

Faces & Places

FACILITIES

ESS lays new foundations for science

Several hundred members of the European scientific community gathered at the construction site of the European Spallation Source (ESS) in Lund, for the Foundation Stone Ceremony on 9 October. The event was held to lay the foundation not only of the new facility, but also for a new generation of science in Europe.

The ESS is a consortium of European nations co-operating in the design and construction of one of Europe's largest active infrastructure projects, which has evolved to meet the scientific demand for facilities that are beyond the capability of individual nations or institutions in scope and complexity (*CERN Courier* June 2014 p27). Following two decades of increasingly sophisticated technical design work, scientists, engineers, project managers and builders have now embarked on the construction of the most powerful neutron source in the world. The facility will provide the tools to enable discoveries in nanotechnology, life sciences, pharmaceuticals, materials engineering and experimental physics. Both the research to come and the establishment of the facility itself will serve as an economic driver for all of Europe.

The foundation-stone event follows the ESS ground-breaking held in early September, when the host countries, Sweden and Denmark, recognized their successful establishment of the pan-European political and economic partnership for ESS. First neutrons are expected by 2019 and the first experiments are scheduled to begin in 2023.



Top: Representatives of the countries involved in the ESS at the Foundation Stone Ceremony. The stone itself was in the form of a puzzle, with different representatives laying the pieces, from the first, bottom left, to the last, bottom right. (Image credits: ESS.)

EXHIBITION

Italian industry and culture come to CERN

At the fifth Italy at CERN, held on 8–10 October, 30 Italian companies presented their products and services. The exhibitors came from a range of technical fields, including superconducting technologies and engineering components. Maurizio Serra, Italian ambassador to the United Nations Office and other international organizations in Geneva, visited the stands after inaugurating the exhibition together with CERN's director-general, Rolf Heuer.

Maurizio Serra, centre, with CERN's director-general, Rolf Heuer, right. (Image credit: CERN-PHOTO-201410-201 – 34.)

Accompanying the industrial stands was an exhibition of a different kind, with paintings by Alberto Di Fabio. In addition, each evening featured Italian musicians in CERN's main auditorium, with performances by the Associazione Musicale Progetto Bel Canto and Duo Poem.



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CERN 60

UN and CERN celebrate 60 years of science for peace and development



At the UN headquarters in New York, the special event to celebrate 60 years of science for peace and development included speakers Carlo Rubbia, left, Kofi Annan, centre, and Hitoshi Murayama. (Image credits: UN Photo/Evan Schneider.)



At a special event at the United Nations headquarters in New York on 20 October, CERN and the United Nations Economic and Social Council (ECOSOC) celebrated science for peace and development, a culmination of events to mark CERN's 60th anniversary. Under the chairmanship of the ECOSOC president, Martin Sajdik, the event included a series of speeches from eminent scientists and world leaders, who underlined the role that science has played in peaceful collaboration, innovation and development.

Following Sajdik's opening speech, introductions were given by the president of the 69th UN General Assembly, Sam Kutesa, and UN secretary-general, Ban Ki-moon. Addresses by the permanent

representatives for Switzerland, Paul Seger, and France, François Delattre, preceded a speech by CERN's director-general, Rolf Heuer, who stressed the importance of effective dialogue between science and international affairs.

The keynote speeches began with Carlo Rubbia, Nobel laureate in physics and former director-general of CERN, followed by Kofi Annan, Nobel-peace-prize laureate and former UN secretary-general. Both spoke about the role that science has played in the past decades to bring people together. Hitoshi Murayama, director of the Kavli Institute for the Physics and Mathematics of the Universe, University of Tokyo, and Naledi Pandor, minister for science and technology of the Republic of South Africa, then spoke on what science can do to contribute to pressing global issues.

Invited representatives of the world of politics, diplomacy and science took part in an interactive discussion, introduced by CERN's Fabiola Gianotti, who is a member of the Scientific Advisory Board to the UN secretary-general. Concluding remarks came from Sebastiano Cardi, chair of the Second Committee of the UN General Assembly, and a video message from Irina Bokova, director-general of UNESCO, as well as from Heuer and Sajdik.

