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PERSONALIA

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In memory of Rudol'f Zinov'evich Levitin

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Rudol'f Zinov'evich Levitin, a charming man, noted scientist, physics experimentalist, expert in magnetism, and professor at Moscow State University passed away on February 26, 2004.

Levitin was born in Khar'kov on May 5, 1928 in a family of employees. His entire research and teaching career was inseparable from Moscow State University (MGU). Having graduated from the university in 1951, he soon entered the postgraduate course at the MGU Physics Department. After graduating from there, he joined the staff of the Chair of General Physics for Natural Sciences Departments, where he rose from junior to leading scientific researcher.

Levitin was one of the brightest representatives of the well-known scientific school focussed on the physics of magnetism and created by professor K P Belov. He played his role in the establishment of the Laboratory for Problems of Magnetism at the MGU Physics Department, one of the main centers for studying magnetism in solids in Russia, and helped in its maturation. With his broad range of scientific erudition, razor-sharp thinking, and infinite kindness, Levitin was a brilliant scientist, teacher, enlightener, and head of a large scientific school on the physics of magnetism. He was always generous in sharing his extensive knowledge of solid state physics with students and colleagues, and he loved doing it. Levitin devoted his efforts and talent to breeding young scientists; his lecture course for students of the Physics Department was for many years the main one in the curriculum of the chair.

Levitin was invariably an active participant in the All-Moscow colloquium on magnetism, and had become one of its major organizers in recent years. His profound and substantive questions and comment, invariably kind, constituted great help in creating a productive atmosphere at the colloquium and in maintaining its high level. He was for many years a member of the Bureau of the Council of the Russian Academy of Sciences on the problems of magnetism and a permanent member of the program committees of the All-Union and Russian conferences on the physics of magnetic phenomena.

Levitin's entire life until his very last day was devoted to pursuing science. His research style was characterized by profound understanding of the physical essence of the phenomena he worked on, rigorous and clear-cut setting up of experimental studies, and lucid presentation of the results obtained. He was predominantly interested in the magnetic properties of rare-earth and actinide compounds and in studying magnetic phenomena in strong pulsed magnetic fields. In this field, Levitin carried out a number of pioneering investigations; he can rightly be regarded as one of the founding fathers of the physics of rare-earth magnetism.

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Rudol'f Zinov'evich Levitin
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Levitin obtained results that substantially broadened the physical understanding of the nature of magnetism and the mechanisms of magnetic phase transitions in rare-earth ferro-, ferri- and antiferromagnets; these results proved to be fundamental for the theory of phase transitions in magnets. Combined studies discovered various types of spontaneous and magnetic field-induced phase transitions in rare-earth magnetic substances, established the main thermodynamic characteristics in the region of transitions, and found the relation between magnetic anomalies at phase transitions and the type of magnetically ordered state, magnetic anisotropy, anisotropy of exchange interactions, and other factors. His works on weak ferromagnetism in hematite and spin-reorientation phase transitions in rare-earth garnet-ferrites in strong pulsed magnetic fields are classic in essence and are widely cited both in special literature and in textbooks.

Levitin's work on various magnetoelastic effects, which constituted an important contribution to the microscopic theory of magnetoelasticity of rare-earth and actinide magnets, fully deserved to be regarded as fundamental for the physics of magnetic phenomena. Levitin was the first to

discover and systematically investigate magnetostriction and other magnetoelastic effects in 3d- and 4f-antiferromagnets. Together with his colleagues, he discovered the giant magnetostriction in rare-earth and actinide compounds, which is thousands of times higher than the magnetostriction of compounds based on elements of the iron group. The experimental and theoretical investigation of giant magnetostriction effects in various classes of 4f- and 5f-magnets clarified the nature of these phenomena and established their relation to the electron structure of the rare-earth or actinide ion. Accumulation of an extensive set of experimental data allowed to specify the conditions under which giant magnetostriction arises in magnets of various types, as well as the effect of magnetoelastic interaction and giant magnetostriction on magnetic anisotropy and various properties of magnets; possible applications of giant magnetostriction to technology were proposed. We need to specially emphasize the experimental study of various classes of actinide compounds carried out under Levitin's guidance, which established the relation of magnetic anisotropy, high intrinsic coercitivity, and magnetostriction with the degree of localization of 5f-electrons.

Levitin's work exerted considerable influence on the progress in itinerant magnetism, including the metamagnetism of collectivized electrons — that is, the transition from the paramagnetic to the ferromagnetic state in an external or effective magnetic field. Some qualitative effects and regularities were found in a number of 3d-4f intermetallic compounds due to the magnetic instability of the itinerant subsystem, caused by specific features of the energy dependence of the density of states $N(E_F)$ in the vicinity of the Fermi level: itinerant metamagnetism, thermally induced metamagnetism, and the giant rise of Curie temperature in response to dilution of the 3d-sublattice. The theory of magnetic phase transitions in ferrimagnets with a single magnetically unstable itinerant subsystem was developed. This achievement makes it possible to establish general patterns of properties of itinerant metamagnets belonging to different classes of compounds, to select features that allow the prediction of itinerant metamagnetism through measurements in relatively weak fields, and to conduct effective targeted search for such magnetic materials.

The span and diversity of Levitin's scientific interests were overwhelming. In recent years, he turned to studying problems and objects of fundamental significance for the physics of magnetism: spin-Peierls and low-dimensional systems, systems with magnetostructural transitions and various types of magnetic instability, magnets with shape memory, and complex multisublattice magnets. In connection with the problem of magnetic instability in 3d-4f ferrimagnets caused by the antiferromagnetic nature of intrasublattice exchange interactions in the 3d-subsystem, the peculiarities were investigated of spontaneous and strong field-induced magnetic phase transitions in natural superlattices — RMn_2Ge_2 intermetallides possessing giant magnetoresistance.

Levitin's work on rare-earth magnets enjoyed a high reputation among colleagues; his extensive and fruitful contacts with scientists in recognized research centers in Czech and Slovak Republics, Poland, France, The Netherlands, and Japan helped integrate Russian science into the international science community. The complex investigation of the magnetism of rare-earth and uranium compounds was awarded with the USSR State Prize (together with scientists from Moscow State University and the institutes of the Academy of Sciences). Giant magnetostriction in rare-earth and uranium compounds, detected by Levitin together with his colleagues, was certified as a discovery. The results of Levitin's fruitful research effort were summarized in two monographs and in the series of fundamental reviews on various problems of the physics of rare-earth magnetism that still help to train new experts in the physics of magnetism.

His devotion to science, important contributions to physics, exceptional erudition in solid-state physics, insatiable curiosity and openness to everything new that he manifested until his last day, and wonderful human qualities made Rudol'f Zinov'evich Levitin likable and popular among scientists in this country and abroad. Such was the person we knew, such is the man we remember, and this is how he will stay in the hearts of the people who knew him.

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