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Lev Petrovich Gor'kov (on his seventieth birthday)

Academician Lev Petrovich Gor'kov, full member of the Russian Academy of Sciences, an outstanding theoretical physicist, was 70 on June 14, 1999.

L P Gor'kov is among the last generation of students of Lev Davidovich Landau and grew into full-fledged scientist under his direct influence.

L P Gor'kov enrolled in the Physico-Technical faculty of Moscow University in 1947; and when the faculty was disbanded, Gor'kov transferred to the Engineering Physics faculty of the Moscow Mechanics Institute (now Moscow State Engineering – Physics Institute). In 1953 he graduated from the institute and immediately started work at the Theoretical department of the Institute for Physical Problems, headed by Landau, and worked there for almost ten years (1953 – 1962).

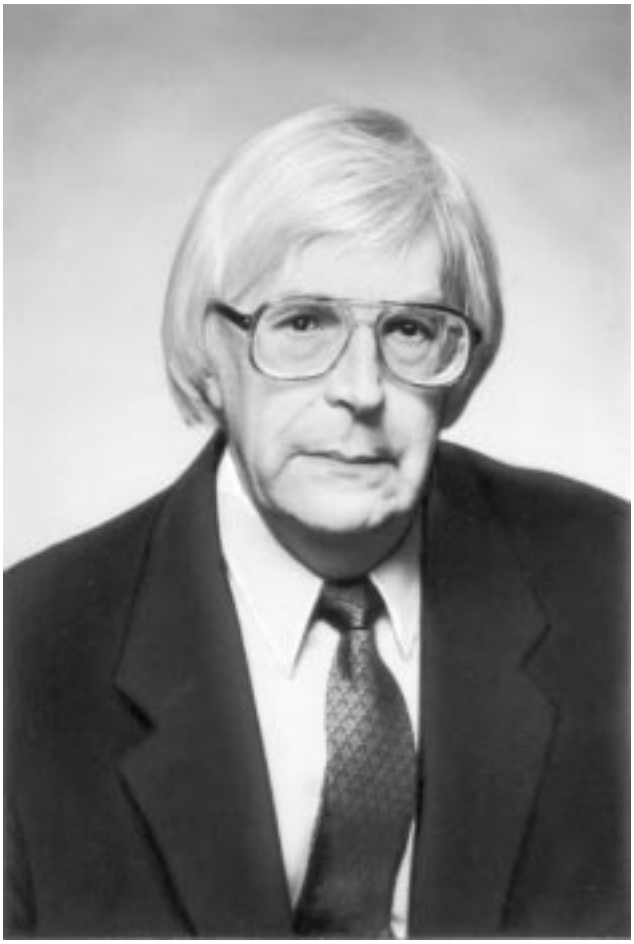
After defending in 1956 his PhD thesis on electrodynamics of spinless particles, Gor'kov tackled a number of problems in hydrodynamics and statistical physics. Among other papers, he published an elegant paper on convective flow in a planar liquid layer (Bénard convection).

Several months after the creation of the theory of superconductivity in 1957 by J Bardeen, L Cooper and J Schrieffer, Gor'kov gave a new field-theory formulation of this theory. He derived two equations (known as the Gor'kov equations) that in fact became fundamental for the theoretical description of superconductivity.

Many achievements in superconductivity theory are connected with Gor'kov's name. In 1959 Lev Petrovich derived the Ginzburg – Landau equations from the microscopic theory. This result had an enormous effect on the ideology of the condensed matter physics as a whole. In 1958 Lev Petrovich together with A A Abrikosov developed the diagram method, the so-called 'cross technique', for describing phenomena in metallic alloys. On its basis, he created in the period 1958 – 1961 the theory of superconducting alloys with nonmagnetic and magnetic impurities. For magnetic impurities, he discovered, 'on the tip of a pen', the effect of gapless superconductivity. This discovery made more profound the understanding of the superconducting state as an ordered state that can exist even in the absence of a gap in the quasiparticle spectrum. The gapless superconductivity discovered in dirty alloys with magnetic impurities is also observed in pure superconductors with unconventional types of Cooper pairing (e.g. p or d types).

In 1961 L P Gor'kov submitted and defended his DSc thesis. In 1966 he was awarded, together with A A Abrikosov and V L Ginzburg, the Lenin Prize for Physics. The same year Gor'kov was elected a corresponding member of the USSR Academy of Sciences.