The UN is supportive of science and its role in society, and this event follows on from when CERN was granted observer status to the UN General Assembly in 2012 (*CERN Courier* January/February 2013 p5).

● For a recording of the webcast, visit <http://webtv.un.org/watch/cern-sixty-years-of-science-for-peace-and-development/3849462291001>.

AWARDS

French Physical Society honours Guillaume Unal

Guillaume Unal, of CERN, has been awarded the Jean Ricard Prize by the French Physical Society (SFP). He was presented with the award by Alain Fontaine, president of the SFP, in a ceremony at the Musée du quai Branly in Paris on 21 October, after a presentation by Livio Mapelli, head of CERN's physics department. Unal

Left to right: Livio Mapelli, Guillaume Unal and Alain Fontaine. (Image credit: Louis Fayard.)

has worked on the CDF experiment at Fermilab and on UA2, NA48 and ATLAS at CERN, where he was a key contributor to the understanding of the liquid-argon electromagnetic calorimeter, and the discovery of the Brout–Englert–Higgs boson in the $\gamma\gamma$ channel.

The Jean Ricard Prize is the SFP's most prestigious award, and has been awarded to an experimental high-energy physicist only a few times since its creation in 1970. The former recipients in experimental



high-energy physics are Georges Charpak, Paul Musset, Marcel Banner, Yves Declais, Alain Blondel and Daniel Fournier.

Itep presents the 2014 Pomeranchuk Prize

Alexander Zamolodchikov of Rutgers University and Leonid Keldysh of the P.N. Lebedev Physical Institute, Moscow, received the 2014 Pomeranchuk Prize in a ceremony at the Institute for Theoretical and Experimental Physics (ITEP) on 18 September. The prize – established by ITEP in 1998 in memory of Isaak Pomeranchuk – is awarded annually to one foreign and one Russian theoretician, for outstanding achievements in the field.

Zamolodchikov was honoured for outstanding results in mathematical physics, including exact S-matrices in the theory



of integrable systems, the construction of two-dimensional conformal field theories, and exact results in renormalization group dynamics. His work has found many applications in the theory of elementary

Leonid Keldysh, left, and Alexander Zamolodchikov, recipients of the 2014 Pomeranchuk Prize. (Image credit: E Demidova/ITEP.)

particles, condensed matter and string models. Keldysh received the award for outstanding results in solid-state physics, including the theory of tunnelling phenomena in semiconductors, a diagram technique for non-equilibrium quantum systems, and the prediction of exciton condensation. They are used in many areas, for example quantum field theory and quantum cosmology.



On 25 June, Evangelos Gazis of the National Technical University of Athens (NTUA) was honoured by the French Ministry of National Education with the insignia of Officer of the Order of Academic Palms for his work at CERN's LHC, bringing together Greek and French communities in the field of physics. Presented to distinguished academics and figures in the world of culture and education, the decoration was originally founded by Napoleon I to honour eminent members of the University of Paris. The ceremony was held at the Institut Français de Grèce, where the insignia was presented by Olivier Descotes, director of the institute, who also cited the work of Gazis in the development in Greece of medical applications of particle physics, such as proton therapy. (Image credit: Institut Français de Grèce.)

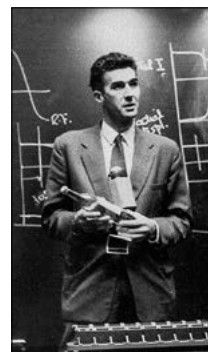
ANNIVERSARY

The John Adams Institute: 10 years strong

John Adams, the great pioneer of CERN's accelerator complex, received his education at evening classes, and mastered his skills not at university but via practical work, first in research at Siemens and then in a UK government radar laboratory. Now, times are better, and graduate students receive education in accelerator science at university, but the necessity of practical research and hands-on experience remains the universal formula for training the next generation of scientists. This formula is the underlying principle of the UK's John Adams Institute for Accelerator Science (JAI).

