Physics – Uspekhi **60** (3) 327 – 329 (2017)

PERSONALIA

PACS number: **01.60.+q**

In memory of Spartak Timofeevich Belyaev

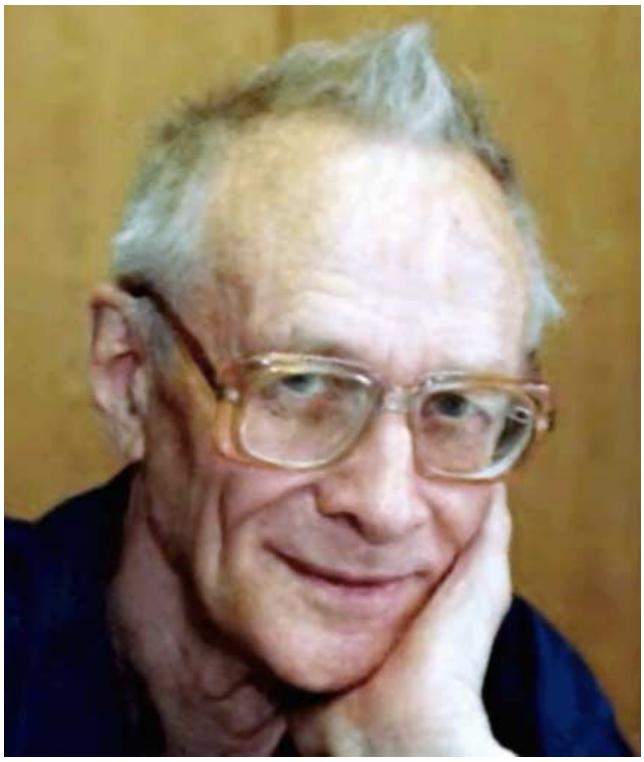
DOI: https://doi.org/10.3367/UFNe.2017.03.038084

The Chief Researcher at the National Research Centre 'Kurchatov Institute', Academician Spartak Timofeevich Belyaev, passed away on January 5, 2017 at the age of 93. Belyaev was an outstanding Russian theoretical physicist, world renowned scientist, pedagogue, and organizer of science. Modern physics is inconceivable without the fundamental results obtained by Belyaev in relativistic plasma kinetics, quantum many-body theory, and nuclear theory.

S T Belyaev was born on October 27, 1923 in Moscow. His father came from peasants of the Mogilev province of the Russian Empire and worked as a foreman at a Moscow factory, and his mother was a pediatrician at the I V Rusakov hospital. In June of 1941, Spartak Belyaev finished high school No. 315 in the city district Sokol'niki, and a week later the war began. Together with his classmates, he went to the military registration and enlistment office as a volunteer, but was refused, and then he found himself admitted to the Military Institute of Foreign Languages. He insisted on a leave and in August was sent to three-month courses for radio operators. From November of 1941 till the end of the WW2 he was in the war as an operator of the field intelligence radio complex, first as a sergeant and at the end of the war as a junior lieutenant. There is a photo of his signature on the Reichstag wall in Berlin.

Immediately after release in 1946, S T Belyaev entered the Faculty of Physics of Lomonosov Moscow State University (MSU). In 1947, he transferred to the newly founded Faculty of Physics and Technology of MSU and in five years found himself in the not numerous group of first graduating students from Moscow Fiztekh (Moscow Institute of Physics and Technology — MIPT) that had detached from MSU.

Still a student, Spartak Belyaev came to work at LIPAN (Laboratory of Measuring Instruments of the USSR Academy of Sciences), which is now the Kurchatov Institute. He worked there practically his whole life, but with a significant 16-year hiatus, which was very important for him. Namely, in 1962 he moved to the newly founded Novosibirsk Akademgorodok (academic town) at the invitation of G I Budker and continued his research in the Theoretical Division of the Institute of Nuclear Physics (INP) of Siberian Branch of the USSR Academy of Sciences. He headed this division after the departure of V M Galitskii. In 1965, he also became Rector and Head of the Department of Theoretical Physics of Novosibirsk State University (NSU). Having left these positions, he returned to Moscow to the Kurchatov Institute in 1978. Here, beginning in 1981, S T Belyaev was Head first of the Department and then of the Institute of General and Nuclear Physics (IGNP) as part of the Kurchatov Institute for 25 years. He also continued contacts with his *alma mater*:



Spartak Timofeevich Belyaev
(27.10.1923 – 05.01.2017)

from 1978 to 1991 he was Head of the Department of Theoretical Physics at MIPT, and in 1995 headed the newly founded educational institute at the Kurchatov Centre, which was later transformed into the Faculty of Nano-, Bio-, Information Technology and Cognitive Science of MIPT.

When S T Belyaev was a senior student, he was employed as a trainee at the legendary Theoretical Sector 10 of LIPAN and very soon accustomed himself to the atmosphere of intense creative research prevailing there. He was greatly impressed by such bright and talented persons as A B Migdal, who was Head of the Sector, B T Geilikman, and recent, like himself, front-line soldiers V M Galitskii, almost his peer, and G I Budker, who, being five years older than he, graduated from MSU before the war. Important was his contact with L D Landau, who delivered the course in quantum mechanics at Fiztekh. In the 1950s, S T Belyaev became a permanent participant at L D Landau's famous theoretical seminar and thought of himself as Landau's disciple. His acquaintance with L D Landau undoubtedly produced a considerable impression on his scientific and personal orientation.

