

Faces & Places

APPOINTMENTS

New leader for UK fusion programme

The UK Atomic Energy Authority (UKAEA) has appointed plasma-physicist Ian Chapman as its new chief executive. Taking over the role from Steve Cowley on 1 October, Chapman will lead the UK's magnetic-confinement fusion research programme at Culham Science Centre and operation of the JET fusion device on behalf of European scientists. Aged 34, Chapman is one of the youngest scientist to lead a major research centre and held various roles at Culham prior to the appointment, including head of tokamak science and



Ian Chapman is one of the youngest CEOs of a major research facility.

fusion programme manager. "I hope my profile means that fusion, and its huge potential to give the world cleaner energy, will get noticed," he says. "Furthermore, I hope my appointment will inspire the next generation of scientists and engineers to make a success of ITER, the international fusion project that in my opinion is the most important experiment mankind has ever done."

AWARDS

QCD pioneer wins Prange prize

Theorist Frank Wilczek of the Massachusetts Institute of Technology in the US has been named the 2016 recipient of the Richard E Prange Prize and Lectureship in Condensed Matter Theory and Related Areas. He received a \$10,000 honorarium and delivered a public lecture, "Some Intersections of Art and Science", at the University of Maryland, which established the award, in September. Wilczek, who shared the 2004 Nobel Prize in Physics, is a pioneer of asymptotic freedom, which underpins quantum chromodynamics (QCD). The Prange Prize honours the late Richard E Prange, whose career at Maryland spanned four decades.



Frank Wilczek at the 2003 HEP-EPS conference in Aachen.

Order of Alfonso X the Wise



From left: Marcial Marín Hellín, José María Lassalle Ruiz, Íñigo Méndez de Vigo y Montojo, José Miguel Jiménez and Carmen Vela Olmo.

Head of CERN's technology department, José Miguel Jiménez, has been awarded a Spanish civil decoration called the Order of Alfonso X the Wise for his outstanding experience in

research and scientific management in particle physics. The ceremony took place at the National Library of Spain, Madrid, on 12 July, in the presence of government ministers.

EXHIBITIONS

CERN tours more popular than ever

CERN is Geneva's top tourist attraction, according to TripAdvisor, welcoming almost 110,000 visitors per year. The laboratory has been listed on the TripAdvisor website since 2012 and currently tops the charts of both the 24 tours and the 28 museums listed for Geneva. CERN has also received a 2016 Certificate of Excellence from the firm in recognition of the quality of its tours and the service it provides to visitors.

CERN's visitor numbers have soared since the start-up of the LHC in 2008 and the discovery of the Higgs boson in 2012, and on 15 July a record number of 755 visitors entered the site (the average is around 400 per day). Recently, the visits service introduced individual guided tours, which are proving to be a great success: every morning the tour slots are fully booked in less than five minutes.



The Globe of Science and Innovation is a landmark for CERN's visitors.



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CERN hits the festival circuit



Charlotte Potter-Landua

More than 30,000 people attended the WOMAD festival in the UK this summer.

On 28–31 July, CERN continued its efforts to reach new audiences by organising a “physics pavilion” at the annual WOMAD music festival in the UK countryside. A three-day programme of talks and events was on offer, including topics such as “What’s the matter with antimatter?” in addition to shows featuring the Cosmic Piano and a musical piece created from the sonification of LHC data. Activities such as two “Build your own cloud chamber” workshops and a live link-up with the ATLAS visitor centre took festival goers up close and personal with particle physics.

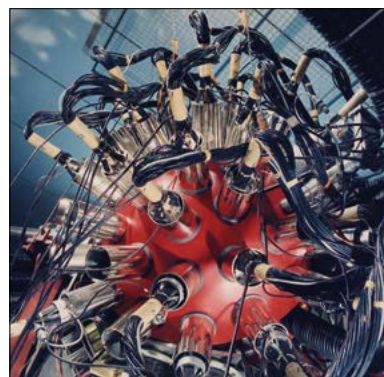
The physics pavilion, which was organised

in conjunction with the UK Institute of Physics, the University of Lancaster and the Science and Technology Facilities Council, received more than 3600 visitors and generated considerable media attention. The event culminated in a packed audience, which had queued for 90 minutes to hear about the science of the long-running science-fiction series *Dr Who*. “I knew we’d got something right when a little girl raised her hand at the end of one session and asked the speaker: ‘How old were you when you knew you wanted to be a physicist?’” says pavilion manager Connie Potter of CERN.

