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PERSONALIA

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Vitaliĭ Lazarevich Ginzburg (on his eightieth birthday)

October 4, 1996, marks the 80th anniversary of the birth of Vitaliĭ Lazarevich Ginzburg, one of Russia's most distinguished theoretical physicists.

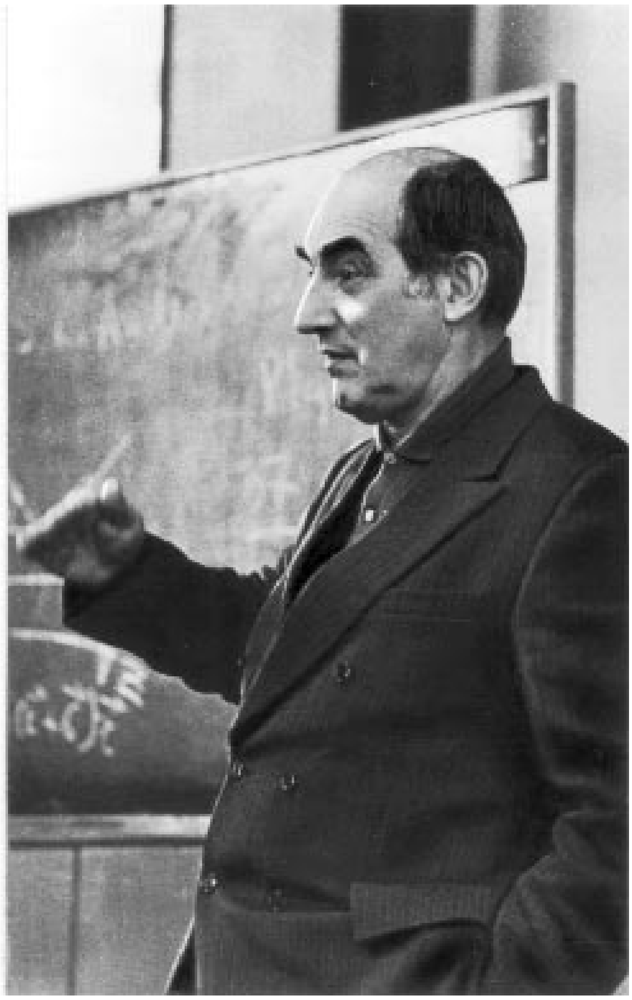
In our age of hyperspecialization, when only a few physicists may be called universal, one can safely attribute this quality to Russian Academician V L Ginzburg, whose fundamental and in many cases pioneering influence seems to be felt in every area of physics research.

V L Ginzburg began his career back in the prewar years when, addressing the quantum electrodynamics of the time he resolved a number of subtle radiation-related problems, in particular the perturbation theory paradox concerning the energy radiated by a uniformly moving charge. In the 1940's he turned his attention to elementary particles, specifically to the higher-spin particle description problem, and developed the first relativistic quantum model of a variable-spin particle. He also examined the inertial and attenuation characteristics of the mechanical moment of a spinning particle and studied the behaviour of the spin-3/2 particle (in particular, its interaction with an external field). Of particular importance, in this context, was his work with I E Tamm in which, for the first time, relativistic equations for a particle with internal degrees of freedom ('relativistic top' model) were developed.

As war broke in 1941, one of the many applied problems that theorists were called upon to solve was wave propagation in ionosphere, and V L Ginzburg became deeply involved in its solution. His contribution to the theory of plasma (of which ionosphere is an example) had a determining influence on the modern theory of radiowave propagation in plasma, in the Earth ionosphere, and in solar corona. These achievements, starting from the prediction, as early as 1942, of the 'tripling' of ionosphere-reflected radio signals, were later included in the fundamental monograph *Propagation of Electromagnetic Waves in Plasma* and other Ginzburg's books.

Ginzburg became known already for his early work on Solar and general radioastronomy, and some of the methods he then proposed were developed further and found widespread application in later years.

