

Andrei Viktorovich Gaponov-Grekhov (on his eightieth birthday)

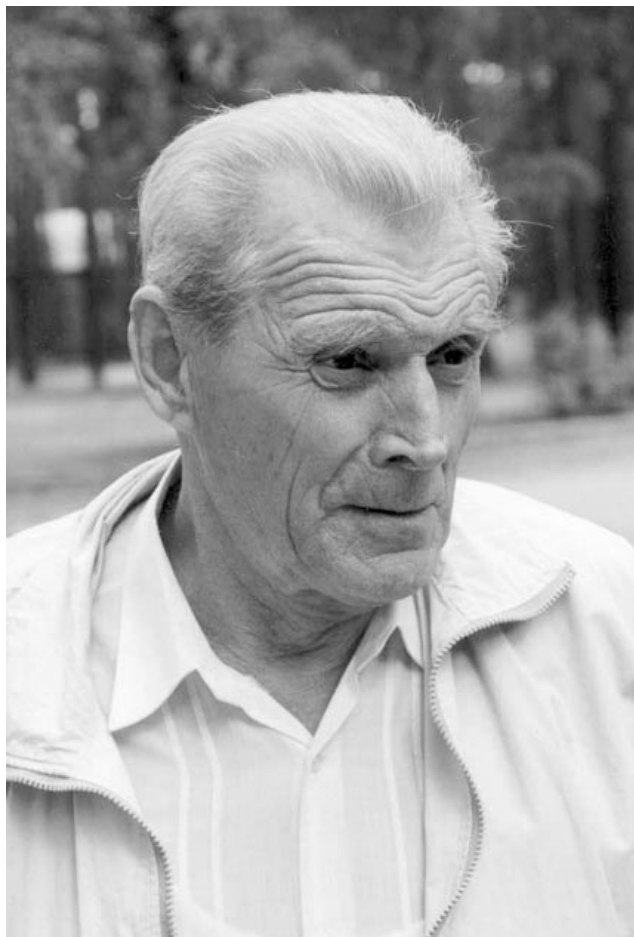
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Andrei Viktorovich Gaponov-Grekhov, a brilliant Russian scientist and outstanding science administrator in this country and Full Member of the Russian Academy of Sciences (RAS) celebrated his 80th birthday on June 7, 2006.

Gaponov-Grekhov took his first steps in science in connection with the development of the theory of electromagnetic emitters in distributed resonance systems. He was doing this work while still a student at Gorky State University under the supervision of M L Levin. In 1949, he graduated from the university and entered the postgraduate course of Academician A A Andronov, one of the founders of the widely known now Nizhnii Novgorod (Gorky) school of radiophysics. A series of research works on the general theory of electromechanical systems proved to be so significant that during the defence of his thesis for Candidate of Physicomathematical Sciences in 1955 Gaponov-Grekhov had the higher degree (DSc) conferred on him instead.

The work on wave dynamics in nonlinear media and on the theory of oscillations in distributed systems that Gaponov-Grekhov and his students carried out in the second half of the 1950s led to the discovery of electromagnetic shock waves and created the foundation of one of the key elements of modern physics — the nonlinear dynamics of distributed systems. This work greatly stimulated progress in such lines of research at the Nizhnii Novgorod school of radiophysics as nonlinear optics, nonlinear acoustics, dynamic chaos, and self-organization in complex dynamical systems. The Nizhnii Novgorod school of radiophysics still occupies leading positions in all these fields.

One of the most impressive scientific achievements by Gaponov-Grekhov that fully revealed his talent as an outstanding scientist and science manager was the creation in 1958–1961 of the theory of stimulated emission of radiation by classical nonlinear oscillators, the formulation on this basis of a new principle of generation and amplification of electromagnetic waves and implementation of this principle in electronic devices. In this work, A V (initials are commonly used by his friends at the mention of Gaponov-Grekhov in his absence) succeeded in both developing the theory and almost simultaneously arranging the experiments and designing actual devices, namely, cyclotron-resonance masers (CRMs) — high-power generators and amplifiers for the centimeter, millimeter, and submillimeter wavelength bands. In later years, relativistic electronics was added to the range of A V's interests in this field of radiophysics. This new area also resulted in the creation of a whole line of high-power relativistic microwave devices capable of generating nanosecond pulses with gigawatt peak power. These sources of powerful microwave radiation worked in controlled nuclear fusion facilities, in high-power radar, and in technological processes, e.g., in plasma-chemical reactors. The work on the



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design and application of high-power microwave sources led by A V was rewarded on three occasions with the USSR and Russia State Prizes.

The role played by leading scientists in progress in their fields is typically not limited to the results that they themselves or their students obtain. We have already mentioned that Gaponov-Grekhov is one of the outstanding managers of national science. One of his most important achievements in this field was the creation in 1976 of the Institute of Applied Physics (IAP) of the USSR Academy of Sciences that he headed for more than a quarter of a century. Under his guidance the Institute grew into one of the leading physics centers of the Russian Academy of Sciences (RAS), where wide-range fundamental and applied facets of research merged successfully. The Institute is very strong in plasma physics, high-power electronics, hydrophysics and hydroacoustics, quantum radiophysics and nonlinear optics, and the physics of millimeter and submillimeter electromagnetic waves. Large-scale complex projects completed at IAP RAS have gained international recognition and earned more than

thirty various awards, including the Lenin Prize, fourteen State Prizes, three Prizes of the Government of the USSR and Russia, and a number of others. At the present moment, A V is Science Supervisor of IAP RAS and still plays a most active role in shaping its current research profile.