Established in 2004, initially as a joint venture between the University of Oxford and Royal Holloway, University of London, the JAI has become an internationally recognized centre for accelerator science. It has earned an international reputation for training the next generation of accelerator scientists, a significant number graduating each year with world-class PhDs to take up posts in industry and at national laboratories.

JAI academics, researchers and students have together developed a strong research programme at the forefront of accelerator science. Spanning national and international facilities and projects, the programme aims at developing novel accelerators for fundamental science simultaneously with systems for medical, biological and industrial applications. Since its foundation, the JAI has developed – and continues to enhance – its connections with industry and its outreach programme. The institute works closely with industrial companies to bring scientific ideas closer to practical



John Adams, leader of the Proton Synchrotron construction team at CERN, when he announced the successful acceleration of protons to 24 GeV on 24 November 1959. (Image credit: CERN-HI-5901881-1.)

applications. Its inspiring and innovative outreach is increasing the desire of younger generations to aspire to technical and scientific careers.

This year, the JAI celebrates its 10th anniversary. At its inauguration ceremony on 25 October 2004, Brian Foster announced that the joint Royal Holloway and Oxford accelerator centre had been renamed the John Adams Institute for Accelerator Science. The JAI and its twin, the Cockcroft Institute of Accelerator Science and Technology, have boosted accelerator research in the UK significantly, regaining international leadership in this vital scientific area, and they have contributed strongly to world-class research and training, of which Adams would be proud.

● The JAI is a joint venture between the University of Oxford, Royal Holloway, University of London, and (since 2011) Imperial College London. For more information, see www.adams-institute.ac.uk/.

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VISITS



Tom Kibble visited LHC experiments for the first time on 10 and 11 October, on his way from Trieste, where he had participated in the 50th anniversary celebrations of the Abdus Salam International Centre for Theoretical Physics (p38). After visiting the ATLAS detector, he delivered a colloquium on the genesis of electroweak unification and the Brout–Englert–Higgs mechanism. The following day, he went underground to see CMS, seen here, before returning to the UK. (Image credit: CMS-PHO-PUBLIC-2014-009–8.)

MEETING

An international workshop on the **Science and Technology of the Free-Electron Laser** is being held at the School of Physics, Devi Ahilya University, Indore, on 4–6 December. The theme of the workshop is undulator technology and free-electron laser science. The national and international free-electron-laser facilities will be discussed, with focus on the design issues of laser-plasma accelerators for free-electron lasers. The event is being held as part of the celebrations of the university's 50th anniversary. For further information, see http://sbfel3.ucsf.edu/www/Indore_FEL_workshop_2014_a.pdf.

CORRECTION

Which was the first cross-border accelerator? The October issue of *CERN Courier* (pp19 and 24) asserted that it was the Super Proton Synchrotron, which started up in 1976 in its 7 km tunnel that straddles the Franco-Swiss border. However, the Proton Synchrotron (PS) Booster, which accelerated its first protons on 26 May 1972, correctly lays claim to this accolade. On the Meyrin site, Route Rutherford follows the border, straight across the middle of the circular Booster. Its four rings currently take protons at 50 MeV from Linac 1 and accelerate them to 800 MeV for injection to the PS (*CERN Courier* September 2012 p33).

The president of Bulgaria, **Rosen Plevneliev**, seated, visited CERN on 14 October. He signed the CMS guestbook during his underground visit to the CMS experimental cavern, accompanied by spokesperson **Tiziano Camporesi**, before visiting the LHC tunnel and meeting with Bulgarians at CERN (Image credit: CERN-PHOTO-201410-205–34.)



NEW PRODUCTS

Keithley Instruments has announced the Model 2460 SourceMeter, the company's latest benchtop Source Measure Unit (SMU) instrument with a capacitive touchscreen graphical user interface. Model 2460 offers users higher power sourcing (up to 105 V, 7 A DC/7 A pulse, 100 W max.) with 0.012% basic measurement accuracy and 6½-digit resolution, making it useful for high-power, high-precision I–V characterization of modern materials and high-power devices. For more details, tel +49 89 84 93 0740, e-mail info@keithley.de or visit www.keithley.com.

