

## SYMPOSIUM

# CERN inaugurates LHC cryogenics



Members of the CERN cryogenic groups in front of the Globe of Science and Innovation, where the symposium took place. (Globe conception T Buchi, Charpente Concept and H Dessimoz, Group H.)



Inauguration and ribbon-cutting ceremony of LHC cryogenics by CERN officials: from left, Giorgio Passardi, leader of cryogenics for experiments group; Philippe Lebrun, head of the accelerator technology department; Giorgio Brianti, founder of the LHC project; Lyn Evans, LHC project leader and Laurent Tavian, leader of the cryogenics for accelerators group.

The beginning of June saw the start of a new phase at the LHC project, with the inauguration of LHC cryogenics. This was marked with a symposium in the Globe of Science and Innovation attended by 178 representatives of the research institutes involved and industrial partners. It also coincided with the stable low-temperature operation of the cryogenic plant for sector 7–8, the first sector to be cooled down (*CERN Courier* May 2007 p5).

The LHC and its large particle detectors make intensive use of superconducting magnets and cryogenics. The LHC helium cryogenic system is the largest and most complex ever built, with more than 160 kW equivalent at 4.5 K and 20 kW at 1.8 K (*CERN Courier* May 2004 p5). Cryogenic systems are important for both the ATLAS and CMS detectors, which use different technologies, with helium and argon required for their superconducting magnet systems and for the ATLAS calorimeter (*CERN Courier* December 2005 p28).

The system for the LHC involves many industrial-scale devices, where reliability is of paramount importance. The LHC's energy of 7 TeV requires a strong magnetic field, which is provided by niobium-titanium

coils operating at 1.9 K. Besides enhancing the performance of the niobium-titanium superconductor, this temperature regime makes use of the excellent heat-transfer properties of helium in its superfluid state. The design for the LHC cryogenics had to incorporate both newly ordered and reused refrigeration plant from LEP operating at 4.5 K – together with a second stage operating at 1.9 K – in a system that could be replicated around the LHC.

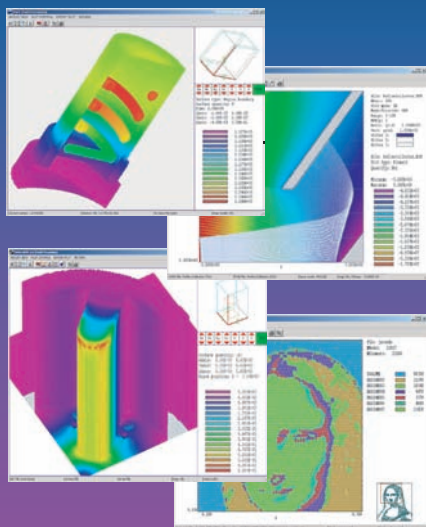
The main elements for both the accelerator and the detectors are now operational. The large superconducting magnets and liquid argon calorimeters for the ATLAS and CMS experiments have been cooled and tested, and all superconducting magnets for the accelerator have been procured from industry, cold tested at CERN and installed in the ring. The first 3.3 km sector of the machine – one-eighth of the circumference – has been cooled down and tested, permitting the full-scale validation of basic design choices. In particular, thanks to the superfluid helium cooling system, the magnet temperature could be controlled to within 0.1 K over the sector length. The results were recently reported at the CEC 2007 conference in Chattanooga,

Tennessee. Although the commissioning work is far from finished, the cryogenics groups at CERN felt that after 10 years of construction it was now a good time to celebrate, organizing the Symposium for the Inauguration of LHC Cryogenics that took place on 31 May–1 June at CERN's Globe of Science and Innovation. After an inaugural address by CERN's director-general, Robert Aymar, the programme included 21 presentations of the different aspects of the system, an industrial exhibition by seven companies, and visits to technical sites above and below ground.

The symposium brought together specialists from industry, participating institutes and CERN, all involved in the design and construction of the LHC cryogenic system. Some 20 general and scientific journalists also attended. The event culminated with the formal inauguration and ribbon-cutting by the LHC project leader Lyn Evans and a final buffet. The event was co-sponsored by Air Liquide DTA (France), ISQ (Portugal) and Linde Kryotechnik AG (Switzerland).

