

Viktor Evgen'evich Golant (on his sixtieth birthday)

Zh. I. Alferov, B. B. Kadomtsev, E. P. Velikhov, R. Z. Sagdeev, V. M. Tuchkevich, and V. Ya. Frenkel'

Usp. Fiz. Nauk **154**, 169–170 (January 1988)

January 14, 1988 is the sixtieth birthday of the well-known Soviet physicist, specialist in the field of plasma physics, corresponding member of the Academy of Sciences of the USSR Viktor Evgen'evich Golant. Golant was born in Leningrad into the family of Professor E. Ya. Golant of the A. I. Gertsen Pedagogical Institute. In 1944 Golant entered and in 1950 graduated from the Physico-mechanical Faculty of the M. I. Kalinin Leningrad Polytechnical Institute (LPI). While still a student Golant carried out under the direction of Ya. I. Frenkel' and published an investigation devoted to the theory of the vibrational-rotational spectra of atomic nuclei. He has retained an interest in theoretical physics throughout his career and his later investigations are marked by a characteristic combination of experiment with an exhaustive theoretical analysis of the results obtained.

Upon graduating from the LPI Golant was assigned to the experimental construction office of the Leningrad factory "Svetlana" where he soon organized and headed a laboratory. During a six-year period of work in the experimental construction office he carried out a series of experimental and theoretical investigations devoted to the pulsed UHF discharge, which were of considerable applied significance. On the basis of this work Golant defended his candidate's dissertation in 1955.

In 1956 Golant was invited by Professor L. N. Dobretsov to join the department of physical electronics of the LPI and for a period of time combined teaching and research activity in the institute with work in the experimental construction bureau. During this period Golant with his collaborators carried out wide ranging investigations of transport processes in a strong magnetic field. These investigations clarified many effects exerting an influence on transport, collisions and oscillations of plasma. In the same period Golant began to give a course of lectures in the LPI on the physics and diagnostics of plasma.

An important milestone in Golant's scientific biography was his being invited in 1958 by B. P. Konstantinov, the director of the A. F. Ioffe Physico-technical Institute of the Academy of Sciences of the USSR (PTI) to join this famous center of Soviet physics to organize work in the field of controlled thermonuclear fusion (CTF). Golant accepted this invitation and starting in 1958 began to work at the PTI combining his work there with the pedagogical and scientific activity at the LPI. That was the time of the important development of work on the CTF when on the initiative of the USSR put forward by I. V. Kurchatov a beginning was made of widespread publication and international discussion of the early work and results of thermonuclear research. At the same time a decision was made on extending the front of thermonuclear research and involving the PTI in it. The lack of adequate diagnostic methods was at that time one of the



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main obstacles for the development of thermonuclear experimentation. Therefore B. P. Konstantinov who became the head of thermonuclear research at PTI proposed that the first task should be the development of diagnostic methods for high-temperature plasma in thermonuclear installations. Several diagnostic groups were set up. Golant's group undertook research and development of diagnostic methods based on the interaction of UHF waves with plasma. In particular he proposed and directed the realization of UHF methods for the study of spatial distribution of electrons, which included the method of phase location of plasma which gained widespread distribution and acceptance. These methods were successfully used in the first Leningrad thermonuclear installation "Alpha," constructed in the late 1950s at the D. V. Efremov Scientific Research Institute for Electro-physical Apparatus, and also for investigating transport processes in other experiments. Work on plasma diagnostics and transport processes in a magnetic field form

the subject of Golant's doctoral dissertation which he defended in 1964.

The subsequent development of Golant's work led to the creation within the PTI of a major plasma physics laboratory the program of which included, along with work on diagnostics, research on the interaction of high-frequency waves with plasma and the physical investigations of high-temperature plasma in a tokamak aimed in the first instance towards the production of an optimal scenario for heating the plasma.

Diagnostic investigations and development directed primarily to application to tokamaks were very broadly developed in Golant's laboratories at the PTI and LPI. The methods being developed included: UHF methods for measuring the parameters of the electron components; laser methods for determining the characteristics of the electron, neutral and impurity components; methods of studying plasma oscillations utilizing IR and UHF scattering; methods of studying transport processes based on injecting macroparticles into the plasma and others. The results of this work were widely acclaimed and are being utilized at many thermonuclear installations, primarily on tokamaks.

