Nikolaĭ Gennadievich Basov (on his fiftieth birthday)

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December 14, 1972 marked the fiftieth birthday of the academician Nikolaĭ Gennadievich Basov, one of the outstanding physicists of the Soviet Union. His name is associated with the birth of a new field of physics, quantum electronics. His series of trail-blazing papers in this direction was awarded the Lenin Prize in 1959 (jointly with A. M. Prokhorov) and in 1964 the highest international prize, the Nobel Prize (jointly with A. M. Prokhorov and the American physicist C. Townes).

The discovery of the principles of the generation and amplification of radiation by quantum systems in the beginning of the Fifties was followed by a number of brilliant studies completed by Basov and his scientific school which made a significant contribution to physics and greatly influenced the development of a number of branches of technology. The development of the physical basis of frequency standards, his bold ideas in the field of semiconductor lasers, studies on the formation and amplification of powerful light pulses, studies of the interaction between powerful light radiation and matter, the development of laser plasma heating for controlled thermonuclear fusion, a large number of papers on powerful gas lasers and chemical lasers, new ideas for the application of lasers to optical electronics, all this is but a short list of the problems which were and continue to be solved by Basov and his team of coworkers.

Basov belongs to the generation of scholars whose creative activity is tied to the postwar period when the rapid tempo of scientific and technical progress attracted to science, especially the natural sciences, a large number of talented young people. If we can now say that Soviet science is in the vanguard of world science, that is to a great extent the achievement of the young postwar generation of scholars who developed the rich traditions of the nations scientific schools.

This achievement is deservingly shared by Basov. At the beginning of the second World War he was an eighteen-year-old graduate of a secondary school in Voronezh and in the first days of the war joined the army and was sent to the Kuĭbyshev and then to the Kiev School of Military Medicine, which he completed in 1943 with the rank of lieutenant in the medical corps. This was followed by service in the chemical warfare defense forces and then at the front. Shortly after the war's end and his return from Germany, while still in the staff of the Soviet army, Basov realized his long-time dream—a decision made on graduation from school—the study of physics. And so he became a student in the now unusual winter class entering the Moscow Institute of Mechanics (now the Physics Engineering). Exactly twelve years later, Basov was elected to the USSR Academy of Science.

In 1948 Basov started as a laboratory assistant and then as an engineer in the Oscillation Laboraroty of the Lebedev Physics Institute, headed by M. A. Leontovich, where somewhat later a group of young physicists under the leadership of A. M. Prokhorov was to gather in a

new scientific pursuit—molecular radiospectroscopy. For Basov and Prokhorov this was the beginning of many years of fruitful collaboration leading to the discovery of quantum radiophysics, which was enormously aided by the creative atmosphere and traditions of high scientific integrity diligently maintained by the scholars of the Institute of Physics of the USSR Academy of Science. Even in the period of intense study of molecular generators, Basov saw the great scientific and technical importance of extending the principles of quantum electronics to the visible wave region. Mastery of the optical region would, in his opinion, make it possible for physicists to study a whole set of new physical phenomena. Although the solution of individual concete problems was to come later and is not yet complete at this date, a decade of progress in science and technology has confirmed the great importance of assimilating the knowledge of the optical region and has, in fact, led to a rebirth of optics as a field of science and technology.

Basov started his work on lasers in 1957 with a search for physical ways of achieving non-equilibrium states in semiconductors. This was not the easiest course, since at that time the optical properties of semiconductors were insufficiently known or employed, and the difficulty of finding the appropriate material and technology complicated the task of developing a semiconductor laser. At the same time, however, the scientific and practical importance of semiconductor lasers was

clearly recognized, and they are now in extensive use and application.

In a report to the Presidium of the USSR Academy of Science in 1961, Basov pointed out the possibility of employing lasers for controlled thermonuclear fusion. This possibility is based on the evident but curious property of several laser systems, which can play in essence the role of energy accumulators with short buildup times. Subsequent work in this area under Basov's leadership has led to new trends in controlled thermonuclear reaction studies—the methods of laser thermonuclear fusion.

In 1963 Basov developed new methods of thermal excitation of laser systems, and somewhat later a number of investigations of chemical lasers was begun under his direction. Great practical interest and value attach to the studies on the stimulation of chemical reactions by laser radiation—the chemistry of vibrationally nonequilibrium molecules. In line with this, it was recently possible for the first time to observe experimentally chemical reactions with excitation of the vibrational modes of the molecule in the infrared region.

Quite recently, a series of studies on high pressure gas lasers, so-called electron-position lasers, was successfully completed under Basov's direction.

Basov assigns a high priority to the development of optical methods of information processing, which depend to a considerable degree on scientific endeavor in the field of semiconductor lasers. The study of the possibilities inherent in coherent light—extremely high-frequency electromagnetic oscillations—promises to increase significantly the speed of information treatment, creating fast-acting optical analogs of the electronic elements and layouts.

This new field, which is organically tied to quantum electronics, will undoubtedly prove to be a highly promising source of new ideas and practical applications.

The problems here enumerated are characteristic of Basov's main scientific interests, although his scientific and organizational activities are much broader.

Basov's creative path is that of a scholar who has devoted all his time and talent to the development of science in his country. Basov is now the head of a large tema of scientists manning a quantum radiophysics laboratory. Almost all the scientific workers in the laboratory are young people who were educated by him from their student days on.

Despite the fact that his duties as deputy director of the institute, member of the Presidium of the USSR Academy of Science, member of the higher examination board, chief editor of the journal "Priroda" (Nature) and of the collection "Quantum Electronics" and other duties occupy a great deal of time, he leads the creative life of the laboratory, being simultaneously the director and active participant in the majority of the projects. Youth is the object of his special concern. In his opinion true progress is possible only when the growth of new scientific ideas outstrips the actual growth of the scientific community. This gap must be filled by the influx of young people who, on entering science, find themselves in the center of scientific activity and have good prospects for growth. This is exactly what enables the young to become independent quickly and to form a large and harmonious team. In this case it is the duty of a director to devote his principal attention to the weak links in the chain.

Talent, constant scientific work and the search for the new, the ability to combine what is interesting in scientific studies with the practical utility of the results are the main characteristics of N. G. Basov. If one attempts to estimate his personal contribution to quantum radiophysics and related fields of science, it turns out to be extremely great. There is scarcely any endeavor in this field which has not felt his influence. Likewise, it is impossible to name a single important trend in modern quantum radiophysics which was not developed by Basov and his team of co-workers.

Noting the anniversary of N. G. Basov, we wish him health, high spirits, enthusiasm and energy in the further course of his scientific activities.

Translated by J. G. Adashko