● The programme for the symposium can be found at <http://indico.cern.ch/internalPage.py?pageId=3&confId=9046>.

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## FACES AND PLACES

### COLLABORATION

## Chile strengthens relations with CERN...

The President of Chile, Michelle Bachelet, paid a visit to CERN during her three-day tour of Switzerland at the beginning of June. The visit was also the occasion for the signing of a co-operation agreement between CERN and Chile's Comisión Nacional de Investigación Científica y Tecnológica (CONICYT), represented by the commission's president, Vivian Heyl.

During the visit, Michelle Bachelet and her delegation were greeted by CERN's director-general, Robert Aymar, and shown the ATLAS experiment and the LHC. Bachelet also took time to meet the Chilean community working at CERN, comprising several physicists in the Theory Group and the ATLAS experiment.

The co-operation agreement between CERN and CONICYT provides a framework for the long-term participation of students and scientific and technical staff from Chile's universities and research institutes in CERN's experimental programme. At the same time, Pedro Pablo Rosso, rector of the Pontificia Universidad Católica, and José Rodríguez, rector of the Universidad Técnica Federico Santa María, also signed agreements with ATLAS spokesman Peter



*The President of Chile, Michelle Bachelet (right), in the ATLAS cavern with (from left to right) Peter Jenni, ATLAS spokesman, Vivian Heyl, CONICYT president, and Robert Aymar, CERN's director-general.*



*Robert Aymar signing the co-operation agreement between CERN and Chile's Comisión Nacional de Investigación Científica y Tecnológica (CONICYT).*

Jenni relating to co-operation between the experiment and their two universities.

## ...and Mexican research council signs MOU

José Antonio de la Peña, the deputy-director for science of the main Mexican funding agency Consejo Nacional de Ciencia y Tecnología (CONACYT), came to CERN on 14-15 May. His visit included the LHC experiments and the CLIC facility, and it concluded with his signing a memorandum of understanding together with Robert Aymar, CERN's director-general, for Mexican contribution to the ALICE experiment.

A major part of the visit centred on discussions between de la Peña and leaders of the ALICE collaboration. The bulk of Mexican effort at CERN is concentrated on the ALICE experiment at the LHC, with about 35 people (half of them students) in two detector projects, the VO (a forward detector) and the cosmic-ray trigger array ACORDE. De la Peña underlined his satisfaction with the ACORDE detector, which has been conceived, completely



*José Antonio de la Peña (right) signs the MOU between CONACYT and CERN.*

designed and produced by the groups from Cinvestav, BUAP (Puebla) and ICN-UNAM, under the project leader Arturo Fernández from BUAP. He also expressed the wish to extend the collaboration of CONACYT to other areas at CERN, mainly in connection with the training of Mexican undergraduate and postdoctorate researchers.



## AWARDS

# EPS honours quark mixing with 2007 prize

The European Physical Society High Energy and Particle Physics Prize for 2007 has been awarded to Makoto Kobayashi of KEK and Toshihide Maskawa of the University of Tokyo for “the proposal of a successful mechanism for CP violation in the Standard Model, predicting the existence of a third family of quarks”. Experimental evidence for CP violation first emerged in 1964 (p12) but it was not until 1973 that Kobayashi and Maskawa pointed to a possible solution to the unexpected phenomenon. They noted that mixing between different quarks (as first proposed by Nicola Cabibbo in 1963) could explain the CP violation so far observed – but only if there were six types of quark, rather than the three known at the time. This bold suggestion was subsequently verified with the discovery in experiments of three new types of quark and by the recent observations by the Belle and BaBar experiments of CP violation in the decays of B mesons at precisely the level predicted by the theory of Kobayashi and Maskawa. Kobayashi received the prize on behalf of the two physicists on 23 July at the EPS conference on High Energy Particle Physics in Manchester. The award ceremony also saw the presentation of further EPS prizes.

For physics that is intimately connected with the third generation of quarks required by Kobayashi and Maskawa, the 2007 EPS Young Physicist Prize was awarded to Ivan



Makoto Kobayashi (right) receives the 2007 EPS HEPP award, on behalf of himself and his colleague Toshihide Maskawa, from David Wark, Chair of the EPS HEPP Board. (Courtesy Per Osland.)