His first series of work devoted to the kinetics of low-density ionized gas in strong external fields was accomplished in collaboration with G I Budker, the future organizer and the first Director of Novosibirsk INP, who in the early 1950s put forward the idea of constructing a new type of electron

Uspekhi Fizicheskikh Nauk **187** (3) 351 – 352 (2017)
DOI: https://doi.org/10.3367/UFNr.2017.03.038084
Translated by M V Tsaplina

accelerator. In one of these studies published in 1956 in the journal *Doklady AN SSSR* (*Proceedings of the USSR Academy of Sciences*), the relativistic kinetic equation was first derived; the result was included in the textbooks. For secrecy, the publications concerning these studies originally appeared as confidential reports. Part of them, carried out independently by S T Belyaev, laid the basis of his Candidate thesis, defended in 1955. It is only in 1958 that the whole series of his studies was published in collected papers *Plasma Physics and the Problem of Controlled Thermonuclear Reactions* published on the eve of the *Second Geneva Conference on the Peaceful Uses of Atomic Energy*.

Also in 1958, two of S T Belyaev's papers appeared in the *Journal of Experimental and Theoretical Physics* (*JETP*) and brought him world fame. These studies were devoted to the application of the methods of quantum field theory to Bose particle systems. In the first of them, the method of Green's functions for Bose systems was developed, while in the second applications of this method to a nonideal Bose gas were considered. At the same time, A B Migdal and V M Galitskii studied analogous approaches to Fermi particle systems. But the problem turned out to be much more complicated for Bose systems, because of the existence of Bose condensate. It is significant that these papers by S T Belyaev were translated for the English version of *ZhETF* (*JETP*) by F Dyson.

Almost simultaneously, a similar method was developed by L P Gor'kov for the description of superconductors. Much later, in 2004, Spartak Belyaev and Lev Gor'kov were awarded Eugene Feenberg medal for this work, which is given for an outstanding contribution to quantum many-body theory. We should mention a sad coincidence: Lev Petrovich Gor'kov passed away a week before Spartak Timofeevich.

S T Belyaev turned to the problems of nuclear physics during his year's work at the Institute of Theoretical Physics in Copenhagen, where he was sent in the autumn of 1957 after his private conversation with I V Kurchatov. Not long before this, Aage Bohr, Ben Mottelson and David Pines advanced the idea of the relation between the energy gap in the spectra of spherical nuclei and the formation of Cooper pairs of nucleons. S T Belyaev made use of the methods of the quantum theory of superconductivity to study the effect of nucleon pairing on the properties of atomic nuclei, and along with the energy gap he obtained a whole number of important results, including those explaining a decrease in the moments of inertia of deformed nuclei compared to the rigid body values. His paper "The effect of pair correlations on the properties of nuclei" that was published in 1959 in a separate issue of *Proceedings of Danish Royal Academy* played a great role in the development of nuclear physics; references to this paper can be found in any serious monograph on the nucleus theory. Having returned from Copenhagen, S T Belyaev generalized the results obtained using the methods of quantum field theory and on the basis of this work defended his Doctor of Sciences thesis in 1962.

Later, in Novosibirsk and in Moscow, alone and with co-authors, S T Belyaev conducted and published many other studies on a microscopic description of the properties of atomic nuclei and collective nuclear excitations, including rotations. In these papers, he considered the manifestations of anharmonism in nuclear oscillations, the relation between single-particle and collective degrees of freedom, nonstatistic phenomena in nuclear reactions, and other interesting effects. In 1964, S T Belyaev was elected a Corresponding Member, and in 1968 a Full Member of the USSR Academy of Sciences.

With time, the range of his interests widened. S T Belyaev thought like a theorist and was fairly skilled in mathematical description of phenomena, and at the same time he conceived of physics as an experimental science. This explained his attention to the experimental technique which became evident as far back as the 1950s at the Kurchatov Institute when he and E K Zavoisky with colleagues developed the method of creating a source of polarized nuclei for accelerators. The years of his work in Novosibirsk were marked by his active participation in discussions of the program of development of experimental facilities, which contributed greatly to the transformation of INP to a world-level research center.

A great achievement of S T Belyaev for Russian science was his participation in the realization of the State program on fundamental nuclear physics, which he headed in the late 1980s and early 1990s. This program, on the one hand, gave Russian physicists the opportunity to conduct research on unique facilities around the world and, on the other hand, made it possible to retain a number of high-tech plants of the military-industrial complex (MIC) that had stopped being sponsored and oriented them to the creation of large facilities for works abroad in the field of high-energy physics.