Murata has announced the addition of the OKD series of non-isolated point-of-load (PoL) DC/DC converters from Murata Power Solutions. Available in three different package formats – through-hole, single-in-line, and surface mount – the OKDx-T/40 is a 40 A, 132 W digital DC/DC converter. These highly efficient (typically 97.2%), fully regulated converters offer a high power density and measure

just 30.85 × 20.0 × 8.2 mm. For more information, tel +44 1252 811666, e-mail atonooka@murata.co.uk or visit www.murata.eu.

Model 307 from **Resolve Optics Ltd** is a high-performance, 40 mm focal length, infrared (IR) lens designed specifically for thermal-imaging applications in the 8–14 µm waveband. Manufactured from germanium, Model 307 lenses come with antireflective coatings that ensure high performance throughout the IR waveband, and operate over 0–40°C without refocusing. For more details, tel +44 1494 777100, e-mail sales@resolveoptics.com or visit www.resolveoptics.com/.

VadaTech has announced a 2U Hybrid Chassis that provides MicroTCA.4-compliant slots along with MicroTCA.0 standard slots. The VT812 2U Chassis Platforms feature four mid-size MTCA.0 and four mid-size MTCA.4 slots, including corresponding MicroRTMs (Rear

Transition Modules for MicroTCA). The MicroTCA.4 architecture is designed primarily for high-energy physics applications, but is an excellent fit for many other applications. The chassis offers dual MicroTCA Carrier Hubs (MCHs), dual redundant power supplies, a JTAG Switch Module (JSM) and a Telco Alarm. For more information, visit www.VadaTech.com.

Wind River has introduced its latest version of Wind River Linux, which users can now access as binary code, in addition to source-code format. The new version is also updated with the current Linux kernel, toolchain, and user space based on the upcoming Yocto Project release. Developed from the Yocto Project open-source development infrastructure, Wind River Linux uses the latest Linux kernel as its upstream source to ensure access to the latest from the open-source community. For more details, tel +33 164 866 664, e-mail isabelle.denis@windriver.com or visit <http://tinyurl.com/wrlinux7>.

OBITUARIES

Walter Thirring 1927–2014

Walter Thirring, one of the most important theoreticians in Austria since 1945, passed away on 19 August, after a long battle with illness.

Walter's grandfather as well as his father, Hans, were physicists too – the latter is well known for his important contributions to general relativity. The family suffered a great deal during the Second World War: Walter's father was dismissed by the Nazis and his brother lost his life. Walter was saved because he was wounded during an exercise in the German army. In line with family tradition, he then succeeded with a picture-perfect career in mathematical physics, after earning his PhD from the University of Vienna in 1949 with distinction, his thesis dealing with aspects of the Dirac equation.

After completion of his thesis, Walter left to visit Erwin Schrödinger in Dublin, Werner Heisenberg in Göttingen, Wolfgang Pauli in Zürich, Albert Einstein in Princeton, and others. In 1954, he returned to Europe as a lecturer at the University of Bern, and also held visiting positions in the US. During this time, he established himself as a pioneer in the newly emerging quantum field theory, and wrote an important paper on renormalization and a paper with Stanley Deser, Marvin Goldberger and Murray Gell-Mann on dispersion relations in particle physics. He also formulated a model for strong interactions based on SU(3), which influenced the work of Gell-Mann that led to the quark model. After a fruitful decade on the road, he finally settled in 1959 as professor at the Institute of Theoretical Physics of the University of Vienna, where he stayed until his retirement in 1995.

