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## Anatolii Alekseevich Logunov (on his eightieth birthday)

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December 30, 2006 marked the 80th birthday of the outstanding Russian scientist, science and higher education administrator, Full Member of the Russian Academy of Sciences (RAS) — Anatolii Alekseevich Logunov.

The many facets of Logunov's activities as a scientist are inseparable from the progress in the new area of fundamental research that has been growing steadily since the beginning of the 1950s — elementary particle physics and high energy physics, and, in recent decades, in the unfolding of new concepts of spacetime and gravitation.

His first papers were devoted to the study of diffusion and acceleration of cosmic rays in the magnetized intergalactic medium.

Logunov's subsequent research work was profoundly affected by close scientific relations and cooperation with Academician N N Bogoliubov.

In 1956, Logunov generalized the renormalization group equations of quantum electrodynamics to the case of the arbitrary gauge of electromagnetic field potentials. These results, together with fundamental publications by Bogoliubov and D V Shirkov, comprehensively solved the problem of consistent formulation of the renorm-invariance methods and their application to quantum field theory.

Continuing the work began by Bogoliubov with an elaboration of the dispersion relations technique, Logunov successfully developed and applied this approach to describing various processes of interaction between elementary particles, for example, to deriving dispersion relations for photoproduction processes of  $\pi$ -mesons on nucleons. Using the dispersion relations and the unitarity condition, he was able to obtain the sets of equations that formed the basis for constructing the theory of processes of hadron photoproduction in the range of low and medium energies and for studying inelastic processes with virtual legs and processes of multiple particle production.

Using the majorization technique developed for the purpose, Logunov was able to derive the dispersion relations for partial amplitudes of nucleon – nucleon scattering in any order of the perturbation theory.

He generalized the well-known Pomeranchuk theorem to cases where the total cross sections and the effective interaction radius increase with increasing energy.

A consistent analysis of the scattering amplitude in terms of the axiomatic method as the boundary value of an analytical function of two complex variables (energy and momentum transfer) led him to the important conclusion that the effective interaction radius of any inelastic process does not exceed the interaction radius of the corresponding elastic process.

In 1967, Logunov proposed a drastically new approach to studying processes of inelastic interaction between highenergy particles based on the concept of the so-called



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inclusive measurement or inclusive reaction, where the characteristics of only one or a few probe particles of a given sort are detected but with account of all possible reaction channels.

The series of theoretical papers by Logunov and his pupils devoted to studying inclusive processes in the strong interaction between particles and experimental investigation of these processes at the Serpukhov accelerator that resulted in the discovery of the properties of scale invariance were added to the USSR State Register of Discoveries.

Continuing to expand the method of dispersion relations, Logunov, together with L D Solov'ev and A N Tavkhelidze, obtained the sum rules at final energies; these were later used as a basis for developing the duality concept. The ideas behind the sum rules also found fruitful applications in quantum chromodynamics.

The quasipotential Logunov–Tavkhelidze equation — a relativistic analog of the Schrödinger equation — became an important contribution to the modern quantum field theory.

In recent years, Logunov has advanced new concepts of spacetime and developed on their basis a relativistic theory of gravitation (RTG).

When constructing his RTG Logunov developed, on the basis of the relativity principle, the concept of the gravitational field as a physical field possessing energy–momentum density and spins 2 and 0.

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The source of the gravitational field in the RTG is the energy-momentum density tensor of all matter fields, including the gravitational field itself.

The relativistic theory of gravitation constructed by Logunov provides explanations for all known gravitational effects with respect to the inertial frame of reference, observable in the solar system. According to the RTG, the uniform and isotropic Universe evolves cyclically from a certain maximum density to the minimal value, and so forth. The RTG predicts that matter with large hidden mass must exist in the Universe. By virtue of the nonzero mass of the graviton, the time dilation stops — the gravitational field demonstrates the RTG-specific property of 'self-restriction', which in the case of strong fields manifests itself as a kind of 'antigravitation'.

Logunov is known worldwide not only as research physicist of high standing but also as an outstanding science administrator. Already when working at the Joint Institute for Nuclear Research (JINR) at Dubna, he and Bogoliubov devoted much time and effort to setting up the Laboratory of Theoretical Physics, which has become one of the leading research teams in world science.

The internationally known research center, the Institute for High Energy Physics (IHEP) at Protvino, was created under his guidance. The launching at IHEP in 1967 of the most powerful accelerator at the time and the successful realization of the research program involving broad international cooperation enriched world science with a number of discoveries of fundamental importance.

In 1970, Logunov received the Lenin Prize for the development and launching of the 70-GeV IHEP proton synchrotron.

Logunov worked tirelessly for creating broad international scientific and technological cooperation in high energy physics in our country.

From 1974 to 1991 Logunov managed a huge research and administration program as Vice-President of the USSR Academy of Sciences. When occupying the position of Rector of the M V Lomonosov Moscow State University (MSU) from 1977 to 1992 he also achieved very much in modernizing and improving the system of training of young scientists, in strengthening research at universities and educational institutes, in popularizing physics, and in raising the profile of physics.

Books and monographs written by Logunov were translated into many languages and enjoy a high reputation among specialists. He is Editor-in-Chief of the journal *Theoretical and Mathematical Physics*.

Logunov has created a large team from his former pupils at the JINR, IHEP, and MSU; it is now widely known through its work in high energy physics, field theory, and the theory of gravitation.

Logunov's research, science management, and teaching activities are widely recognized both here and abroad. He is a Full Member of the Russian Academy of Sciences and a member of a number of academies in other countries, holding an honorary doctorate at many universities around the world. His work was rewarded with the Lenin and State Prizes. He has received a large number of Russian and international orders and medals.

In his capacity as Science Director of the RF State Research Center 'Institute for High Energy Physics' (Protvino), Logunov is actively engaged in various aspects of high energy physics and continues to pursue his intense personal research work.

We hope Anatolii Alekseevich maintains his amazing level of energy and keeps working for many more years for the good of our science and country.

V S Vladimirov, S S Gershtein, V G Kadyshevskii, V A Matveev, V A Petrov, A N Tavkhelidze, N E Tyurin, D V Shirkov