

## Gennadii Andreevich Mesyats (on his 80th birthday)

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29 February 2016 is the 80th birthday of the outstanding Russian physicist and organizer of science academician Gennadii Andreevich Mesyats. He is a recognized world leader in the field of electrophysics, pulsed power, and high-current electronics.

The research work of academician G A Mesyats began in 1957 when he was a student at Tomsk Polytechnic Institute (TPI). To study the pulsed electric discharge in dielectrics he designed a high-voltage nanosecond generator. In 1958, he defended his graduate work on this subject and entered the postgraduate program at TPI. G A Mesyats's first scientific publication was his 1959 paper in the journal *Radiotekhnika i Elektronika* on the study of strongly overstressed air gaps. Gennadii Andreevich published the results of his graduate work in the collective monograph "High-voltage test facilities and measurements" (1960). In 1961, Gennadii Andreevich Mesyats defended his candidate thesis "Design and investigation of high-voltage nanosecond pulsed devices with spark gaps". Presented there were the results that greatly influenced further development of the technique of high-power nanosecond pulses.

In 1962, G A Mesyats was a senior research worker and then head of the electronics laboratory of the Research Institute of Nuclear Physics. He actively used high-voltage nanosecond pulsed generators to investigate discharges in vacuum, liquids, gases, and solid dielectrics, to research problems of quantum electronics, to create spark chambers, etc. Owing to the work of Gennadii Andreevich and his colleagues, the technique of generating high-power nanosecond pulses was gradually formed as an independent scientific area. This work was compiled in the monograph "The technique of generation of high-power nanosecond pulses" (with G A Vorob'ev as co-author, 1963) and was then used in his doctor's thesis, "Studies of generation of high-power nanosecond pulses", which he successfully defended in 1966 at TPI. It should be emphasized that G A Mesyats's doctor's thesis contained three extensive scientific directions. First, the generation of high-power nanosecond pulses. Second, high-current emission electronics and high-power electron beams on the basis of explosive electron emission (EEE), discovered by him. Third, gas electronics and pulsed gas lasers based on high-pressure volume gas discharge (VGD) revealed by him. The discovery of the EEE phenomenon gave start to a new area in the field of high-current electronics and allowed reaching exclusively high electron currents up to  $10^7$  A. In 1967, G A Mesyats's group created the first high-current pulsed periodic nanosecond accelerator Sinus.

In 1969, G A Mesyats and a group of colleagues moved to the Institute of Atmosphere Optics of Siberian Branch of the



Gennadii Andreevich Mesyats

USSR Academy of Sciences (SB AS USSR), organized the department of high-current electronics, and became deputy director of the institute. Here, he carried out a series of studies on the application of ferromagnetic materials using high-power nanosecond technique, suggested and realized the idea of gas laser pumping by EEE beams, proposed metal-dielectric cathodes, realized subnanosecond commutation in a gas, and measured transition times of autoelectronic to explosive emission.

In 1977, on the initiative of G A Mesyats, the Institute of High-Current Electronics (IHCE) of SB AS USSR was founded in Tomsk, where he became director. At IHCE, research work was started in the field of relativistic microwave electronics, high-power nanosecond X-ray technology, solid-state radiation physics, the electric explosion of conductors, including Z-pinches, and the technological application of high-power nanosecond electron and ion beams. Seeking the method of fast current breakdown to create high-power nanosecond generators with inductive energy accumulation led to the creation of plasma erosion interrupters. This became a revolutionary event in high-current electronics, because it became possible to obtain megavolt pulses with currents up to  $10^7$  A.

In 1979, G A Mesyats was elected Corresponding member and in 1984 Full member of the USSR Academy of Sciences (now Russian Academy of Sciences — RAS).

In 1986, Mesyats became chief of the Urals Scientific Center of the USSR Academy of Sciences and founded the Institute of Electrophysics (IEP) of the USSR Academy of Sciences in Sverdlovsk (now Ekaterinburg), where he invited 25 scientists from Tomsk, Novosibirsk, and Moscow and was assigned director of this institute. At this institute, Mesyats and colleagues discovered ectons—portions of electrons from plasma that occur under EEE; it was proved that ectons play a fundamental role in the cathode spot of a vacuum arc, in a unipolar arc, and in the transition of a glow discharge into an arc; they discovered the SOS effect in silicon semiconductors, began work on runaway electrons, discovered superradiation of picosecond electron beams; and elaborated the identification of minerals by nanosecond electron beams.

In 1987, the Ural Division of the USSR Academy of Sciences was organized on the initiative of G A Mesyats, where he was elected chairman of the division and vice-president of the USSR Academy of Sciences. From 1998 to 2004, G A Mesyats was the first vice-president of RAS and at the same time remained director of IEP. In 2004, Gennadii Andreevich was elected director of the Lebedev Physical Institute (FIAN) and held this position till 2015. Here, he continued developing research work on high-current electronics and electrophysics, and organized and headed the program of fundamental research of RAS Presidium. Within the framework of this program, new results were obtained on EEE, relativistic electronics, plasma microwave electronics, X-pinch, Z-pinch, the ecton conception of an electric arc, the theory of the Tanberg effect, etc. During his work at FIAN, he personally and his colleagues published over 100 scientific papers.

