Physics – Uspekhi **68** (4) 425 – 427 (2025)

PERSONALIA

PACS number: **01.60.+q**

Sergei Apollonovich Nikitov (on his 70th birthday)

DOI: https://doi.org/10.3367/UFNe.2025.03.039894

April 23, 2025 was the 70th birthday of the prominent scientist, physicist, and specialist in solid-state electronics, Academician of the Russian Academy of Sciences (RAS) Sergei Apollonovich Nikitov.

S.A. Nikitov was born in 1955 in the city of Berdichev, Zhitomir region of Ukrainian SSR. His parents, clerks, were participants in the Great Patriotic War who found themselves there after demobilization and worked there all their lives.

After finishing Berdichev Secondary School No. 2, Sergei Apollonovich entered the Department of Physical and Quantum Electronics (DPQE) of the Moscow Institute of Physics and Technology (MIPT). After graduating from MIPT in 1979 and the postgraduate course in 1982 and defending his candidate thesis, he joined the Fryazino branch of the Institute of Radio Engineering and Electronics (IRE) of the USSR Academy of Sciences as a junior research fellow. In 1985, S.A. Nikitov became a senior research fellow. In 1991 he defended his doctoral thesis and became a leading research fellow, and since 1995 he has been professor, a chief research fellow, and head of laboratory in the Moscow part of the IRE, now RAS. From 2002 to 2014, S.A. Nikitov was deputy director of the IRE RAS, and since 2014 he has been director of the V.A. Kotelnikov IRE RAS.

S.A. Nikitov is a disciple of Yurii Vasil'evich Gulyaev — academician of RAS, one of the greatest physicists and founder of the field of functional electronics.

During the 1980s–1990s, Sergei Apollonovich consistently developed a new research area at the junction of the physics of magnetic phenomena and electronics — magnetoelectronics. In those days, with the advent of high-quality iron-yttrium garnet magnetic films, it was proposed to use them to create magnetic memory on cylindrical magnetic domains. Unfortunately, this did not work out, but it was possible to implement a number of integrated devices of functional electronics, such as delay lines, resonators, and various microwave filters operating at frequencies up to 20 GHz.

In this area, starting with his candidate thesis devoted to the development of basic concepts of magnetoelectronics based on spin waves in periodic structures, S.A. Nikitov obtained fundamental results important both for the understanding of the physics of processes associated with spin waves and for future experimental studies and practical applications. During these years, he proposed a new direction in the physics of thin-film magnetic heterostructures — the study of nonlinear processes in such objects. He was the first to predict and later, together with his colleagues, experimentally discovered parametric processes, the phenomenon of self-focusing, nonlinear interaction of spin, acoustic, and plasmonic waves in heterostructures containing layers of ferro-, antiferromagnets, piezo- and ferroelectrics, and semiconductors. By the end of the 1980s, S.A. Nikitov, based on the obtained results, prepared and defended his doctoral thesis on nonlinear phenomena in thin-film magnetic structures.

Sergei Apollonovich Nikitov

Beginning in the late 1980s and during the 1990s, S.A. Nikitov was often invited abroad to the leading scientific universities of England, Germany, Italy, France, the USA, and South Korea to carry out and supervise joint scientific research. Thus, in universities in Salford (England), Bochum (Germany), Rome (Italy), and Toulouse (France), he, in fact, originated and supervised research in many scientific fields. The main inviting parties were the Royal Society of Great Britain, the Landau–Volta Foundation (Italy), and others. In England, for instance, an experimental laboratory was founded, which possessed an installation of Brillouin spectroscopy similar to that used in the P. Grünberg's laboratory to discover the effect of giant magnetoresistance (later, P. Grünberg and A. Fert received the 2007 Nobel Prize for this discovery). As a result of joint work with foreign colleagues, the effect of spatial self-

Uspekhi Fizicheskikh Nauk **195** (2) 451 – 452 (2025)
Translated by A N Tsaplin

Sergei Apollonovich Nikitov and Peter Grünberg, a laureate of the 2007 Nobel Prize for the discovery, together with Albert Fert, of giant magnetoresistance (GMR) in 1988.

focusing of spin waves and the existence of spin wave solitons in thin-film structures were predicted for the first time and discovered, a new method of magnetic imprint-lithography was proposed and experimentally confirmed, etc.

