

In memory of Anatoly Alekseevich Logunov

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The outstanding theoretical physicist and organizer of large-scale studies in high-energy physics in this country, Anatoly Alekseevich Logunov, passed away on 1 March 2015. A Full Member of the USSR Academy of Sciences since 1972, Anatoly Alekseevich was Vice President of the USSR Academy of Sciences from 1974 to 1991, Rector of Moscow State University (1977–1992), and Director (1963–1974 and 1993–2003) and Research Supervisor (1974–2012) of the Institute for High Energy Physics (Protvino).

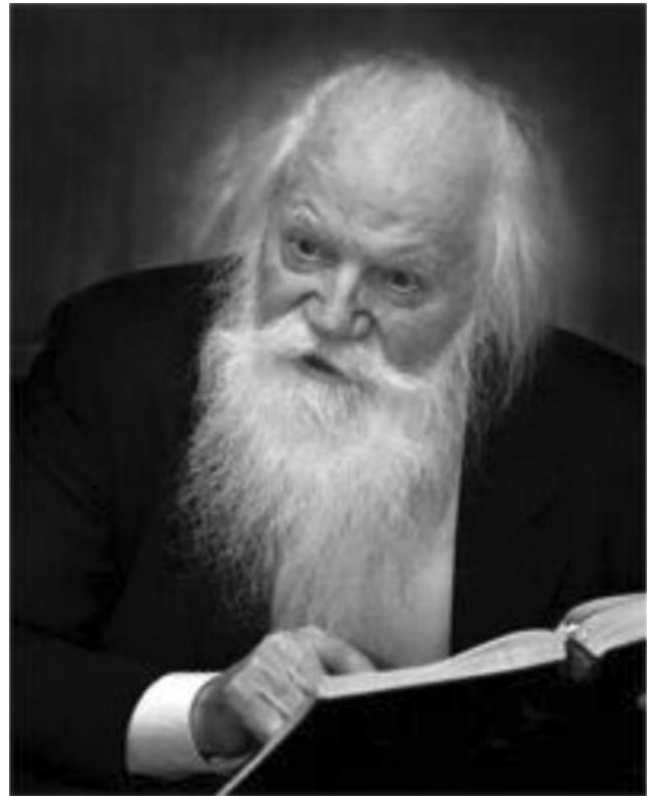
A A Logunov was born on 30 December 1926 in the village of Obsharovka, Kuibyshev region. After finishing secondary school with honors, he entered Kuibyshev Aviation Institute, from which he later moved to the Moscow Aviation Institute. However, he then finally concentrated on physics and, having passed the exams at the University for three years as an external student, he continued studying at the Faculty of Physics of the Moscow State University. On graduation, he was offered a postgraduate studentship and in two years, in 1953, defended his Candidate of Sciences thesis devoted to particle acceleration in interstellar magnetic fields. Soon after that, A A Logunov joined the team of young theoretical physicists working under the guidance of N N Bogoliubov on topical problems of renormalization theory and dispersion relations in quantum field theory.

In 1956, he managed to generalize the renormalization group equations to gauge theories (QED) through the introduction of a ‘running’ gauge parameter. Three years later, he (together with N N Bogoliubov and D V Shirkov) showed that a successive account of the causality principle allows elimination of the ‘ghost’ pole from the effective QED coupling constant.

In 1956, A A Logunov was invited to work at JINR (Dubna) as deputy director of the Laboratory of Theoretical Physics (LTP), then headed by N N Bogoliubov. Anatoly Alekseevich took an active part in the formation of a team of researchers at the laboratory. He managed to draw young talented researchers (many of whom later became well-known scientists) to the work at LTP.

In the early 1960s, A A Logunov proved the dispersion relations for a number of important processes on the basis of the Feynman diagram ‘majorization’ technique, which he improved.

In 1963, he (together with A N Tavkhelidze) formulated a covariant generalization of the interaction potential on the basis of the ‘quasipotential equation’ which allowed keeping the probabilistic interpretation of the wave function in the relativistic context. As a further development of the method of dispersion relations, A A Logunov (together with L D Solovijev and A N Tavkhelidze) derived in 1967 the



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famous ‘finite-energy sum rules’ that coupled the resonance region in hadron scattering to the high-energy region in terms of the Regge trajectories. This result served as a basis for the ensuing development of the idea of ‘duality’. The sum-rule method further on found fruitful realization in quantum chromodynamics.

The increasing role of multiple particle generation in high-energy collisions fostered A A Logunov to seek a new approach to the study of multiparticle processes. In 1967, he introduced a new class of scattering cross sections (later called inclusive), allowing us to understand generic properties of multiple particle production, and obtained some general constraints on their high-energy behavior.