Scientifically, Walter was probably best



Walter Thirring. (Image credit: Austrian Central Library for Physics.)

known for what is now called the Thirring model, which is an exactly solvable model in two dimensions with quartic fermionic interactions. Another milestone was the proof of the stability of matter, with Elliott Lieb. He was also widely known for his excellent textbooks in theoretical physics, mainly on quantum electrodynamics and quantum field theory. His particular concern was to put his lectures on a solid mathematical foundation, which led to the four-volume work on mathematical physics. His scientific legacy also comprises famous students and collaborators, such as Julius Wess.

During his travelling years, Walter learned to appreciate the international character of modern science and became aware of its all-importance. When he returned to his home country, his insight and interest in these matters were crucial in re-establishing Austria in the scientific landscape. In particular, he was instrumental in facilitating Austria's membership of CERN in 1959,

which paved the way for research on a truly international basis. His special ties with CERN culminated in membership of the directorate of CERN as head of the Theory Division, from 1968 to 1971. As a member of the directorate, Walter participated in the decision to build the Super Proton Synchrotron on the CERN site – a decision that proved to be crucial for the future of CERN and of particle physics.

Walter always stressed that international collaboration and combined effort is of utmost importance for smaller countries such as Austria, which by themselves could not afford large-scale science such as particle physics. In line with this, he spent much effort in fostering European collaboration, especially in view of the dominant US and Russian activities in science. One of his most visible achievements is the Erwin-Schrödinger-Institut für Mathematische Physik in Vienna, which has become a renowned international centre of research in mathematical physics. Given its location, it became an important meeting point for scientists from both Eastern and Western Europe. Moreover, the Walter Thirring Institute for Mathematical Physics, Astrophysics and Nuclear Investigations, in the Ukraine, founded in 1996, as well as the collaboration with the Bogolyubov Institute for Theoretical Physics of the National Academy of Sciences of Ukraine, serve an important role in the peaceful interaction between scientists of the East and West.

Walter's death is a great loss for science and international collaboration, and we will keep his memory alive at CERN.

● *Harald Grosse, Wolfgang Lerche and André Martin, on behalf of Walter's friends at CERN and in Vienna.*

Bruno Righini 1931–2014

Bruno Righini, who for 32 years was responsible for the Electronic Test and Maintenance Group of the Experimental Physics (EP) Division at CERN, passed away recently after a sudden and cruel illness.

A physicist at the University of Bologna who had written textbooks on general and transient electronics, Bruno arrived at CERN in 1964. He oriented the still small group towards experimental physics, which

at the time was moving from photographic bubble-chamber detectors to counters and electronic recording. This development gave an extraordinary impulse to the creation of new sections for digital electronics and data acquisition, both being fields where Bruno's competence was outstanding. Sections in charge of instruments, of their design and of the study of the corresponding specifications and standards were duly extended. In

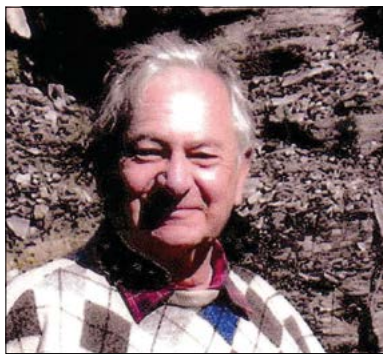
short, the group became responsible for the evaluation, selection and procurement of the electronic equipment used in the experiments and stored in a central pool.

Bruno solved the delicate function of selection by establishing an objective system of tests that were transparent and open to all. The suppliers, if they wished, could participate in tests at CERN, therefore removing any possible doubt about receiving

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fair treatment. This, and other solutions, were widely appreciated by the experimental physicists, and contributed to making the group close-knit and united in its purpose, as well as to giving proper credit to the people concerned.

Bruno always kept in close contact with the physics teams and understood their needs well. He dealt with people in a simple, unassuming and intelligent way, which gave everybody the feeling of being treated with due consideration. For many of us, he was not only a colleague but also a dear friend, to the extent that we could debate at length, without different opinions ever becoming a point of importance. He was open minded and liked to listen, in



Bruno Righini. (Image credit: Mrs B Righini.)

search of a clear definition of a problem or a better solution. His keen sense of justice made discussions interesting, purposeful and constructive. The group and the Electronics Pool became gradually an essential and indispensable feature of the EP Division, and were recognized as such by the internal staff as well as by external visiting teams.

