



## In Memory of Leonid Sergeevich Kuzmin (1946–2022)

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Picture from family archive

On April 14, 2022, a recognized experimental physicist, Professor Leonid Sergeevich Kuzmin, passed away at the age of 75. He was born on July 10, 1946, in Moscow, USSR.

Leonid Kuzmin's academic career began in 1965 in the Department of Physics of Moscow State University. He pursued both undergraduate and doctoral studies under the supervision of Dr. Konstantin Likharev. His PhD thesis “Non-degenerate single-frequency parametric amplification using Josephson junctions with self-pumping” was defended in 1977. In 1997, he received a habilitation degree (Dr. Sci.) for the

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thesis entitled “Correlated Tunneling of Electrons and Cooper Pairs in Ultrasmall Tunnel Junctions.”

In the late 1980s, glasnost in the former Soviet Union enabled many gifted researchers to pursue careers in the West. Leonid used this opportunity to gradually move his research activity to Chalmers University of Technology. His short-term visiting research positions were followed by a semi-permanent position sponsored by the Swedish Research Council and eventually (in 2004) to a professorship at Chalmers.

L. S. Kuzmin’s personality was deeply rooted in his passion for science and technology, enhanced by his inborn intuition for physics. At the beginning of his scientific career, he explored high-frequency properties of point-contact Josephson junctions. This study has led to the discovery of a completely new effect: the non-degenerate single-frequency parametric amplification. In the early 1980s, a part of Likharev’s group started to focus on tunneling in nanoscale junctions between superconducting and normal metals. Leonid joined this study with much enthusiasm; in just a few years, his extraordinary talent for advanced experimentation using even rudimentary equipment available has allowed him to observe the earlier predicted effect of discrete correlated single-electron tunneling in double junction structures. Curiously, this work was published in JETP Letters on March 6, 1987—the same day a report on the observation of this effect by T. Fulton and G. Dolan of Bell Labs was submitted for publication in Physical Review Letters. Leonid continued that line of research at Chalmers and in 1989 observed a counterintuitive and important phenomenon—the effect of external impedance on single-electron tunneling. And in 1991, he (assisted by his Chalmers colleagues) finally succeeded to achieve his major scientific goal: to observe the so-called Bloch oscillations of Cooper pairs in ultra-small Josephson junctions. Such oscillations had been predicted by the Moscow group in the mid-1980s, and their experimental observation by Kuzmin et al. had a major scientific impact.

At the turn of the millennium, Dr. Kuzmin became interested in the development of high-frequency radiation detectors and bolometers for cosmological applications. In order to measure small variations in the cosmic background radiation, thermal noise in their detectors must be minimized. With this goal, Kuzmin has developed detectors with on-chip electron cooling, cold-electron bolometers, and demonstrated efficient electron cooling down to the mK range and high detection sensitivity under a high power load. Recently, cold-electron bolometers were flown in balloons by a prominent Italian group to test their immunity to cosmic rays. Kuzmin’s last important achievement was his work on microwave single-photon counters for axion dark matter search.

More generally, with his strong commitment to the development of receiver systems for radio astronomy, Dr. Kuzmin was a major force behind the consolidation of Chalmers as a major center in this field. His involvement in research on various types of superconductor detectors and amplifiers was noted by others in several different contexts (i.e., as the Van Duzer prize), and he played an important role in building strong collaborations in both Russia and Europe on detectors for radio astronomy.

Another major side of Dr. Kuzmin's life was being a permanent magnet to attract many undergraduate and graduate students to his research field. His passionate mentoring and personal touch have contributed much to their current scientific careers.

Very typical of Leonid was his enthusiasm and cheerfulness in whatever he was doing. His laughter was never far away, and he was always bubbling with new ideas—not only scientific ones. He was happy to talk about his participation in the famous long-distance skiing event—the Vasaloppet. He arranged a series of symposia in the mountains of Lapland and was proud to beat again and again the world record in constructing the strongest igloo, helped by the many international participants.

We keep our colleague and friend Leonid Kuzmin in loving memory.

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