Furić of the University of Chicago, Guillermo Gómez-Ceballos of the Massachusetts Institute of Technology and Stephanie Menzemer of Ruprecht-Karls-Universität Heidelberg. They were rewarded for “their outstanding contributions displaying individual creativity and collaborative

effort to the complex analysis that provided the first measurement of the frequency of  $B_s$  oscillations”.

The 2007 Gribov Medal for outstanding work by a young physicist in theoretical particle physics and/or field theory was awarded to Niklas Beisert of the MPI für Gravitationsphysik for his “contributions to the exploration of integrability properties of a 4D quantum field theory,  $N=4$  supersymmetric Yang-Mills theory”.

The 2007 EPS Outreach Prize was awarded to CERN’s Richard Jacobsson and Charles Timmermans of NIKHEF and Radboud University for their “outstanding contributions in promoting high-energy physics to the public and in high schools in Europe”. Jacobsson has been involved in outreach at CERN for many years, most recently with the LHCb experiment for the LHC. Timmermans is the principal initiator of the HISPARC project through which Dutch high-schools are participating in the study of cosmic rays (CERN Courier July/August 2004 p12). In addition, the Outreach Prize Selection Committee made special mention of Anne Gaud McKee, who lost her life in a walking accident in 2006. She created the company Mimescope and, in particular, the spectacle *The DELPHI Oracle*, performed at CERN at the closure of LEP in 2000 and later in Lausanne, Paris, London and Edinburgh (CERN Courier June 2000 p31.).

## INDUSTRY

## ATLAS rewards two pixel suppliers

The Fraunhofer Institut für Zuverlässigkeit und Mikrointegration (IZM) in Berlin and the company SELEX Sistemi Integrati have received supplier awards from the ATLAS collaboration, presented in a ceremony held on 13 June. The prizes were for the manufacture of modules for the ATLAS pixel detector. SELEX supplied 1500 of the modules for the tracker, while IZM produced a further 1300. The modules, each made up of 46080 channels, form the active part



ATLAS spokesperson Peter Jenni (right) presented the ATLAS supplier awards to Herbert Reichl, IZM director, and Simonetta Di Gioia from SELEX.

of the ATLAS pixel detector. IZM and SELEX received the awards for the excellent quality of their work – the average number of faulty

channels per module was less than  $2 \times 10^{-3}$ . They also stayed within budget and on schedule. The two suppliers demonstrated great flexibility in designing modules based on electronic components and sensors that were imposed by the experiment.

In responding to the challenge, IZM and SELEX used two different methods. SELEX used a process involving indium deposits followed by thermocompression, while IZM opted for the electrolytic deposition of Pb/Sn. Both techniques allowed the strict characteristics required by ATLAS to be met. SELEX worked in close collaboration with the Genoa and Milan INFN groups, while IZM collaborated with the University of Bonn.

## APPOINTMENTS

# SLAC announces new heads for particle and particle astrophysics

Steven Kahn, the current deputy-director of the Kavli Institute for Particle Astrophysics and Cosmology (KIPAC), has been named the next director of particle and particle astrophysics (PPA) at SLAC. David MacFarlane, currently the assistant director for elementary particle physics, will take on the role of deputy-director of particle and particle astrophysics.

As director of PPA, Kahn will oversee SLAC's B-Factor programme (the PEP-II accelerator and the associated detector, BaBar), the work at KIPAC sponsored by the US Department of Energy, the SLAC-based teams working on the ATLAS experiment at the LHC at CERN and also the International Linear Collider effort, advanced accelerator research and the non-accelerator particle physics programmes.

He will replace Persis Drell, who has served as director of PPA since 2002, on 1 August. Drell will stay on as deputy director of the laboratory until the end of the year. In addition to serving as deputy director of PPA, Kahn retains the joint faculty appointment at SLAC and in Stanford's physics department that he has held since moving to Stanford four years ago. Prior to that, Kahn served as chair of the physics department at Columbia University, where



David MacFarlane (left) and Steve Kahn take on new roles at SLAC. (Courtesy SLAC.)

he oversaw both astrophysics and particle physics research. He has also served on the Fermilab Physics Advisory Committee for the past four years and was an influential member of the committee that wrote the High Energy Physics Advisory Panel's *Quantum Universe* report. While he will step down from his current role at KIPAC to take

the new position, he will continue working as deputy-director of the Large Synoptic Survey Telescope project.

