 © 2016 Uspekhi Fizicheskikh Nauk, Russian Academy of Sciences

PERSONALIA

PACS number: **01.60. + q**

Vladimir Evgen'evich Fortov (on his 70th birthday)

DOI: 10.3367/UFNe.0186.201601h.0109

Academician Vladimir Evgen'evich Fortov — an outstanding scientist and President of the Russian Academy of Sciences — turned 70 on January 23, 2016. V E Fortov has made a major contribution to the physics of extreme states of matter and high energy densities, nonideal plasmas, shock and detonation waves, thermophysics, chemical physics, space research, and energetics, as well as several other realms of physics and technology.

V E Fortov was born into the family of air force engineer-lieutenant colonel Evgenii Viktorovich and history school-teacher Galina Ivanovna in the town of Noginsk, Moscow Region. Vladimir's childhood and school years were spent near a military airfield, which could not help having an influence on the course of his life. Upon graduation from school in 1962, he entered the Aerophysics and Space Research Department of the Moscow Institute of Physics and Technology (MIPT), where he engaged in research under the supervision of V M Ievlev, a corresponding member of the USSR Academy of Sciences, even in his second year at MIPT. In 1968, V E Fortov graduated from the institute with distinction in Thermodynamics and Aerodynamics and became a post-graduate student of MIPT. He defended his thesis, entitled "Thermophysics of Nuclear Rocket Engines," in 1971, ahead of schedule.

A fortuitous meeting (or maybe the decree of destiny?) with academician Ya B Zel'dovich suddenly changed the life of the young scientist. Yakov Borisovich witnessed V E Fortov's report to a scientific conference and recommended him to Nobel Laureate N N Semenov, and, instead of going to the Far East, where he had been placed in a job, Vladimir Fortov started working in the Chernogolovka Branch of the Institute of Chemical Physics of the USSR Academy of Sciences. And so, with Ya B Zel'dovich's magic touch, Vladimir Evgen'evich engaged in research in the area of nonideal plasma physics and the thermophysical properties of extreme states of matter beginning in 1971. The results of this research formed the basis for his doctoral thesis, "Nonideal plasma investigations using dynamic methods," which he defended in 1976, only five years after the commencement of his research. This subject area has been the focus of Fortov's attention until the present time: his monograph, *Extreme States of Matter on Earth and in the Cosmos* (Berlin: Springer, 2011), was published in "The Frontiers Collection" book series to become a resource book for researchers in this area. Just the other day, his book *Extreme States of Matter*: *High Energy Density Physics* came out (Berlin: Springer, 2016).

In parallel with plasma research, V E Fortov is deeply involved in studies of the mechanics of deformation and damage to materials exposed to high pressures, temperatures, and high deformation rates. Beginning in the 1980s, he supervised experimental and theoretical research into the mechanical properties of materials, damaging elements, barriers, and structures of special hardware.

Vladimir Evgen'evich Fortov

The expertise acquired in the course of studies of a high-velocity impact was in demand in the early 1980s, when a team of scientists headed by academician R Z Sagdeev started implementing the Vega International Space Program aimed at studying Halley's comet. The protection of the Vega spacecraft from meteorites and the system of dust impact analyzers fulfilled their task, and the computer codes employed in this case were later adapted for studying the problem of asteroid hazards. In particular, early in 1994, a group supervised by Fortov made a detailed prediction of the possible observable effects of an extraordinary space event — the collision of Shoemaker–Levy comet with Jupiter in July 1994. The data of subsequent observations carried out by many laboratories in the world confirmed the high accuracy of these predictions. Similar work was performed in 2005 in connection with the Deep Impact Project — a space experiment in which pioneering observations were made of a high-velocity collision of a metal striker with the nucleus of the 9P/Tempel comet.

The successful solution to many scientific problems was facilitated by V E Fortov's active cooperation with the General Physics Institute (GPI) and the Institute for High

Uspekhi Fizicheskikh Nauk **186** (1) 109 – 110 (2016)
DOI: 10.3367/UFNr.0186.201601h.0109
Translated by M V Tsaplina

Temperatures (IHT) of the USSR Academy of Sciences, which were then headed by academicians Aleksandr Mikhailovich Prokhorov and Aleksandr Efimovich Sheindlin. Experiments in the pulsed laser irradiation of targets, which were performed at GPI, permitted verifying computational and physical models at megabar pressures typical for hypersonic collisions with high-velocity meteorites. To this end, railotron electrodynamic accelerators and explosion generators of high-power shock waves were made at IHT.