Much of Ginzburg's work has been devoted to radiation and to propagation of light in solids and liquids. His major achievements here are in the electrodynamics of superluminal radiation sources, a field which had grown out of the FIAN discovery of the Vavilov – Cherenkov effect and its subsequent interpretation by I E Tamm and I M Frank. Apart from the quantum theory of this effect, V L provided, among other things, the theory of superluminal radiation in anisotropic and heterogeneous media; the theory of superluminal radiation from electric or magnetic dipoles; and the theory of the Vavilov – Cherenkov effect in vacuum ('light spot' sources). In 1945, in collaboration with I M Frank, Ginzburg sets forth a theory of a new — 'transition' type — radiation arising when a particle crosses the interface between two media. The effect was later observed experimentally and provided a basis for the experimental study of the optical properties of surfaces; fast particle detection and energy measurement are further examples of its application. The work on transition radiation and related problems was published as *Transition Radiation and Transition Scattering* in 1984 by V L Ginzburg and V N Tsytovich.



Vitaliiĭ Lazarevich Ginzburg

Yet another large area of V L Ginzburg's concern is the electrodynamics of continua with a spatial dispersion of response functions. Together with V M Agranovich, he was

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co-author in 1965 and 1979 of a monograph on this subject, *Crystal Optics with Spatial Dispersion and Excitons*. The basic objective of this work was to develop a unified description of a wide range of optical phenomena (near-resonance gyrotropy, 'complementary' waves, the anisotropy in cubic materials, etc.) associated with the existence of excitons in a physical medium.

The structure and properties of solids and liquids is one further fruitful direction of V L's research. In 1945 he started working on the phenomenological theory of ferroelectricity which in due time came to replace earlier model approaches. His major discovery, the disappearance of an eigenfrequency at the phase transition point, later grew into a widely used 'soft mode' concept.

One of the key problems in the theory of phase transitions is that of the validity limits of Landau's mean field theory. A simple and physically transparent criterion established by V L Ginzburg and predictably named after him (the term 'Ginzburg number' has also gained currency) is undoubtedly one of his classical results.

V L Ginzburg's interest in superfluidity goes all the way from the critical velocity problem to neutron stars (or pulsars). His long-term concern is, in particular, the phenomenological theory of superfluidity where his work with L P Pitaevskiĭ and A A Sobyanin is now widely popular.

The theory of superconductivity enjoys a unique position in V L Ginzburg's scientific work, his interests here ranging from thermoelectric effects in superconductors to superconductivity in the Universe as a whole. The semiphenomenological theory of superconductivity developed by him in cooperation with L D Landau included some important elements of the microscopic Bardeen – Cooper – Schrieffer theory and not only survived the advent of this latter some years later but has in fact been applied in thousands (!) of later publications. It is this theory which underlies a series of studies on superconductivity in strong magnetic fields and alloys for which V L Ginzburg,A A Abrikosov, and L P Gor'kov shared the country's highest (Lenin) award in 1966.

Turning now to high-temperature superconductivity, perhaps even today it is too early for V L's role in the discovery and investigation of this phenomenon to be estimated in its full entirety. One can say without fear of exaggeration that he is the only physicist of influence who for more than a quarter century remained a firm high-T_c believer and kept vigorously translating his belief into practice. Still today the study of high-temperature superconductivity mechanisms takes much of his time and effort and is indeed one of his top research priorities.

Among V L Ginzburg's very early ideas many remain in use today. These include his fundamentally novel methods of condensed matter investigation; the fundamental 'second idea' crucial to the thermonuclear weapons project (the term itself being due to A D Sakharov); and of course his astrophysical and space-related ideas.

Closely associated with V L's radioastronomy activity is his work on the astrophysics — or more specifically, origin — of cosmic rays. As early as 1951 he established the relation between the characteristics of the electronic component of the rays on the one hand and the intensity of the synchrotron radiation they produce in galactic magnetic fields, on the other. With this discovery, and based on known data, he was able to draw some conclusions about the relativistic electrons — and under some additional assumptions, also about protons and nuclei — in cosmic rays in remote regions of the Universe. These results were crucial to the understanding of the origin of cosmic rays. Of great importance was the cosmic ray halo idea put forward by V L Ginzburg and later borne out by experiment.

