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PERSONALIA

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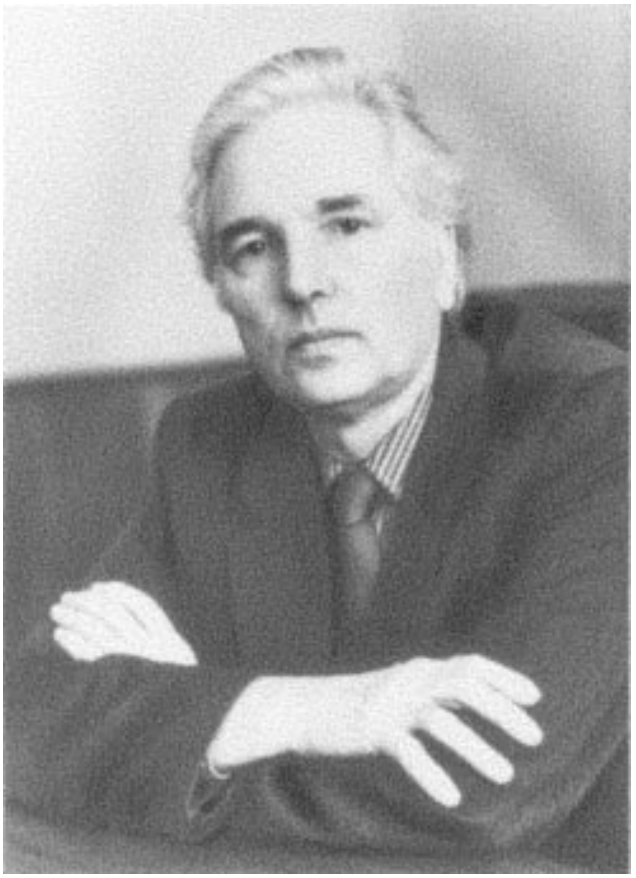
Gennadiĭ Andreevich Mesyats (on his sixtieth birthday)

On February 29, 1996 the academician Gennadiĭ Andreevich Mesyats — outstanding scientist and great organiser of scientific activities — celebrated his 60th birthday.

In order for a scientist to become a seminal figure in any new field of research and develop this area successfully, it would be necessary to combine a number of features, i.e. possessing great curiosity, intuition, superb organizational skills, ambition and having the opportunity to study with the right teacher at the right time. All of this coalesced in 1957 when, still a student, G A Mesyats was preparing to take his Master's degree under the supervision of the excellent physicist A A Vorob'ev — then dean of the Tomsk Polytechnical Institute. When investigating the physics of dielectric disruption G A Mesyats was to invent a pulse generator with a nanosecond leading edge, which he succeeded brilliantly in doing, while also creating an oscilloscope, since, at the time, there was as yet no instrumentation to record such short-time processes. As a post-graduate student (1958 – 1961) G A Mesyats performed experiments on this generator and summarized findings of the best laboratories available in the USSR and abroad. And while proceeding in this endeavour, he succeeded in formulating the basic principles involved in producing pulses with nanosecond risetimes and proving that with a decrease in the time of voltage application there is a substantial increase in the electric strength of a number of dielectrics.

G A Mesyats then went on to work as a senior researcher and head of a laboratory at the Research Institute of Nuclear Physics in Tomsk, where he assembled a team of collaborators — S P Bugaev, B M Koval'chuk, Yu P Bychkov, Yu P Usov, F Ya Zagulov and others — who worked together in performing experiments involving the development of pulsed power systems operating on the nanosecond scale and investigations into their possible application in various fields. From 1962 to 1966 this same task force produced the first high-power peaking-capacitor generators which are now used worldwide, while at the time they were used to carry streamer chambers, Q-factor modulation systems of ruby lasers and the first peakers with a discharge along the surface of a dielectric in a vacuum, ferrite valves, etc. During these years, the groundwork was laid for technique of generating high-power nanosecond pulses. Moreover, the research carried out by G A Mesyats zeroed in on the initial stages of the discharge formation in a vacuum and he showed that the discharge originates from the cathode, not the anode, as all other researchers had previously maintained. This research was to become a cornerstone of the theory of explosive emission of electrons, which he was to frame subsequently. Furthermore,



Gennadiĭ Andreevich Mesyats

these experiments also served as the basis for developing the metal-dielectric cathode, which was used in USSR's first heavy-current electron accelerator (1967). The Americans 'discovered' these cathodes only in 1993.

The results of this work were summarized in the monograph *The Technique of Forming High-Voltage Nanosecond Pulses* (1963) and in his doctoral dissertation (1966). It was the world's first monograph in this branch of science. The detection of the explosive emission of electrons has been acknowledged as a priority discovery from 1966.

The second major outgrowth of the work which G A Mesyats performed during these years is the discovery of a new type of discharge in the overvolted gas gaps of high-pressure spatially uniform discharge. It was shown that in certain conditions a discharge does not go to a spark discharge, but operates in the entire volume of the gas. The subsequent research of G A Mesyats in this area led to the invention of high-power gas switches and gas lasers. The discovery of high-pressure space gas discharge has also been acknowledged as a priority one since 1966.

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Translated by S Frauzel

In 1968, along with having developed methods for generating high-power nanosecond pulses G A Mesyats together with B M Koval'chuk, S P Bugaev and V V Kremnev were awarded the Lenin Komsomol prize. The results of their laboratory experimentation have received international recognition and acclaim.