During this time, a number of important scientific and organizational problems were solved at FIAN. The participation in CERN work was substantially widened, a new class of proton accelerators was worked out for treatment of oncological diseases, and the RadioAstron and Thesis observatories were launched into the Earth's orbit. The X-pinch setups developed earlier at FIAN for photography with subnanosecond exposition of high-density plasma formations were realized in the form of compact devices. Much work was done to organize the V L Ginzburg center of superconductivity; progressive studies are already being carried out today on the unique equipment set. A unique visible-range multiterawatt-power combined laser was created, and the discipline of laser cooling of atoms appeared at FIAN. G A Mesyats actively developed the innovation work at FIAN and at RAS at large — a technology park, the best in RAS and among the top-10 technology parks in Russia — was founded on the Troitsk Ground of FIAN. In 2004, FIAN became a co-founder — together with RAS — of the journal *Uspekhi Fizicheskikh Nauk*. The invariable support on the part of the institute largely protected the journal, its current activity, and its further development.

G A Mesyats has published more than 600 scientific papers and more than 20 monographs. These are well-known monographs such as *Technique and Formation of High-Voltage Nanosecond Pulses* (1963), *Generation of High-Power Nanosecond Pulses* (1974), *High-Power Nanosecond X-ray Pulses* (1983), *Pulsed Electric Discharge in Vacuum* (1984), *Pulsed Gas Lasers* (1991), *Physics of Pulsed Gas Breakdown*

(1991), *Ectons* (3 volumes, 1993–1994), *Ectons in Vacuum Discharge: the Breakdown, the Spark, and the Arc* (2000), *Pulsed Power* (2004), *Introduction to Pulsed Energetics and Electronics* (2009), and *Explosive Electron Emission* (2011).

G A Mesyats pays great attention to pedagogical work and work with young scientists. Many of his disciples became candidates and doctors of sciences, were elected academicians and corresponding members of RAS, and were awarded international prizes, State Prizes of the USSR and RF, Prizes of the Council of Ministers of the USSR and RF, and Lenin Komsomol Prizes. G A Mesyats was founder of the Chair of Plasma Physics at Tomsk State University and the Chair of Electrophysics at the Ural Polytechnic Institute. For many years he was chairman of the board of trustees of Tomsk Polytechnic Institute. Now he is head of the Chair of Electrophysics at the Moscow Institute for Physics and Technology (MIPT).

G A Mesyats is engaged in social activity of national importance. He has been chairman of the Council of Young Scientists under the Central Committee of the Young Communist League, deputy of Sverdlovsk regional Soviet of People's Deputies, chairman of the Council of Directors of the Research Institutes of Sverdlovsk, chairman of the Council of Directors of the Institutes of RAS, member of the Council on Science and High Technologies under the RF President, chairman of the Committee on Science and Education of the State Duma, a member of a number of committees and councils under the RF Government, and chairman of the board of trustees of Demidov Scientific Foundation organized on his initiative in 1992. From 1998 to 2005, G A Mesyats was head of the Higher Attestation Commission of RF.

G A Mesyats takes an active part in international research work. He worked on the Commission on physical education of IUPAP, participated in the work of the general assembly of UNESCO, was head of the Russian–American commission on technologies of dual-purpose application, was many times head of Russian delegations at international scientific conferences, and delivered many lectures at various scientific institutions in the world. He is a member of the organizing committees of many international conferences, a member of editorial boards of a number of journals and scientific societies, a foreign member of the USA National Academy of Engineering, a member of the New York Academy of Science, a member of the National Academy of Sciences of Ukraine, a member of the National Academy of Sciences of Armenia, a member of the American Physical Society, a member of the American Optical Society, a member of the International Society for Optoelectronics, and an honorable professor of a number of universities in Russia and around the world.

G A Mesyats has received many Russian and foreign awards: the Lenin Komsomol Prize, State Prizes of the USSR and Russian Federation, prizes of the USSR and RF Governments, the Demidov Prize, the International Global Energy Prize, and the International W Dyke, E Marx and Maria Sklodovskaya-Curie Prizes. He was awarded A G Stolev Prize, the N N Moiseev Gold Medal, the academician S V Vonsovskii Gold Medal, and the academician M A Lavrent'ev Gold Medal. G A Mesyats was awarded the Order of Lenin, the Order of Red Banner of Labor, the Order of the Badge of Honor, Orders of Merit for the Fatherland of 2nd, 3rd, and 4th degrees, the Order of Honor, the “Danaker” Order (Kirghizia), and the title of Knight of the

Legion (of Honor) (France). He is an honorary citizen of the Tomsk region and of the town of Ekaterinburg.

We whole-heartedly wish Gennadii Andreevich health, strength, optimism, talented students, and cordial and friendly meetings!

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