David MacFarlane served as spokesperson for the BaBar collaboration from 2004 until 2006, and he joined SLAC's faculty in the autumn of 2005 from the University of California at San Diego.

## LETTERS

## Thirring's achievements

The short article above the picture of Walter Thirring and Julius Wess on p38 of the July/August 2007 edition of *CERN Courier* mentions the Thirring model, but this is only one of Thirring's many achievements. Besides contributions to gravity and general relativity – following in the line of his father, Hans Thirring – he made pioneering contributions to dispersion relations and the quark model, and he obtained many beautiful results in the field of rigorous quantum mechanics. In particular, with

Elliott Lieb, he gave a beautiful proof of the “stability of matter”, i.e. the fact that, if you ignore gravity, an assembly of  $N$  atoms has a binding energy and a volume proportional to  $N$ . He is also a pianist, an organist and a composer of chamber music.

Andre Martin, CERN.

## The Greek origin of zero

In his review of *The Human Touch* by Michael Frayn (*CERN Courier* July/August 2007 p54) Gordon Fraser said: “The concept of zero, attributed to the Greeks, was imported from

the Orient (the Arabic zifr is commemorated in our ‘cipher’).” However, readers of *CERN Courier* should be informed that the concept of zero is correctly attributable to the Greeks. By trying to understand what there is between zero and one, Zeno (500 BC) discovered his famous formula, the modern formulation of which is:

$$1 = \sum_{n=1}^{\infty} \left(\frac{1}{2}\right)^n$$

The Arabic zifr came many centuries later. Antonino Zichichi, INFN/University of Bologna/CERN.

## CO-OPERATION

# The members of ERF sign charter document of formal association

At a recent meeting at DESY in Hamburg, the founding members of the European Association of National Research Facilities (ERF) signed a charter document to constitute the association formally.

The ERF is an initiative by 11 European laboratories to promote the co-operation between individual nationally funded large-scale research facilities in Europe. Among its associates are European laboratories that provide large facilities with neutrons, lasers, synchrotron light, ions and particles with open access to international scientific communities. Its present chair is Albrecht Wagner, chairman of the DESY directorate. The association now has 14 nationally funded European laboratories as members, which together serve more than 13 000 users worldwide and cover a wide research spectrum, from archaeology to life sciences, including an estimated 20% directly or indirectly connected with industry.

The aim of the ERF is to provide a forum to coordinate the development of leading national facilities for European research and to develop mechanisms and best practices for international access to large-scale research facilities. It will act as a source of



Albrecht Wagner (DESY and Chair of ERF) signing the ERF charter document. From left to right: A Kleyn (FOM Rijnhuizen), R Eichler (PSI), D Raoux (Soleil), K G Jeffery (STFC), C Rizzuto (Elettra), W Sandner (MBL/Laserlab-Europe) and M Steiner (HMI).

scientific and technical expertise for national and European policy making and represent a large constituency of large-scale research facilities speaking with one voice to decision makers. With the help of topic-oriented joint initiatives and consortia, the ERF will make resources for large-scale research facilities available by co-operation.

● The founder members of ERF are Société Civile Synchrotron Soleil, France;

Gesellschaft für Schwerionenforschung mbH, Germany; Elettra-Società Sincrotrone, Italy; DESY; MAX-Lab, Sweden; Grand Accélérateur National d'Ions Lourds, France; Paul Scherrer Institut, Switzerland; FOM Rijnhuizen, the Netherlands; Max-Born Institut, Germany; Hahn-Meitner Institut, Germany; and Science and Technology Facilities Council, UK.

● <http://www.europeanresearchfacilities.eu>.

## NEW PRODUCTS

**DeMaCo** has gained three renewed certificates this year. Along with ISO 9001, it was awarded the ISO 3834-2 certification for welding quality assurance. The company has also obtained the PED Module H and H1 certificates, which indicate the independence to design and produce pressure equipment without a TPI. For more information, see [www.demaco.nl/vacuum](http://www.demaco.nl/vacuum).