We all feel the sadness of his premature passing away, and wish to express our sympathy and deepest condolences to his family in these difficult circumstances. We will always remember Bruno, his natural wisdom, his quiet wit and his deep understanding of our human society at CERN.

● *His colleagues and friends.*

Alan Astbury 1934–2014

Alan Astbury, a distinguished experimental particle physicist and emeritus professor at the University of Victoria, passed away on 21 July in Victoria, after a brief illness. He was renowned for his leading role in the discovery of the W and Z bosons at CERN in 1983, for his tenure as director of TRIUMF (1994–2001), and for his lasting contributions to particle physics in Canada.

Born in Crewe, England, Alan obtained his BSc and PhD at the University of Liverpool. Following postdoctoral research at the Lawrence Radiation Laboratory, Berkeley, he returned to the UK to the Rutherford Laboratory in 1964, where he remained for 19 years. There, with others, he rapidly devised an experiment at the laboratory's 7 GeV proton synchrotron, Nimrod, which verified the 1964 discovery of CP violation in neutral kaon decays. He went on to conduct further experiments, both at Nimrod and at CERN's 25 GeV Proton Synchrotron, where in the years 1970–1973 he led a UK collaboration in a programme using an antiproton beam. These experiments found new states in hadron spectroscopy – work that contributed to the experimental foundations of the quark model. He chaired CERN's Electronic Experiments (1975–1976) and Proton Synchrotron (1976–1978) committees, and also served as *ex-officio* member of the Scientific Policy Committee.

In 1977, Alan joined Carlo Rubbia in an ambitious project at CERN's Super Proton Synchrotron that aimed at colliding counter-rotating proton and antiproton beams at the highest energies ever achieved to produce the W and Z bosons of the weak force. A year later, Rubbia invited



Alan Astbury. (Image credit: TRIUMF.)

Alan to become co-spokesperson for the UA1 experiment, and in 1983 both the UA1 and UA2 experiments announced the discoveries of the W and Z bosons – an achievement that led to the awarding of the Nobel Prize in Physics to Rubbia and Simon van der Meer in 1984.

From 1976 to 1983, Alan served on the Experiments Evaluation Committee for the TRIUMF laboratory, where the University of Victoria (UVic) played a large role as a founding member, through the work of Michael Pearce and other faculty members. Apparently, something caught Alan's attention about Victoria, and in the summer of 1983 he took up the university's inaugural R M Pearce Chair of Physics.

Once at UVic, Alan started a world-class programme in particle physics, with initial efforts spent on the UA1 experiment. He became a member of the Stanford Linear Accelerator Centre Scientific Policy Committee, and a year later, in 1985, UVic became a member of the SLAC Large

Detector collaboration. Alan's expertise quickly benefited the Canadian subatomic community and its long-term planning.

In 1990, it became clear that the Large Electron–Positron collider (LEP) in CERN was rapidly reaching its design specifications, and Alan brought his research group at UVic into OPAL, one of the four large experiments. He was director of the Institute of Particle Physics of Canada from 1991 to 1995, and his support was critical in establishing the ATLAS Canada collaboration in 1992. He attracted a number of outstanding young Canadian particle physicists to UVic, and several graduate students from his group were awarded Canada Research Chairs, while many others went on to faculty positions in Canada and abroad.

In 1988, the consortium of universities that created and ran TRIUMF proposed that the accelerator complex be expanded to produce very high intensity and much higher energy beams that could be used for many experiments, including neutrino physics. Alan was made the leader of what was called the Project Definition Study for the TRIUMF Kaon Factory, producing a report in 1990. The Canadian government rejected the project – although a similar project was built eventually in Japan – and for a while it looked as though TRIUMF was coming to an end.

