Vadim L'vovich Berezinskiĭ (Obituary)

A. A. Abrikosov, L. P. Gor'kov, I. E. Dzyaloshinskiĭ, A. I. Larkin, A. B. Migdal, L. P. Pitaevskiĭ, and I. M. Khalatnikov

Usp. Fiz. Nauk **133**, 553–554 (March 1981)

PACS numbers: 01.60. + q

Vadim L'vovich Berezinskii, a talented theoretical physicist, died on June 23, 1980 after a long difficult illness.

V. L. Berezinskiǐ was born on July 15, 1935, in Kiev. Having graduated in 1959 from the Physics Department at Moscow State University, and then completing graduate work at MIFI, he was directed in 1963 to work at the Moscow Textile Institute. Starting in 1968, he worked in the Scientific Research Institute for Heat Instrumentation, and in 1977, he tranferred to the L. D. Landau Institute of Theoretical Physics at the Academy of Sciences of the USSR.

V. L. Berezinskiǐ had a wide range of interests: from problems in hydrodynamics and solid state physics to problems in elementary particle physics and gravitation. He was one of those few people who tackled difficult problems and solved them. His talent was revealed most clearly and fully when he encountered problems in which a clear physical statement of the problem required at the same time overcoming considerable mathematical difficulties. For such problems, he was unique. Here, together with his talent as a theoretical physicist, his endowments, which allowed everyone around him to see in him an outstanding mathematician, were revealed.

For the few years that were given to him by fate, he had time to accomplish much. His name will always remain in the world physics literature primarily in connection with the solution of two fundamental problems: theory of phase transitions in two-dimensional systems and theory of localization in disordered one-dimensional conductors.

Recently, a large number of two-dimensional systems has been discovered experimentally. These include He^4 films and smectic liquid crystals, submonoatomic layers, adsorbed on crystal surfaces, layered magnetic substances, dichalcogenides of transition metals, and others. Interest in these systems is to a large extent explained by the many unusual physical properties of such systems, predicted by V. L. Berezinskiǐ. In the past, it was known that long-range order in such systems is destroyed by thermal fluctuations at any temperature. V. L. Berezinskiǐ first showed that, in spite of this, a thin (of the order of several angstroms) film of liquid helium at low temperatures has the property of superfluidity. Two-dimensional crystals, which do not have long-range order, have a finite shear modulus. Two-dimensional magnetic substances show a resistance to a nonuniform rotation of spins. V. L. Berezinskiǐ understood the general nature of all these phenomena and called them transverse rigidity, which is now adopted in world literature. He showed that in

VADIM L'VOVICH BEREZINSKIĬ (1935-1980)

systems having transverse rigidity correlations drop off slowly (as a power law) with temperature, which is what determines the fundamental properties of the new low-temperature phase, Berezinskiǐ's phase.

V. L. Berezinskiǐ first discovered the important role of topological defects in this phase: vortices in a film of superfluid He^4, dislocations in a two-dimensional crystal, and vortical configurations in magnetic substances. At low temperatures, such defects form molecules. At some definite temperature, these molecules begin to dissociate, leading to destruction of Berezinskiǐ's phase. A quantitative calculation of the dissociation of defect molecules was carried out two years later in other papers. An experiment on a film of He^4 brilliantly confirmed the predictions of the theory.

V. L. Berezinskiǐ's ideas were fruitful in many areas. His ideas on topological defects, which gave rise to many interesting applications both in the physics of the condensed state as well as in elementary particle physics, gave rise to special interest.

The last decade was marked by an increased interest in problems of electron transport in linear organic conductors. In this connection, it was necessary to determine the extent of the validity of the qualitative arguments of Mott and Twose (1961), predicting that in

 0038-5670/81/030249-02$01.10

a linear chain with a random distribution of scattering centers there is no diffusion of particles and all quantum mechanical states are localized. V. L. Berezinskiĭ was able to develop an unusually complicated mathematical apparatus, with the help of which he rigorously proved that the correlator of the wave functions at different spatial points decreases exponentially with distance, and he was able to obtain an asymptotic formula for the frequency dependence of the conductivity. It was proved rigorously that static conductivity vanishes identically for defects. Thus, the residual resistance of a one-dimensional conductor is infinite, while the temperature dependence of the conductivity has a semiconductor-like nature. These results placed V. L. Berezinskiĭ among the most important theoretical physicists in the world, working in the area of solid state theory.

V. L. Berezinskiĭ continued to work until the end of his life. Already terminally ill, he completed several papers concerning an investigation of the role of interactions in the problem of localization. He was actively interested in the latest results appearing in the literature.

The short but fruitful life of V. L. Berezinskiĭ is a worthy example of unselfish service to science and loyalty to one's calling.

Translated by M. E. Alferieff