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PERSONALIA

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Vitalii Lazarevich Ginzburg (on his ninetieth birthday)

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October 4, 2006 was the 90th birthday of the outstanding theoretical physicist, full member of the Russian Academy of Sciences, Vitalii Lazarevich Ginzburg. Ginzburg's contribution to the scientific and social life of the 20th century and the first years of the 21st is tremendous. It has been rewarded with distinguished international scientific prizes, degrees, and national awards.

In 2003 Ginzburg won the Nobel Prize in Physics "for the pioneering contribution to the theory of superconductors and superfluids." The prize specially mentioned the creation by V L Ginzburg and L D Landau of the semi-phenomenological theory of superconductivity. This paper was published in 1950 and preempted a number of important elements in the Bardeen – Cooper – Schrieffer (BCS) microscopic theory created several years later. Far from fading into oblivion after the advent of the BCS theory, the Ginzburg – Landau theory continues to be used in thousands (!) of publications. A relativistic generalization of the Ginzburg – Landau theory and the ideology that was partly created in this theory were widely used in quantum field theory (e.g., spontaneous symmetry breaking) and in cosmology and a number of other fields in physics and mathematics.

In addition to the classic paper written with Landau, Ginzburg has carried out a large number of studies of physical effects predicted by this theory. A series of papers by him on superconductivity in high magnetic fields and on the theory of superconductive alloys (and also the papers of A A Abrikosov and L P Gor'kov), including work on the creation of, progress in, and applications of the Ginzburg – Landau theory, received the highest prize in our country (the Lenin Prize, 1966). The range of his interests in the physics of superconductivity spans the field from thermoelectric phenomena in superconductors to manifestations of superconductivity in the Universe.

It would not be erroneous to claim that it is still difficult to pay proper tribute to the role that Ginzburg has played in the discovery and development of high-temperature superconductors (HTSCs). It is no exaggeration to say that he was the only top-range physicist who for nearly a quarter of a century firmly believed in the feasibility of high-T_c superconductivity and transformed this faith into practical activity with amazing energy.

Even today, the study of high-T_c superconductivity remains for Ginzburg a priority field of research to which he devotes much time and energy. Thus, he has written extensively in recent years on the need to widen the research in our country not only on high-T_c superconductivity but also on the hypothetical creation of superconductors that would work at room temperature (RTSCs). He is greatly worried by the apparent loss of interest in these problems, and even in science as a whole, by our state and our society.

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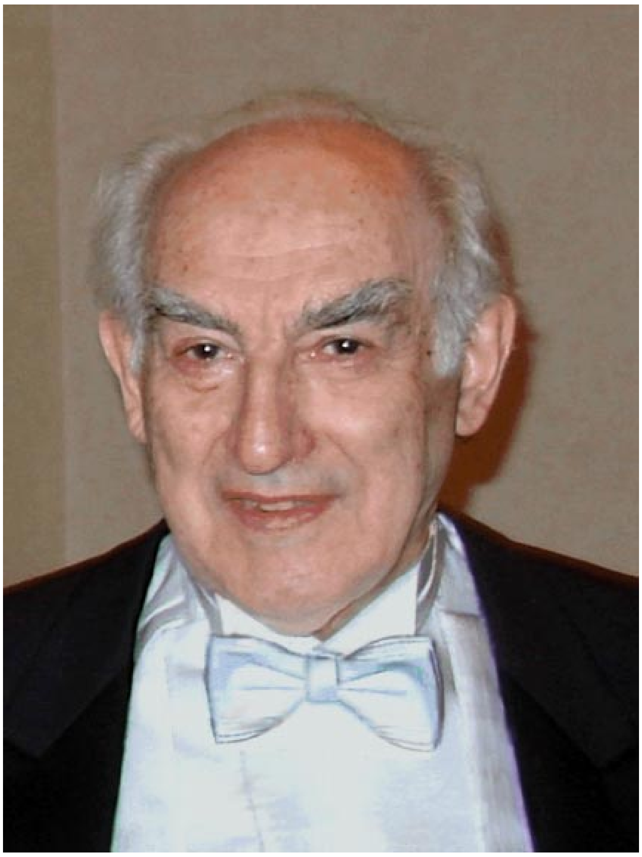
Translated by V I Kisin



Vitalii Lazarevich Ginzburg

In our age of hyperspecialization only a few physicists deserve to be called universalists. Ginzburg is undoubtedly one of them. His work formed the basis for many areas of research in today's physics, and he obtained results of critical importance in very nearly every field of physics.