Alan took over as director of TRIUMF in 1994, and created a new vision for the laboratory and a new accelerator project to create rare nuclei – the Isotope Separator and ACcelerator (ISAC). By the time that he retired as director in 2001, TRIUMF had an international reputation as a world leader in nuclear astrophysics and nuclear-structure physics. At the same time, Alan and

TRIUMF played crucial advisory roles on the early design of the ATLAS experiment. As TRIUMF's director, he oversaw and facilitated important Canadian contributions to both the LHC and the ATLAS detector. Canada's proud role in the recent discovery of the Higgs boson owes much to his remarkable foresight.

On the international front, Alan was appointed to the Physics Research Committee (1987–1993) that advised the directors of DESY. Along the way, he was recognized for his accomplishments with the 1986 Rutherford Medal from the UK's Institute of Physics, was made a fellow of the Royal Society of Canada in 1988, and elected fellow of The Royal Society of London in 1993.

He was awarded many honours after he stepped down as director of TRIUMF in 2001. These included the British Columbia Science Council Career Achievement Award, the Canadian Association of Physics Medal for Lifetime Achievement in Physics, and the UVic Craigdarroch Gold Medal for Career Achievement, as well as honorary degrees from the University of Liverpool, UVic and Simon Fraser University. He was president of the International Union of Pure and Applied Physics from 2005 to 2008, and during this time recruited new members and instituted a new award for young scientists.

It was hard to remember that Alan was an emeritus professor. He came into UVic

every day. His door was always open, and he continued to give advice and regale us with amusing anecdotes. He had a lifelong passion for football (soccer) and traditional jazz, and would often talk about the latest game result in the British Premier League or the World Cup. He was very interested in the welfare of the students and postdoctoral fellows, and also followed the career of some young jazz pianists closely. Alan was an exceptional man who inspired his peers with his courage, wisdom, humour and humanity.

A devoted husband and father, he is survived by his wife Kathy and his daughters Elizabeth and Gillian.

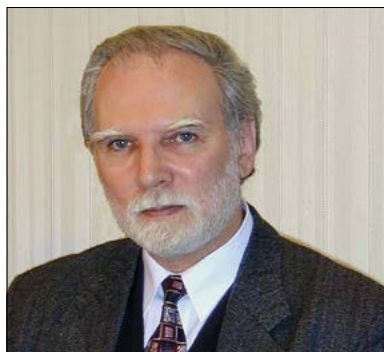
• *Richard Keeler and Michel Lefebvre, University of Victoria.*

Vladimir Georgievich Kadyshevsky 1938–2014

On 24 September, the scientific leader of JINR, Vladimir Georgievich Kadyshevsky, died suddenly. A prominent scientist in elementary-particle theory and high-energy physics, he had an unflinching interest in the most challenging and principle issues in physics, creative approaches in research, and a rich intuition.

Kadyshevsky was born on 5 May 1937 in Moscow. He studied at the Suvorov Military School in Sverdlovsk from 1946 to 1954, before entering the physics department of the Lomonosov Moscow State University (MSU). He immediately expressed an interest in theoretical physics. In 1959 his diploma thesis "On Mass Spectrum and Fundamental Length in Field Theory" won first prize and was awarded the medal of the USSR Ministry of Education at the All-Union Olympiad for students' theses. He graduated in 1960 and continued his studies as a postgraduate under Nikolai Bogoliubov. He successfully defended his PhD thesis in 1962, before starting work at the Laboratory of Theoretical Physics of JINR.

From 1964, Kadyshevsky published a series of papers dedicated to the covariant Hamiltonian formulation of quantum field theory. He worked out a unique diagram technique that, unlike the well-known Feynman technique, operates on amplitudes on a mass surface. Its application to the problem of the interaction of two relativistic particles allowed him to reduce the number of variables and establish the 3D integral equation for the relativistic scattering amplitude that is now known as the Kadyshevsky equation. His approach allows the transfer of research methods, intuition and experience accumulated in the theory



Vladimir Kadyshevsky. (Image credit: JINR.)

of analogous non-relativistic systems – for example, few-nucleon atomic nuclei – to the sphere of elementary-particle physics. The Kadyshevsky equation is today used for practical calculations of hadron–hadron interactions and for the description of the quark structure of hadrons.