Two years later, the experimental study of inclusive processes at the Serpukhov accelerator led to the discovery of the phenomenon of ‘scale invariance’ in the hadron production.

At the age of 36, A A Logunov was appointed Director of the newly founded Institute for High Energy Physics in Protvino near Serpukhov, where an accelerator to an energy of 70 GeV was being built. The team of scientists, engineers, and workers organized by A A Logunov managed to take up in a very short time the grand scientific and technical

challenge of constructing and successfully launching the proton accelerator, the largest in the world at that time (1967–1972). A A Logunov made a great personal contribution to the design and creation of the world-scale research facility with the U-70 proton accelerator.

A A Logunov set himself the task of making the Institute organized by him a true national scientific center. To work out the program of research at the accelerator, the Scientific Coordination Council was established in which outstanding scientists from different institutes of the country took part.

A A Logunov played a decisive role in the organization and development of large-scale international scientific and technical collaboration in research at the U-70 accelerator which further on became the basis of collaboration of institutes from our country and scientific centers in Europe (CERN, Switzerland, and Saclay, France) and the USA (Fermi National Accelerator Laboratory, Batavia, IL). His personal deep conviction in the international nature of fundamental science helped him to overcome the opposition and get the necessary support from the government and scientific community.

The state program in high-energy physics was worked out under the guidance of A A Logunov in the 1980s. The approved program consolidated the efforts of the Ministry of Medium-Machine Building, the USSR Academy of Sciences, and the Ministry of Higher Education in developing and implementing in our country several large world-scale scientific projects.

A A Logunov founded leading scientific schools in the area of quantum field theory and gravitation theory. Remarkable teams engaged in experimental physics, as well as accelerator physics and technology, appeared in our country in 1970–1980 with his active participation in carrying out programs of research and development of the U-70 accelerating complex.

In 1977, A A Logunov became Rector of Moscow State University. In the 15 years of his work as rector, studies in different fields of science were further advanced. Tutorage of young scientists was enhanced, the international relations of MSU were extended, and cooperative scientific research with foreign universities was fostered. Two new faculties appeared. The scientific-research, computational, and instrumental facilities of the university germinated. For over 45 years, Logunov headed the Department of High Energy Physics, which he founded at the Faculty of Physics. In the late 1980s, Rector A A Logunov got authorization from the government to enlarge the MSU area and build a modern library. On his initiative, MSU acquired the status of a self-governed State Higher Educational Institution of Russia.

In the 1970s, Anatoly Alekseevich turned to the problems of gravitation. His goal was to formulate a theory of gravitation in which the energy, momentum, and angular momentum conservation laws would be strictly obeyed. In Logunov's theory of gravitation (relativistic gravitation theory, RGT), the source of gravitational fields is the total energy–momentum tensor conserved in Minkowski space, and the gravitational field is a gauge field which, in combination with the metric tensor of Minkowski space, makes up the metric tensor of Riemannian space. Thus, material bodies move as if they were in an 'effective' Riemannian space. Along with the Hilbert–Einstein equations, four additional equations emerge in RGT that couple the Riemannian space and Minkowski space. On the basis of

these equations, Logunov predicted as far back as 1984 that the space geometry of the Friedmann universe is flat and, therefore, a large 'dark' mass must exist.

Having studied thoroughly the work of Albert Einstein and David Hilbert, A A Logunov came to the conclusion that in the well-known General Relativity solutions, where the matter goes under the Schwarzschild radius, the causality principle is violated. At the same time, A A Logunov understood that there is the problem of cessation of contraction of a massive star which has exhausted its nuclear fuel to the gravitational radius. He showed that according to RGT the internal star energy must rise unrestrictedly as the star surface approaches the Schwarzschild surface, which may lead to an explosion and prevent, as he hoped, the occurrence of a 'black hole'. Anatoly Alekseevich thought of his studies in the field of gravitation as his lifework and was engaged in these problems to his last days.

A A Logunov led an active state and public life. His creative and scientific–organizational activities were highly evaluated by state authorities. A A Logunov received the highest Soviet and Russian awards for his outstanding contribution to the development of national science. He was awarded the title of Hero of Socialist Labor and received the Lenin Prize (1970) and the State Prizes of the USSR in the field of science and technology (1973, 1984), the J W Gibbs (1992) and N N Bogoliubov (1996) Prizes, and the first-degree Lomonosov Prize (2001). He was honored with titles by many foreign universities, and was elected a foreign member of several foreign academies.

Colleagues and generations of researchers will always remember the remarkable scientist, teacher, and supervisor — Anatoly Alekseevich Logunov.

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