

In Memory of Anatoliĭ Robertovich Regel' (1915–1989)

May 14, 2005, marked the passing of 90 years since the birth of Professor Anatoliĭ Robertovich Regel', Doctor of Physics and Mathematics, Honored Science Worker of the Russian Soviet Federal Socialist Republic, and an outstanding representative in the last galaxy of disciples of A.F. Ioffe. A.R. Regel' passed away in 1989, four-and-a-half months before his 75th birthday. Celebrating his 90th birthday, we pay homage to a person whose name is well known to the authors and readers of this journal thanks to his outstanding contribution to the development of semiconductor physics.

A.R. Regel' was born in St. Petersburg into the family of botanist R.É. Regel', whose predecessors were also botanists. In 1938, A.R. Regel' graduated from the Industrial Institute (at present, the St. Petersburg State Polytechnical University) and became a researcher at the Physicotechnical Institute of the USSR Academy of Sciences, where he was involved with studies of tank armor. At the very beginning of the Great Patriotic War, Regel' was sent, as a member of a special team of researchers from the Physicotechnical Institute, to Sevastopol, where, under the guidance of A.P. Aleksandrov and later I.V. Kurchatov, he was involved in work under field conditions concerned with the protection of the warships in the Black Sea fleet from German magnetic mines. In 1942, this work was continued in connection with ships in the Caspian and Amur flotillas and, later, the Pacific fleet. The developed method for demagnetizing ships was so efficient that none of the demagnetized ships were destroyed by magnetic mines during the entire period of the war. For his work, Regel' was awarded the Red Star Order and a medal "for the defense of Sevastopol."

In 1943, Regel' returned to the Physicotechnical Institute, where he continued his work in the area of tank armor; these studies were completed with the defense of his candidate thesis. Later on, the scientific interests of Regel' moved towards semiconductor physics. On the basis of a suggestion by Ioffe, Regel' undertook a detailed study of changes occurring in the electronic properties of semiconductors and metals as a result of melting; in addition, he also intended to study the electronic properties of these materials in a liquid state. The idea was to clarify the role of short- and long-range order (in the arrangement of atoms) in the formation of the energy-band structure. Regel' developed a new contactless method for measuring the electrical conductivity of solids and liquids in a rotating magnetic field. He exhaustively studied the electrical, thermal,



and thermoelectric properties, as well as the density and viscosity, of a large number of semiconductors, metals, and alloys in the vicinity of melting, as a result of which the long-range order is destroyed. The results obtained played the determining role in the formation of contemporary concepts of liquid and amorphous semiconductors and brought Regel' worldwide recognition. Specialists in the field of semiconductor physics know well the Ioffe–Regel' criterion that defines the role of short-range order in determining the electronic properties of semiconductors. In his review of Regel's doctoral thesis, which was concerned with this problem, Ioffe wrote, in August 1956,

"Regel's thesis is an outstanding event in semiconductor and solid-state physics..."

The studies carried out by Regel' have revealed the determining role of short-range order and, in particular, the coordination number in controlling the metallic and semiconductive properties of a material... The novelty and extensiveness of the results obtained and the ability of Regel' to adequately explain these results and incorporate them into a predictable general pattern

make the thesis under consideration a notable contribution to present-day knowledge about matter in its various states ..."

In 1952, Ioffe had to leave the Physicotechnical Institute. He organized the independent Semiconductor Laboratory at the Presidium of the USSR Academy of Sciences; this laboratory, after two years, became the Institute of Semiconductors. Regel' was among a small team of Ioffe's closest colleagues who followed Ioffe and then formed the nucleus of the new institute. Ioffe highly valued the scientific competence, organizational aptitude, and personality of Regel' and appointed Regel' to be his successor as the director of the institute. After the death of Ioffe in October 1960, Regel' became the director of the Institute of Semiconductors. Regel' considered it his duty to preserve the structure, line of research, and staff of the institute. He took responsibility for general guidance of Ioffe's chosen line of research, i.e., thermoelectricity, where, in addition to a number of scientific problems, numerous practical applications appeared, especially in the field of thermoelectric cooling. Regel' was elected the chairman of the section on thermoelectric energy conversion in the council dealing with the problem of direct conversion of thermal energy to electric energy and the vice-chairman of the council on the physics and chemistry of semiconductors at the Presidium of the USSR Academy of Sciences. At that time, he became a permanent member of the editorial board of the journal *Fizika i tekhnika poluprovodnikov (Semiconductors)* and was involved in very time-consuming activity related to the erection of the new building for the institute (this new building had been planned by Ioffe himself). In spite of the fact that he was very busy, Regel' headed the laboratory and continued his extensive scientific activity.

In 1973, Regel' was awarded the Ioffe Prize by the Presidium of the USSR Academy of Sciences for a series of studies concerned with the electronic conductivity of liquid semiconductors. Studies carried out by Regel' and his coworkers on the chemical thermodynamics of semiconductors and published in three monographs were awarded the State Prize of the USSR in 1981. Regel' was awarded the Order of the Red Banner of Labor for his scientific achievements and was given the rank of Honored Science Worker of the Russian Soviet Federal Socialist Republic.

Regel' remained the director of the Institute of Semiconductors until 1972, when this institute was amalgamated with the Physicotechnical Institute. After the amalgamation and until his death, Regel' was the

head of a large department that consisted of several laboratories.

Regel' gave much of his time to pedagogical activity. He supervised the work of his collaborators and numerous postgraduate students and often acted as an opponent for candidate and doctoral theses. It was amazingly easy to come and see Regel' on a matter of concern. It was sufficient to slightly open the door of his office, where he had installed a special writing-desk for himself (the large writing desk and armchair that belonged to Ioffe were kept in place as a memorial), and invitation to come in would immediately follow if he was not engaged in conversation with somebody else. Contact with Regel' was always extremely useful and instructive. During any discussion, Regel' was invariably benevolent and displayed an evident wish to help. If the help required not only advice from Regel' but also positive action, this action invariably followed.

It is not often that one can meet a person who enjoyed such wide popularity as Regel'. This popularity was due to both his scientific achievements and his amazing personality. Regel' loved skiing and kayak trips, loved and understood humor, loved nature and people, and was a convinced optimist. In his spare time, Regel' would drop in at the laboratory to compete with the younger members of staff in weight-lifting competitions using a two-pood weight without any consideration of status or position.

Regel' was a man of principle; however, his adherence to principles was not inflexible. He could give up something of secondary importance in order to attain a more important success elsewhere. However, Regel' always had a moral barrier, which he could never be forced to step over. It is the presence of this barrier (in other words, probity) that was the most distinguishing feature of his personality. The people who knew Regel' will always remember him in their hearts.

**S.G. Shul'man, R.V. Parfen'ev,
followers, colleagues, and friends.**

The editorial staff endorses the kind words of praise contributed by followers and friends of Regel', who was our colleague and made a notable contribution to the progress of this journal.

Translated by A. Spitsyn