**Interface Concept** and **ACT/Technico** have unveiled a new high-performance COTS graphics PMC, the IC-GRA-PMCa. As an advanced graphics board, the IC-GRA-PMCa features a 128 MB DDR memory at 266 Mbps, two video output channels with

resolutions of up to 1280 × 1024 pixels at 60 Hz and multiple interfaces (DVI, VGA, RGB, STANAG). Two video inputs support an SVGA capture resolution. For further details, tel +1 800 445 6194, +1 215 956 1200 or +33 298 573 030; e-mail [sales@acttechnico.com](mailto:sales@acttechnico.com) or [info@interfaceconcept.com](mailto:info@interfaceconcept.com), or see [www.acttechnico.com](http://www.acttechnico.com).

**AMS Technologies** has announced the availability of new current-sense resistors from Caddock Electronics, Inc. The Model SR20 is now available in resistance values as low as 0.005 ohm (5 milliohm) for continuous currents up to 20 A. It features Kelvin (four-wire leads) for accurate

1% performance. The compact footprint uses little board space, but operates cool for outstanding stability. For details, tel +49 89 89 577 514; email [caddock@ams.de](mailto:caddock@ams.de) or see [www.ams.de](http://www.ams.de).

**Andor Technology** has launched two new spectrographs, the Shamrock SR-500 and SR-750. Features include direct and responsive control of the spectrograph and camera through Andor Solis software, allowing the user to control wavelength and calibration, grating selection, shutter control and filter selection, and a facility to join spectra together. For details, tel +44 28 9023 7126 or see [www.andor.com](http://www.andor.com).



### MINISTERIAL VISITS

On 11 June, the Austrian minister of science and research, **Johannes Hahn** (left), visited CERN. After touring the CMS experiment with **Felicitas Pauss**, deputy president for the collaboration committee of CMS, Hahn visited the computing centre, met with CERN's director-general, **Robert Aymar**, and later met Austrian students based at CERN.



Poland's minister for science and higher education, **Michał Seweryński** (centre), followed suit on 12 July. His tour of CERN included the CMS experiment, together with the spokesperson, **Jim Virdee** (left), and CERN's chief scientific officer, **Jos Engelen**. His visit finished with a presentation of Polish companies involved with CERN. The minister also had time to meet Polish personnel at CERN.



The following day, on 12 June, it was the turn of **Claus Hjort Frederiksen** (left), the Danish employment minister, to come to CERN. He was given a tour of the ALICE cavern by **Jens Jørgen Gaardhøje** from the Niels Bohr Institute and a member of the ALICE collaboration, and also visited the ATLAS experiment.



A day later, on 13 July, **Ján Mikolaj** (second from left), deputy prime minister and minister of education of the Slovak Republic, came to CERN. His visit included a tour of the ALICE experiment, here with deputy spokesperson Paolo Giubellino (yellow hard hat), ATLAS and the computer centre. He was also shown the CLIC facilities and took time to meet the Slovak personnel working at CERN.



Lithuanian prime minister **Gediminas Kirklis** (far left) came to CERN on 2 July. His visit included a guided tour of the ATLAS cavern, accompanied by CERN's director-general, **Robert Aymar** (second from left) and an inspection of the LHC tunnel.



**Anton Anton** (far right), president of the National Authority for Scientific Research in Romania, came to CERN on 19 April. His visit included tours of the ATLAS and ALICE experiments and the LHC tunnel. Here he talks with members of CERN's Romanian community.

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## OBITUARIES

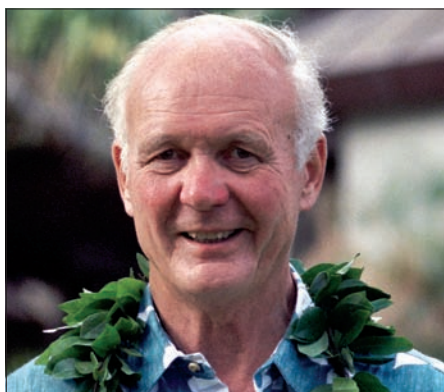
# Vincent Z Peterson 1921–2007

Vincent Z Peterson died peacefully in Berkeley, California, on 17 May 2007. He was 85. He was professor of high-energy physics, first at Caltech and later at the University of Hawaii, where he founded – and then headed – the high-energy physics group until his retirement in 1992.