The work on superconductivity theory and other problems of statistical physics required the development of a new mathematical technique which would generalize the Feynman diagram method for the temperature Green's functions and which grew into the main method of calculation in the condensed matter physics. This technique was the subject of the monograph that was first published in Russian in 1962 and never reprinted since, but went through numerous print runs abroad — the famous 'green book' by A A Abrikosov, L P Gor'kov and I E Dzyaloshinsky, *Quantum Field Theoretical Methods in Statistical Physics*. This book became a bible for several generations of theoretical physicists over the world. The book brought to its authors the L D Landau Prize of the Academy of Sciences of the USSR.



Lev Petrovich Gor'kov

In 1963 L P Gor'kov moved to Chernogolovka near Moscow as head of the Theoretical Department of the Institute of Chemical Physics, and in 1965 moved to the Institute of Theoretical Physics which brought together many of L D Landau's students. It is quite difficult even to list all the significant results obtained during the Chernogolovka period in Gor'kov's life. We will select and describe only those which appear to be the most important at present.

In 1964 L P Gor'kov and G M Eliashberg calculated the polarizability of small metal particles in a high-frequency field

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and showed that all three types of the so-called Wigner-Dyson level statistics are realized in such particles. This paper is very popular these days in connection with progress in the physics of mesoscopic phenomena.

In 1967 Gor'kov and I E Dzyaloshinsky found the Mott exciton spectrum in a strong magnetic field; this is an important result that is constantly used in semiconductor physics and in the theory of the quantum Hall effect.

At the beginning of the 1970s Gor'kov and G M Eliashberg developed the general theory of non-stationary phenomena in superconductors. The theory found numerous applications in the description of specific dynamic dissipative processes, namely: the motion of vortices and domain walls in superconductors and also in superconducting phases of helium-3, the conductivity in thin superconducting wires and superconductor – normal metal contacts, and the behavior of superconductors in ac fields.

In 1979 a paper by L P Gor'kov, A I Larkin and D E Khmel'nitsky created the foundations of the theory of weak localization: they defined a regular method of calculating quantum corrections to conductivity in alloys.

In 1984 Gor'kov together with G E Volovik suggested a symmetry classification of superconducting states in crystals, which is used nowadays as the principal tool for the identification of superconducting phases in high-temperature superconductors and heavy-fermion compounds.

In 1987 Gor'kov was elected as a full member of the Academy of Sciences of the USSR.

In addition to research, L P Gor'kov always spent a great deal of his energy helping the progress of young theoreticians. For a quarter of a century (1966 – 1991) he headed the chair of Problems of Theoretical Physics of the Moscow Physico-Technical Institute (now Moscow Institute of Physics and Technology — MIPT). The fact that this chair was allowed to hire new researchers from among the best students of MIPT after conducting annual competitive exams was to a large extent the achievement of the head of the chair himself and owed to the unparalleled respect that he commanded at the institute. Their very first steps in physics were made, over the years, by S A Brazovsky, A M Finkelshtein, N B Kopnin, G E Volovik, K B Yefetov, Vl S Dotsenko, O Dorokhov, P B Wiegman, L S Levitov, Vik S Dotsenko, A Yu Kitaev, P Kalugin and other scientists of world renown.

In 1991 L P Gor'kov moved to the USA where he worked first at the University of Illinois at Urbana-Champaign and then became the Director of Programs at the National Laboratory of Strong Magnetic Fields at Tallahassee in Florida. In 1993 L P Gor'kov together with A A Abrikosov and V L Ginzburg were awarded the John Bardeen Prize. In 1997 he was elected an Honorary Member of the American Physical Society.

Lev Petrovich Gor'kov still keeps up his vigorous research program, publishes papers on the physics of metals with heavy fermions and on the de Haas – van Alfven effect in first mixed superconducting state. Owing to his exquisite taste for specific physical phenomena and his brilliant understanding of experimental methods, L P Gor'kov was, and remains, the leading expert on all classes of new materials in the condensed matter physics — whether these be superconductors with A15 structure, or organic quasi-one-dimensional metals, or compounds with heavy fermions, high-temperature superconductors or the latest fad, the manganites.

Lev Gor'kov keeps working very much, and he is full of new ideas and plans. He still scorns compromise in science, and demonstrates utmost responsibility to the job at hand. Many of his colleagues and students were and are grateful for his kindness and support.

We wish Lev Petrovich good health, new achievements and success in all his endeavors.

A F Andreev, Yu A Bychkov, G Ye Volovik,
V L Ginzburg, S V Iordanskiĭ, Yu M Kagan,
N B Kopnin, V P Mineev, L P Pitaevskiĭ,
G M Eliashberg