Semen Aleksandrovich Al'tshuler (on his seventieth birthday)

Sh. Sh. Bashkirov, A. S. Borovik-Romanov, K. A. Valiev, V. L. Ginzburg, M. M. Zaripov, B. I. Kochelaev, A. M. Prokhorov, M. A. Teplov, and I. L. Fabelinskiĭ

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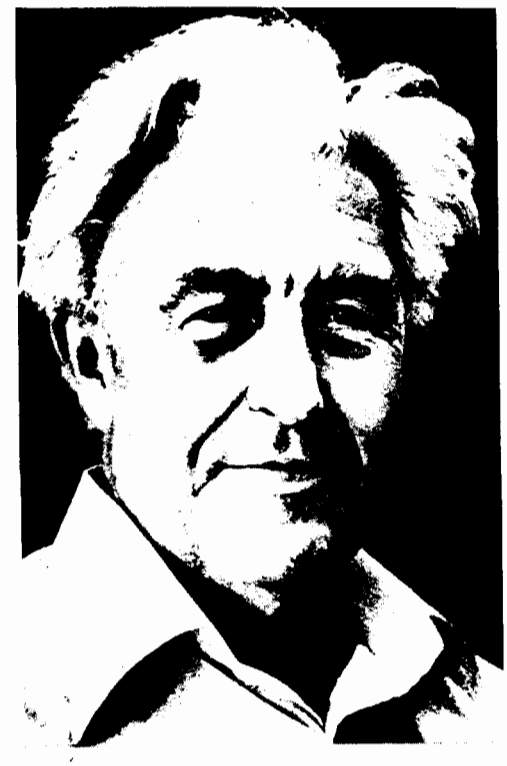
The prominent Soviet physicist and corresponding member of the Academy of Sciences of the USSR, Semen Aleksandrovich Al'tshuler, celebrated his seventieth birthday on September 24, 1981.

S.A. Al'tshuler was born in the town of Vitebsk. In 1928, after graduation, he went on to study at Kazan' University. In 1932, he began graduate work under the direction of I.E. Tamm at the Physical Institute of the Academy of Sciences. From the very beginning of his professional career, S.A. Al'tshuler concentrated on the magnetic properties of matter. His first research project concerned elementary particles and atomic nuclei. His work, in which he predicted the existence of the magnetic moment of the neutron and correctly estimated its magnitude and sign, published together with I.E. Tamm in 1934, is well known. The existence of a magnetic moment for a neutral particle seemed at the time so unusual that many physicists, even the most prominent, did not believe this result at the time.

In 1934, S.A. Al'tshuler returned to Kazan' University, with which he has been henceforth affiliated for the rest of his life. He soon began a close scientific collaboration with E.K. Zavoĭskiĭ, who at that time was developing a sensitive method for measuring absorption of radio waves in matter, and with B.M. Kozyrev, who was concerned with paramagnetic relaxation. They thought of the idea of using Zavoĭskiĭ's method for observing nuclear magnetic resonance. The expected signals were obtained in May–June of 1941, but their reproducibility was inadequate, and the only trace of their research was preserved in a joint paper published only in 1944, wherein it was stated that the grid current method for measuring absorption of radio waves in matter can be used to measure nuclear magnetic moments. As is well known, E.K. Zavoĭskiĭ continued these studies and in 1944 he discovered electron paramagnetic resonance.

The war interrupted S.A. Al'tshuler's scientific work. From the first days of the war, he volunteered for front-line duty. He spent the entire war in antitank artillery units and was discharged in 1946 as a major, decorated for his service in combat with orders and metals.

Returning to Kazan' University, S.A. Al'tshuler took an active part in teaching and scientific research in the area of paramagnetic resonance. Under his initiative, the study of the effect of nuclear spin on the paramagnetic resonance spectrum was initiated and in 1948 the hyperfine structure of the EPR resonance line was discovered (in manganese ions in work by A.S. Al'tshuler, B.M. Kozyrev, and S.G. Salikhov). The study of the hyperfine structure of paramagnetic resonance spectra played an important role in determining the nuclear spins of a number of isotopes and is very important for studying the distribution of electron spin density in matter.