Vince was born and raised in Galesburg, Illinois, and went to Pomona College, majoring in physics. During the Second World War, he was assigned to special projects in antisubmarine detection in the US Navy. After the war, he attended the University of California, Berkeley, where he received his PhD in physics with W K H Panofsky, before joining Caltech, where he remained for 12 years.

In 1962, he was hired by the University of Hawaii to set up a programme in high-energy physics. Hawaii had become the 50th state of the US in 1959 and had decided that its university should become a major research institution. Vince was able to get a sizeable grant from the Atomic Energy Commission and brought in Bob Cence and Vic Stenger in 1963 to form the core experimental group. He developed a close collaboration with the Moyer–Helmholtz group at the Lawrence Radiation Laboratory in Berkeley, while his own group began assembling the apparatus needed for bubble chamber analysis in Hawaii. Vince had a great feeling for what was important in the field and made sure that the Hawaii group was always involved in forefront experiments, particularly through close collaborations with Berkeley, Fermilab and several large university groups.

Among various important experiments,



Hawaii was involved in studying CP violation in  $K^0 \rightarrow 2\pi^0$  at the Bevatron, transition radiation at SLAC, charmed particle production, weak neutral weak currents and QCD with neutrinos at Fermilab.

Detector development was one of Vince's continuing interests and he maintained close ties with colleagues at high-energy labs. In particular, he encouraged and supported the work of Hawaii group-member Sherwood Parker at Berkeley and SLAC. This included the development of wire chambers for external muon identification, silicon microstrip detectors and pixel detectors.

Vince did not neglect the theoretical side of high-energy physics but arranged for Peter Dobson and San Fu Tuan to come to Hawaii to start a theory group. Starting in 1965, Vince and San Fu organized a series of highly successful topical conferences that took place every other summer until 1985. At one memorable conference in 1973, Don Perkins of Oxford announced the discovery of weak neutral currents at CERN, to the

great excitement of the other attendees, including Richard Feynman.

Vince was part of the international committee that organized conferences on neutrino physics and was conference director for the Neutrino '81 meeting in Maui. In the 1980s, the experimental group split into accelerator and non-accelerator physics and the Hawaii DUMAND Center was formed with the purpose of building an undersea muon and neutrino detector off the coast of the Big Island of Hawaii. Vince was the director, with Vic Stenger as associate director and John Learned as technical director. Although the project was eventually cancelled, Hawaii pioneered the field of VHE neutrino astrophysics, which is still under active development today with experiments in the Mediterranean and Antarctica. With Vince's encouragement, Learned and other group members played major roles in the IMB proton-decay experiment in Cleveland and the Super-Kamiokande experiment in Japan. The 1998 paper announcing the first evidence that neutrinos have mass included Learned, Stenger and other group members as co-authors.

Vince and his wife Elisabeth (Tess) always treated the members of the group as family, holding many Sunday barbecues at their house in Kailua close to the beach. They spent sabbatical years in Rome, Oxford and Geneva, always keeping in touch with friends around the world – many of whom visited them in Hawaii. Vince led a long and fulfilling life, and he will be remembered and missed by his family and friends.

*Andrea Peterson and Vic Stenger.*

# Wolfgang Kummer 1935–2007

Wolfgang Kummer, a prominent Austrian theoretical physicist and former president of CERN Council (1985–1987), passed away on 15 July 2007 after a long fight with cancer. He obtained a doctorate in physics in 1960 from the Technical University of Vienna and in 1968 became one of the youngest full professors ever,

heading a newly founded second institute for theoretical physics devoted to theoretical high-energy physics.

From early on, Kummer's career was intimately connected with CERN, where he came on a Ford scholarship from October 1961 until March 1962, which Walter Thirring had obtained for him. This

brought Kummer into contact with Victor Weisskopf, then director-general of CERN, and Weisskopf invited him to come back as a CERN fellow and his scientific assistant from 1963 to 1964. In 1966, Kummer became the first director of the Institute for High Energy Physics of the Austrian Academy of Sciences, which he led until the



end of 1971, parallel to his professorship at the Technical University. Simultaneously, he also became the Austrian delegate to the CERN Council and was soon elected to chair the Finance Committee, overseeing the construction of the ISR. In 1980, Kummer returned to the CERN Council as its vice-president at the point when the SPS was taking shape as a proton-antiproton collider, and the job was more suitably filled by a physicist than a pure diplomat.