● womad.co.uk/the-physics-pavilion/

Vintage silicon detectors preserved

The Nikhef laboratory in Amsterdam has teamed up with the Museum Boerhaave in Leiden to preserve some of the earliest silicon detectors. Developed for the “BOL” nuclear research project between 1967 and 1977, 64 silicon units were located inside of a cast-bronze spherical frame that fully surrounded the beam target. The system’s 4π coverage, position measurements for several coincident particles and full-absorption energy determination for hadrons precluded the standard concept used today in collider experiments in particle physics. Although the historical roots of the silicon detectors in the LHC experiments can be traced to this “checkerboard” design, today the position precision of the silicon trackers is at least 50 times better. The BOL inner-detector body, together with silicon-detector units, the associated front-end electronics, read-out boards and multiple-ADC boards, will become part of the Dutch scientific heritage collection in the Rijksmuseum Boerhaave – where they will join the helium



IKO-Nikhef

View of the BOL chamber, which was installed in a beam at the IKO cyclotron in Amsterdam in 1969.

liquefier used by Heike Kamerlingh Onnes in 1908 to discover superconductivity and microscopes made by Antoni van Leeuwenhoek in the late 17th century.

10,000th teacher visits CERN



Maximilien Brice/CERN

HST 2016 teachers with CERN Director-General Fabiola Gianotti.

This summer, CERN welcomed its 10,000th school teacher, who was a participant of this year's International High School Teacher (HST) programme. This three-week-long

residential programme, which has taken place every July since 1998, saw 48 teachers come to CERN from across the world. The HST programme aims to increase teachers'

knowledge about the research being carried out at CERN and offers a range of educational resources for use by the teachers to inspire their students' curious minds (see also p53).

CONFERENCES

Strong interactions in Montpellier

The 19th International Montpellier Conference in Quantum Chromodynamics (QCD16) took place in Montpellier, France, on 4–8 July. Around 50 participants took part, with equal numbers of theorists and experimentalists, to discuss all aspects of QCD. This ranged from formal field-theory approaches to confinement, in addition to phenomenological facets such as proton structure, pion form factors, exotic and standard meson spectroscopy, determinations of the strong coupling constant α_s , and searches for new physics beyond the Standard Model.

Highlights from this year's event included a summary of new determinations of α_s and the experimental status of the exotic XYZ spectra by the BESIII experiment, with new improved determinations of their masses from QCD spectral sum rules at NNLO. Meanwhile, CLAS, HERA, the LHC and the NICA-SPD project have gained deeper



Alize photo

Delegates at QCD16 in Montpellier.

insights on the structure functions and properties of the proton. BESIII has also obtained improved results on light hadron spectroscopy from J/ψ decays and, along with NA62, made new measurements of baryon and pion form factors. New BaBar results on the low-energy cross-sections relevant for the muon $g-2$ contribution were also presented, confirming previous experimental results. The meeting also saw a formal non-trivial proof of the gauge invariance of the gluon operator A^2 among

presentations about the non-perturbative aspects of QCD and the quark–gluon plasma. These QCD presentations were complemented by talks from ATLAS and CMS about precise measurements of the top-quark mass, electroweak parameters such as those relevant to the Higgs boson, and searches for new physics.

The 20th International Conference in Quantum Chromodynamics, which celebrated its 30th anniversary last year, will be held in Montpellier on 3–7 July 2017.

Extreme QCD weighs up results

The summer of 2016 will be remembered as a time of some confusion in particle physics. The main event of the summer conference season was the confirmation that a statistical fluctuation at an energy of 750 GeV seen by the LHC's ATLAS and CMS detectors was indeed just that, and not evidence for a new fundamental particle, as had been hoped by many. It was therefore

reassuring to spend three days discussing a theory we traditionally do not understand very well, but where there are copious experimental data and many exciting applications: non-perturbative quantum chromodynamics (QCD).