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In subsequent years, S.A. Al'tshuler developed the theory of spin–lattice relaxation in paramagnetic solids. This research led him in 1952 to predict and construct a theory of a new physical phenomenon: acoustic paramagnetic resonance, which was later recorded in the state register of discoveries and inventions. This work was the beginning of research on the quantum properties of solids using acoustic methods. For the first time, it was possible to measure directly the magnitude of the interaction of sound waves with the electronic shell of par-

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amagnetic ions and nuclei, having a quadrupole moment. This helped the understanding of the kinetics of magnetization of matter and other low-energy processes in solids. The capabilities of spectroscopy, compared to paramagnetic resonance, which is effective only when magnetic dipole transitions between energy levels are allowed, were considerably extended. Progress in work involving acoustic paramagnetic resonance led to the creation of a new area of specialization in physics: quantum acoustics.

In 1965, S.A. Al'tshuler proposed using Mandel'shtam–Brillouin scattering to study nonequilibrium phonons emitted by a spin system. Later, in work together with his coworkers, using this method, he discovered the beautiful phenomenon of avalanche-like emission of phonons, induced by a specially prepared nonequilibrium distribution of magnetic dipoles in local magnetic fields. The effective temperature of the resonant phonons at the peak of the avalanche attained millions of degrees with the temperature of the specimen equal to several degrees.

S.A. Al'tshuler's suggestion of using the so-called Van Vleck paramagnets as a working substance in the adiabatic demagnetization process is very important for the technology of obtaining superlow temperatures. Here we are talking about substances with paramagnetic ions whose ground state is a singlet state, but the nuclear magnetic moment is anomalously large due to admixtures of excited electronic states and its coupling with lattice vibrations is much more efficient. Using this method, it was possible to cool the crystal lattice to tenths of a millidegree. This is as low a record-breaking lattice temperature as can be obtained by the usual nuclear demagnetization; however, with the use of Van Vleck paramagnets, the change in entropy and refrigerating capacity increased by several orders of magnitude.

S.A. Al'tshuler's service to the organization and direction of experimental research at the Kazan' University in the area of magnetic radio spectroscopy and quantum electronics is enormous. Here, a corresponding problem-solving laboratory was started, which at the present time is a combined experimental department, including a laboratory for growing crystals, a cryogenic laboratory, and so on.

S.A. Al'tshuler has many students: he prepared more than forty candidates of science, of whom nine became doctors and already have their own students. Semen Aleksandrovich's considerate and well-meaning relation with young scientists is especially important. He always discusses scientific questions as with equals, hearing out the opinion of a student with as much seriousness as the opinion of a professor. It is remarkable that many scientists, whom he did not even know personally, consider S.A. Al'tshuler their teacher. His book, co-authored with B.M. Kozyrev, entitled *Electronic Paramagnetic Resonance* (Fizmatgiz, Moscow, 1961; second edition 1972) and republished in Poland, German Democratic Republic, England, and in the U.S.A., played a large role here; this book was the first monograph on this subject.

S.A. Al'tshuler is presently carrying on major scientific organization and social work. He is the chairman of the scientific committee at the Academy of Sciences of the USSR on the problem of radio spectroscopy of condensed media, chairman of the doctoral committee concerned with the defense of dissertations, a member of a number of committees, and a member of the editorial board of JETP.

For his services, S.A. Al'tshuler has been awarded three Orders of the Great Patriotic War, Orders of the Red Star, the Red Banner of Labor, a Badge of Honor, and medals. He has been given the title of Honored Scientist of the Russian Soviet Federal Socialist Republic.

We congratulate Semen Aleksandrovich on his seventieth birthday and wish him health, new interesting work, and talented students.

Translated by M. E. Alferieff