One of the first to realize the significance of gamma astronomy and x-ray astronomy, V L devoted much effort to developing these methods and showed, in particular, that the former of them may provide invaluable evidence about the proton-nuclear cosmic ray component — much as radioastronomy may about the electronic one. The basic results obtained in this area are contained in *The Origin of Cosmic Rays*, a monograph V L published in co-authorship with S I Syrovatskiĭ in 1963 (the supplemented 1964 English edition should be mentioned here).

It is hardly possible, even in this special anniversary paper, to touch on all aspects of physics in which V L Ginzburg has been and still is being active, and surely what has been written thus far says little of his role in science. Most recently, he has shown enviable activity in such areas as the Van der Waals forces; diamagnetism; 'soft' modes in ferroelectric materials; and toroidal dipole moments. He has restudied the problem of boundary conditions in macroscopic superconductivity and continues investigations into thermoelectric effects in superconductors. His fundamental topical reviews cover high-T_c superconductivity mechanisms, the origin and propagation of cosmic rays, gamma astronomy, special aspects of the general theory of relativity, and other fundamental problems in physics and astrophysics.

The number of V L Ginzburg's scientific publications has long passed the four-hundred mark, and of his twenty odd monographs, written solo or co-authored by students or colleagues, almost all have been translated into other languages. V L Ginzburg's is deeply committed to the popularization of scientific knowledge. The third edition of his book *On Physics and Astrophysics*, published as recently as late 1995, rather than drawing some bottom lines, describes instead the dynamical development of the physical science and discusses where the terrestrial and space research should, in the author's view, go next.

Most recently, the 1500th(!) session of the V L Ginzburg's internationally famous weakly seminar on theoretical physics took place in FIAN. Each such session is not only a source of scientific information but invariably a festive and shall we say happy experience for all attendants, the 'orgy of wit' as B T Geĭlikman once put it.

V L Ginzburg's teaching career started in his younger years at Gor'kiĭ University and has always occupied an important place in his life and scientific biography. In 1968 he set up and since then has headed the Physics and Astrophysics Chair at the Moscow Physical Technical Institute. Of more than two hundred graduate and postgraduate students that have over the years passed through the Department, some 80 have defended their candidate's and more than 30, doctor's dissertations. Among V L Ginzburg's students one finds associates and members of the Russian Academy od Sciences.

The scientific activity of V L Ginzburg brought him international recognition. He was elected into many foreign academies and scientific societies, among them the London Royal Society, the National Academy of Sciences of the USA, the European Academy, the International Academy of Astronautics, the Academy of Sciences and Arts of the USA, the academies of India, Denmark, etc. Among V L Ginzburg's many prestigious honors he is the recipient of the

Bardeen award, of the Wolf award, and of the London Royal Astronomical Society Gold Medal.

The Russian Academy of Sciences recognized V L Ginzburg's outstanding achievements by conferring on him its highest award, the Great M V Lomonosov Gold Medal, and he was also awarded the S I Vavilov Gold Medal and the L I Mandelstam and the M V Lomonosov Academy of Sciences Prizes.

V L Ginzburg is also the winner of USSR Lenin and State Prizes and was decorated with USSR orders. In 1989–1991 he represented the Academy of Sciences in the Supreme Soviet of what was then the Soviet Union.

V L Ginzburg's profound insight, the vigor and breadth of his research, and his reputation for scientific integrity, together with his warm and kind personality and unflagging attention to his younger colleagues and students, has attracted to him many physicists and astrophysicists, both unexperienced and full-fledged. A number of major scientific schools he founded enjoy worldwide reputation.

Congratulating V L Ginzburg's on his 80th birthday, we hope he conserve for many years ahead his indefatigable enthusiasm and creative drive and wish him every success and joy both in and out of his scientific activities. We are very sincerely grateful to him for all he has done for our science.

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V V Zheleznyakov, N S Kardashov, L V Keldysh,
D A Kirzhnits, O N Krokhin, V I Ritus,
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