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PERSONALIA

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In memory of Aleksandr Alekseevich Vedenov

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Professor Aleksandr Alekseevich Vedenov, an outstanding scientist, a physicist of world fame, a Corresponding Member of the Russian Academy of Sciences, DSc in physics and mathematics, died after a serious illness on 28 January 2008.

A A Vedenov was born in Moscow on April 30, 1933. His father, Aleksei Nikolaevich Vedenov, was educated as a lawyer and worked as an economist, and loved his hobby — photography; his mother Mirra Efimovna Berdichevskaya was a geologist. During the Great Patriotic War Aleksei Nikolaevich was on active duty at the front. Mirra Efimovna spent the difficult war years with two children away from home, having been evacuated, where the elder Vedenov, Sasha, constantly took care of his younger brother Yurii. The family returned to Moscow in 1943.

After graduating *summa cum laude* from high school in 1950, Aleksandr Alekseevich Vedenov enrolled in the Physics Department of Moscow State University (MGU). While still in his junior and senior years at the university, he successfully attended L D Landau's 'theoretical minimum' and published three research papers by the time he graduated from the university; the broad range of scientific interests that he demonstrated at the very beginning accompanied him throughout life, as did his ability to work in different fields of theoretical physics. Having graduated from MGU in 1956, A A Vedenov joined the postgraduate studies at MGU and at the same time began working at M A Leontovich's department at the I V Kurchatov Institute of Atomic Energy (KIAE) where he stayed for the rest of his life. In 1963, A A Vedenov received a DSc in physics and mathematics, and in 2003 was elected Corresponding Member of the Russian Academy of Sciences.

The main avenues of A A Vedenov's research were the physics of rarefied and dense plasmas, the physics of polymers and liquid crystals, gas discharge, gas-discharge lasers, the propagation of radiation and its interaction with matter, molecular biology, and problems of associative memory.

Beginning with the mid-1950s, A A Vedenov took a great interest in the physics of rarefied and dense plasmas. He was interested in the thermodynamic and kinetic properties of plasmas, the dynamics and instability of waves in gas plasmas and in vacuum electronic devices, and the propagation and generation of electromagnetic waves in solid-state plasmas. Using diagram techniques, A A Vedenov and A I Larkin derived the virial expansion of the equation of state of a plasma and then applied it to strong electrolytes. Together with E P Velikhov and R Z Sagdeev, he developed a quasilinear theory of classical plasma. Then A A Vedenov generalized the theory to the case of quantum plasma and also applied the quasilinear theory to the problem of relaxation of electron and ion beams in a plasma. Together with L I Rudakov, he developed the theory of the modulation instability of turbulent rarefied plasma. These publications on quasilinear theory brought A A Vedenov world fame and are still among the most quoted papers in plasma physics.

Aleksandr Alekseevich Vedenov
(30.04.1933 – 28.01.2008)

At the beginning of the 1960s, A A Vedenov was invited to head the Theoretical Sector at the affiliate of the KIAE (FIAE) in Krasnaya Pakhra (now the town of Troitsk). The principal area of research in his first years at FIAE was magnetohydrodynamic (MHD) generators, but at the beginning of the 1970s the work started at the affiliate on designing high-power gas lasers. At this point, A A Vedenov was supervising work on the physics of electric discharges in a flowing gas, but took active part in it as well. He and his disciples and coworkers were building the foundation of the physics of fast-flow gas discharge lasers. A A Vedenov also developed the theory of propagation of high-power laser radiation in the atmosphere and the theory of interaction of high-power radiation with matter; he also investigated processes taking place in the laser processing of materials.

A A Vedenov focused much attention on methods of analyzing experimental data in many different fields of science — from nuclear physics and plasma physics to molecular biology. He highly valued good experiments, knew experimental techniques inside-out, and loved to go into detail. This was a great help in suggesting new practical applications of scientific breakthroughs, in tenaciously guid-

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ing the creation of instruments and technical devices on the basis of theoretical achievements.

In 1986, A A Vedenov, along with a group of authors, received the USSR State Prize for the development of powerful gas discharge lasers for industrial applications.

There at FIAE he also took part in the development of a tunable far-infrared source in the 100 – 5000 μm range. Together with V A Alekseev, he studied electrical conduction and the thermo-emf of dense cesium and mercury vapors. He was one of the authors of the discovery of the ionization potential lowering with increasing plasma density — a very important effect for determining the thermodynamic and kinetic properties of weakly ionized plasmas. He also studied phase transitions in strongly nonideal plasmas.

A A Vedenov's range of interests was exceptionally wide. He was permanently searching for new fields to apply the tools of theoretical physics, formulated original problems, and relentlessly searched for their solutions. Together with A M Dykhne and M D Frank-Kamenetskii, he developed the theory of helix-to-coil transition that describes the process of DNA molecule 'melting' in molecular biology. He developed the theory of supramolecular structures in solutions — liotropic liquid crystals and clays. He worked on the problems of artificial intelligence. He published one of the groundbreaking seminal papers on artificial neuron networks which later gave rise to an entire new field in informatics.

