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In Memoriam: Evgeniĭ E. Gorodetskiĭ (1941–2015) and Sergeĭ B. Kiselev (1951–2015)

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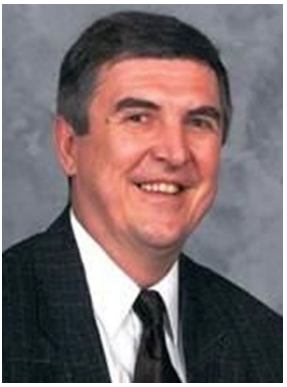
Evgeniĭ Efimovich Gorodetskiĭ
(09/22/1941–11/07/2015)



Sergeĭ Borisovich Kiselev
(02/16/1951–10/06/2015)

Dr. Evgeniĭ E. Gorodetskiĭ, a prominent Russian theoretical physicist, who has worked in the area of phase transitions in fluids for 50 years, and Dr. Sergeĭ B. Kiselev, a talented, Russian trained, thermophysicist, who lived and worked in the US since 1992, died in the late fall of 2015. Both Evgeniĭ and Sergeĭ were our long-term collaborators and personal friends.

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Evgeniĭ Gorodetskiĭ was born on September 22, 1941 in Krasnoufimsk, Ural Region, just after his parents and two siblings, sister Inna (11 years old) and brother Alexander (3 years old), had been evacuated from Moscow in view of a possible capture of Moscow by approaching German troops. His father, Efim Naumovich Gorodetskiĭ, and mother, Polina Veniaminovna Gurovich, were historians. Life in evacuation was harsh for little children. Evgeniĭ had pneumonia several times and barely survived. In 1944, the family returned to Moscow. After graduation from a Moscow high school in 1959, Evgeniĭ studied physics at Gorky University (in the city of Nizhny Novgorod that was named Gorky at the time). From 1965 till 1978, he worked at the research institute of the U.S.S.R. State Committee for Standards and Product Quality Management in Mendeleevo in the Moscow Region, Russia's equivalent of the National Institute of Standards and Technology (NIST) in the US. In 1970, Gorodetskiĭ received his Ph.D. degree in molecular physics and thermophysics. Gorodetskiĭ's Ph.D. advisor was Moshe Giterman, currently Professor Emeritus at Bar-Illan University in Israel. In 1978, Gorodetskiĭ joined Russia's National University for Oil and Gas ("Gubkin Institute") and in 1988 the Research Institute for Oil and Gas of the Russian Academy of Sciences in Moscow. From 1995 until his sudden death, Gorodetskiĭ was Head of the Laboratory for Phase Transitions at the Research Institute and Professor of physics at the University (part time). For many years, Gorodetskiĭ collaborated with our research group at the University of Maryland in College Park. He visited Maryland several times and, in 1999–2000, was a guest researcher in our group.

Dr. Gorodetskiĭ made significant contributions to the physics of phase transitions and critical phenomena in fluids. He and Moshe Giterman were able to explain why the thermal conductivity should diverge at the vapor–liquid critical point [1], completely independently of similar results being obtained in the US at about the same time (1968–1970). This spectacular phenomenon had been experimentally discovered by one of us (JVS) in 1962, but remained unexplained for a few years. Subsequently, Giterman and Gorodetskiĭ' extended their theory to dynamic critical phenomena in binary fluids [2]. In 1971, again independently from similar studies in the West, Gorodetskiĭ, in the collaboration with Alexander Voronel and one of us (MAA), generalized the concept of critical-point universality to binary fluids [3]. Another important contribution of Gorodetski and his collaborators at the Moscow Oil and Gas Institute, in collaboration with scientists at the AT&T Bell Laboratories, was the demonstration of coupling between fluctuations of the director and the translational order parameter in liquid crystals, also referred to as Halperin–Lubensky–Ma effect.

We personally have benefitted from a productive collaboration with Gorodetskiĭ in Moscow and our research group at the University of Maryland, since the early nineties. This collaboration has led to a general formulation of critical phenomena in fluid mixtures, known as "isomorphism of critical phenomena," in terms of mixing of the physical fields into the Ising-model/lattice-gas scaling fields. Another interesting result was the discovery that coupling between the entropy and concentration fluctuations in near-critical binary fluids could result in a classical analog of the quantum Landau–Zener effect: "avoiding crossing" of coupled dynamic modes. While being a theoretical physicist, Gorodetskiĭ was also deeply involved in experimental studies and engineering applications. Specifically, we have enjoyed collaboration with Gorodetskiĭ on studies of asphaltene aggregation by dynamic light scattering.

Sergeĭ B. Kiselev was born on February 2, 1951 in Yevpatoria, Crimea. His father, Boris Danilovich Kiselev and his mother, Ljudmila Antonovna Kiseleva, were engineers, working in the food industry. From 1968 through 1974, Sergeĭ studied thermophysics and thermal engineering at the Moscow Power Technical University, where he graduated with a Diploma of Engineer. From 1964 through 1978, he worked at the same institution as Gorodetskiĭ, namely in Mendeleevo in the Moscow Region. In 1981, Kiselev received a Ph.D. degree in molecular physics and thermophysics (one of us, MAA, was his Ph.D. advisor) and in 1991 he received a distinguished degree of Doctor of Sciences. From 1978 through 1991, Kiselev was a researcher and teacher at the Gubkin Institute and the Institute for Oil and Gas Research in Moscow, just as Gorodetski at that time. In 1992–1993, Kiselev was a guest researcher at the Institute for Physical Science and Technology, University of Maryland, College Park, working in the research group of one of us (JVS). From 1995 till 1998 Kiselev was a guest researcher at NIST, Boulder, Colorado and from 1998 till 2008, Kiselev was an Associate Research Professor at the Colorado School of Mines, Golden, CO. Kiselev activities both at NIST and at the Colorado School of Mines in Colorado cover a most productive period in his research career.

Dr. Kiselev made several important contributions in theoretical and engineering thermophysics. For many years, he had worked on the problem of crossover between mean-field critical behavior and fluctuation-induced scaling critical behavior in fluids and fluid mixtures. He developed a phenomenological theory of crossover in the early 1990s at the Institute for Oil and Gas in Moscow [4,5]. Subsequently, he collaborated with us comparing his crossover formulation with the one that had been developed at the University of Maryland. In addition, he also developed an original approach to address critical crossover behavior of transport properties in fluids and fluid mixtures [6]. Kiselev became very active incorporating his crossover theory into a large number of equations of state, in collaboration with J. C. Rainwater, M. L. Huber, D. G. Friend, R. A. Perkins, I. M. Abdulagatov and others at NIST, and in collaboration with J. F. Ely, L. Sun, and others at the Colorado School of Mines. He also showed how the crossover theory can be incorporated in various versions of the SAFT equation in collaboration with C. McCabe. With L. Lue he showed how the crossover theory could be applied to polymer solutions. Another internationally recognized contribution of Kiselev was an unambiguous fundamental definition of the physical limit of stability in fluids, the thermodynamic spinodal ("kinetic spinodal"), including application to supercooled water.

A more complete discussion of the contributions of Kiselev on the subject of thermodynamic critical crossover behavior is included in a review of Behnejad et al. [7] and an evaluation of his contributions on the subject of critical crossover behavior of transport properties in a recent review of Sengers and Perkins [8].

Personally, we are grateful for having had Evgeniĭ Gorodetskiĭ and Sergei Kiselev as scientific collaborators and as friends. More generally, Gorodetski and Kiselev exemplify the improved interactions between Russia and the US in the area of thermophysics in the past decades.

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