Ginzburg started his life in theoretical physics before the Second World War with problems in quantum electrodynamics of the time. He was able to elucidate a number of subtle aspects in the theory of radiation, including the paradox in the perturbation theory treatment of the emission of energy when a charge moves at constant speed. Later (in the 1940s) he turned to problems in elementary particle theory that arose in the description of higher-spin particles. He constructed the first relativistic quantum model of a particle that can occupy states with different values of spin; discussed the effects of inertia and decay of the mechanical moment of a spin particle; and studied aspects dealing with spin-3/2 particles (including interaction with an external field). An important step in this work was the paper written by him in collaboration with I E Tamm, which proposed for the first time relativistic equations for a particle with internal degrees of freedom (known as the 'relativistic top' model).

The war that started with the USSR in 1941 demanded that theoreticians solve numerous problems in practical applications, including problems in wave propagation in the ionosphere. Ginzburg joined this work vigorously. His treatment of plasma theory (as the ionosphere is indeed a good example of a plasma environment) influenced most decisively progress in the modern theory of propagation of radio waves in plasmas, in the terrestrial ionosphere, and in the solar corona. This work began with the prediction (as early as 1942) of the effect of tripling of radio signals reflected from the ionosphere. Later, these results made part of Ginzburg's fundamental monograph *Propagation of Electromagnetic Waves in the Plasma* and of other books by him.

Ginzburg's name is closely tied to the very first studies of solar radio emission and to the rise of radio astronomy. He proposed a number of methods in radioastronomical research that became widely used by observers.

A considerable part of Ginzburg's research lies in the field of theory of the light emission and propagation in solids and liquids. This work covers first of all the electrodynamics of superluminal radiation sources, which became an interesting subject after the discovery of the Vavilov – Cherenkov effect at the P N Lebedev Physics Institute (FIAN) and the explanation of its nature by I E Tamm and I M Frank. Ginzburg developed the quantum theory of this effect, the theory of superluminal radiation in anisotropic and inhomogeneous media, the theory of superluminal radiation emission from a source having an electric or magnetic dipole moment, the theory of the Vavilov – Cherenkov effect in a vacuum (from sources of the type of lightbeam spot), and so forth.

In 1945 Ginzburg, together with Frank, developed the theory of a new type of radiation — the transition radiation that appears when a moving particle crosses the interface between two media. This effect, which was later confirmed experimentally, formed the foundation of experimental techniques for studying the optical properties of the surface of detection, for measuring the energy of fast particles, etc. Ginzburg's work on transition radiation and related problems was summarised in the monograph *Transition Radiation and Transition Scattering*, written together with V N Tsytovich (1984).

Another chunk of Ginzburg's work, summed up in the monograph *Crystal Optics with Spatial Dispersion and Excitons,* written together with V M Agranovich (1965 and 1979), dealt with developing the electrodynamics of matter continua with a spatial dispersion of response functions and was aimed at a unified description of a wide range of optical phenomena (near-resonance gyrotropy, 'complementary' waves, anisotropy in cubic crystals, etc.) associated with the existence of excitons in a physical medium. A new edition of this book is being prepared for publication in English.

Ginzburg obtained a whole range of brilliant results in the theory describing the structure and properties of solids and liquids. Beginning in 1945, he worked on constructing a phenomenological theory of ferroelectric phenomena that would replace earlier approaches based on particular model concepts. These papers presented an important conclusion on the disappearance of one of the eigenfrequencies of natural oscillations at the phase transition point — a conclusion that later evolved into the widely used concept of 'soft modes'.