On V E Fortov's initiative, research in the area of high-temperature thermophysics was launched at IHT beginning in 1986. Large experimental facilities were constructed for producing high pulsed pressures and temperatures; the 13Ya3 spherical explosion chamber was built — the world's largest and a unique technical structure. High-power shock-wave generators and experimental techniques of studying the physical properties of matter under extreme conditions elaborated with the use of explosions, as well as laser, relativistic electron, and ion beams, permitted constructing wide-range semiempirical equations of state for a large number of chemical elements and structural materials employed in the design of new technical equipment. This suite of investigations is being successfully continued in the Joint Institute for High Temperatures (JIHT) of the Russian Academy of Sciences, which has been headed by Fortov since 2007.

V E Fortov proposed several applications of electron and ion beams and of soft X-ray radiation for the solution of special problems. A facility was constructed in the Department of the Institute of Chemical Physics, where explosion magnetic generators were employed to produce the first multimegawatt microwave radiation pulses in 1987. In cooperation with the St. Petersburg school of Nobel Laureate academician Zh I Alferov and the school of academician G A Mesyats, gigawatt sources of harmonic centimeter radiation were made, new data were obtained concerning the resistance of electronics to high-power electromagnetic radiation, and extensive work was carried out in special-purpose research areas, including those related to the development of next-generation rocket and defense technologies and antiterrorist equipment.

In recognition of V E Fortov's work in the area of thermophysics and thermomechanics of extremely high pressures and temperatures, he was elected a corresponding member of the USSR Academy of Sciences in 1987 and a full member of the Russian Academy of Sciences (RAS) in 1991.

Another impressive line of V E Fortov's research is highly nonideal dust plasma. He supervised a series of pioneering experimental investigations into the structural and dynamic properties of plasma-dust crystals and liquids over a broad temperature and pressure range. For the first time, plasma crystals and liquids were obtained in a glow discharge, thermal plasmas, UV-radiation plasma, radioactive and cryogenic plasmas; experiments in plasma and crystallization under microgravity conditions were made aboard the Mir space station and the International Space Station (ISS).

Not only does Vladimir Evgen'evich investigate extreme states in scientific laboratories, but he also takes an active part in extreme expeditions. Specifically, in May 2005, V E Fortov participated in a cruise aboard the Volk atomic submarine; in 2007, he participated in the High-Latitude Arctic Deep-Sea Expedition to the North Pole; in 2008 (in the framework of the International Polar Year Program), he took part in the International Antarctic Expedition to the South Pole and the Pole of Relative Inaccessibility; in 2010, he descended to the depths of Lake Baikal and Lake Leman (Switzerland); and in 2014, he visited the Vostok Polar Station in the Antarctic. Fortov is a prize winner of the USSR championship in yachting, rounding Cape Horn and the Cape of Good Hope on a yacht and crossing the Atlantic Ocean on a sailing yacht. He is keen on alpine skiing, tennis, piloting, and extreme traveling.

Vladimir Evgen'evich's scientific and life experience related to extreme situations is in demand when it is required to study the causes and consequences of anthropogenic catastrophes, whose bitter lessons are vitally important to analyze carefully to rule out such socks in the future. In 1988, Fortov visited the Chernobyl nuclear power plant as a member of a workgroup of the USSR Academy of Sciences formed for estimating the impact of the accident. In 2009, he was a member of the committee appointed to investigate the disaster at the Sayano-Shushenskaya hydropower plant.

Vladimir Evgen'evich has been doing scientific-organizational work and has been engaged in public activity for many years. V E Fortov's promotion to senior academic and public positions fell on the hard years for Russian science, which followed the disintegration of the USSR. V E Fortov has been and is doing his best to stop negative processes. In 1993, he was appointed the First Chair of the Russian Foundation for Basic Research to organize its formation and operation as the first independent nondepartmental science institution in our country. While in this office, he increased its financing threefold. The first Russian system for the independent appraisal of scientific projects and grant allocation was worked out at the foundation, and a scientific telecommunication network connected to foreign scientific centers was put into operation. These steps were quite timely and necessary for Russian science.

From 1996 through 1998, Fortov was Deputy Chair of the Russian Government, Chair of the State Committee on Science and Technology, and Minister of Science and Technology of the Russian Federation (RF). Adopted during this period were the Law on Science and Scientific-Technical Policy of the RF, the Strategy of Science and Technology Development of the RF, and several other state documents aimed at protecting and maintaining the scientific-technical network of the country. The key points of these documents (a 4% budget allocation for science, the legal status of the Academy of Sciences, the property of scientific institutions, the land tax, equipment, support for state science centers, etc.) played a stabilizing role for domestic science. During V E Fortov's work in the government, the financing of science was increased by a factor of 1.8 and the financing of the RAS 2.2-fold, the fraction of the RAS in the science budget of the country increasing from 17% to 23% (for an average oil barrel price of \$14 at that time). Together with academicians A V Gaponov-Grekhov, V E Zakharov, and V P Skulachev, Fortov proposed and implemented the Program for the Support of Prominent Scientists and Leading Scientific Schools in Russia. Many thousands of scientists in the country received material support, international scientific and technical cooperation broadened, and the exchange of scientific instruments and equipment was simplified by abolishing taxes and customs duties.

