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Vasilii Vasil'evich Parkhomchuk (on his 70th birthday)

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The 1st of September 2016 was the 70th birthday of Vasilii Vasil'evich Parkhomchuk, a Corresponding Member of the Russian Academy of Sciences (RAS), Head of laboratory of Budker Institute of Nuclear Physics (BINP) of SB RAS, one of the world's leading specialists in the field of physics and technology of charged-particle accelerators and storage rings and the development of the ion-beam electron cooling method, and pioneer of the Russian scientific school of accelerator mass spectrometry.

It was due to a fortunate confluence of circumstances that Vasilii Vasil'evich got engaged in science. In the early 1960s, the Siberian Branch of the USSR AS began holding All-Siberian Olympiads for schoolchildren to attract talented young people to science. The information about the olympiad reached the god-forsaken Altaian village where Vasilii Parkhomchuk went to school. He took part in the olympiad and in 1963 was invited among the winners to the summer physico-mathematical school (PMS) in Akademgorodok near Novosibirsk. He finished secondary school already in Novosibirsk, where talented children from the whole of Siberia (and not only Siberia) were receiving their education at the physico-mathematical secondary school founded not long before. In 1964, he finished the PMS and entered the Faculty of Physics of Novosibirsk State University. While a first-year student, Vasilii Vasil'evich began working at BINP SB USSR AS at B V Chirikov's laboratory. He was a student when he made a strong impression on his future teacher, Academician G I Budker (who later became his scientific supervisor in the postgraduate program).

In 1971, V V Parkhomchuk joined the team of physicists and engineers who started work on an experimental demonstration of ion–beam cooling by electrons proposed by G I Budker. For this purpose, a model of an antiproton accumulator (storage ring NAP-M) was set up at the Institute within a short period of time. V V Parkhomchuk took an active and very productive part in the assembling and launching of this facility and subsequent experiments on it. His exceptional talent as experimental physicist and striving to obtain clear-cut results were quite obvious already in the first experiments with electron cooling, and favored to a great extent both the general success of the work and the promotion of V V Parkhomchuk to the leadership in these experiments. The results obtained on NAP-M already in the first years (1974 and later) changed considerably the conceptual view of specific features and efficiency of the electron cooling method and contributed to the formulation of an adequate theory of this method. These results remain partly unexcelled even today.

V V Parkhomchuk also took a very active part in designing and conducting unique experiments on the BINP facility MOSOL for examination of single-pass electron cooling. In 1986–1988, V V Parkhomchuk and colleagues thoroughly studied here cooling kinetics under strong magnetization, demonstrated the high sensitivity of the method to the conditions of formation and transport of electron beams, and experimentally observed for the first time a substantial difference in the cooling of positively and negatively charged ions by electrons.

Vasilii Vasil'evich Parkhomchuk

V V Parkhomchuk carried out a number of impressive experiments aimed to investigate and compare the potentials of electron and stochastic coolings, on the neutralization of the space charge of an intense electron beam and relaxation of the electron velocity distribution in such a beam, and discovered the suppression of intrabeam scattering in extremely cold ion beams. These and other results were met with great interest by the international accelerator community and stimulated an experimental investigation of the methods of heavy-particle beam cooling at the leading accelerator centers in the world, initiating the design in these centers of ion storage rings with electron cooling systems — 'coolers': CERN (1978), Fermilab (1980), Indiana State University, USA (1988), Max Planck Institute, Heidelberg (Germany) (1988), University of Tokyo (1989), Uppsala

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University, Sweden (1989), GSI in Darmstadt, Germany (1990), Stockholm University (1992), and the Jülich Research Centre, Germany (1992).

A large number of electron cooling devices with extremely high, often record parameters were worked out, designed, fabricated and put into operation under the guidance of V V Parkhomchuk in the framework of international collaboration. As far back as the late 20th century, a new-generation electron cooling system that increased 10 to 20 times the current circulating in the ion synchrotron was designed and implemented for the GSI synchrotron of the German scientific laboratory GSI in the town of Darmstadt.

