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Kirill Petrovich Gurov

An outstanding theoretical physicist, Doctor of Physico-mathematical Sciences, Professor Kirill Petrovich Gurov, died on 29 September 1994 after a serious illness. Life subjected this courageous man to many major ordeals, but each time he met his fate with dignity and remained, in spite of all the adversities, a very good man, cheerful, witty, and full of joie de vivre to his last days.

Kirill Petrovich Gurov was born on 6 March 1918 in Moscow in the family of gentry; his father was a regular officer. As a child he was educated at home and by the time he went to school he was fluent in French and German. He joined the second form directly. He learnt easily and with great interest, but at the age of 13 he was struck by a serious illness accompanied by total loss of hearing. During the many months of his illness this little boy did on his own two years' curriculum and was then a year ahead of his classmates. This was the first demonstration of his strong character and outstanding abilities. He finished school with distinction and in 1936 was accepted by the Physico-mathematical Department of the Moscow State University without having to pass an entrance examination.

However, fate tested him severely once again: in 1937 his father fell victim of the repression. This did not break the young man. He continued to study at the University, working according to his own plan. He was one of the best students and had a personal Stalin scholarship. In 1941 he graduated with distinction.

During the war K P Gurov worked in a Kuibyshev factory. He greatly overfulfilled the norm for a grinder and yet had time to work with 'Sovinformbyuro': he contributed 90 papers in Russian, German, and French to a variety of publications.

In 1944 K P Gurov returned to Moscow and became a postgraduate student under N N Bogolyubov at the Moscow State University. In two years he was ready with his thesis for the degree of Candidate, which he successfully defended. The joint paper by K P Gurov and N N Bogolyubov on "Kinetic equations in quantum mechanics" [*Zh. Eksp. Teor. Fiz.* **17** 614 (1947)] was the final stage in the task of justifying the kinetic theory on the basis of dynamic treatment of a many-particle system. The well-known monograph of N N Bogolyubov on *Problems of Dynamic Theory in Statistical Physics*, which appeared a year earlier, did not go beyond the framework of classical nonquantum mechanics of the motion of gas particles. The paper of K P Gurov and N N Bogolyubov provided a convincing dynamic justification of the kinetic theory based on the quantum-mechanical analysis of a many-particle system. This pioneering work revealed in particular how the conditions for weakening the Bogolyubov correlation were related to the usual, in the quantum theory of scattering, boundary condition imposed on the scattering amplitude, which ensures that the kinetic equations are irreversible. This reduced the problem of thermodynamic irreversibility to a problem in the quantum theory of scattering. Further development of this method, which became known as the Bogolyubov – Gurov method, was presented in the first monograph of Kirill Petrovich on *Fundamentals of Kinetic Theory* (Moscow: Nauka, 1966), which became a classic.

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Later, K P Gurov applied successfully the ideas and methods of nonequilibrium statistical physics when working at the A A Baikov Institute of Metallurgy of the Soviet

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Academy of Sciences. He was invited there in 1954 by Professor I B Borovskii. K P Gurov worked at this Institute for 40 years, right up to the last days of his life. His main scientific interests were the diffusion processes and the phase transformations in alloys caused by these processes. A special place in his work, and in a sense the core of his investigations, was the 'hole gas' method he developed. This method takes satisfactorily into account the active role played by the vacancy subsystem in the study of diffusion processes. The use of this method for the description of the diffusion fluxes under mutual diffusion conditions in binary and multicomponent alloys, forming substitutional solid solutions, was the main content of K P Gurov's doctoral thesis. His work can be found in the opening chapters of the monograph of I B Borovskii, K P Gurov, I D Marchukova, and Yu E Ugaste *Mutual Diffusion Processes in Alloys* (Moscow: Nauka, 1973). The editor and leading author of this monograph was K P Gurov.

