Aleksandr Iosifovich Shal'nikov (Obituary)

A. F. Andreev, A. S. Borovik-Romanov, N. V. Zavaritskii, Ya. B. Zel'dovich,

E. I. Kandel', S. P. Kapitsa, K. O. Keshishev, I. P. Krylov, A. Ya. Parshin,

L. P. Pitaevskii, M. S. Khaikin, Yu. B. Khariton, and Yu. V. Sharvin

Usp. Fiz. Nauk 151, 725-726 (April 1987)

Academician Aleksandr Iosifovich Shal'nikov, a prominent experimental physicist, died on 6 September 1986. Soviet science and Soviet physicists have suffered a grievous loss.

A. I. Shal'nikov was born on 10 May 1905 in Petersburg. In 1928 he graduated from the Leningrad Polytechnical Institute. In 1923-35 he worked in the Leningrad Physicotechnical Institute, and from 1936 and until his last days in the Institute of Physics Problems of the Academy of Sciences of the USSR where he was invited by P. L. Kapitsa at the time the Institute was being organized. In 1946 Shal'nikov was elected a corresponding member of the Academy of Sciences of the USSR and in 1979 a full member.

From 1928 Shal'nikov taught at first in the Leningrad Polytechnical Institute, and after his transfer to Moscow in the Mocow State University, where in 1944 he was elected as a professor and later organized a low-temperature physics laboratory.

Many years of ceaseless intensive work by Shal'nikov in a number of different fields of physics and technology led to significant results. In the early stages he devoted much effort to the development and improvement of different physics instruments-counters for light quanta, iconoscopes, electron diffraction cameras and vacuum apparatus. Shal'nikov's scientific activity at the Leningrad Physicotechnical Institute at that time was associated with investigating processes of evaporation and condensation of materials in high vacuum. Due to his brilliant ability for experimental work, his inventiveness, his energy and his exceptional conscientiousness, Shal'nikov formed during that time his style of scientific work, the intense tempo of which was combined both with thoroughness in design of experiments and with repeated checking of results. The investigation was concluded only at the stage of total "transparency" and reproducibility of the phenomenon, at the stage of complete reliability of the apparatus that had been developed.

From the beginning of this work at the Institute for Physics Problems Shal'nikov's principal scientific interests were in the field of low-temperature physics-the physics of superconductors and of liquid and solid helium. In addition to working along these lines, in 1947-1955 he carried out a number of responsible technological investigations, which made it possible to solve successfully problems of important state significance. Since the early 1960s Shal'nikov also provided continual aid to surgeons, having developed and prepared a number of subtle and at the same time simple and reliable instruments for carrying out operations by freezing tissues.

Shal'nikov obtained the first fundamentally important



ALEKSANDR IOSIFOVICH SHAL'NIKOV (1905 - 1986)

results in many new fields, which later attracted the interest of numerous followers. He developed methods of obtaining extremely thin homogeneous metallic films and observed the sharp increase in the critical fields for thin superconducting films in comparison with massive superconductors. Condensing a metal on the surface cooled to helium temperatures, Shal'nikov already in 1938 also observed the significant increase in the critical temperature of films.

With the aid of a series of ingenious experiments Shalni'kov succeeded in obtaining reliable proof of the twophase nature of the intermediate state of superconductors and in estimating the dimensions of the domains in such a two-phase system. Shal'nikov with his collaborators carried out extensive investigations of thermal and electromagnetic properties of superconductors, which made a big contribution to the development of the modern ideas regarding superconductivity.

Since the early 1960s Shal'nikov undertook a number of investigations of the properties of liquid and solid helium. After investigating the mechanism of electrical charges in liquid helium Shal'nikov set himself the task of studying exhaustively the properties of solid helium. With this aim in mind he developed a new method of growing helium crystals, which enabled him to obtain crystals that were recordsetting in terms of their purity and perfection. These methods which have now become classic were of decisive significance for all subsequent investigations of solid helium.

Shal'nikov was the first to succeed in observing the motion of electrical charges in helium crystals and to investigate the mechanism of this process. The high degree of perfection of the lattice of helium crystals enabled him in investigating their thermal conductivity to discover a new phenomenon the Poiseuille flow of phonon gas, and then also the existence of second sound in helium crystals associated with the oscillations of the density of the distribution of phonons. Shal'nikov was the first to note the unusual kinetics of the growth of helium crystals. A development of these investigations led in recent years to the discovery in his laboratory of a fundamentally new mechanism for the growth of crystals specific for helium—quantum crystallization. For his series of papers on the investigation of crystalline helium the Presidium of the Academy of Sciences of the USSR awarded to A. I. Shal'nikov the P. N. Lebedev Gold Medal.

Realizing the resonsibility for advancing the development of Soviet experimental physics Shal'nikov in 1956 organized the new journal "Pribory i tekhnika eksperimenta" (Instruments and Experimental Techniques) which under his continuing editorship became one of the largest and most authoritative journals devoted to the methodology of physics experimentation.

Shal'nikov's fruitful scientific activity has been rewarded by high state awards: he received two Orders of Lenin, five Orders of the Red Banner of Labor, the "Badge of Honor" Order, and four State Prizes of the USSR.

Having personally worked in the laboratory throughout his life Shal'nikov generously devoted his efforts and his outstanding pedagogical talent to the education of a large group of experimental physicists. The seminar which he conducted for students of the Moscow State University taught them both a thorough analysis of experiments, and a lively, enthusiastic attitude towards science and remained for them one of their brightest memories. His responsiveness and benevolence, the breadth of his interests were known to many people who received from him good advice and active help.

We shall forever treasure in our hearts the memory of Aleksandr Iosifovich Shal'nikov, a prominent scientist and a remarkable man.

Translated by G. M. Volkoff