In the last decade, electron cooling devices have been elaborated and built under the guidance of V V Parkhomchuk at BINR SB RAS for the Institute of Modern Physics in Langzhou (China) and the famous Large Hadron Collider in Geneva. These devices allow cooling a charged particle beam to cryogenic temperatures on the scale of fractions of a kelvin. The electron cooling system in the town of Langzhou is being successfully used as part of an acceleration complex for the ion therapy of malignant tumors, whereas the low-energy ion ring (LEIR) became the key element that late in the last year's record-energy LHC experiments with heavy-ion colliding beams allowed the first observation of a new physical phenomenon, namely, the suppression of quark–gluon jets occurring in the lead ion interaction. A device for proton–beam cooling by electrons with a working voltage of 2 million volts for the COSY complex at the German Research Centre in the town of Jülich allowed a record proton beam cooling rate, which will in turn pave the way for unique experiments on polarized proton scattering by internal targets, the study of nuclear forces, and filling the gaps in the available experimental data on the nucleon structure.

At the present time, V V Parkhomchuk's main efforts are concentrated on developing two new electron cooling devices for the Russian Federation Project NIKA (JINR, Dubna). One of them is intended for preliminary accumulation of 'cold' ion beams in the booster synchrotron. The operation of this device with a working voltage of 60 kV is now being tested and is intended to provide the required quality of the ion beam for subsequent ion acceleration in the Nuclotron synchrotron. The other device with a working voltage up to 2.5 million volt will provide storage and a long confinement of relativistic ions in the NIKA heavy-ion collider. The exploitation of these devices will foster new unique experiments in the physics of nuclear (hadron) matter under extreme parameters and will possibly open the prospect of obtaining a new aggregate state of matter, namely, quark–gluon plasma (QGP) in the state of the so-called 'mixed phase', i.e., the transition state from QGP to hadron matter. And what is especially important, these electron cooling devices will operate in Russia.

It is particularly pleasant to notice the breadth of scientific interests of V V Parkhomchuk and the wealth of his bold ideas. The project of creation of an accelerator mass spectrometer (the first in Russia) for measuring ultralow isotope concentrations with a relative sensitivity at the level of 10^{-15} was brilliantly realized under his guidance at BINP SB RAS. The device is operating successfully at the Geochronology of the Cenozoic Era Center for Collective Use, founded at the Siberian Branch of RAS, and is employed for carrying out complex research in various areas of science, namely, archeology, geology, ecology, limnology, and medicine. The Center has given Russian scientists a unique tool for performing high-sensitivity experiments on sample dating and for a wide range of other applications with the use of microscopic amounts of investigated objects and samples.

The overwhelming majority of the above-mentioned studies were implemented by Vasilii Vasil'evich personally and with his immediate participation in the work at the control panel of these devices. He holds to this style in spite of his age.

V V Parkhomchuk's high qualification and the skill of finding simple and graceful solutions to complicated physical and technical problems are well known in Russia and abroad. His authority among outstanding specialists in accelerator physics is exceedingly high: he is member of international committees on the development of electron cooling methods under the Institute of Modern Physics of China and the Jülich Research Centre GSI, a member of the Joint Academic Council on the Physical Sciences of SB RAS, and a member of the Academic Council of the Budker Institute of Nuclear Physics of SB RAS.

The catholicity of V V Parkhomchuk's scientific interests, his energy, his organizational abilities, and his high personal qualities attract scientific youth to him. Being a graduate of the first class admitted to the M A Lavrent'ev Novosibirsk Physico-Mathematical School, he delivered lectures at this school for many years and has long worked actively at Novosibirsk State University. Many of his disciples occupy top-level positions in leading accelerator laboratories in Russia and around the world.

For his scientific merits V V Parkhomchuk was awarded the 2002 State Prize of the Russian Federation and the 1999 Order For Merits to the Fatherland of second degree, and the 2004 Order of Friendship with the Chinese People's Republic. He received the 2016 International Wilson Prize for the key contribution to the experimental and theoretical development of the electron cooling method.

Dear Vasilii Vasil'evich, we wish you sound health and new great success for the benefit of science and the Fatherland.

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