Physics – Uspekhi **59** (12) 1268 – 1270 (2016)

PERSONALIA PACS number: **01.60. + q**

Mikhail Vladimirovich Danilov (on his 70th birthday)

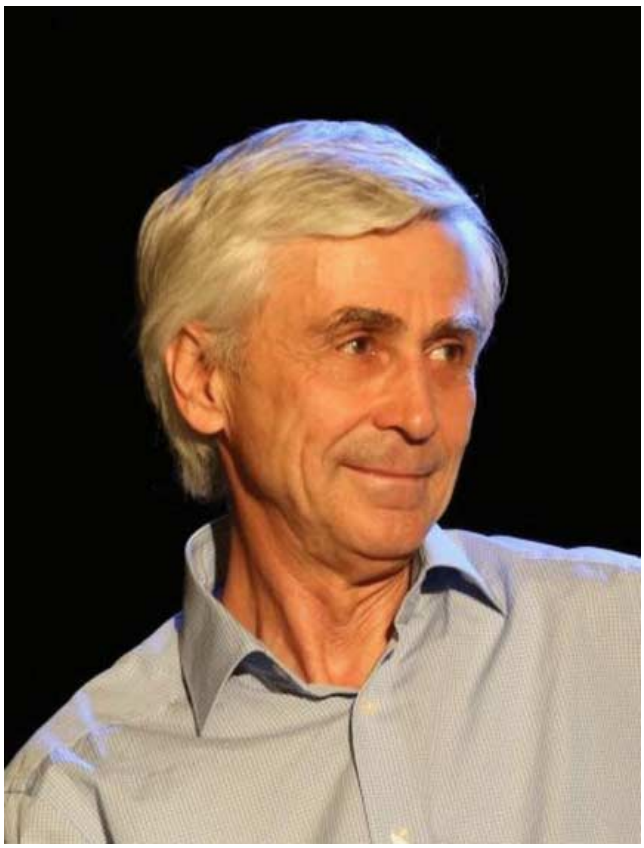
DOI: https://doi.org/10.3367/UFNe.2016.11.037990

Mikhail Vladimirovich Danilov, the eminent Russian physicist of international fame, celebrates his 70th birthday on November 5, 2016. He is a Full Member of the Russian Academy of Sciences (RAS), Chief Researcher of the Lebedev Physical Institute of RAS (FIAN), and a Member of the Bureau of the Physical Sciences Division of RAS.

Mikhail Vladimirovich was born in the small town of Institut Puti near Moscow (now a region of Moscow) into a family of railway workers. His father, Doctor of Sciences and Professor Vladimir Nikolaevich Danilov, was Head of a Chair at the Moscow Institute of Transport Engineers (MIIT). In 1964, M V Danilov entered the Faculty of Physics at Lomonosov Moscow State University (MSU), and already as a senior student devoted himself to scientific activity at the Joint Institute for Nuclear Research (JINR, Dubna). Here, under guidance of the Chair of Elementary Particle Physics headed by B M Pontecorvo, the talented student defended his graduate work dedicated to search for the decay $\mu \to e\gamma$. After that he began to work at the Institute of Theoretical and Experimental Physics (ITEP), where Mikhail Vladimirovich has progressed from a young specialist to a Director. The supervisor of his PhD thesis, defended in 1978, was V A Lyubimov, with whom M V Danilov developed wire gas detectors and analyzed the experimental data on the pion–proton scattering from the Serpukhov accelerator (Protvino). In 1990, M V Danilov became a Doctor of Sciences, in 1997 he was elected a Corresponding Member of RAS, and in October 2016 became a Full Member of RAS.

Mikhail Vladimirovich made a unique contribution to the development of modern science. He was an active initiator of international cooperation, realizing that only equitable participation in international scientific projects and competition with the world largest scientific centers can elevate the Russian physics to a qualitatively new level. The international experiment ARGUS (Research Center DESY, Germany), where Mikhail Vladimirovich headed for a long time a team of ITEP physicists and was a member of the committee that guided the work of the collaboration, became one of the most successful projects in the history of high-energy physics. Mikhail Vladimirovich took part in the elaboration of the project, in the data acquisition, and in the data analysis. In particular, he made a decisive contribution to the development and deployment of the central drift chamber — the primary ARGUS subsystem.