Ginzburg's classical results concern one of the key aspects of the theory of phase transitions — that of the limits of applicability of Landau's mean field theory. Ginzburg established a simple and physically transparent criterion of applicability of the Landau theory (known as the Ginzburg criterion; the 'Ginzburg number' is also used). The current theory of fluctuations near the critical point clarified the profound meaning of this criterion in terms of the effective mass and interaction parameters of the corresponding quasiparticles.

Ginzburg's achievements in the field of superfluidity cover a broad range of problems: from that of critical velocity to superfluidity in pulsars (neutron stars). The semiphenomenological theory of superfluidity, developed with L P Pitaevskii and A A Sobyanin, gained wide recognition; Ginzburg has been working on it for many years now.

A considerable number of ideas that Ginzburg advanced many years ago remain useful and efficient today. In this group we find his proposals of cardinally new research methods in condensed matter physics, a fundamental application idea (2nd idea, as A D Sakharov put it) which was of principal importance for developing the hydrogen bomb, and also ideas that addressed cosmic space and astrophysical research.

A large series of Ginzburg's papers reflecting his work in radioastronomy deal with the astrophysics of cosmic rays, or rather with the theory of their origin. This effort began in 1951 with finding the relation between the characteristics of the electronic component of cosmic rays and the intensity of magnetic bremsstrahlung radiowaves that cosmic rays generate in galactic magnetic fields. This made it possible to get a measure of relativistic electrons from radioastronomical data and, with additional assumptions, also of protons and nuclei in cosmic rays in remote regions of the universe. This analysis had an enormous impact on the creation of the theory of the origin of cosmic rays. Ginzburg developed an important idea of the cosmic rays halo, which was later confirmed in observations.

Ginzburg was one of the first to realize the importance of gamma and x-ray astronomy and devoted considerable effort to help them reach maturity. Among other things, his work demonstrated that gamma astronomy could provide unique information on the proton – nuclear component of cosmic rays, just as radioastronomy supplies us with data on their electron component. The main results in this field were summarized in 1963 in Ginzburg's monograph *The Origin of Cosmic Rays*, co-authored by S I Syrovatsky (an enlarged edition was published in English in 1964).

It is impossible to list all the areas in which Ginzburg has worked and continues to work, even in an article devoted to his 90th birthday. The brief description above gives only a small illustration of his many years of life in physics.

The way Ginzburg works in physics is simply enviable. After his 70th birthday he tackled the theory of the Van der Waals forces and the problem of superdiamagnetism, studied 'soft modes' in ferroelectrics and toroidal dipole moments moving uniformly in a medium, and re-examined boundary conditions in the macroscopic theory of superconductivity. He is still interested in thermoelectric effects in superconductors, he wrote fundamental reviews and papers devoted to the mechanisms of high-T_c superconductivity and to the problems concerning the origin and propagation of cosmic rays, gamma astronomy, special aspects of general relativity, and other fundamental aspects of physics and astrophysics.

The list of Ginzburg's scientific publications has climbed to beyond four hundred entries; by himself and together with his students and colleagues he has written about twenty monographs which, almost without exception, have been translated and published abroad. Only in 2001 – 2006 Ginzburg published more than 20 original papers, plus four monographs. In addition, he also wrote and had published over the same period several dozen science-popularizing articles and critiques.

For instance, Springer published in January 2001 Ginzburg's *The Physics of a Lifetime* in English; the Russian reader is familiar with three consecutive editions of this book under the title *On Physics and Astrophysics*. In 2003 – 2004 the Physics and Mathematics Publishing House (FML) published the 3rd enlarged edition of his book *On Science, Myself and Others*, which in 2005 was published in English by the Institute of Physics (IoP) publishing in Britain. Ginzburg's Nobel lecture and his other articles on low-temperature physics were also published by FML in a book *On Superconductivity and Superfluidity. An Autobiography* that appeared in 2005. Springer is now preparing a translation into English. These books not so much sum up as outline the dynamics of the evolution of physics as a science and points of view on how research into terrestrial and Ginzburg's extraterrestrial problems should be pursued.

