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Personalia

VITALIĬ LAZAREVICH GINZBURG

(On his fiftieth birthday)

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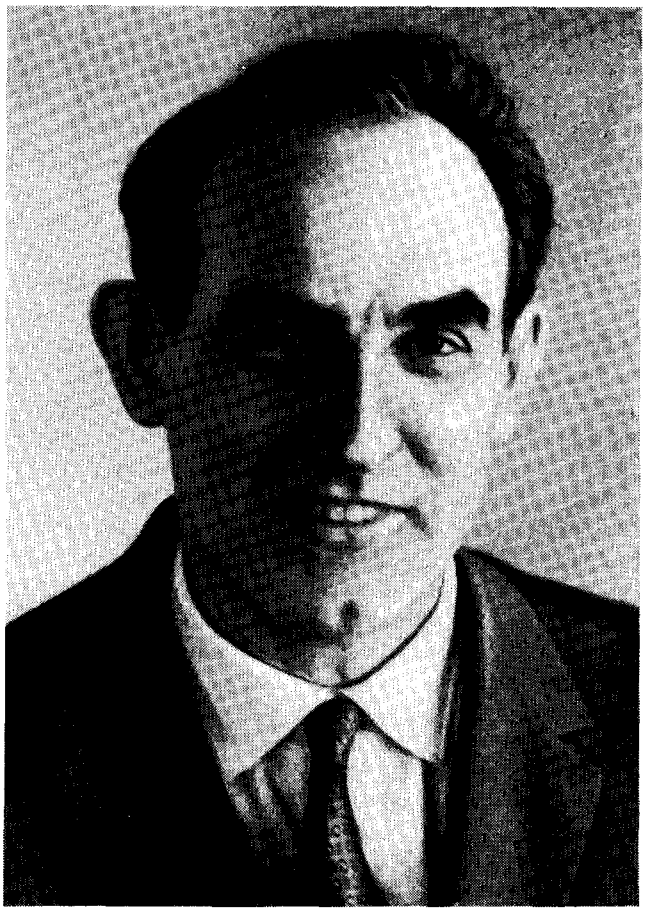
ACADEMICIAN Vitaliĭ Lazarevich Ginzburg was born on October 4, 1916 and has consequently reached his fiftieth birthday. This is unexpectedly little, if one is to judge from some two hundred published scientific papers in the most varied branches of physics, from a series of monographs translated abroad and constantly revised and reprinted, from the numerous students, including doctors whose number runs to a two-digit figure, from his decorations, and from his Lenin, State, and other prizes. If, however, we turn our attention to his present-day exceptional scientific activity and productivity, and if we note how quickly he responds to new experimental discoveries, then it is difficult to believe that he has already five decades behind him.



Ginzburg's education followed a nonstandard path. After completing the seven-year school, he worked two years in an x-ray laboratory and enrolled directly in the second year of the Moscow State University physics department (in 1934). After graduation (1938), he became one of G. S. Landsberg's graduate students in experimental optics. However, although he always stayed close to experiment, his theoretical bent soon prevailed. It is not unlikely that temperament also played its part: an experimenter has to wait very long for an answer to his question. But theoretical physics, as recently stated by Feynman, is "a very easy matter." And although this point of view contradicts almost all commonly held opinions, it may seem true to V. L. Ginzburg. Indeed, interesting results were produced in abundance - one after the other.

At the university, in graduate school, and then as a doctoral candidate (at FIAN [Physics Institute of the Academy of Sciences]), Ginzburg found himself in the scientific atmosphere created by L. I. Mandel'shtam and I. E. Tamm. Conditions were produced here for merging lucid physical understanding and physical intuition with consistent theoretical research; for a broad survey of physics—all of physics; for the love of the paradox; for search for an interesting but significant twist in each problem; for receptivity to everything that is new and for an assured foothold on classical physics, one might say monism in the understanding of both new and old physics; for continuous and passionate search, yet combined with a cool head; for that combination of deep respect for authority and a critical attitude towards it, which produces a truly democratic way of life in science and gives rise to readiness to listen equally seriously to a Nobel prize winner and a senior student. V. L. Ginzburg grew up as a scion of the same school, albeit in a time that was essentially different in style. Later on, his friendship with L. D. Landau also introduced new features in his personality as a physicist.

