing for UK particle physics. This was a very rapidly changing field at the time but a subject in which Gareth's insight and guidance was to prove invaluable. He was also a prominent member of the Particle Physics Grants Committee and other bodies that manage funding for UK particle physics.

Gareth Hughes was a member of the ALEPH and ATLAS collaborations.

He was an excellent teacher, his gentle sense of humour and infinite patience making him a much sought after member of staff by both undergraduate and postgraduate students. He eventually became director of undergraduate courses within the physics department at Lancaster.

Gareth's quick grasp of a situation and clear insight made him an extremely valuable colleague with whom to discuss problems. He was widely known and, in turn, seemed to know everyone. This proved to be a great help on numerous occasions. He retired from the physics department in 2007 but continued his involvement with the ATLAS experiment as an emeritus staff member until his death following a short illness. He will be sorely missed by us all but especially by his wife Jane, daughter Siân and son Owain, and his four grandchildren.

● *His friends and colleagues.*

Faces & Places

Thomas Massam 1936–2016

Thomas Massam received his undergraduate degree in physics in 1956 at the Chadwick Laboratory, Cambridge, and his PhD at the University of Liverpool in 1960. Jovial but very serious and tireless at work, Tom devoted his life to experimental-physics research and to his family.

I had the privilege of meeting Tom at the Fermi Summer School of Physics in Varenna, Italy, in 1962. The topics discussed at the school were the results of the Blackett group on the unexpected V particles, later called "strange" by Gell-Mann, and the effects of "virtual physics" in properties of the elementary particles and the experimental-plus-theoretical research needed. Tom was the most active student of the school, and soon afterwards he joined my group at Bologna University and remained there until his retirement in 2002. Together we performed experiments in all of the important laboratories in Europe, including CERN, DESY, ADONE and Gran Sasso.

Tom had an extraordinary intelligence, work capacity and "scientific fidelity". He

L Cifarelli

Tom Massam helped to set up the first large-scale non-bubble-chamber facility at CERN.

is also one of the founders of the Ettore Majorana International Centre for Scientific Culture, established at CERN in the early 1960s with its headquarters in Erice, Sicily. In 1972, Tom initiated an International School of Theory Application of Computers.

Tom played a major role, contributing with his extraordinary experimental talents, in experiments that established evidence for the Standard Model during the 1960s and afterwards. He helped to set up the first large-scale non-bubble-chamber facility at CERN, and was a close collaborator in our adoption of electromagnetic calorimeters as a tool to separate leptons from hadrons to allow searches for new particle states. Together, we started the first heavy-lepton search and developed a new technology to measure the time-of-flight of particles with a very high precision, leading to the first experimental observation of anti-deuteron production.

Tom, research director in the INFN unit of Bologna, was also giving regular physics courses to the students at the ISSP International School of Subnuclear Physics in Erice, established in 1963.

Tom is no longer with us. On 1 December 2016 he left his beloved family, Veronica with three children Peter, Steven, Paul, and his friends and colleagues with the unforgettable memory of his extraordinary life.

● *Antonino Zichichi*.

Arthur Rosenfeld 1926–2017

Arthur H Rosenfeld, a long-time member of the faculty at the University of California, Berkeley, and distinguished senior scientist at the Lawrence Berkeley National Laboratory, passed away in Berkeley on 27 January at the age of 90. A student of Enrico Fermi, he was a leading participant in the revolutionary advances in particle physics in the 1950s and 1960s before striking out in a new direction, where he became legendary. A fitting tribute to Art was the award in 2006 of the Enrico Fermi Award of the US Department of Energy "for a lifetime of achievements ranging from pioneering scientific discoveries in experimental nuclear and particle physics to innovations in science, technology, and public policy for energy conservation that continue to benefit humanity. His vision not only underpins national policy but has helped launch an industry in energy efficiency".

Art's first impact on the physics community was with Jay Orear and Robert Schluter, when the three of them produced the book *Nuclear Physics* consisting of the notes from Fermi's course at the University of Chicago. Art came to Berkeley from Chicago and was part of Luis Alvarez's

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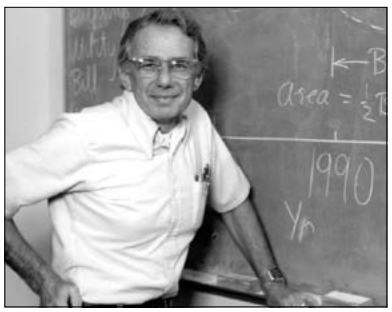

Art Rosenfeld helped establish the Particle Data Group among his many achievements.

team, which used bubble chambers to discover many of the meson and baryon resonances, including the omega meson and the Σ*(1385), which led to the recognition of SU(3) flavour symmetry. Art co-authored papers not only with experimenters, but also with Murray Gell-Mann, Shelly Glashow, and Sam Treiman. The 1957 *Annual Review of Nuclear Science* paper with Gell-Mann, "Hyperons and Heavy Mesons (Systematics and Decay)", was the beginning of the Particle Data Group. Today's Particle Data Group and the *Review of Particle Physics* are, 60 years later, Art's legacy to the physics community.

Much greater still is Art's legacy to the US and international communities, which benefit today from his relentless pursuit of increased efficiency in the use of energy through both technological advances and political advocacy. The oil embargo of 1973 led Art to wonder why he saw so many obviously wasteful practices in the use of energy. He devoted the rest of his career to rectifying this. That per-capita usage of energy in California remained essentially constant from 1973 to 2006, while it rose by 50% elsewhere in the US, was given the name "The Rosenfeld Effect," because of Art's success in getting the state to adopt policies encouraging efficient use of energy.