V L Ginzburg has been sending his papers to *Uspekhi Fizicheskikh Nauk* (UFN) (now *Physics Uspekhi* in English) since 1940 (he has published 105 in *UFN*), has been a member of the *UFN* Editorial Board since 1964, and became *UFN*'s Editor-in-Chief in August 1998. His overflowing energy and more than 60 years of loving relationship with the journal have been an impetus for sustaining *UFN*'s old traditions (among other things, this makes it possible to maintain the high impact factor of this journal) and to launch completely new initiatives, such, as for example, adding to the contents a new section that would reflect the changing environment (Physics News on the Internet) and placing on the *UFN* site (http://www.ufn.ru) the section "UFN's Tribune" and the entire archive of the journal in Russian since 1918.

For several decades, Ginzburg conducted an absolutely unique seminar on theoretical physics that met at FIAN every week. Each seminar was not only a source of scientific information but also a kind of festive occasion and source of happiness for all its participants, an 'orgy of brainpower', as someone in the audience once said. When the seminar ground to a halt (at its 1700th meeting!), the physics community of not just Moscow but of the entire country felt orphaned. Reminiscences of the participants were collected in a book *The Seminar*, to be published by FML in 2006 to mark Ginzburg's jubilee year.

Teaching has occupied an important place in the life and scientific biography of Ginzburg. He first taught at Gorkii University and in 1968 headed the Chair of Problems in Physics and Astrophysics that he created at the Moscow Institute of Physics and Technology (known as MFTI — FizTekh). In the years of its existence, it has trained more that 200 graduates and postgraduates, of which about 80 have received PhD degrees and more than 30 DSc degrees. Among Ginzburg's students we find corresponding and full members of the Russian Academy of Sciences (RAS).

Ginzburg is as vigorous as ever in disseminating scientific knowledge and exposing fake science. He has paid considerable attention to these issues in many of his public talks, articles, and interviews. Most of these articles can be found on the UFN Tribune (www.ufn.ru/tribuna) and in the magazine *Zdravyi Smysl* (Common Sense).

Ginzburg's achievements in science have earned him wide recognition by the world scientific community. He has been elected to many academies and scientific societies abroad, including the Royal Society of London, the National Academy of Sciences of the USA, the European Academy, the International Academy of Aeronautics, the Academy of Sciences and Arts of the USA, and the academies of India, Denmark, and other countries.

Among Ginzburg's international honors we see, in addition to his Nobel Prize, the highly prestigious Bardeen award, the Wolf award, the London Royal Astronomical Society Gold Medal, the UNESCO Niels Bohr Gold Medal, the Nicholson medal of the American Physical Society, the Smolukhovsky medal of the Polish Physical Society, and the O'Ceallaigh medal (of the International Union of Pure and Applied Physics).

The Russian Academy of Science gave Ginzburg its highest honor, the M V Lomonosov Grand Gold Medal, as well as the S I Vavilov Gold Medal and the L I Mandelshtam and M V Lomonosov prizes of the Academy of Sciences.

Ginzburg also received the Lenin and State Prizes, was given the Lenin Order and other orders of the USSR. In 1989 – 1991 he was elected People's Deputy from the USSR Academy of Sciences. At the moment, he is a member of the Presidential Council on Science, Technologies and Education of the Russian Federation.

Exceptional kindness and purest principles in science, the broadest imaginable span of scientific interests, profound penetration into the essence of problems he elects to attack, attentive fostering of new generations of researchers, postgraduates, and students — these qualities cannot but attract both young and experienced physicists and astrophysicists to Ginzburg. He has been able to build several large science schools, each of which enjoys a well-deserved high reputation among colleagues.

Wishing Vitalii Lazarevich Ginzburg all the best on his 90th birthday, we would like to express our gratitude for everything that he has achieved and continues to achieve in science.

From the bottom of our hearts, we wish him many more years of the same creative enthusiasm and the same inexhaustible energy, new and wonderful creative successes, and great happiness in science and life.

A F Andreev, B M Bolotovsky, M A Vasil'ev,
A V Gurevich, V V Zheleznyakov, N S Kardashov,
L V Keldysh, Yu V Kopaev, E G Maksimov,
G A Mesyats, L P Pitaevskii, V Ya Fainberg