Ginzburg has been working since 1940 in the theoretical division of FIAN, headed by I. E. Tamm, and has been since 1951 director of a sector and deputy director of a division. Starting with 1945, he has been simultaneously in charge of the Department of radiation and radio-wave propagation of the radiophysics department of the Gor'kiĭ state university, and has

been in close contact in recent years with the group of students he trained there, serving as consultant at the Radiophysics Research Institute of the Gor'kiĭ University. This work in Gor'kiĭ has been an important part of his life.

Even in the first 5—7 years of his scientific activity, Ginzburg tackled different branches of physics and obtained important research results in each.

In quantum electrodynamics, he solved a number of subtle problems in both classical and quantum theory of radiation, and already in 1940 he defended his candidate's dissertation. Thus, for example, he showed that the then-paradoxical result, whereby perturbation-theory calculations show that a uniformly moving electron emits radiation, was the consequence of incorrect initial conditions, in which it is assumed that the electron exists but the dragged transverse electromagnetic field does not. Ginzburg was the first to propose the use of the so-called Coulomb normalization of potentials. He developed the quantum theory of the Vavilov-Cerenkov effect and the theory of Cerenkov radiation in crystals (1940).

His doctoral dissertation dealt with the theory of elementary particles (1942). It summarized his investigations, in which he considered, on the basis of a generalization of classical theory, the effects of inertia and damping of the mechanical momentum of a particle with spin in an external field, and constructed the first relativistic theory of a particle capable of existing in states with different spins. Related to the same set of investigations is one in 1947 (jointly with I. E. Tamm), in which he formulated equations of a new type. The solutions of these equations, which generalize the theory of the relativistic top, can form an infinite-dimensional representation of the Lorentz group and describe a particle with higher spins.

Turning to radiophysics, Ginzburg showed in 1942, i.e., long before the development of radiospectroscopy and quantum electronics, that the propagation of radio waves in the atmosphere without strong absorption is possible for a number of frequencies only as a result of stimulated-emission processes. In 1943 he considered the passage of a radio signal through the ionosphere and predicted an effect (confirmed several years later) whereby a signal reflected from the ionosphere triples in the earth's magnetic field.

His work in solid-state physics is represented by a thermodynamic theory of ferroelectric phenomena. Ginzburg pointed out that barium titanate (whose anomalous properties were observed a short time before) is ferroelectric (1945).

Belonging to the same period is the first work on superconductivity, which has led to subsequently confirmed conclusions.

In addition, he obtained a number of interesting results on acoustics, molecular optics, plasma physics, and applied problems in optics and electrodynamics.

One might think that by 1945 this flood of work defined the scope of Ginzburg's work. Shortly afterwards, however, he added radioastronomy, the theory of the origin of cosmic rays, astrophysics in the narrower sense of the word, problems of thermonuclear fusion, and others.

It is already clear from the foregoing that it is impossible to review here Ginzburg's work in any detail. We are forced to confine ourselves only to the highlights.

The work on the theory of Cerenkov radiation branched out into an entire discipline (emission from uniformly moving particles in homogeneous and inhomogeneous media), which was developed also by his students and other Soviet theoreticians in close connection with his own research. Ginzburg himself clarified, besides the foregoing, many other problems (emission of quanta inside the Cerenkov cone, which is connected, strangely enough, with excitation of a radiating system, for example with the transition of a radiating atom moving with superluminal velocity from a lower to a higher level, the possible use of the Vavilov-Cerenkov effect and of the superluminal Doppler effect for the generation of microwaves, and many others). For all these investigations, the Presidium of the USSR Academy of Sciences presented V. L. Ginzburg with the M. V. Lomonosov Prize.

Related to this is work (done in conjunction with I. M. Frank), in which a new effect was predicted and calculated—transition radiation, which occurs when a charge moves uniformly and crosses the boundary between two media. This effect was subsequently observed in full accord with the theory, was investigated in by many theoretically and experimentally in the USSR and abroad, and became a tool of metal-optics research.

