

Aleksandr Mikhaïlovich Prokhorov (On his seventieth birthday)

A. P. Aleksandrov, A. S. Borovik-Romanov, K. A. Valiev, E. P. Velikhov,
S. V. Vonsovskii, V. L. Ginzburg, Ya. B. Zeldovich, B. B. Kadomtsev, and
V. A. Kotel'nikov

Usp. Fiz. Nauk **149**, 577-578 (July 1986)

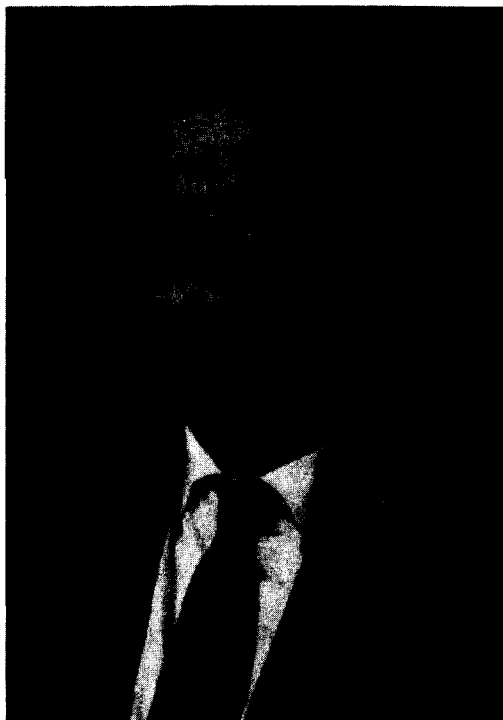
Academician Aleksandr Mikhaïlovich Prokhorov, an outstanding physicist and great organizer of Soviet science, celebrated his seventieth birthday on July 11 of this year.

A. M. Prokhorov is one of the founders of quantum electronics, the field of physics which led to the development of fundamentally new types of generators and amplifiers of electromagnetic radiation—lasers and masers. For the last 30 years Aleksandr Mikhaïlovich has directed much of his attention towards the establishment, development and wide practical application of this field of physics. At the same time, A. M. Prokhorov has made significant contributions to various areas of radiophysics, solid state physics, spectroscopy and physics of magnetic phenomena.

For the last 13 years Aleksandr Mikhaïlovich Prokhorov has served as the head of the Division of General Physics and Astronomy of the Academy of Sciences of the USSR, devoting much effort to the development of key areas of physics in our country.

After graduating from Leningrad University in 1939, A. M. Prokhorov began his graduate studies at the P. N. Lebedev Physics Institute of the Academy of Sciences of the USSR. The Second World War interrupted his scientific studies; Aleksandr Mikhaïlovich served in the ranks of the armed forces from the outbreak of war until his second wounding in 1944. Demobilized as a war invalid in 1944, Aleksandr Mikhaïlovich continued his research at the Physics Institute of the Academy of Sciences of the USSR. In the years 1944-1950 he carried out a series of fundamental investigations in radiophysics, developed the theory of tube oscillator frequency stabilization, and was the first to establish experimentally the coherence of microwave radiation from electrons in a synchrotron. In those same years A. M. Prokhorov began his research in a new branch of spectroscopy—gas radiospectroscopy. His studies led A. M. Prokhorov to the idea of a molecular generator—a new type of generator of electromagnetic oscillations based on stimulated molecular emission.

In the years 1953-1955 this idea was theoretically developed and experimentally verified by A. M. Prokhorov (in cooperation with N. G. Basov): they developed the theory of a molecular generator, constructed the first quantum generator in the microwave range using a beam of ammonia molecules, and proposed one of the most effective methods of obtaining inversion states in quantum systems—that of auxiliary radiation (pumping). These studies laid the foundation for quantum electronics—one of the most important research fields of modern physics—thus A. M. Prokhorov



ALEKSANDR MIKHAÏLOVICH
PROKHOROV

made a crucial contribution to the establishment and development of this field.