In his capacity as head of research for defense areas at IAP RAS and as Chairman of the Integrated RAS Council for Hydrophysics Problems, A V has made important contributions to Russia's defense capabilities in the field of fundamental and application aspects of work for the navy. In fact, it was his initiative that started work in the low-frequency range of acoustic waves as the 'working tool' for the active diagnostics over large areas of the ocean. In the mid-1980s, demonstration environmental experiments were run under his scientific leadership and proved conclusively the possibility of remote diagnostics of the underwater space on distances of up to one thousand kilometers; the scientific and technological foundation was created for building powerful low-frequency acoustic emitters without which no serious experimental studies are possible for the 'remote' acoustics of the ocean. The hydroacoustic emitters designed at IAP RAS have characteristics that remain unsurpassed and are used successfully in numerous environmental experiments. For instance, these emitters were utilized in unique Russian–American TAP and ACOUS projects on the propagation of low-frequency (in the 20-Hz band) signals on stationary transarctic routes that appear to have constituted an important step toward the implementation of the idea of global thermometry of the oceanic climate by means of low-frequency acoustics.

Teams guided by A V have obtained world-class results in quantum electronics, laser physics, and nonlinear optics. Thus, the first laser in the USSR working on a ruby crystal grown in this country was built in 1962. In the period of explosive progress in quantum electronics (1965–1990), the work carried out by the researchers at IAP largely defined the frontlines of the field. Two State Prizes, the Prize of the USSR Council of Ministers and the Prize of the Russian Government that IAP's scientists obtained between 1983 and 1997 are good evidence. In 1999, the first femtosecond terawatt-power laser facility in Russia started working at IAP, and now a 200-terawatt femtosecond laser facility has been completed. It was through A V's initiative that these results largely wiped out the gap between Russian science and the world level in femtosecond optics; it stimulated progress in a novel research avenue — the physics of ultraintense electromagnetic fields and of their interaction with matter.

In 2001, A V became the head of one of the largest programs of fundamental research of the RAS Presidium, namely, Femtosecond Optics and the Physics of Superintense Laser Fields that coordinates the activities of more than 20 academic institutes in a strategically important field of modern physics — the creation and application of laser sources of radiation of ultrashort duration for use in scientific, industrial, information-oriented, biomedical, and military-technology applications.

The importance of AV's contribution to solving fundamental and practical problems in modern physics, the national economy, and defense field received well-deserved recognition: he was elected Corresponding Member of the USSR Academy of Sciences in 1964, and Full Member in 1968; received three State Prizes (in 1967, 1983, and 2003), the Demidov Prize (in 1995), the highest distinction of the RAS — the M V Lomonosov Grand Gold Medal (in 2000), was made Hero of Socialist Labor (in 1986), received two

Orders of Lenin (in 1975 and 1986), the Order of the October Revolution (in 1981), and the Order For Distinguished Service for the Fatherland of the Third Class (in 1999).

During his entire career at the Institute he himself created, A V has invariably paid special attention to training new generations of scientists. It was in fact in the very first years of the life of IAP RAS that a system was installed for the continuous education of researchers which included the specialized Physics & Mathematics Lyceum, some closely related departments and chairs at Nizhnii Novgorod State University, and an institute for trainees and postgraduate studies. All these key components of the young scientist training program were merged into a specially created Scientific and Education Center with IAP RAS; its organization in 2001 is a brilliant confirmation of the fact that in the dark 1990s the Institute headed by A V not only survived but in fact received a new impetus for expansion. The obvious proof of the high efficiency of the system of guiding young talents at IAP RAS is that: in the last seven years nine series of research projects by young scientists at IAP RAS have won RAS medals for young scientists (in physics, Earth sciences, and scientific instrument making).

Academician Gaponov-Grekhov's work as Head of the Board of the State Program for Support of Leading Science Schools in Russia is evidence for his high scientific and moral reputation. A V was one of the founding fathers of this program aimed at sustaining and strengthening Russian scientific schools — they constitute a most important and, in many ways, unique factor for the progress of science in our country. In these rather difficult times for science in general, this program plays a very special role in maintaining the position of national science in society.

A V has for many years now been the Editor-in-Chief of the *RAS Izvestiya, Physics Series*, Editor-in-Chief of *NAUKA*, the Main Editorial House of Physics and Mathematics Literature. He also sits on the editorial boards of a number of leading scientific journals.

We salute Andrei Viktorovich Gaponov-Grekhov on his jubilee and wish him many years of unfailing health and new achievements in each of the many facets of his activities, as well as the further progress of his creation — the Nizhnii Novgorod scientific school of radiophysics.

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S V Golubev, V V Zheleznyakov, V E Zakharov,
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