The “extreme QCD” conference, the 14th conference in the series, was held at Plymouth University in the UK from

1 to 3 August, with 80 participants. Here, “extreme” refers to conditions of high temperature or density that can occur in neutron stars, the early universe or heavy-ion collisions at the LHC and at the Relativistic Heavy Ion Collider (RHIC) in the US.

Ulrich Heinz of Ohio State University started the presentations by reviewing



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Keynote speakers at XQCD 2016: Anders Hansen, Ulrich Heinz, Yuya Tanizaki, Daniel Nogradi, George Fleming, Claudia Ratti, Biagio Lucini and Guido Cossu.



Alan Stewart Plymouth University

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some of the intriguing and puzzling results that have come out of the LHC, including hints of collective flow behaviour not only in heavy-ion collisions but even in high-multiplicity proton–proton collisions. In other talks, we heard of progress in lattice QCD calculations of thermodynamic quantities, which form the basis of the analysis of heavy-ion experiments, including novel ways of computing the energy-momentum tensor and calculations of transport properties of the quark–gluon plasma. There were also stimulating talks on topics as varied as the eigenvalue spectrum from the Dirac operator in QCD, and new approaches to thermalisation in heavy-ion collisions.

The ever-increasing speed of supercomputers and the continual improvement of algorithms have turned lattice field techniques into a precision tool for physical systems that can be written as a path integral with similar properties to a probability problem. However, there are still classes of problems, such as working at nonzero chemical potential, that require path integrals with complex actions, and thus are almost impossible to solve using standard Monte Carlo algorithms. Delegates heard about recent progress that has been made towards tackling this so-called “sign problem” using methods such as the density of states, complex Langevin and Lefschetz thimble integration.

This was followed by a wide-ranging and thought-provoking panel discussion about the problems and prospects of finite-density QCD. Speakers gave a clear overview of the issues of critical interest to the experimental heavy-ion programmes, and many of the non-perturbative techniques developed to solve QCD are now being applied to other systems. For example, lattice field theory is being used to study the 2D carbon allotrope graphene, in addition to calculating the properties of novel dark-matter candidates from strongly interacting theories.

The next extreme QCD conference will be held in Pisa in June 2017, where further progress on the sign problem and pertinent theory relevant to the heavy-ion programme will no doubt be reported.

● xqcd2016.math-sciences.org.

EVENT SPOTLIGHT



KRUGER 2016
DISCOVERY PHYSICS AT THE LHC
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www.kruger2016.tlabs.ac.za

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The fourth biennial Workshop on **Discovery Physics at the LHC (Kruger 2016)** will be held in South Africa on **4-9 December** at the Protea Hotel Kruger Gate, which is located 100 m from the entrance to the Kruger National Park. The surroundings and the physics results presented during this workshop will serve to inspire discussions between theorists and experimentalists on the latest LHC and Tevatron measurements, as well as expectations for the future. Attendance will be limited to about 100 participants, and more information can be found at www.kruger2016.tlabs.ac.za.

VISITS



On 16 August, ambassadors and mission staff from the Group of Fifteen – a group formed in 1989 comprising countries from Latin America, Africa and Asia, with a common goal of enhanced growth and prosperity – visited the ATLAS visitor centre with former collaboration spokesperson **Peter Jenni** (4th from the left) and young ATLAS scientist **Nedaa Asbah** (6th from the right).

Sophia Bennett/CERN

Following Romania's ascension to full CERN membership in July, a ceremony was held on 5 September at which the Romanian flag was raised at the CERN entrance. The blue, yellow and red flag joined those of the other 21 Member States of CERN in a ceremony attended by the president of Romania, **Klaus Iohannis**, the Romanian minister for education and scientific research, **Mircea Dumitru**, and several other members of the president's office, the government and academia in Romania.



Maximilien Brice/CERN

LETTERS

The home of the SPS

The article by Lyn Evans celebrating 40 years of SPS operation (*CERN Courier* July/August 2016 p61) raised a lot of memories, but I must take issue with the author on one point. He says that the machine was initially supposed to be built in the south of France, whereas in fact there were five candidate sites advanced by the Member States. The achievement of John Adams in presenting an acceptable – and cheaper – plan for the SPS at CERN was enormous. It was helped by one simple point: CERN was where the skills were, where the people best equipped to design and build the machine lived.