With the active participation of M V Danilov in this experiment an extensive series of studies of the properties of beauty and charmed hadrons and τ-leptons were performed, a search for new phenomena and particles was carried out. For the first time, the fundamental parameters of the Standard Model — the elements of the Cabibbo–Kobayashi–Maskawa matrix, $|V_{td}|$ and $|V_{ub}|$, were measured, while $|V_{cb}|$ was extracted with the minimal model dependence. The discovery of a large mixing in the $B_d^0 - \bar{B}_d^0$-bar system led to the prediction of an unexpectedly large t-quark mass. A number of nonleptonic decays of heavy hadrons were found, clarifying the influence of the strong interaction on weak decays. The world best constraints on the τ-neutrinos mass and numerous decays of τ-lepton with lepton or lepton-flavor violation were obtained. The parity violation in the decays of τ-lepton was observed and the Michel parameter was measured with the best accuracy, which confirmed the lepton universality and fully excluded the V, A or $V + A$ weak current structures of τ-decays. The best limits were imposed, within the attainable range of masses and lifetimes, on the probability of the production of the Higgs boson, gluino, axion and other new particles. The hadronization processes for quarks and gluons were also studied, and a high baryon yield in B-decays was found. A number of charmed hadrons were observed for the first time.



Mikhail Vladimirovich Danilov

The results obtained by ARGUS formed the basis for the modern theory of elementary particles and to the emergence of new scientific directions. The most impressive one was the study of CP violation in the decays of beauty mesons for

Uspekhi Fizicheskikh Nauk **186** (12) 1379 – 1380 (2016)
DOI: https://doi.org/10.3367/UFNr.2016.11.037990
Translated by M V Tsaplina

which two specialized detectors Belle and BaBar were built at the asymmetric electron–positron colliders KEKB (Japan) and SLAC (USA), and later in the LHCb experiment at the Large Hadron Collider at CERN (Switzerland). Accumulating knowledge and ideas born at ARGUS experiment, B-factories made a giant step in understanding the mechanism of *CP* violation in the Standard Model. The Nobel Prize in Physics 2008 awarded to M Kobayashi and T Maskawa for the theory confirmed experimentally by BaBar and Belle was an evidence of the correct choice of the research direction.

Along with the precision measurement of the parameters of *CP* violation in the Belle experiment, Mikhail Vladimirovich and his students made a number of outstanding discoveries: a variety of rare decays of charmed and beauty hadrons were measured, numerous exotic states of charmonium and bottomonium were found, which paved the way to the new era in the quarkonium theory and caused a revision of the Standard Quark Model.

The success of the Belle experiment motivated the scientific community to take a decision on upgrading the accelerator KEKB and development of the new experiment Belle-II, which will produce a 50-fold increase in statistics, and will allow to obtain precise data on the processes of production and decay of heavy quarks and leptons. In recent years, a team of physicists, including Mikhail Vladimirovich and his disciples, has designed, created, and installed in the Belle-II detector a unique subsystem for the registration of long-lived kaons and muons on the basis of original silicon photodetectors invented and developed in Russia.

With his broad scientific vision, Mikhail Vladimirovich initiated the participation of ITEP in the H1 experiment on the electron–proton HERA accelerator (DESY, Germany) and made a great contribution to the creation of a liquid-argon calorimeter. The H1 experiment revealed a number of interesting results. In particular, the proton structure function measured at the HERA accelerator to the highest precision proved to be exclusively important not only for understanding the fundamental properties of matter but also for designing further experiments at proton colliders, e.g., at the LHC at CERN. In another project under the general guidance of M V Danilov, ITEP physicists created important subsystems of the HERA-B detector used to study the mechanisms of charmonium and beauty quark production.

The experimental techniques occupy a special place in the sphere of interests and activity of Mikhail Vladimirovich. In particular, he worked on the development of wire gas detectors and the design of a quartz Cherenkov calorimeter. M V Danilov initiated the development of a new type of hadron calorimeter with a high granularity and read out using silicon photodetectors allowing application of the recently elaborated 'Particle flow' method for a considerable improvement in the energy resolution of hadron jets. Such calorimeters will be employed in next-generation experiments.