After the advent of the personal computer, A A Vedenov constantly searched for new ways of using it. He suggested a method of computer-assisted reconstruction of 3D images of objects on the basis of their plane photographs or drawings. In 1996, Aleksandr Alekseevich, starting with three-dimensional stereoimages of strange attractors, formulated approximate conservation laws for chaotic systems. He created a series of three-dimensional images of Moscow-of-old from the artist A M Vasnetsov's paintings, used to produce a stereo film that one can watch at the Palaty v Zaryad'e affiliate of the State Historical Museum.

A A Vedenov was known to invariably respond most vigorously to important emerging academic and practical problems. When he worked on a project concerning the use of power generated by atomic reactors for improving agricultural productivity, he acquired profound knowledge of photosynthesis and formulated a question about the maximum achievable productivity of plants. After the Chernobyl power station catastrophe, he took part in working out the measures needed to eliminate the consequences of the accident, and sought nonstandard approaches to the diagnostics of radioactive contamination using bacteria and novel technologies of cleaning farm produce. He took part in the search for possible applications of high-power gas lasers for fire extinction in gas wells.

After returning to KIAE in 1998, A A Vedenov worked on various aspects of the theory of atomic reactors, taking into account possible oscillations and instabilities. Along with E N Nikolaev, he worked actively on using supercomputers for modeling the dynamics of charged plasma in ion traps. He created the theory of ion separation at atmospheric pressure on the basis of nonlinear ion mobility.

In his last years, Aleksandr Alekseevich continued to be interested in biology, working on a physical model of the bacterial cell as an ensemble of polymerizing molecular machines and studying the physical foundations of the life processes of a bacterial cell with a view to the possible creation of a new generation of pharmaceutical substances. He planned to write a book on the subject but, unfortunately, this was not to be.

A A Vedenov published his main results in review papers in *Uspekhi Fizicheskikh Nauk* (*UFN*); in collected volumes of *Voprosy Teorii Plazmy*; in a series of monographs *Teoriya Turbulentnoi Plazmy* (*Turbulent Plasma Theory*, Moscow: Institut Nauchnoi Informatsii, 1965), which were translated into English: (London: Iliffe Books – New York: American Elsevier Pub. Co., 1968); *Fizika Elektrorazryadnykh* CO_2*-Lazerov* (*Physics of Electric Discharge* CO_2 *Lasers*, Moscow: Energoizdat, 1981); *Modelirovanie Elementov Myshleniya* (*Modeling the Elements of Thought Processes*, Moscow: Fizmatgiz, 1982). Together with G G Gladush he published a monograph, *Physical Processes in Laser Processing of Materials* (Moscow: Energoatomizdat, 1985). He also wrote a *Book of Problems in Plasma Physics*, for students and a monograph, *Physics of Solutions* (Moscow: Nauka, 1984).

In addition to his research projects, A A Vedenov devoted a lot of his time to editorial work. He edited a number of books, translations, and volumes of collected papers in various fields of knowledge. He paid much attention to popularizing science, penned popularizing texts on *Photosynthesis* and *Mathematics of Stereoimages*, and wrote for the Russian magazines *Priroda* (*Nature*) and *Khimiya i Zhiz'n* (*Chemistry and Life*).

A A Vedenov devoted much effort to teaching new generations of scientists. He held a professorship at the Chair of Molecular Biophysics at the Moscow Institute of Physics and Technology (MFTI). He kept an alert eye on the progress of science in various fields of physics and biology and responded to it in his lectures. His informal conversations with students and young researchers about physics, biology, economics, and politics, and his original approach to all these fields stimulated interest in science and intense independent thinking in young people. We find many CandSc and DSc scientists, even Full Members of the Academy of Sciences, among his former students.

A A Vedenov's typical trait was his insistence and ability to reduce the most complicated questions to maximum simplicity and to make qualitative estimates. He encountered no obstacles in settling into an unfamiliar field of science, mastered the available literature on the new subject, was never afraid to ask an expert a 'stupid' question, and insisted on getting a clear and satisfactory answer. Such dialogs always helped in better understanding the essence of the problem. Aleksandr Alekseevich was eager to discover analogies to complex and incomprehensible phenomena. Essentially a theorist, he perceived physics as an experimental discipline and regarded Enrico Fermi as an exemplary outstanding physicist.

A A Vedenov loved life and was a warm-hearted, cheerful, and responsive person. His hobbies were stone dressing, jewellery fashioning, and hunting. His kindness, erudition, and interest in everything new, his ability to rapidly arrive at a required answer through a 'back of the envelope' estimate attracted people. They would ask to talk to him about the most varied problems and always received his understanding, kind criticism, and useful advice or would be pointed to a very unexpected analogy.

Anyone who had the fortune of knowing this wonderful man, his friends, colleagues, disciples, relatives, and immediate family, will always remember him with gratitude.

A A Abrikosov, E P Velikhov, N S Kardashev,
V I Kogan, Yu S Lazurkin, N F Myasoedov,
V D Pis'mennyi, L P Pitaevskii, N N Ponomarev-Stepnoi,
D D Ryutov, R Z Sagdeev, V P Smirnov