This same argument played a part in the approval of LEP a decade later. Papers had been published that purported to show that the new machine should be built in Hamburg rather than Geneva. This caused problems at

the political level in one Member State to my knowledge, and I guess at least two.

● *John Walsh, Swindon, UK.*

Neutrino discovery date

Christine Sutton's article about the detection of neutrinos (*CERN Courier* July/August 2016 pp17-19) correctly states that Cowan and Reines were the first to see neutrinos at a distance from the emitting nucleus via inverse beta decay.

However, a series of experiments beginning in 1936 (e.g. *Proc. Camb. Phil. Soc.* 32 301) searched for evidence of the neutrino's existence by measuring the energy and momentum of the recoil of the nucleus and of all other particles emitted in a beta-disintegration decay process. These experiments showed clearly that missing momentum and energy in beta decay required an explanation and that the neutrino hypothesis was the best candidate.

In 1938, Crane and Halpern (*Phys. Rev.* 53 789) used a chlorine-38 beta source in a cloud chamber to observe the recoiling nucleus and the associated beta particle for individual events. Although the track left by the recoiling nucleus was not long enough to allow an energy measurement, it generated ionisation that was assumed to be proportional to the kinetic energy of the recoil motion. Crane himself did not claim to have detected neutrinos, but stated: "It seems now to have been adequately shown experimentally that there is apparent non-conservation of momentum in the beta decay, and that, quantitatively, the maximum amount of extra momentum found is in satisfactory agreement with that called for either by the neutrino hypothesis, or by much more general theoretical arguments which relate the disappearance of momentum to the disappearance of energy."

● *Andrew Sabersky, Chico, California.*

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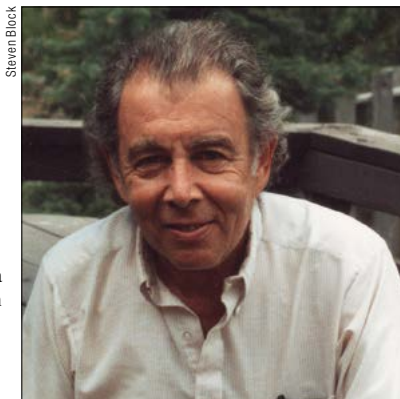
OBITUARIES

Martin Block 1925–2016

Particle physicist Martin M Block died on 22 July in Los Angeles, California, aged 90, following a short illness. His career was distinguished not only in terms of the contributions he made but also by its longevity: his first paper was published in 1949 and his most recent in 2016. Block was also an active participant in the Aspen Center for Physics, where he founded its enduring Aspen Winter Physics Conferences in 1985.

Block completed his doctorate at Columbia University in 1952, where he helped to design magnets for the Nevis Cyclotron. As a young professor at Duke University, he contributed the revolutionary notion that parity was not conserved in weak interactions. The idea, which came to him while he shared a room with Richard Feynman at a Rochester meeting on high-energy physics in 1956, offered a solution to the so-called “tau-theta” paradox: two otherwise identical particles that decay into different parity states and thus were believed to be distinct.

The story was recounted in Feynman’s 1985 memoir *Surely You’re Joking, Mr. Feynman*: “Anyway, I was sharing a room with a guy named Martin Block, an experimenter. And one evening he said to me, ‘Why are you guys so insistent on this parity rule? Maybe the tau and theta are the same particle. What would be the consequences if the parity rule were wrong?’ I thought a minute and said, ‘It would mean that nature’s laws are different for the right hand and the left hand, that there’s a way to define the right hand by physical phenomena. I don’t know that that’s so terrible, though there must be some bad consequences of that, but I don’t know. Why don’t you ask the



Martin Block questioned parity conservation.

experts tomorrow?’ He said, ‘No, they won’t listen to me. You ask.’ So the next day, at the meeting... I got up and said, ‘I’m asking this question for Martin Block: What would be the consequences if the parity rule was wrong?’ Murray Gell-Mann often teased me about this, saying I didn’t have the nerve to ask the question for myself. But that’s not the reason. I thought it might very well be an important idea.”