Art, together with a number of nuclear and particle physicists, and with the backing of Andrew Sessler, the director of the Lawrence Berkeley Laboratory in the mid-1970s, developed programmes in energy efficiency for buildings, appliances and lighting, which became a major part of the Laboratory's

programme. Art's efforts extended beyond the laboratory. He was a founder of the American Council for an Energy-Efficient Economy, a non-profit organisation that continues today to push for policies that increase energy efficiency. Art served in the Clinton administration from 1994 to 1999 as senior adviser to the DOE's assistant secretary for energy efficiency and renewable energy, and subsequently as commissioner at the California Energy Commission under two state administrations.

Among the numerous honours Art received was the National Medal of Science and of Technology and Innovation presented by president Barack Obama in 2011 for "extraordinary leadership in the development of energy-efficient building technologies and related standards and policies".

Art showed that the analytical skills and pragmatism the physics community values could be put to use on practical problems facing humanity. The result of his dedication was profound and lasting contributions to energy efficiency. Despite Art's ever growing fame, he remained an unassuming colleague, and we remember him as a friend whose achievements transcended the scope of our ordinary research endeavours.

● *Robert N Cahn*.

Durga Prasad Roy 1941–2017

Durga Prasad Roy, or DP as he was popularly known, passed away on 17 March in Cuttack, India, after a brief illness. He was active until his last days, having posted a review on the arXiv preprint server in August 2016, participated in conferences in 2017 and having given a series of lectures on the Standard Model at the University of Hyderabad just a few days before he fell ill.

DP completed his PhD in particle physics in 1966 at the Tata Institute of Fundamental Research (TIFR), Mumbai, and was a postdoctoral fellow at the University of California (1966–1968), CERN (1968–1969) and the University of Toronto (1969–1970). He moved to the Rutherford Laboratory in the UK (1970–1974), and was a reader at Visva Bharati University, India, from 1974 to 1976. He joined TIFR in 1976 and retired 30 years later in 2006. He then became a member of the Homi Bhabha Centre of Science Education.

Scientifically, DP had an instinct for recognising what is important. He made pioneering contributions in particle- and astroparticle-physics phenomenology. His early research work was in the area of "Regge phenomenology and duality", which addresses the dominant part of cross-sections for hadron–hadron collision processes. Using these ideas, DP predicted exotic mesons called baryonium (now termed tetraquarks) as well as exotic pentaquark baryons – robust predictions that continue to attract the attention of experimentalists and lattice-QCD experts. Along with his collaborators, he suggested to look for a hard isolated lepton and jets as a signature of the top quark, a methodology widely adopted at the CERN and Tevatron proton–antiproton colliders.

TIFR

DP made pioneering contributions in particle and astroparticle physics.

He also worked extensively on many popular theories of physics beyond the Standard Model, such as supersymmetry. He suggested a promising signature with which to search for charged Higgs bosons using tau decays and the distinctive polarisation of these particles, which is currently being used in the ongoing search for charged Higgs boson at the LHC. Likewise, the missing transverse-momentum signature for supersymmetric particles suggested by DP is being widely used in the ongoing collider searches for these particles.

DP and collaborators, and other groups, employed global fits of the solar-neutrino data, including the SNO neutral-current data from 2002, to pin down the large-mixing-angle (LMA) Mikheyev–Smiron–Wolfenstein (MSW) solution to the solar-neutrino problem. This was tested by two impressive sets of neutrino-spectrum results published by the KamLAND experiment in 2003 and 2004. Incorporating these data further in their analysis, and focussing on the LMA–MSW solution in the two-neutrino framework, DP and collaborators ruled out the high-mass-squared-difference LMA solution by more than three standard deviations and converged on the low-mass-squared difference LMA as the unique solution.

His scientific achievements were recognised by the Meghnad Saha Award and the SN Bose Medal. He was elected fellow of the Indian Academy of Sciences, Indian National Science Academy and National Academy of Sciences.

Along with his colleague Probir Roy, DP started a series of workshops in high-energy physics phenomenology called WHEPP that still initiate a lot of collaborative work today. He was passionate about undergraduate teaching, but also had many interests outside science. He was a weightlifting champion of Orissa, an expert swimmer, and a connoisseur of Indian classical music and dance. His passion for adventure always showed up in the after-work evening activities at WHEPP workshops. He also had strong views on the lack of experimental investigations in ancient India, and published them in an article in the *Indian Journal of History of Science* in 2016.

DP leaves behind a loving wife, Monika, and a daughter, Kalyani.

● *Rajiv V Gavai*.

Recruitment

For advertising enquiries, contact *CERN Courier* recruitment/classified, IOP Publishing, Temple Circus, Temple Way, Bristol BS1 6HG, UK.
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Currently, the gross annual salary for these positions is BRL 251.598,23.

Interested applicants must submit the following information by June 16, 2017:

- Research plan;
- List of publications;
- Curriculum vitae (including, in particular, date of birth, year and institution of PhD, title of thesis and name of supervisor).

The candidate should also indicate the names and e-mail addresses of not less than three renowned physicists. These physicists will receive an e-mail message from us with instructions on how to submit a recommendation letter on the candidate's behalf.

The final decisions will be announced by the end of August 2017 and the selected candidates will be expected to start their activities at the IIP in November 2017 – although a different arrangement can also be agreed upon.

For further enquiries, please contact **tenure-track-2@iip.ufrn.br** or access our web page **www.iip.ufrn.br**.

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