

In memory of Karl Karlovich Rebane

DOI: 10.1070/PU2008v051n04ABEH006556

November 4, 2007 was the sad day when Karl Karlovich Rebane, an outstanding scientist and science manager, one of the best experts in solid state theory and optical spectroscopy of the condensed state of matter, departed this life.

Karl Karlovich Rebane was born on April 11, 1926 in the town of Pärnu (Estonia). He fought in the Great Patriotic War in the Soviet Army, receiving medals for distinguished active service. He was highly educated in 1947–1952 at the Physics Department of Leningrad State University (LGU), majoring at the Chair of Theoretical Physics headed by V A Fock. Karl Karlovich maintained close ties with Leningrad (now Saint-Petersburg) State University for the rest of his life.

K K Rebane worked in Estonia, in Tartu at the Institute of Physics and Astronomy, and later at the Physics Institute (and was its Director from 1973 to 1976); he was a Professor at Tartu University beginning in 1958. K K Rebane was Full Member of the Estonian Academy of Sciences, Secretary-Academician of the Division of Physico-Technical and Mathematical Sciences, and Vice-President and President (1973–1990) of the Academy of Sciences of the Estonian SSR. In 1976, he was elected Corresponding Member of the USSR Academy of Sciences, and in 1983, Full Member of the Academy in the Division of General Physics and Astronomy. K K Rebane remained Full Member of the Russian Academy of Sciences even after the demise of the Soviet Union and was in close contact with Russian scientists. In 1993, he became Honorary Member of the A F Ioffe Physico-Technical Institute of the Russian Academy of Sciences. In 2000, K K Rebane received a state-awarded distinction — the Order of Friendship — for his great contribution to the progress of science and for helping connect Estonian and Russian scientists.

Karl Karlovich devoted his theoretician's talent to solid-state physics, namely, to that part of it which deals with optical spectroscopy of crystals and which in the laser epoch gained the status of one of the most important fields of modern physics, both academically and for applications. His work contributed very significantly to the theory of the optical spectra of crystals containing impurity centers and point defects. The specifics of optical spectra of local centers in a crystal lattice are connected most strongly with the interaction between electronic states of local centers and lattice vibrations. He successfully applied the method of moments for describing the electronic–vibrational spectra of local centers in crystals. K K Rebane's monograph *Elementary Theory of the Vibrational Structure of Impurity Centers in Crystals*, published in Russian and translated into English, became a book of reference for several generations of spectroscopists studying the spectral and luminescent properties of crystals.



Karl Karlovich Rebane
(11.04.1926 – 04.11.2007)

The theoretical papers by Karl Karlovich focused much attention on dynamic processes occurring in the excited electronic states of impurity crystals. He formulated the general concept of 'secondary emission' from crystals in response to their optical excitation. The classification of secondary emission proposed by Karl Karlovich (luminescence, scattering, "hot" luminescence) played an important role in understanding the complicated processes taking place when light interacts with crystalline substances of this class.

Karl Karlovich paid special attention during his long creative life in physics to the properties of purely electronic transitions in solids; they produce extremely narrow 'zero-phonon' absorption and fluorescence lines in low-temperature optical spectra. In his papers, Karl Karlovich treated many aspects of the theory of zero-phonon lines that, in his words, constitute the "cornerstone" of a significant number of areas in modern laser spectroscopy of activated media. Karl Karlovich greatly contributed to the advancement of such fields of investigations as high-resolution laser matrix

spectroscopy, the spectroscopy of single impurity molecules, and the burning of stable narrow spectral dips ('holes') in the contours of zero-phonon lines — not only as a theoretician but also by initiating new experimental studies. Karl Karlovich comprehensively supported the research of the team headed by his permanent partner in life and in work, Lyubov' Aleksandrovna Rebane; this led to the experimental discovery of the phenomenon of stable burning of narrow 'holes' in the spectral contour of zero-phonon lines emitted by impurity molecules in condensed media; for this discovery the team — together with another team headed by R I Personov at the Institute of Spectroscopy, USSR AS — won the USSR State Prize.

Karl Karlovich maintained his creative activity until the end of his life. His work in the latest phase of his career presented new results and new ideas concerning the use of zero-phonon lines in methods of spatiotemporal holography and optical informatics. One of his last publications treated his suggestion of a novel ultrasensitive technique based on the Doppler effect for studying spectral holes in contours of zero-phonon lines (here, Karl Karlovich made use of the analogy between the properties of zero-phonon lines and Mössbauer γ -resonance lines). In a number of Karl Karlovich's publications, such concepts of physics as energy and entropy were used in treating such general social subjects as economics, ecology, protection of the environment, and the fight against terrorism. These publications reflected the broad span and scale of Karl Karlovich's interests, his tremendous erudition, and his highly responsible approach to the role of a scientist in society. These brilliant characteristics of a high-caliber scholar were obvious in K K Rebane's activities in the high academic positions he occupied. The importance of Karl Karlovich's achievements as a science administrator goes far beyond the borders of Estonia, where Karl Karlovich certainly deserves the glory of developing modern avenues of physics research at the Institute of Physics in Tartu and of lifting the international standing of the scientists of this institute. For many years Karl Karlovich headed the Joint Optics Council of the USSR Academy of Sciences and represented the country in the international Organizational Committee for Luminescence of the European Physical Society.

In the years when international cooperation met with the greatest difficulties for the physicists of our country, Karl Karlovich applied great effort to organize meetings for scientists from various countries. It will suffice to remember a series of four bilateral Soviet – American symposia on optics in 1975 – 1990, which involved the participation of the leading American scientists conducting laser studies of solids; K K Rebane was one of their main organizers. These symposia, together with bilateral seminars with European scientists organized in Estonia with the active support of K K Rebane in his capacity as President of the Academy of Sciences of the Estonian SSR, played a very important role in establishing scientific links between the scientists of our country and the world scientific community. They certainly prepared the ground for the broad and extremely useful international cooperation of Russian physicists which was settled in the last 10 – 15 years.

The scientific achievements of K K Rebane were awarded with the P N Lebedev Gold Medal of the USSR Academy of Sciences (1981) and the S I Vavilov Medal of the Znanie Society for active popularization of science. His contribution to science brought him many high governmental distinctions.

Anyone who communicated with Karl Karlovich remembers him as an attentive, well-meaning, and considerate interlocutor, and they will remember his unusual humor (that he himself defined as "Ugro-Finnish"). In fact he was quite capable of taking a hard stance when defending his point of view in matters of science administration. He was an interesting interlocutor, not only talking about science, but equally about life and history, and also about the sport of fishing — he was a fanatic of this hobby. Karl Karlovich was a wonderful family man, and both his children, son and daughter, followed their parents and became physicists. Karl Karlovich Rebane left a bright legacy, not only in science, and will live on in our memories.

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