Since 1995, S.A. Nikitov has been head of the Laboratory of Magnetic and Optical Phenomena in Thin-Film Heterostructures at the IRE RAS, and in 2003 he was elected a corresponding member of RAS in the Division of Nano- and Information Technologies (DNIT RAS).

At the same time, S.A. Nikitov and his colleagues started research in the field of radio- and medico-biological physics, devoted to data, signal, and image processing. In particular, he and his colleagues determined the algorithms of some biological mechanisms and laws, namely, a discrete-pulse type of data presentation (the spike nature of neuron signals), the Weber–Fechner law concerning the stimulus level quantization thresholds (the frequency-pulse signal modulation), etc. Point processes were investigated as prototypes of neuron (pulsed) pulse-type signals, and answers were given to questions of information extraction from point processes (a series of such studies was carried out in 1995–2015).

At the same time, S.A. Nikitov was also engaged in studies in the field of fiber optics. For example, he and his colleagues examined excitations, resonant and other phenomena related to the propagation of cladding modes of fiber waveguides, and the effects of interaction of these modes with fiber core modes, including in photon-crystal fibers. S.A. Nikitov and his colleagues proposed a new method for creating such fibers on the basis of blank 'drilling' with further fiber extraction. The obtained results were important for creating sensors of various physical quantities based on inclined fiber Bragg grating (IFBG), including those with a metallic (plasmonic) coating. The physical principles of excitation of cladding modes in such structures were studied, and the main properties of IFBGs were considered. Particular attention was paid to sensor applications of inclined gratings, including data processing methods. A new method for applying thin metallic films to the lateral surface of a fiber-optic waveguide was proposed. Published on the basis of these studies was the monograph entitled *Cladding modes of fiber-optical waveguides*.

In 2010, S.A. Nikitov became one of the first winners of the Megagrants competition aimed at creating world-class laboratories at higher educational institutions in Russia. He chose N.G. Chernyshevsky Saratov State University (SSU) as the organization, where the Metamaterials laboratory was formed on his initiative, which became a prototype of similar laboratories created later at other universities. For already over a decade, the laboratory has been operating effectively, yielding world-class scientific results. In particular, a Brillouin spectroscopy complex was implemented, allowing measurements of the properties of space-time dynamics of coherent and incoherent excitations in magnetic micro- and nanostructures. The complex provides a spatial resolution of wave excitations up to 100 nm with a time resolution up to 0.1 ns in the frequency range from 1 GHz to 1.5 THz. New methods for measuring the electrophysical parameters of composite materials with carbon nanotubes have been developed, based on the use of microwave photonic crystals, and unique measuring equipment has been manufactured for nondestructive control over parameters of nanostructures and composites with original specialized software intended for the production of broadband absorbing coatings for protection against radar detection of aircraft, constructed using stealth technology. New methods have been formulated for calculating and designing devices on volume and surface acoustic waves (SAWs) containing 1D, 2D, and 3D phonon-crystal structures, and the following have been created on their basis: (a) a multilayer ultra-wideband piezotransducer in the form of a 3D phonon crystal introduced during the invention of microwave signal delay lines for systems of aircraft protection against rockets with radar homing; (b) a high-Q highly stable SAW microresonator in the 2000-MHz frequency range, which is an order of magnitude smaller than currently used dielectric resonators and has a mass two orders of magnitudes less; it was applied in the design of equipment with high synchronization of generators in a system detecting objects made with stealth technology; and (c) radio frequency identification mark on SAW based on a 1D phonon crystal in the frequency range of 2450 MHz with sizes 2 to 3 times smaller than its analogues (22 mm in diameter) and an identification range of over 3 m (depending on the reader antenna size), which can serve as the basis for introducing automated accounting in large-scale production, including radioactive products. Laboratory breadboards of ring oscillators of dissipative solitons of an envelope with the use of nonlinear elements in the form of magnon crystals, quasicrystals, and irregular (bent) ferromagnetic micro waveguides were constructed. A conception was proposed for creating double negative media based on ferro- and antiferromagnetic semiconductors and metamaterials with metallic inclusions operating in both the microwave and terahertz frequency ranges. Experimental samples of silver nanocubes and gold-silver nanostructures obtained on their basis with plasmon resonance in the terahertz (optical) frequency range (300–500 THz) were obtained and characterized. This is a new type of nanomaterial — plasmon nanopowders applied for analytic, diagnostic, and therapeutic goals in oncology.