Important, indeed. The 1957 Nobel Prize in Physics went to Tsung-Dao Lee and Chen-Ning Yang for their theoretical analysis of the process, but it was not shared by Madame Chien-Shiung Wu for her 1956 experimental demonstration of parity violation in the beta decay of cobalt-60 nuclei, nor was Block’s contribution acknowledged at the time.

At Duke, Block developed the first liquid-helium bubble chamber and used

it to study the properties of several newly discovered particles. He left Duke for Northwestern University in 1961, where he served on the faculty for the remainder of his experimental career. He co-discovered the eta meson and later worked on collaborations at ever-higher energies, involving heavy-liquid bubble chambers and, eventually, modern counter detectors. His work took him to accelerators all over the world, with extended experimental stints at Berkeley, Brookhaven, Fermilab – and particularly at CERN, which he visited in every decade from the 1960s until the 1990s.

His lifelong passion for the mountains, especially skiing and fly fishing, eventually took him to Aspen, where he purchased a home and joined the Aspen Center for Physics in its nascent years. There, he embarked upon a second career in theoretical and computational physics. A central focus of this work concerned the forward-scattering amplitudes of hadron collisions, specifically the issue of why the proton–proton interaction cross-section grows with the square of the logarithm of the energy. His work anticipated quantitatively measurements that were eventually performed at the LHC. In one of his final papers, he showed that data demonstrate convincingly that both the proton–proton and antiproton–proton scattering amplitudes asymptotically approach those of a so-called “black disc,” presumably as a consequence of gluon saturation.

Block is survived by his wife, Beate, his two children, Steven and Gail, and two grandchildren.

● Steven Block, *Stanford University*, and Francis Halzen, *University of Wisconsin-Madison*.

John Madey 1943–2016

The international accelerator community was saddened to learn about the passing of the pioneer of the free-electron laser, John M J Madey of the University of Hawaii at Mānoa, on 5 July.

Raised in Clark, New Jersey, John Madey and his older brother Jules took an early interest in amateur radio. In 1956, when John was 13 and Jules was 16, they began relaying communications from the South Pole to families and friends in the US. Madey

received a degree in physics and a masters in quantum electronics from the California Institute of Technology in 1964 and 1965, where he first raised the question of whether it was possible to enhance the transition rate for bremsstrahlung through stimulated emission. He continued thinking about the question while working on his doctoral degree at Stanford, at which time he invented the free-electron laser (FEL).

A FEL can produce coherent

electromagnetic radiation of extremely high intensity and high quality that is tunable over a wide range of frequencies, which is of great interest for research in physics, chemistry, biology and medicine. While classical FELs use mirrors or optical cavities, a more recent FEL variant, operating at ever-shorter wavelengths, is the linac-based FEL such as the Linac Coherent Light Source at SLAC or the European X-FEL in Hamburg, Germany.

Faces & Places

Madey was awarded a PhD in 1970 and appointed professor of electrical engineering in 1986. In 1988, he left Stanford to take up a tenured position at Duke University, moving his FEL research laboratory with him the following year. He joined the University of Hawaii at Mānoa in 1998.

Madey was bestowed with numerous awards and international recognitions, including the Stuart Ballantine Medal from the Franklin Institute in 1989, the 2012 Robert R Wilson Prize from the American Physical Society and the 2016 Willis E Lamb Award for Laser Science and Quantum Optics. He was also the keynote speaker at the 2015 Nobel Symposium on Free-Electron Lasers in Sigtuna, Sweden. Madey held 13 patents on FEL-related technological inventions and published many important papers. These included a seminal publication on stimulated emission in 1976 (*Phys. Rev. Lett.* **36** 717) and, more recently, a comprehensive review article on the history of the FEL invention (*Phys. Rev. ST Accel. Beams* **17** 074901).

University of Hawaii



Free-electron laser pioneer John Madey.

John Madey was also a highly dedicated teacher, patiently mentoring his students and sharing with them his vast knowledge and wisdom.

• Pui Lam, University of Hawaii, Vladimir Shiltsev, Fermilab, and Frank Zimmermann, CERN.

