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PERSONALIA

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Gennady Nikolaevich Kulipanov (on his 70th birthday)

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Gennady Nikolaevich Kulipanov, Deputy Director of Budker Institute of Nuclear Physics of the Siberian Branch of the Russian Academy of Sciences (RAS) and Director of the Siberian Synchrotron and Terahertz Radiation Centre, Full Member of the RAS, celebrated his 70th birthday on January 25, 2012.

Gennady Nikolaevich is an expert of world renown in charged particle accelerators and free electron lasers. G N Kulipanov's interests span many fields: the study of nonlinear resonances and stochastic instability of particle motion in charged particle storage rings; the development and application of high-brightness X-ray synchrotron radiation sources built around specialized electron storage rings, accelerators–recuperators, wigglers, and undulators; the design and application of free-electron lasers emitting in the UV region to terahertz range, based on electron storage rings and accelerators–recuperators.

In 1963, G N Kulipanov graduated with a distinction from the Novosibirsk Electrotechnical Institute (NETI) (currently the State Technical University of Novosibirsk — NGTU), majoring in electronic devices. Since 1963, he has worked at Budker Institute of Nuclear Physics of SB RAS. In 1970, he submitted and defended his PhD thesis, "Experimental study of nonlinear resonances", and in 1994 he wrote his DSc thesis, "Generation of powerful synchrotron radiation beams for research and technological applications". In 1997, he was elected Corresponding Member of the RAS in the Physical Sciences Division (Physics subdivision), and in 2003 was elected Full Member of the RAS in the Physical Sciences Division (Physics subdivision).

In 1980, G N Kulipanov rose to head the Synchrotron Radiation Laboratory. Since 1992, he has held the positions of Deputy Director of Budker Institute of Nuclear Physics and Director of the Siberian Synchrotron and Terahertz Radiation Centre. He was Deputy Chairman and member of Presidium of the SB RAS since 1999 to 2008.

In 1967–1968, G N Kulipanov with his colleagues carried out a series of pioneering research projects using the VEP-1 storage ring for experimental investigation of nonlinear resonances and stochastic instability. When studying a single nonlinear resonance, G N Kulipanov was able to show that the behavior of particles in the betatron phase space near nonlinear resonances in storage rings and accelerators can be described in terms of the phase stability range, frequency of phase fluctuations, width of phase stability range, etc., which most physicists recognized only in the context of the mechanism of longitudinal phase stability.

As the next step, the whole interaction pattern for a pair of resonances throughout the range of distances between them and the power ratio were obtained for the first time. Of special interest is the experimental study of stochastic instability processes theoretically predicted by B V Chirikov. The following effects were experimentally confirmed and investigated: splitting of resonances and formation of a stochastic layer in the case of two resonances differing in power; complete destruction of the phase-stability region in the interaction between two identical resonances. The position of the boundary for the transition from an adiabatic regime to stochastic instability was established in the area of the separatrix under periodic passage of betatron oscillations through a resonance.

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It was experimentally demonstrated that the development of stohasticity goes through purely dynamic effects, namely the excitation of the second-order resonances within the phase stability region. The overlapping of the second-order phase stability regions, which was observed in the case of identity of main interacting resonances, led to the formation of phase stability regions of higher orders and to complete stochastic destruction of the phase stability regions.

G N Kulipanov's work resulted in significant progress in our understanding of the physics of these phenomena and facilitated efficient continuation of research at the next stages — increasing the luminosity of colliding-beam facilities and the brightness of synchrotron radiation sources.

In 1971, G N Kulipanov with his colleagues began to expand a field that was novel at the time: the generation of

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synchrotron radiation and its application to basic research and various technologies. Specialists of Budker Institute of Nuclear Physics created the world's first special generators of synchrotron radiation — superconductive 'snakes' and various types of undulators. This progress made it possible to increase the hardness, intensity, and brightness of synchrotron radiation sources. G N Kulipanov and his pupils proposed and experimentally implemented a number of schemes of setting up experiments that made use of the specific features of synchrotron radiation, and then designed and created experimental equipment adequate to the source of radiation. These achievements led to the creation of the Siberian Synchrotron Radiation Centre (SSRC) based on the electron–positron storage rings of INP of SB RAS — an open-access multiuser scientific center where research is conducted every year and application-oriented problems are solved by scientists from various research institutes of SB RAS, other cities of Russia, the CIS, and other countries.

An impressive illustration of the active work at the SSRC is the development of the method of X-ray fluorescence elemental analysis using synchrotron radiation (XFA–SR). The method provides a sensitivity of up to 2×10^{-9} g/g, and allows detection of amounts of substances down to 10^{-13} g in microscopic specimens and realization of the idea of X-ray microprobe. This method is far superior to any other instrumental method for nondestructive analysis in a number of elements (yttrium, the group of light platinoids, rare-earth elements).