In optics, we can mention work on the scattering of light in helium II, gases, and liquids and the soon-to-be fulfilled prediction of critical opalescence in phase transformations in solids (1955). Since 1958, he has been engaged in problems in the theory of optical excitons in crystal optics, with allowance for spatial dispersion. These investigations were summarized and the entire theory neatly systematized in a book written jointly with V. M. Agranovich, "Crystal Optics with Allowance for Spatial Dispersion, and Exciton Theory" (1965).

Radio-wave propagation in the atmosphere and in a plasma (ionosphere, solar corona) has been the subject of many studies initiated by the already mentioned researches of 1942. We are referring here to the study of the passage of pulses and propagation of radio waves in an inhomogeneous or in a magnetoactive plasma, nonlinear effects, a unified picture of magnetohydrodynamic and radio waves in a plasma, etc. These problems are the subject of a monograph,

published in three enlarged and revised editions, the last of which is called "Propagation of Electromagnetic Waves in a Plasma" (1960). It was published also in English in the USA and in the Netherlands, and its enlarged edition was published also in England. This book is probably the best text in the world dealing with this most timely topic.

Ginzburg started to work in radioastronomy during its early development stage. As early as 1946 he reported a number of unexpected deductions regarding the radiophysics of the solar corona, which were subsequently confirmed and serve as the basis of the theory of the radiation from the quiet sun. Later (1952—1961) the theory of the sporadic radio emission from the sun was developed. Many papers contained indications of new research methods which, as a rule, were subsequently used, for example, the method of investigating discrete sources by observing diffraction from the lunar edge, etc.

A special division is made up by researches in which the theory of cosmic synchrotron radiation was developed, together with the associated radioastronomical theory of the origin of cosmic rays. Also well known is the book by V. L. Ginzburg and S. I. Syrovatskiĭ, "The Origin of Cosmic Rays" (1963), an enlarged edition of which was published in England and a second edition of which is now under preparation.

This work overlaps also research on other problems in astrophysics (the nature of radiogalaxies and quasars, gamma and x-radiation from galaxies, gravitational collapse of a magnetized star within the framework of general relativity, etc). This field is almost his principal passion at the present time.

Finally, a large group of researches has been devoted to superconductivity and superfluidity. Principal among them is the phenomenological theory of superconductivity which he has developed together with L. D. Landau. Its correctness was confirmed by the subsequently developed Bardeen-Cooper-Schrieefer microscopic theory of superconductivity. It became a reliable foundation and an exceedingly convenient tool for the investigation of a large number of phenomena. In particular, A. A. Abrikosov and L. P. Gor'kov have developed on its basis a theory of superconducting alloys. In 1966 Ginzburg, together with the co-authors, was awarded the Lenin Prize for this work. Recently he pointed out that surface conductivity is possible in principle in crystals, and this idea has immediately attracted attention. Many interesting researches were devoted to superfluidity.

V. L. Ginzburg has also occupied himself with anomalous electron emission from metals and with metal optics. He advanced and discussed (1954-56, 1965) a number of hypotheses concerning experimental verification of general relativity. In 1950-51 he was one of the theoreticians studying the problem of controlled thermonuclear reactors and allied problems (published in 1962).

He is a now-rare all-around physicist and is besides interested in general scientific and general cultural problems going beyond the scope of physics. In this connection, we cannot fail to note his popularizing activities—lectures, which invariably attract tremendous audiences, articles in UFN and in popular periodicals and brochures, and radio and television appearances.

All this is combined with scientific-organizational work. He is not only the head of large scientific staffs at FIAN and at the Gor'kiĭ Radiophysics Institute, but is also the editor in chief of the journal "Radiofizika" a member of the editorial staffs of UFN and Nauka i zhizn' (Science and Life), an active member of the board of the Division of General and Applied Physics of the USSR Academy of Sciences, etc.

There are all grounds for expecting that his vigorous activity, which has been going on for more than a quarter-century, will continue without abatement for many more years, justifying the hope and fervent desires of his many friends.

Translated by J. G. Adashko