Mikhail Vladimirovich closely and successfully cooperates with theorists. The results of this interaction have been new experimental studies and observations, as well as the development of new theoretical approaches. For example, his 1980 discussion with theorists led to the first DASP (DESY) observation of the now well-known hadron transition in bottomonium: $\Upsilon(2S) \to \Upsilon(1S)\,\pi^+\pi^-$. The discussion of the preliminary results of the measurement of exclusive semileptonic B-meson decays in the ARGUS experiment at the beginning of 1987 stimulated the development of the new theoretical area now known as the Heavy Quark Effective Theory. And the joint consideration of plans for an experiment on the search for the light Higgs boson resulted in a notable revision of the theoretical estimates of probabilities of different decays of such a boson. At the same time, sensible scientific skepticism has never left Mikhail Vladimirovich in his communications with physical theorists. In the mid-1980s, relying on the data of the UA1 experiment (CERN), most physicists believed that the t-quark mass does not exceed 50 GeV, which implied that observation of neutral B_d^0 meson oscillations was inaccessible for the experiments of that time. Contrary to this reigning notion, M V Danilov actively initiated a search for oscillations of beauty mesons, and in 1987 the ARGUS experiment has discovered this fundamental process. The measured rate of oscillations was the first indication that the mass of t-quark is much higher than 50 GeV, and in 1994 the t-quark with mass of ~ 175 GeV was observed at Tevatron.

The many-year scientific and organizational activity of Mikhail Vladimirovich Danilov is a brilliant example of creativity and service to science. His active civil position allowed him to make a weighty contribution to the maintenance and development of Russian science. M V Danilov founded and goes on actively developing one of the most efficient scientific schools in the field of elementary particle physics. He is a Professor and Head of Chairs in the Moscow Institute of Physics and Technology (MIPT) and in the National Research Nuclear University 'Moscow Engineering Physics Institute' (NRNU MEPhI). Dozens of candidate theses have been defended under his guidance. His disciples, with Doctors of Sciences, Professors, and Corresponding Members of RAS among them, are now leaders of international projects and have their own scientific schools.

Mikhail Vladimirovich is much dedicated to outreach activity, including science education and popularization. His captivating lectures reveal the beauty of the fundamental knowledge and greatly motivate younger generations to physics studies. The annual Moscow International Winter School of Physics headed by M V Danilov has been attracting both Russian and foreign students and young scientists for several decades now.

Mikhail Vladimirovich's sphere of interests now includes experiments in the field of high-energy physics, neutrinos, cosmic rays, and the search for dark matter. Together with his colleagues, he is carrying out a unique experiment, DANSS, at the Kalinin nuclear power plant (Russia), where the registration of the products of inverse beta decay process induced by antineutrinos on protons is used for monitoring the composition of the fuel in the reactor and also for a search for sterile neutrinos. With his participation, the collaboration CALICE is developing and building a fine-granularity hadronic calorimeter for the future International Linear Collider (ILC). The COMET experiment is aimed at the search for muon conversion to the electron with lepton number violation in the nucleus field. In the LHC experiment CMS (CERN), Mikhail Vladimirovich's group is seeking new particles and phenomena and is working intensely to modify the hadron calorimeter.

Mikhail Vladimirovich is the author of more than 600 scientific papers and is one of the most cited Russian scientists. Undoubted evidence of his achievements is the prestigious awards he has received, among which is the Max Planck Prize (Max Planck Society–A von Humboldt Foundation) and the A P Karpinsky Prize (A Tepfer–RAS Foundation).

Mikhail Vladimirovich Danilov has been elected as a member and as a chairman to numerous scientific Committees and Boards determining the scientific policy both in Russia and in the largest international research centers. These include the Bureau of the Physical Sciences Division of RAS, the CERN Scientific Policy Committee, SLAC Technical Committee, the Scientific Council of DESY, and the International Committee on Future Accelerators (ICFA). For many years he served as the Chair of the Dissertation Committee at ITEP and of one of scientific and technical committees of ROSATOM. He worked in the Program Committee of SSC and also, as a member of International Committee on the future linear electron–positron collider, he coordinated Russia's participation in detector projects for this machine.

Together with numerous colleagues, disciples and friends we heartily wish Mikhail Vladimirovich Danilov all the best on his 70th birthday and wish him many years of good health and of successful continuation of his multifaceted scientific and pedagogical activity for the benefit of science and Russia.

T A-Kh Aushev, A E Bondar, M B Voloshin,
M I Vysotsky, D I Kazakov, R V Mizuk,
V A Novikov, G V Pakhlova, P N Pakhlov,
V A Rubakov, V Yu Rusinov, T V Uglov