

Yurii Vasil'evich Gulyaev (on his sixtieth birthday)

Academician Yurii Vasil'evich Gulyaev celebrated his sixtieth birthday on 18th September 1995. He is a full member of the Russian Academy of Sciences, an outstanding scientist in the field of radiophysics and electronics, and Director of the Institute of Radio Engineering and Electronics of the Russian Academy of Sciences.

Yu V Gulyaev was born in Tomilino (Moscow Province) into the family of an office worker. He graduated in 1958 from the Radiophysics Department of the Moscow Physicotechnical Institute and became a postgraduate student at the Institute of Radio Engineering and Electronics of the USSR Academy of Sciences, in a division headed by S G Kalashnikov. He began his scientific work in the theory of semiconductors under the supervision of V L Bonch-Bruевич. The very first papers of Yu V Gulyaev—on the theory of impurity mobility of electrons in semiconductors at low temperatures, on the 'impact' mechanism of charge-carrier recombination in semiconductors, and on the electronic properties of dislocations in semiconductors and their influence on nonequilibrium electronic processes—made him a known theoretical physicist. In 1962 Yu V Gulyaev went to England where he worked for a year with S Edwards in the Physics Department at Manchester University, headed by B Flowers. He studied the theory of electronic properties of disordered solids, particularly that of heavily doped semiconductors. Returning to the Institute of Radio Engineering and Electronics, Yu V Gulyaev continued his research in the field of the theory of semiconductors: he predicted the dependence of the photoconductivity on the polarisation of incident light, the negative photoconductivity in a quantising magnetic field, and the unique features of the Faraday effect due to 'hot' electrons in semiconductors. He also formulated the criterion of the drift electric instability in semiconductors such as gallium arsenide, which accounted (in the quantitative sense) for the Gunn effect.

However, Yu V Gulyaev gained greatest renown for his work on acousto-electronics, microwave acoustics, and acousto-optics. Together with V I Pustovoit, he put forward in 1964 the fundamental idea of using surface acoustic waves (SAWs) in electronics and proposed a layer piezoelectric–semiconductor structure as the base element of acoustoelectronic devices. Gulyaev (and independently, somewhat later, American scientist J L Bleustein) predicted and studied a new fundamental type of SAWs, known in the



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world literature as the Gulyaev–Bleustein waves. He predicted and investigated the transverse acousto-electric effect due to SAWs, providing the basis for devices performing convolution, correlation, fast Fourier transformation, and other operations on radio signals. He studied the characteristics of SAWs in periodic structures on the surfaces of solids.

Yu V Gulyaev predicted theoretically and investigated a new class of transport phenomena in semiconductors associated with the drag of electrons by acoustic waves: they include the acoustomagnetolectric effect (Discovery Diploma No. 133), the acoustothermal and acoustomagneto-thermal effects, the acoustoconcentration effect leading to acoustoluminescence, and the acoustomagnetic effect. In 1971 he proposed the 'acousto-injection transistor', the first in a series of semiconductor devices with acoustic transport of charges. Yu V Gulyaev developed a nonlinear theory of acousto-electronic phenomena accounting for the numerous effects which appear in the course of propagation of high-intensity sound in semiconductors.

Yu V Gulyaev made a major contribution to the development of acousto-optics. He was the first to consider the diffraction of light by electron waves which accompany sound in semiconductors, the diffraction of light by sound in an active medium and in particular the acoustic distributed feedback in lasers, as well as resonant and nonlinear acousto-optical phenomena in solids.

Yu V Gulyaev established a well-known, in our country and abroad, school of specialists on acousto-electronics, microwave acoustics, and acousto-optics. His pupils and colleagues who participated in many of these investigations are now setting the pace in the development of promising directions in these fields of physics and electronics. The work of Yu V Gulyaev and his school has created a new trend in techniques for information processing, communications, television, broadcasting, and radar, which is growing in importance every year.

The development of the physical principles of SAW-based devices by Gulyaev was recognised by a prize—shared with four other European physicists: E A Ash, J H Collins, E G S Paige (Great Britain), and K A Ingebrigtsen (Norway)—awarded in 1979 by the European Physical Society. The work of Yu V Gulyaev and his colleagues in the fields of acousto-electronics, microwave acoustics, and acousto-optics was rewarded twice (in 1974 and 1984) by the state Prize of the Soviet Union, and in 1983 by the State prize of the Russian Federation.

Yu V Gulyaev made striking contributions also in other branches of solid-state physics, radiophysics, and electronics. For example, in 1965 he predicted the existence of 'second spin waves' in ferromagnets (these waves are analogous to second sound in liquid helium, predicted by L D Landau). Later, in cooperation with P E Zil'berman, he developed a transport theory of the interaction of spin waves with electrons in ferrite-semiconductor layer structures, which provided the theoretical foundation for spin-wave electronics, a new direction in the physics and technology of solids.

In 1978 Yu V Gulyaev proposed and developed successfully a new 'radiophysical' approach to the study of the operation of the human body, based on comprehensive measurements of physical fields and radiations emitted by humans during their activities. Cooperation with teams from a number of leading medical organisations has led to the development, which is still continuing, of new noninvasive early-diagnostic methods.

In recent years Yu V Gulyaev has been paying much attention to the construction of instruments and devices for vacuum microelectronics which, in respect of a number of parameters, have important advantages over solid-state microelectronic devices.

In 1979 Yu V Gulyaev was elected a Corresponding Member and in 1984 he became full Academician of the Soviet Academy of Sciences.

Yu V Gulyaev is an energetic, sociable and companionable man who has made a major contribution to public affairs and as an organiser of science. In 1989, he was elected National Deputy of the USSR and Chairman of a Sub-Committee on Informatics and Communications of the Supreme Soviet of the Soviet Union. He led a team which prepared a comprehensive Programme for the Development of Telecommunication and Informatics Systems in the Soviet Union, taking account of the special conditions in the Soviet Union and of the world-wide experience.

Yu V Gulyaev is now heading the National Scientific-Technical Programme entitled 'Promising Telecommunication Facilities and Integrated Communication Systems' at the Ministry of Science and Technical Policy of the Russian Federation. In addition to directing a major institute, Yu V Gulyaev is participating, as a member of the Presidium of the Russian Academy of Sciences, in coordination of fundamental research in the field of radio engineering, electronics, and communications. He also heads the Saratov Scientific Centre of the Russian Academy of Sciences, and he has put much effort into the establishment of this centre.

Yu V Gulyaev was elected President of the A S Popov Russian Scientific and Technical Society for Radio Engineering, Electronics, and Communications; President of the International Union of Scientific and Engineering Organisations of the Federation of Independent States; and Chairman of the Russian Section of the International Institute of Electrical Engineering and Electronics Engineers.

Gulyaev's outstanding contributions to the development of world and Russian radio engineering, electronics, and communications gained him, in 1995, the award of the A S Popov Gold Medal of the Russian Academy of Sciences.

All of us cordially wish Yurii Vasil'evich new major successes in his multifaceted scientific and organisational activities.

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