In 2014, S.A. Nikitov headed one of the first major projects supported by the Foundation for Advanced Research in the field of 'Nanoplasmonics,' which gave a number of important fundamental and practical results.

S.A. Nikitov has published over 600 scientific papers, received more than 55 patents for inventions, been a co-author of four monographs and more than 10 chapters in collective monographs, eight reviews, and papers in the journal *Uspekhi Fizicheskikh Nauk* (*UFN*) [*Physics – Uspekhi*], and given over 500 talks at scientific conferences.

S.A. Nikitov is actively involved in teaching. He is head of the Electronics Department at MIPT, the Department of Information Security at the Russian New University, and the Institute of Mechanics and Physics at SSU. For many years, he has delivered the basic course in solid state physics at the MIPT Department of Physical and Quantum Electronics and at the Phystech School of Electronics, Photonics, and Molecular Physics. He has supervised 15 candidates and 4 doctors of sciences.

S.A. Nikitov is an active participant in organizing scientific events in Russia and abroad. He is a co-chair of the organizing committee of the All-Russian Conference on Spin Waves, a member of program and organizing committees of international conferences on magnonics, the East-West Conference on Magnetism, the Moscow International Symposium on Magnetism, and many others.

From 2003 to 2013, Sergei Apollonovich actively participated in the work of RAS and was an academic secretary of the RAS Commission on Improvement of RAS Structure and a member of the Youth Affairs Commission. At the present time, he is the head of the Academic Council of RAS, Fundamental Problems of Creation and Functioning of Telecommunication Systems, and is a member of scientific councils of RAS for space, quantum technologies, and studies in the field of defense, the Scientific Council of DNIT RAS for new materials of electronic engineering, and the Scientific Council of DPS RAS for condensed media. He is a co-chair of the Scientific Council of the International Association of Academies of Sciences (IAAS) on problems of functional materials of electronic engineering. S.A. Nikitov is president of the Russian Scientific and Technical Society on Radio Engineering, Electronics, and Communication.

For many years, he had been at the head of the Russian section of the Institute of Electrical and Electronics Engineers (IEEE). S.A. Nikitov is the Editor-in-Chief of the journal *Radiotekhnika i Electronika* (*Journal of Communications Technology and Electronics*), and a member of the editorial boards of the journals *Uspekhi Fizicheskikh Nauk* (*Physics–Uspekhi*), *Akusticheskii Zhurnal* (*Acoustic Journal*), and others.

Over the years of his work, Sergei Apollonovich has received a number of domestic and international awards. He is a laureate of the Komsomol Prize of Moscow Region (1981), the 1984 Lenin Komsomol Prize, and the 2009 RF Government Prize. He was awarded the Medal of the Order, For Merits to the Fatherland 2nd degree (2021), and Gratitude of the RF President (2024). He is also a laureate of the 1984 Humboldt Prize (Germany) and an honorary doctor of Paul Sabatier University (Toulouse, France).

On behalf of Sergei Apollonovich's disciples, colleagues, and friends, we heartily wish him many happy returns of the day, sound health, a successful continuation of his creative activity, and new remarkable scientific results.

Yu.V. Gulyaev, L.M. Zelenyi,
V.V. Kveder, N.A. Kuznetsov, A.N. Lagar'kov,
O.I. Orlov, V.Ya. Panchenko, O.V. Rudenko,
A.N. Saurov, A.S. Sigov, V.V. Ustinov