Between 1985 and 1987, Kummer was president of CERN Council, a term that was briefly interrupted by the consequences of a terrorist attack at Vienna airport on 26 December 1985, where Kummer was one of the victims, suffering from severe injuries from hand-grenade splinters and shrapnel. After only 11 days in intensive care (and in a rather critical condition), he recovered quickly and immediately resumed his job as Council president. He even attended the annual Schladming Winter School two months after these events, and he skied as ever. Clearly, his regular sporting activities



*Wolfgang Kummer (right) with Victor Weisskopf during Weisskopf's 80th birthday celebrations at CERN in 1988.*

were crucial for his amazingly quick recovery. But Kummer was not only a sportsman in his spare time, he was also a man of culture – in particular a pianist and trained tenor, which in Geneva led to regular chamber music evenings with colleagues such as Volker Soergel and Jack Steinberger.

While Kummer held numerous academic and administrative positions, such as being secretary and then president of the High Energy Board of the European

Physical Society from 1995 to 1999, he was especially responsible for building up a theoretical high-energy physics group at the Technical University of Vienna – covering a broad range of research in quantum field theory, string theory and (mainly 2D) quantum gravity. Kummer had contributed foundational work in quantum gauge field theory, in particular by using ghost-free non-covariant gauge fixing. Since the early 1990s, he mainly worked on two-dimensional gravity and he was unceasingly productive much beyond his official retirement in 2003, despite deteriorating health. He remained an active member of the Austrian Academy of Sciences and chairman of the Advisory Board of the Institute for High Energy Physics, Vienna.

Kummer will be missed, both as an eminent physicist and by those who knew him personally as a man of sincere kindness and warmth. We mourn his loss together with his wife Lore, who was always by his side. *W Majerotto, A Rebhan, M Regler, and W Thirring, Vienna.*

## Carlo Caso 1940–2007

Italian physicist Carlo Caso from Genoa University and INFN passed away on 7 July, after several months of a courageous fight against cancer. He actively participated in the experimental programme at CERN throughout his scientific career, spending some seven years at the laboratory as a fellow and scientific associate.

Carlo's long involvement in particle physics started in the 1960s, with the Genoa group, using CERN's liquid-hydrogen bubble chambers – first the 2000 HBC and later the Big European Bubble Chamber – to study various facets of the production and decay of meson and baryon resonances. He later joined a collaboration using the European Hybrid Spectrometer with a rapid-cycling bubble chamber as vertex detector. Among many achievements, this team was the first to measure – with excellent precision – the lifetime of the charmed D mesons. At the start of the LEP era, Carlo and his group moved to the DELPHI experiment and participated in the construction and running of the High-



density Projection Chamber (the barrel electromagnetic calorimeter) and then contributed significantly to measurements of beauty physics and Higgs searches.

After LEP, Carlo's interest turned to the LHC and the ATLAS experiment. He led a group from Genoa engaged in the design and construction of the pixel detector and made significant personal contributions to this effort. He also maintained an active interest in the ATLAS experiment and its collaboration, serving as chairman of the ATLAS Publication Committee. Sadly, Carlo

did not survive to enjoy the LHC data.

Alongside his research, Carlo played an important role as a teacher. A full professor of experimental physics in Genoa, he was able to motivate many of his students. He instilled in them a love of physics, and to ask questions and not to be satisfied with a superficial answer. In addition to all other activities, he also found time to serve as chairman of the Physics Department of Genoa University, chairman of the University Council and member of the Physics Advisory Committee of the Italian Ministry of Education. He was a member of several national and international physics societies and was still acting as expert reviewer for the scientific programmes of Europe. For years, he also devoted part of his energy to the Particle Data Group, where he was responsible for the gauge bosons sector.

Our thoughts and sincere sympathy are with his family, including his wife Lella and his daughters Alessandra and Raffaella. We will all miss Carlo sorely. *His friends.*