After the pioneering research that led to the development of microwave quantum generators, A. M. Prokhorov and his students carried out in 1955-1960 several fundamental investigations culminating in the development of a fundamentally new class of low-noise amplifiers in the microwave range: quantum amplifiers using paramagnetic crystals and then quantum generators in the optical range—that is, lasers. Among these studies by A. M. Prokhorov two stand out: his suggestion of employing ruby crystals as the active material in masers and his idea of using open resonators for quantum generators. The first of these suggestions led to the development of effective microwave masers which proved to be of great practical use, for instance in radio reception systems for deep space communications and radioastronomy; the second suggestion resulted in the development of lasers. Now lasers of all types and frequency ranges employ open resonators.

In the following years A. M. Prokhorov and his co-workers carried out important studies pertaining to the construction of various types of lasers, the interaction of intense laser radiation with matter, the different applications of lasers in science, technology, and medicine. Outstanding among these were the invention and construction of a powerful new gas laser—the gas dynamics laser; development of new highly effective materials for solid state lasers—doped crystals and glasses; elaboration of the physical basis for the production of optical materials that are resistant to laser radiation; discovery of several effects in the interaction of laser radiation with matter; discovery of the multi-focus structure of wave packets in nonlinear media and elaboration of an adequate theory of self-focusing, multistep resonance excitation of molecules by IR radiation leading to their dissociation; slow burning of laser plasma.

In recent years A. M. Prokhorov has paid much attention to the field of fiber optics and development of fiber optic communications. These studies are of significant scientific interest and great practical importance. In this area A. M. Prokhorov and coworkers have obtained a number of new results (in particular, they discovered and investigated nonlinear effects of radiation transmission in lightguides), developed effective means of obtaining fiber lightguides characterized by lowest possible losses, built several experimental communications lines based on fiber lightguides. The range of A. M. Prokhorov's scientific interests is very wide. He consistently supports new directions in physics, electronics, and other areas. In particular, under his immediate guidance the Institute of General Physics of the Academy of Sciences of the USSR which he heads pursues research in the fields of microelectronics, plasma physics, controlled thermonuclear fusion using stellarator-type systems, new developments in spectroscopy (laser spectroscopy, submillimeter spectroscopy), applied hydrophysics.

Characteristic of A. M. Prokhorov's scientific and scientific-organizational style is the coupling of basic research with practical applications, the effort to introduce rapidly scientific results into the economy. In this he has achieved great success and has been recognized, both in our country and abroad, as an outstanding scientist and scientific organizer.

For his fundamental research in the field of quantum electronics he has received the Lenin and Nobel prizes; for

his studies of submillimeter spectroscopy he received the State Prize of the USSR. A. M. Prokhorov is a Hero of Socialist Labor, a four-time recipient of the Order of Lenin.

He was elected member of foreign scientific societies and academies, and received honorary degrees from foreign universities.

An order of Patriotic War, First Class and a medal "for Bravery" were conferred on A. M. Prokhorov for his active participation in World War II.

For his great scientific accomplishments and his organizational talents A.M. Prokhorov was elected to the Presidium of the Academy of Sciences of the USSR and as the Academician-Secretary of the Division of General Physics and Astronomy; he has been appointed as Editor in Chief of the Great Soviet Encyclopedia.

As the Academician-Secretary of the Division of General Physics and Astronomy and as the scientific director of several major research projects, Aleksandr Mikhaïlovich coordinates and supervises the work of academic and sectoral institutes, concentrating the work in the most promising directions of fundamental physical research, including those that have direct economic applications.

The reputation of Aleksandr Mikhaïlovich as a scientist, director, and teacher is extremely high. He has made a great contribution to the preparation of scientific cadres at the highest levels: his students include several Academicians and Corresponding Members of the Academy of Sciences of the USSR, tens of Doctors and about 200 Candidates of Science.

Alongside his scientific and organizational activity, A. M. Prokhorov has participated in public and political service. He has been a member of the Communist Party of the Soviet Union since 1950, and is an active propagandist of the internal and foreign policy of the Party, and a participant in the international scientific peace movement.

Aleksandr Mikhaïlovich is known for his outstanding energy, industriousness, sense of humor, and friendliness—hence his warm rapport with many.

We express our heartfelt congratulations to Aleksandr Mikhaïlovich on his anniversary and wish him good health and further success in his work.

Translated by A. Zaslavsky