From 2001 through 2013, academician Fortov was academician-secretary of the Division of Energetics, Machine Building, Mechanics, and Control Processes of the RAS. As commissioned by the leaders of the country, the

division analyzed the energy accident in Moscow in May 2005, revealed its causes, and issued recommendations to amend the energy situation in the Moscow region and other regions in the RF. With the active participation of the RAS, the Energy Strategy of Russia was developed and adopted, as was a large-scale agreement on scientific and technical cooperation in the area of traditional and next-generation energetics of the country. A major Rosatom–RAS agreement on scientific and technical cooperation in a broad range of basic and applied research areas was prepared and signed for the purpose of rapid development of nuclear power engineering. An interdepartmental Minatom–RAS council was established and is successfully functioning.

From 1986 through 2001, V E Fortov was vice-president of the RAS. Developed on his initiative at that time were powerful domestic supercomputers with a massively parallel architecture, as well as networks of cluster high-performance computer systems. Several mathematical simulation centers were set up, and a Russian-Indian supercomputer center was organized.

In May 2013, on the eve of the beginning of a very hard period for the scientific community, Vladimir Evgen'evich Fortov won election to become president of the Russian Academy of Sciences. In this position, he has to solve the difficult tasks of maintaining and strengthening Russian science in the course of radical and painful transformations, and strive to raise the authority and role of the RAS in the new conditions. His numerous articles and appearances in the mass media and his adherence to the position of principle testify to his deep responsibility and steadfast drive for leading the ship of the academy and the entire scientific community through all storms and the shoals of the contemporary dramatic period in the history of Russian science.

V E Fortov devotes considerable attention to work at the Department of the Physics of High-Temperature Processes of his native MIPT. He has been supervisor of 13 doctoral and more than 40 candidate's theses, and 5 of his pupils have been elected members of the RAS. In 2010, the pedagogic merits of Fortov and his colleagues were awarded with an RF Government Prize in the field of education.

V E Fortov has personally, and jointly with his colleagues, published about 30 monographs and over 800 original papers in the leading foreign and domestic journals. The lately fashionable Fortov's Hirsch index is 50.

V E Fortov is deputy chair of the Council on Science and Education under the RF President, chair of several onterdepartmental coordination councils and scientific councils of the RAS, a member of the Research Advisory Board under the UN General Secretary and several other domestic and foreign councils and committees. Fortov is editor-in-chief of five Russian journals and a member of the editorial boards of several foreign and domestic publications.

In recognition of his scientific and organizational activities, V E Fortov has been awarded many domestic and international prizes. He is a laureate of A P Karpinskii (1997), P Bridgman (1999), M Planck (2002), H Alfven (2003), G Duvall (2005), and Glass (2009) International Awards. He was decorated with the UNESCO Albert Einstein International Gold Medal in Physics (2005), N N Semenov Gold Medal (2008), Andrei Pervozvannyi International Prize (2010), I V Kurchatov Gold Medal (2011), R I Soloukhin Zolotye Ruki International Prize for outstanding achievements in the area of gas dynamics (2012), and Global Energy Prize (2013), and has been elected a member of many foreign and international academies and universities.

V E Fortov has been decorated with the Orders for Services to the Fatherland of 4th (1996), 3rd (1999) and 2nd (2016) degree, the Orders of Labor Red Banner (1986) and Honor (2007), the German Federal Cross of Merit of 1st degree (2006), the French Legion of Honor (2006), the Orders of Honorary Russian Citizen (2010), Friendship (2011), and Engineering Glory (2011), the Order of Aleksandr Nevskii (2014), and many medals. Fortov is Laureate of the State Prizes of the USSR (1988), RF (1997) and RF Government Prizes (1997, 1999, 2002, 2010), as well as international United Kingdom Queen Victoria (2011) and Socrates (2012) Awards. He has been awarded a UNESCO Medal for his contributions to the development of nanoscience and nanotechnologies (2015).

We toast Vladimir Evgen'evich on his 70th birthday and wish him good health, happiness, inexhaustible vital energy, and optimism, as well as good luck and new achievements for the benefit of science!

A F Andreev, A V Gaponov-Grekhov, S S Gershtein,
V E Zakharov, L M Zelenyi, G A Mesyats, Yu M Mikhailov,
V A Rubakov, O V Rudenko, V A Sadovnichii,
I M Khalatnikov, A E Sheindlin, I A Shcherbakov