Research and development projects headed by G N Kulipanov and focused on specialized storage rings as sources of synchrotron radiation are of huge importance. The first storage ring, Siberia-1, started to work successfully as a source of vacuum ultraviolet and soft X-ray radiation at the I V Kurchatov Institute of Atomic Energy Center in 1983. Besides, the 2.5-Gev storage ring Siberia-2 — a dedicated source of synchrotron radiation designed at Budker Institute of Nuclear Physics of SB RAS for the Moscow region — was successfully launched there in 1997.

A new area of further work in the field of synchrotron radiation is the concept, proposed by G N Kulipanov in 1997 and accepted internationally, of the 4th-generation synchrotron radiation source based on an accelerator-recirculator with energy recuperation. This will be a fully spatially coherent source of X-ray radiation with average brightness exceeding the brightness of the best up-to-date sources by a factor of several dozens.

In 1988, using the VEPP-3 storage ring as a base, G N Kulipanov and his colleagues created the first free electron laser (FEL) working in the spectral range from the infrared to ultraviolet regions. This achievement successfully implemented the idea proposed at Budker Institute of Nuclear Physics of SB RAS (by N A Vinokurov and A N Skrinsky) of the 'optical klystron'. In 2003, a one-pass accelerator-recuperator was launched, which served as a base for a terahertz FEL. A record-high mean power output of 500 W was obtained in the 0.12–0.24 mm wavelength range. The emission of the Novosibirsk FEL has been used since 2005 for physics, chemistry, and biology research. In 2009, the second stage of the FEL, based on the two-pass accelerator-recuperator, was launched, and a power output of 500 W was obtained in the spectral range of 40–80 μm, which is also a world record. The full-scale FEL will have a four-pass accelerator-recuperator serving as a basis for three FELs in the range from 5 to 240 μm, with a mean emission power of several kilowatts.

In recent years, G N Kulipanov has taken active part in the implementation of international projects. Projects that have directly involved G N Kulipanov were the development at Budker Institute of Nuclear Physics of SB RAS of elliptical wigglers and helical undulators for generating circularly polarized X-ray beams for research centers in the United States, France, and Switzerland; superconducting wigglers with record magnetic fields of 7.5–10 T for the United States, Canada, Germany, Italy, Japan, Great Britain, Spain, Brazil; and a compact terahertz microtron-based free electron laser for South Korea.

From 2001 till 2004, G N Kulipanov was a member of the Council for Sciences, High Technologies, and Education under the President of the Russian Federation, was a member of the International Councils for Science and Technology Policy in SPring-8 (Japan), CAT (India), and 4GLS (UK), represented Russia in the Working Group of the International Committee for Future Accelerators (ICFA), the European Committee for Future Accelerators (ECFA), and the Committee of the European Society of Synchrotron Radiation.

In recent years, G N Kulipanov has been a member of the Foundation Council of the RFBR, the Learned Council of the JINR (Dubna), the International Committee of the European Free Electron Laser, Rosatom Scientific and Technical Council No. 3, and the International Council for Science Policy in KAERI (South Korea).

G N Kulipanov sits on the editorial boards of the scientific journals *Physics–Uspekhi* of the RAS; *Surface*: *X-Ray, Synchrotron, and Neutron Research; X-Ray Science and Technology, and Synchrotron Radiation News*.

G N Kulipanov is Professor at the Chair of Accelerators and Electrophysical Installations of Novosibirsk State Technical University, and President of the Alumni Association of NGTU-NETI. Among his students, three have received the DSc degrees and twenty are PhDs.

As a sign of recognition of the importance of G N Kulipanov's work, he was awarded the medal of the Order of Merit for the Motherland of the 2nd Class (1999), the Order of Honor (2007), the honorary badge Academician I V Kurchatov of the 2nd Class, a number of other medals, and a number of awards from industry and regional authorities.

Academician G N Kulipanov was also awarded the honor of becoming RIKEN Eminent Scientist (Japan, 1995), which marks his internationally recognized achievements in the physics of accelerators and synchrotron radiation; the Academician V I Veksler Prize of the Russian Academy of Sciences (2003); and the RF Government Prize in Science and Technology (2007).

G N Kulipanov's profound knowledge and broad scientific outlook allow him to successfully engage in research, and his rich life experience and inexhaustible scientific and social temperament permit him to be always in the thick of events and to possess the most recent and precise information on the widest range of issues.

Gennady Nikolaevich Kulipanov's friends and colleagues and his many students wish him all the best from the bottom of their hearts on his seventieth birthday, as well as good health, creative success, and a long happy life at the same level of inexhaustible energy and humor.

L M Barkov, N A Vinokurov, M V Kovalchuk, V N Korchuganov, E P Kruglyakov, E B Levichev, N A Mezentsev, I N Meshkov, V V Parkhomchuk, A N Skrinsky, I B Khriplovich, Yu M Shatunov