The effectiveness of the 'hole gas' method can be seen particularly clearly in studies of the influence of electric and elastic fields on the diffusion processes. In a series of papers, K P Gurov and his colleagues developed a microscopic approach which made it possible to take into account the influence of arbitrary elastic fields on the diffusion fluxes in binary systems. This approach yielded for the first time a system of equations describing the processes of mutual diffusion taking into account elastic effects. The use of the equations derived in an analysis of the process of coalescence made it possible to generalise the Lifshitz–Slezov theory and to account for the reverse of the coalescence effect — dissolution of large particles.

Application of the 'hole gas' method enabled K P Gurov and his colleagues to make a major contribution to the development of the general theory of mutual diffusion in alloys. In the early seventies they proposed a mathematical formalism which can be used not only to estimate the contribution of nonequilibrium vacancies to diffusion fluxes, but also to develop an alternative theory of the process on the basis of microscopic rather than phenomenological (as hitherto) considerations.

K P Gurov also made a universally recognised contribution to the development of a phenomenological theory of mutual diffusion in multiphase binary systems. His greatest achievement in this field of research was a theory, put forward by him together with A M Gusak, of 'diffusion competition of phases' in which the thermodynamics and the kinetics of phase nucleation in a concentration gradient field are taken into account simultaneously. This theory made it possible to formulate the criteria for the suppression and growth of phases, and to account for the relationships governing solid-phase reactions in diffusive amorphisation.

K P Gurov remained a theoretical physicist, but had a surprising 'feel' for the ideas arising from experiments, which he infused with new meaning. In mid-seventies K P Gurov worked with great passion, enthusiasm, and creative efficiency on what was then a new branch of knowledge: space materials science. He was a member of the team of scientists working on the first international Soviet–American 'Soyuz–Apollo' space project. Gurov not only helped to explain the nature of the influence of the conditions of weightlessness on the processes of solid–liquid phase interaction in metals, but became the chief driving force in a monograph, written by a team and entitled *Melting, Crystallisation, and Phase Formation at Zero Gravity* (Moscow: Nauka, 1979), which reported the results obtained.

Gurov's theoretical work on transport processes and on the kinetics of phase formation in solids and in solid–liquid metal systems not only made an important contribution to the fundamental theory of metals and alloys, but made it possible to solve successfully many problems in practical materials science.

For many years K P Gurov was member of the Editorial Board of the journal *Fizika i Khimiya Obrabotki Materialov* (Physics and Chemistry of the Processing of Materials), where his scientific erudition and intellect, his wide horizons, and his exceptional editorial abilities were fully employed in a critical but uncommonly benevolent analysis and selection of papers for publication in this journal.

Gurov was member of the Scientific and Topical Councils of the Institute of Metallurgy of the Russian Academy of Sciences and of the Topical Council of the Institute of General Physics of the Russian Academy of Sciences. He was always one of the most active participants in the procedures associated with the defence of a thesis. The width of his interests and the depth of understanding of a problem, seemingly far from his own research subjects, were always surprising.

K P Gurov was in close contact with colleagues and friends at many scientific centres and institutes. He frequently travelled to present lectures and was a constant participant of the Ural 'Kourovka' Schools on the theory of solids. An outstanding editor, he helped many well-known authors to publish their monographs. His benevolent care in reading theses and refereeing papers earned him constant respect. It was always very interesting to work with him and his selfless devotion to matters in hand and exceptional capacity for work were always a delight. He was always faithful to those high moral principles which are followed by the best representatives of the scientific community.

The surprising responsiveness, enormous erudition, adherence to principles, insight into scientific matters, love of life and optimism, the ability to be natural and simple in any situation, the indulgent attitude to authority, rank, and title, true intelligence — all these were Gurov's qualities. And this is by far not all one could say about this remarkable man and scientist.

A bright, unique man, faithful to his principles, good, just and steadfast; this is how we shall always remember Kirill Petrovich Gurov.

O A Bannykh, V G Bar'yakhtar,
S V Vonsovskii, A M Gusak, L I Ivanov,
V V Kondrat'ev, A V Nazarov, V I Okulov,
V N Pimenov, A A Rukhadze, V P Silin,
G G Taluts, Yu E Ugaste