The principal work in Golant's laboratory in the field of interaction of waves with plasma was associated with the study of the characteristics of the interaction in the neighborhood of the hybrid plasma resonances. Among the results obtained we note the experimental discovery and investigation of absorption associated with the linear transformation of waves into a slow plasma mode, the discovery of enhanced scattering associated with the transformation, the investigation of parametric instabilities in the neighborhood of resonances. The results obtained have found many different applications in work on heating and diagnostics of plasma.

In recent years the work in Golant's laboratory began to be directed primarily to investigations of the heating of plasma, its influence on the stability and thermalization in tokamaks. Golant was the initiator of utilizing UHF waves for heating. He and his collaborators proposed and were the first to apply a method for the heating of plasma which utilizes the slowing down and transformation of waves in the neighborhood of the lower hybrid resonance. In this case the possibility was demonstrated of the lower hybrid heating of electrons and ions and limitations were studied due to the parametric instability of the periphery. In the highest frequency range of electron cyclotron resonance a successful series of experiments was conducted on plasma heating with the aid of UHF generators (gyrotrons) developed by A. V. Gaponov-Grekhov and his collaborators. In these experiments the special features of the propagation and absorption of UHF waves over a broad range of conditions were studied, possible schemes for heating the electron component of plasma were proposed and verified, and the influence of heating on plasma confinement was investigated.

Together with investigations of the UHF heating experiments were mounted in Golant's laboratory on plasma heating in a tokamak as a result of the adiabatic compression of the plasma by the increasing magnetic field. TUMAN (an acronym of the Russian words toroidal'nye ustanovki s magnitnym adiabatcheskim nagrevom = toroidal installations using magnetic adiabatic heating) installations constructed at the PTI were used to study the equilibrium and stability of

plasma in the course of compression, and it was shown that plasma compression not only leads to its heating, but is also accompanied under certain conditions by the suppression of MHD oscillations and an improvement in its thermal insulation. Experiments were started combining compression with high-frequency heating, and the efficiency of such a combination was demonstrated. Also possibilities were demonstrated of utilizing combined heating as a method of active diagnostics of plasma in a tokamak. The research of the group headed by Golant made an essential contribution to the general program of work on controlled thermonuclear fusion. It was widely acclaimed both in the USSR and abroad. Golant devotes much attention to the training of scientific manpower, combining his scientific work with teaching at the LPI, and training graduate students and research associates. From 1981 onwards he is in charge of the plasma physics department at the LPI. In the laboratories headed by him and within the department a large group of highly qualified specialists, doctors and candidates of science have received their training.

V. E. Golant is the author or co-author of more than 150 publications including 5 monographs. The book by V. E. Golant, A. P. Zhilinskiĭ, and I. E. Sakharov, "Fundamentals of Plasma Physics" (published in Russian by Atomizdat, M., 1977 and in English translation by Wiley, N.Y., 1980) written on the basis of a course of lectures, was also published in Japan.

V. E. Golant is involved in extensive scientific-organizational work. In addition to being in charge of the laboratory at the PTI and of the department at the LPI, he is the chairman of the PTI council on the problems of plasma physics and physical electronics; the weekly plasma seminar under his chairmanship has been in operation at the PTI for more than twenty years. He is a member of the Bureau of the Councils of the Academy of Sciences of the USSR on the problems of "Plasma Physics" and "High-Temperature Plasma Physics", he is the chairman of the section on "Plasma heating", a member of the Section of the Council of the State Committee on Atomic Energy. V. E. Golant is a member of the editorial board of *Zh. Tekh. Fiz.* and *Pis'ma Zh. Tekh. Fiz.*, and he is a member of the editorial council of the international journal "Nuclear Fusion".

In 1983 V. E. Golant as a member of a group of physicists was awarded the State Prize of the USSR for their research on the electron cyclotron heating included in a program of work "Powerful gyrotrons in the millimeter wave range and powerful gyrotron complexes for thermonuclear research." In 1984 he was elected a corresponding member of the Academy of Sciences of the USSR.

The fruitful scientific, pedagogical and scientific-organizational activity of V. E. Golant resulted in his being deeply respected and acknowledged. His characteristic benevolence, and readiness to respond to requests made to him, reinforce such feelings among his colleagues, collaborators and students.

On the sixtieth birthday of Viktor Evgen'evich Golant we offer him our heartfelt wishes for good health and new important successes for the benefit of Soviet science.

Translated by G. M. Volkoff