In 1970 G A Mesyats transfers to a recently established Institute for Atmospheric Optics under the Siberian Branch of the Soviet Academy of Sciences as deputy director and sets up the department of heavy-current electronics. Times were hard back then as the new Institute did not have its own buildings and the department was literally spread out in 17 basements and semi-basements across the city. G.A. Mesyats involved in the development of pulse power technology both new research workers, who were to go on to become prominent scientists (E A Litvinov, A S El'chaninov, G P Bazhenov, V G Shpak, Yu D Korolev, V V Osipov) and research teams which had worked at other institutes (such laboratories as leaded by G N Furseĭ, D I Vaĭsburd and Yu A Kotov, Yu E Kreĭndel', Yu B Yankelevich, and A M Iskol'dskiĭ).

From 1970 – 1976 powerful and unique pulse electron accelerators were produced both for single and repetitive pulses, subnanosecond pulse generators used to carry lasers, accelerators with inductive energy storage and opening switches based on electrically explosive wires, the properties of cathode and anode plasma in the diodes of accelerators were studied, the theory for the explosive emission of electrons was set out, wide-aperture beams of electrons were produced for the first time, high-power ultraviolet pulse lasers and several types of electron-beam pumping CO_2-lasers with a radiation energy of up to 5 kJ, and, finally, generators of electron and ion beams with plasma emitters were invented.

All of this work conclusively proved that the research team headed up by G A Mesyats firmly occupied a leading position among the international scientific community concerned with high-power pulse electronics. For this very reason, the decision was taken in 1977 to establish in Tomsk the High-Current Electronics Institute, whose director he became. In addition to the existing curriculum, the institute body embarked upon new research trends in the field of relativistic RF electronics, X-ray pulse technology, the production and technological application of electron and ion beams.

This Institute was the first to produce compact millimeter-range generators with an output of up to 10^8 W; microwave oscillators with a wavelength of 3 cm, a pulse repetition rate of 100 Hz and a power of up to 10^9 W; compact X-ray apparatus; plasma erosion opening switches presently used in most high-power pulse generators with currents of up to 10^7 A at voltages of 1 MV; electron and ion accelerators with plasma emitters for technological applications; various research projects on the technological applications of charged particle beams were begun; the invention of the world's first line transformer and on its base — the 'Snop' electron accelerator with a current of up to 10^6 A were developed and built.

In 1978 G A Mesyats was awarded a State prize of the USSR, in 1979 he was elected correspondent member and in 1984 a full-fledged member of the Academy of Sciences of the USSR.

In 1985 G A Mesyats heads up the Urals Scientific Centre of the Academy of Sciences, which, thanks to his unflagging efforts and solicitude, was reorganized in 1987 as the Ural Division of the AS, affiliating both the previous branches of the AS in the Urals and the newly-founded scientific centres and research teams in Perm', Izhevsk, Chelyabinsk, Syktyvkar, Arkhangel'sk and Orenburg. In 1986 G A Mesyats was elected member of the Presidium of the AS USSR and in 1987 — vice-president of the AS USSR.

In 1986 G A Mesyats established the Institute of Electrophysics in Sverdlovsk. Over the years, this institute headed up by him has carried out many promising research projects in the field of the technique of forming the nanosecond pulses and used them in various applied fields. He and his research team have investigated and discovered the effective sources of ions on the base of cold-cathode discharges, sketched out and realized an electroexplosive method for producing nanopowders of metal oxides and invented equipment for compacting ultra-disperse systems, discovered a new conductivity mechanism in flint diodes which makes it possible to use them as repetitive opening switches, pioneer research was performed to develop the theory of the explosive emission of electrons, a method and equipment were devised for cathode-luminescent analysis of matter and the enhancement of compact nanosecond generators was continued. G A Mesyats was directly involved in all of these research projects or acted as an attentive expert and advisor. In recent years G A Mesyats has been concerned with a new phenomenon — the ecton. This term refers to portions of electrons (up to 10^{12} units) which are emitted by a cathode as a result of the explosion of the cathode microvolume. The discovery of ectons has made it possible to give the new theory of the vacuum-arc cathode spot and explains a host of phenomena in electric discharges in gas and vacuum.

G A Mesyats is actively committed to social and scientific activities. He sits on many scientific committees, international organizations, editorial boards and scientific societies. At his initiative the Demidov prizes have been resumed and awards are now made to outstanding scientists across Russia. The Demidov Science Foundation is also operational.

The activities of G A Mesyats as scientist, pedagogue and organizer have on numerous occasions been the object of government awards (the orders of Lenin, the Red Banner of Labour, the Badge of Honour, for merits to the Homeland) and W Dyke international award for work on the explosive emission of electrons and the E Marx award for work on the generation of high-power nanosecond pulses. Dozens of his students have become candidates and doctors of science, members of the Russian Academy of Sciences and the recipients of numerous awards. He has published over 500 articles and 15 monographs and made 25 inventions.

We would like to convey to G A Mesyats our warmest wishes and hope he will go on to achieve even greater success in all his multi-faceted scientific and organizational endeavours.

A F Andreev, S P Bugaev, S V Vonsovskiĭ,
A V Gaponov-Grekhov, L V Keldysh,
B M Koval'chuk, Yu A Kotov, A M Prokhorov,
M V Sadovskiĭ, V E Fortov