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PERSONALIA

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In memory of Sergei Ivanovich Anisimov

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The outstanding world-famous theoretical physicist, recipient of prestigious scientific awards, and corresponding member of the Russian Academy of Sciences (RAS) Sergei Ivanovich Anisimov passed away on October 15, 2019 after a long disease. The development of physical hydrodynamics and high energy density physics was inseparably linked with him.

Sergei Ivanovich Anisimov was born in Leningrad on December 11, 1934. There, in the city on the Neva River, he finished school and entered the Leningrad Polytechnical Institute. On graduating from the Physico-Mechanical Faculty, he began his scientific activity in Minsk at the Institute of Physics of the Academy of Sciences of BSSR. In 1965, Sergei Ivanovich was invited to the Institute for Theoretical Physics of the USSR Academy of Sciences (now the Landau Institute for Theoretical Physics of RAS) (then newly founded in the Noginsk Research Center in Chernogolovka) as head of the Sector of Physical Hydrodynamics and Plasma. After that, the scientific activity of S I Anisimov was closely related to the institute, the formation and development of which is inseparable from his name. Sergei Ivanovich defended his doctoral thesis at the Institute of Physical Problems of the USSR Academy of Sciences with P L Kapitza as chairman of the Academic Council and A A Abrikosov as secretary; Ya B Zeldovich, R Z Sagdeev, and A D Sakharov were his academic reviewers.

S I Anisimov's contribution to the thriving field of high energy density physics was invaluable — he was one of the founders of this field of science. His broad erudition and all-round knowledge allowed him to work successfully in various fields of physics. He obtained quite a number of important results in plasma physics, the study of the molecular phase of solid hydrogen at megabar pressures, dielectric– metal phase transition under pressure, and the theory of the Gunn effect in semiconductors. S I Anisimov's comprehensive erudition in theoretical physics became apparent in the pioneering work (together with I E Dzyaloshinskii) on topological defects in nematic liquid crystals. This work took a deserved place in the *Course of Theoretical Physics* by Landau and Lifshitz.

With the appearance of lasers, the main thrust of S I Anisimov's creative activity was research work on the interaction of high-power laser irradiation with matter. His first work in this area was during his Minsk period, when he created a model of quasi-stationary laser ablation of metals, which immediately became widely popular and has been used up to date to elaborate different laser-based technological processes. Later on, he performed a series of studies of laser inertial thermonuclear fusion, the hydrodynamics and kinetics of thermonuclear combustion of microtargets, in which he found exact criteria of uniform and spark ignition. He discovered the important phenomenon of repeated target collapse and established optimal relations between the concentrations of thermonuclear fuel components. S I Anisimov was one of the initiators of the large-scale numerical simulation of Langmuir wave collapse — the principal mechanism of high-energy electron generation in thermonuclear targets.

Sergei Ivanovich Anisimov
(11.12.1934 – 15.10.2019)

The results of his studies of the interaction between laser radiation and matter underlay his book (in co-authorship with Ya A Imas, G S Romanov, and Yu V Khodyko), *Effects of High-Power Radiation on Metals*, which became the first monograph in the world on this subject (it was translated into English in the USA). It was precisely studies in this area that showed the breadth of Sergei Ivanovich's scientific erudition and his high professionalism.

Studies of the phenomenon of the multiquantum photoeffect in metals under intense laser radiation and the theory of optical dielectric breakdown due to absorbing microinclusions are among the most important studies by Sergei Ivanovich. These are his fundamental contribution to the physics of nonstationary processes at high energy densities, the same as the theory of deep metal melting under high-power radiation (e.g., of a CO_2 laser). S I Anisimov obtained

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pioneering results on polymer ablation under excimer laser irradiation. The photophysical, photochemical, and thermal ablation mechanisms were elaborated in detail, thus providing insight into a large array of experimental data.

An important contribution of Sergei Ivanovich to the physics of laser interaction with matter was the prediction of laser sublimation instability and examination of its thermal mechanism. It was later revealed that many different instabilities occur under the action of laser radiation on matter. He formulated the original evaporation theory, taking into account the liquid surface dynamics with a collective character of atomic oscillations in a substance undergoing evaporation.

Especially important is S I Anisimov's pioneering contribution to the theory of processes taking place under the interactions of ultrashort, including femtosecond, laser pulses with matter. Ahead of its time, this theory was formulated by him as far back as the early 1970s, much earlier than femtosecond laser technology was developed (it received the 2018 Nobel Prize). With the appearance and an extensive propagation of femtosecond lasers, the two-temperature model of interaction of ultrashort laser pulses with metals developed by Sergei Ivanovich came to be in great demand, gained recognition all over the world, and became an integral part of laser-matter interaction physics.

S I Anisimov's fundamental knowledge and his comprehensive physical erudition proved to be indispensable in a very interesting project concerning cosmic space studies. It was one of the most successful projects realized by the Vega Soviet space program studying Halley's comet. Sergei Ivanovich took part in work of paramount importance, namely, the design and elaboration of protection of the space probes Vega-1 and Vega-2 from cosmic dust. This work remains very topical and in demand, especially as concerns the detailing of interplanetary flight projects. For his great contribution to the development of the space project, S I Anisimov was awarded the USSR State Prize.

For his scientific achievements in the field of plasma physics, Sergei Ivanovich was awarded the Alexander von Humboldt Prize and the Landau–Spitzer Prize. For his great contribution to the physics of interaction of ultrashort laser pulses with condensed matter, he was given the A G Stoletov Prize. S I Anisimov was elected a member of the Commission of the International Union of Pure and Applied Physics (IUPAP) and a member of the Executive Committee of the International Association on High Pressure Physics and Technology (AIRAPT); he was a member of the editorial boards of several leading Russian and international scientific journals. For his fruitful scientific activity, he was awarded the Order of the Badge of Honor and medals of the USSR and the Russian Federation.

During all his multifaceted scientific activity, Sergei Ivanovich paid great attention to preparing highly qualified scientific brainpower. He founded a scientific school in the field of physical hydrodynamics and high energy density physics that holds one of the leading places in the world. He was a professor at the Moscow Institute of Physics and Technology (MIPT), where he delivered lectures on theoretical physics, and was a research supervisor at the Laboratory of Nonlinear Optics at MIPT, sharing his all-round knowledge with students. For several years, S I Anisimov was head of the Theoretical Department of the Joint Institute for High Temperatures of RAS. Seven doctors and more than 30 candidates of science were among his students.

Sergei Ivanovich had an exceedingly polymathic personality. He was not alien to the worlds of music, literature, or sports (as a young man, he was the number one tennis player in Belarus). And his ability to speak like a native with Frenchmen, to speak German fluently with his students from Germany, citing Goethe by heart, and, of course, his brilliant knowledge of English always aroused genuine admiration. He was also extremely sensitive and responsive to those around him.

The departure of Sergei Ivanovich Anisimov is a great loss for science and for all his friends, colleagues, and disciples.

I E Dzyaloshinskii, V E Zakharov, N A Inogamov,
I V Kolokolov, E A Kuznetsov, V V Lebedev,
S P Novikov, R Z Sagdeev, A A Starobinskii,
S M Stishov, V E Fortov, I M Khalatnikov