In those same years, as Director of IGNP as part of the Kurchatov Institute, S T Belyaev did his best to organize collective works with other institutes, in particular with CERN. By organizing collaboration and participating in discussions of experiments, he became a competent member of two international collaborations aimed at the study of double beta decay and collisions of relativistic heavy ions. In the 1980s and 1990s, S T Belyaev did much to create a high-power source of synchrotron radiation (SR) at the Kurchatov Institute. Along with deep and diverse knowledge of electron accelerator physics, the decisive role was played by his friendly relations with the best specialists in this field from Novosibirsk INP who worked on the project and helped in its realization. Success would have been impossible without the constant efforts of Spartak Timofeevich in support of the project in the Russian Academy of Sciences and in sponsoring departments of Ministries. The extant SR source at the Kurchatov Centre is a world-class facility.

However, S T Belyaev was interested not only in large-scale projects but also in rather modest experiments that gave unexpected results. For instance, in recent years he devoted much time to the correlations revealed by Yu L Sokolov on one of the setups at the Kurchatov Centre during the study of interferences of 2s and 2p states of the hydrogen atom. S T Belyaev not only published his considerations concerning this issue but also tried to convince his colleagues from INP to continue measurements using other approaches. In a similar way, the unusual phenomena discovered by V I Morosov and his colleagues in experiments on the precision measurement of the neutron lifetime motivated Spartak Timofeevich to undertake an elaboration of a consistent theory of elastic and inelastic interactions of ultracold neutrons with matter. The basic principles of this theory were presented in the papers published in the 2000s.

Noteworthy is S T Belyaev's selfless participation in work on the elimination of the aftereffects of the Chernobyl accident of April 1986. He became a scientific supervisor of the Chernobyl expedition of the Kurchatov Institute and for many years, beginning in July 1986, spent one or one and a

half months in Chernobyl examining the situation on the spot. Simultaneously, as Chairman of the Committee of the Academy of Sciences on Chernobyl's scientific problems, he coordinated work assessing the consequences of the disaster with the participation of foreign specialists and visited the affected Ukrainian and Belarussian regions. His numerous published papers and reports with the discussion and estimation of the appropriateness of the measures taken to liquidate the consequences of the Chernobyl disaster are not only of historic interest.

Spartak T Belyaev was first engaged in pedagogical activity as far back as the 1950s by M A Leontovich, Head of the Department of Theoretical Physics at the Moscow Engineering Physics Institute (MEPI). But Belyaev's pedagogical activity actually became serious in the years of the establishment of Novosibirsk State University. He had to work out ways to attract talented youth, to arrange educational programs, and to regulate the coordination of students' studies with their participation in the research work in scientific institutes of the Novosibirsk Center. S T Belyaev played great role in the transformation of NSU into one of the leading universities in the country.

S T Belyaev continued to work hard as Head of the Department of Theoretical Physics at his native MIPT. He initiated a revision of the curriculum and changed radically the structure of the educational process, which made it possible to offer to students courses in modern problems of science along with the basic programs. In all his posts, S T Belyaev actively advocated the 'Fiztekh system' which he felt keenly at the very beginning of its formation when he was a student, and supported and developed as a pedagogue, Head of the Department, and Rector.

He had his own particular view of education and science that came about for the most part owing to meetings and collaboration with bright and high-profile people, including, along with those already mentioned, A P Aleksandrov, I V Kurchatov's successor as Director of the Kurchatov Institute for many years, Yu B Rumer, with whom he was brought closely together at Novosibirsk State University, and Niels Bohr. In Copenhagen, Bohr showed great interest in S T Belyaev and V M Strutinskii, who had come from Moscow partly because that was the first such visit after long years of no scientific contact. Later on, during Bohr's visit to Moscow in 1961, S T Belyaev met him repeatedly. The impression produced on S T Belyaev by these meetings can be judged by his two 1985 papers issued to the centenary of the great Danish scientist and devoted to both Bohr himself and his contribution to nuclear physics.

From the late 1990s, S T Belyaev guided the leading scientific school — the team of theoretical physicists of IGNP supported by grants from the President of the Russian Federation. His school is actually much wider and includes also those who were his disciples, and NSU and MIPT graduates who appreciated the results of the organizational and pedagogical activities of Spartak Timofeevich, and his staff members and colleagues engaged in their mutual scientific work and discussions. Several generations of physicists working in Russia and abroad consider themselves to be his disciples.

For his service in battle and labor, S T Belyaev was awarded many orders and medals. Along with the above-mentioned Eugene Feenberg Medal, his scientific efforts were honored by the L D Landau Gold Medal of RAS (1998), the M V Lomonosov Great Gold Medal of RAS (2010), and the I Ya Pomeranchuk Prize for theoretical physics (2012).

In one of his interviews, Spartak Timofeevich formulated the 'maximum identity' principle, implying openness and responsibility along with the willingness to work with full dedication. Combining this principle with audacious physical intuition, deep and lively thought, and the great talent of a theorist, he reached amazing heights in science. This noble principle of Spartak Timofeevich Belyaev is a lesson for all of us.

Yu G Abov, A L Barabanov, E P Velikhov,
S S Gershtein, V I Ilgisonis, M V Kovalchuk,
A A Korsheninnikov, G N Kulipanov, P V Logachev,
V A Matveev, A N Skrinsky, G V Trubnikov