His name is also connected with the relativistic formulation of quantum field theory in quantized space–time that satisfies the unitarity requirements and the generalized causality condition. His internationally acknowledged work in this field foreshadowed research in non-commutative geometry in the 1990s that is now the focus of theoreticians' attention. In the theory of internal symmetry, Kadyshevsky postulated a number of correlations for effective cross-sections and the masses and magnetic moments of hadrons that have been proved experimentally. Even before the Standard Model of electroweak interactions was

constructed, he studied lepton–hadron symmetries that are revealed in weak processes.

Kadyshevsky became professor at MSU in 1970 and for many years was head of the Elementary Particle Physics Chair. Many of his students have become successful, well-known scientists, working in scientific centres in Russia and abroad. On numerous occasions he guided the work of schools for young scientists, international symposia and conferences. On his initiative a new university – the International University of Nature, Society and Man – was opened in Dubna in 1994, and a year later he became its president.

After being head of a group of Soviet physicists working at Fermilab in the years 1977–1978, Kadyshevsky later led JINR's activities for the DELPHI experiment at CERN's Large Electron–Positron collider in the years 1983–1985, in particular guiding related theoretical research. Then, at the suggestion of Bogoliubov, he was elected to be director of the Laboratory of Theoretical Physics of JINR in 1987. In this position, he made an important contribution to promotion of the scientific traditions of the Dubna theoretical school, and to the development of broad international co-operation.

In 1992, Kadyshevsky became head of JINR, a position he held until 2005. During these difficult years, he and his colleagues managed not only to maintain the institute but also to enhance its position considerably. In this period, experiments on Russia's first superconducting accelerator of relativistic nuclei – the Nuclotron – began; the research reactor IBR-2 was upgraded to provide neutron beams with record parameters; the synthesis of new superheavy elements was

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carried out; and there was much progress in the development of programmes in particle physics at JINR and at other large scientific centres around the world. From 2005, in his position as the institute's scientific leader, he contributed greatly to the development of the main scientific trends and international co-operation at JINR.

He undertook a range of scientific organizational activities. He was member of the Presidium of the Russian Academy of Sciences, and of the Expert Advisory

Board under the chairman of the Russian Federation Accounts Chamber. For a number of years he was president of the Union of Scientific Societies of Russia and a member of the board on particles and fields of the International Union of Pure and Applied Physics. His scientific achievements brought a number of prizes, and he was an honorary doctor of several foreign universities, as well as an honorary or foreign member of various academies.

Vladimir Kadshevsky was an active

advocate of values of fundamental science. He strived to increase the public prestige of Russian science and the Russian Academy of Sciences. He had a strong sense of responsibility, devotion to science, ambition and an extraordinary commitment to work. These features combined in his character with a natural refinement, amiability and kind attitude towards people. His friends, students and colleagues will always remember him in their hearts.

● *Staff members of JINR.*



In December 2010, a coating on CERN's Globe of Science of Innovation, above, gave the iconic structure an appropriately seasonal look for those who have a taste for traditional Christmas pudding.

Snow is often a feature of winter at CERN, but the winter of 1962–1963 was one of the coldest in northern Europe, with extreme conditions from the frozen river Rhine in Germany to frozen sea on the UK's coast. CERN also froze, as is evident from the black-and-white picture taken in January 1963 of the barracks that were still being used as labs and offices.

Nearly 50 years later, harsh conditions arrived again in Europe, from around 22 November in 2010. Heavy snow arrived in Switzerland on 26 November, followed by a week of cold weather. In the photo taken below at CERN on 2 December 2010, the sun may have been shining on the Jura mountains in the background, but the low temperatures ensured that there was not much call for the use of CERN bicycles. (Image credits: CERN-GE-1012315-01, top, CERN-GE-6301205, right, CERN-GE-1012315-04, below.)