Roberto Petronzio 1949–2016

Our dear colleague Roberto Petronzio passed away on 28 July at the age of 67. He was a CERN fellow from 1977 until 1979 and a staff member in the theory division from 1980 until 1986. He played a significant role in our field as professor at the University of Tor Vergata, president of the INFN (2004–2011) and as a member of the CERN Council. Roberto was a major contributor to the development of QCD. He was involved, among other projects, in the first complete calculation of the NLO anomalous dimensions, and in the resummation of soft-gluon emission in partonic processes. He was also involved in the non-perturbative analysis of the theory. In particular, along with Cabibbo and Parisi, he was one of the first members of the APE collaboration, which managed to construct the famous series of supercomputers for numerical simulations. Together with Cabibbo and Martinelli, he proposed the use of lattice simulations to compute weak amplitudes. These results are of great importance in flavour physics, for example in analyses at B factories and in similar work carried out at CERN by the LHCb, ATLAS and CMS collaborations.

Roberto was well-anchored in the Standard



Theorist Roberto Petronzio served on the CERN Council.

Model but always looking for harbingers of new physics. He had an eclectic knowledge of particle physics and related subjects. His legacy is also represented by several generations of brilliant young physicists spread across different laboratories and universities throughout the world. He had a charming and wonderful personality and was a great asset to our community. He will be dearly missed.

• His colleagues and friends.

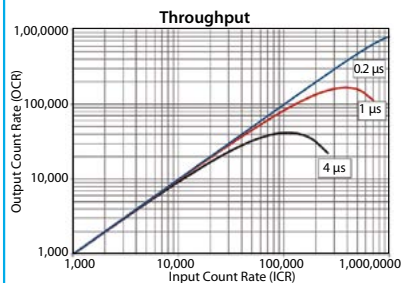
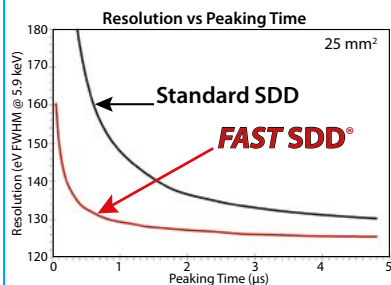
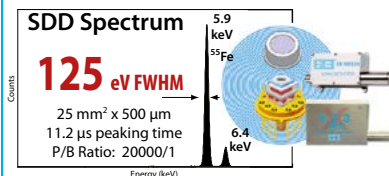
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Yoshio Yamaguchi 1926–2016

Yoshio Yamaguchi, who propelled particle physics in the post-war world, passed away on 12 August. His research encompassed a wide field of particle physics.

After his education at the University of Tokyo, Yamaguchi joined Osaka City University and co-founded a particle-physics group. The group was soon attracted by the new particles that were being detected in collisions between cosmic rays and the atmosphere, and Yamaguchi proposed that they are created in pairs – marking the first step towards understanding strange particles.

Yamaguchi spent much time abroad and first went to the University of Illinois at Urbana, where he proposed a separable potential of nuclear interactions. Shortly afterwards, he was invited to the newly founded theory division of CERN, where he stayed from 1957 to 1961. Former CERN Director-General Viki Weisskopf wrote in his memoir: “Yamaguchi contributed much to the scientific atmosphere in the theoretical



Yoshio Yamaguchi helped to establish KEK.

division at CERN.” He was very quick to catch the essence of new experiments and it was general lore at CERN that when you made an experimental proposal, you must go and talk to Yamaguchi in advance to convince him, or you would get in trouble in the proposal meeting.

Yamaguchi then moved to the Institute

for Nuclear Study (INS) at the University of Tokyo, where he led the theory group. Besides theory, he helped to create a new particle-physics laboratory in Japan that was realised eventually as KEK. He later moved to the physics department at Tokyo to teach. His lectures were popular, although he worked his students hard and had high expectations.

Yamaguchi was not only an excellent and versatile physicist, but a first-class manager. He returned to the INS as director until his retirement, and was a co-founder of the International Committee for Future Accelerators in the 1970s, chair of the International Union of Pure and Applied Physics from 1993 to 1996, and contributed to creating the Asian Pacific Center for Theoretical Physics.

Yamaguchi also had a wide cultural background in European and Japanese classics. We will greatly miss this giant of particle physics.

● *His friends and students.*

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