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MIKHAIL GRIGOR'EVICH MESHCHERYAKOV

(On his sixtieth birthday)

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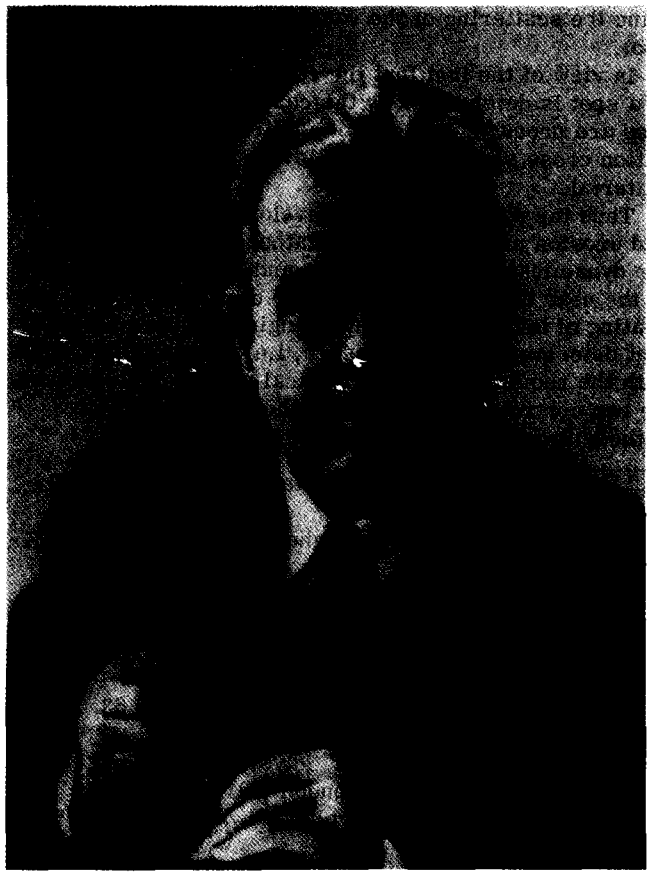
MIKHAIL Grigor'evich Meshcheryakov, well-known Soviet physicist, Corresponding Member of the USSR Academy of Sciences, and twice laureate of the State Prize, celebrated his birthday this September. His activity has been inseparably linked with the construction of powerful accelerators in our country and with the development of research in the field of nuclear physics and elementary particle physics. For many years, he has combined physical research and development of new experimental apparatus with extensive work on the organization of science and the training of scientific cadres.



Meshcheryakov was born on 17 September 1910 in the village Sambek (Taganrog province, Donskoe Voisko oblast') in a poor peasant's family. After completing the three-year village school he was forced to help his mother (his father was killed in the western front in 1916) to work the farm. Only in 1930 was he able, by combining factory work with night study, to complete his secondary education. In the same year he enrolled in the physics department of the Leningrad University. Already as a second-year student, he began to specialize, under the guidance of Professor L. V. Mysovskii, in the field of the physics of natural radioactive transformations of atomic nuclei.

After being graduated with distinction from the Leningrad University in 1936, Meshcheryakov started graduate study under the guidance of Professor I. V. Kurchatov at the Radium Institute of the USSR Academy of Sciences, where the first one-meter cyclotron of our country was then being constructed, and where intense interrelated research was being pursued in nuclear physics, radiochemistry, and geochemistry. Meshcheryakov's growth as a scientist occurred while he was on the staff of this institute.

The first experiments in which he participated were devoted to the absorption of slow neutrons by atomic nuclei. He then proceeded to study radiative capture of neutrons with energies higher than 1 MeV by complex nuclei, and observed that the cross section of this process fluctuates strongly with increasing mass number of the nucleus. This result, which became famous because it contradicted the then-prevalent statistical theory of nuclear reactions, later served as one of the arguments in favor of the shell model of the nucleus.

An important circumstance in Meshcheryakov's further creative path was he concentrated his efforts, since 1938, on the startup of the one-meter cyclotron. In 1940 he headed the Cyclotron Laboratory of the Radium Institute and soon, together with D. G. Alkhazov and L. M. Khromchenko, he achieved normal operation of the cyclotron and obtained intense beams of accelerated particles.

From the very start of World War II, Mescheryakov was at the front. In 1942, released from the hospital and demobilized, he started working on applied problems. In 1944, soon after the breaking of the Leningrad blockade, he restored the cyclotron of the Radium Institute and used it as a high-resolution mass spectrometer, completing together with E. L. Grigor'ev and A. A. Reut a cycle of experiments on the determination of the isotopic composition of helium from various sources. To search for isotopes having a very low abundance, he proposed and realized a highly sensitive method of registering single accelerated helium ions at the cyclotron output, using thick-layer nuclear emulsions. It was thus established that the relative abundance of the isotope He^3 in helium extracted from a radioactive mineral 1.8×10^9 years old is less than 10^{-10}, whereas the relative abundance of He^3 in helium from gas wells is about 10^{-7}. This experimental fact led to a deduction of great importance in geochemistry, that the helium released from the earth is not all due to natural α decay of radioactive nuclei. It was also found that the upper limit of the abundance of He^5, the very existence of which was then under discussion, was

less than 10^{-14} in helium of any origin. This result served as clear-cut evidence of the instability of He^5.

In 1946–1947 Mescheryakov served as the Soviet Union's expert in the Atomic Commission of the UN. After returning from the US he was transferred to Moscow, to the Laboratory of the USSR Academy of Sciences (now the Atomic Energy Institute) and designated as scientific supervisor of design and construction of the then largest accelerator, the six-meter cyclotron, in the region of the village Bol'shaya Volga (now the city of Dubna). Using the experience gained in the startup of the one-meter cyclotron in Leningrad, Meshcheryakov together with a group of associates completed a physical model of the new accelerator within a short time, and solved successfully a number of complicated scientific and technical problems connected with the development of the six-meter synchrocyclotron.

During the same time, in 1947–1949, at Meshcheryakov's initiative and with his direct participation, a large cycle of systematic investigations of the interactions between deuterons and α particles accelerated to 15.5 and 26.4 MeV respectively with complex nuclei were investigated with the cyclotron of the Laboratory of the USSR Academy of Sciences. The results of these experiments, which led to the observation of hitherto-unknown features of nuclear processes at cyclotron energies, were reported by him in the form of a dissertation, which he successfully defended in 1950 and for which he was granted the degree of Doctor of Physical and Mathematical Sciences.

Following the successful startup of the large synchrocyclotron in 1949, a new branch of scientific research, the physics of high-energy particles, was initiated in our country. Supported by I. V. Kurchatov, Meshcheryakov organized around this accelerator an independent center of high-energy physics and assumed its scientific direction. The rapid development of experimental research with the synchrocyclotron, which yielded scientific results of first class, caused this center to be reorganized in 1953 as the Institute of Nuclear Problems of the USSR Academy of Sciences, and Meshcheryakov was its director until 1956, when the institute was absorbed by the Joint Institute for Nuclear Research.

Since 1950, Meshcheryakov's scientific interests were focused on investigations of nucleon-nucleon interactions above the pion production threshold. Outstanding among the numerous investigations of this cycle is the experiment performed by him, with B. S. Neganov, wherein the resonances of the reaction $p + p \rightarrow \pi^+ + d$, due to the formation of an excited state of a nucleon with total angular momentum and isotopic spin equal to $3/2$, were observed for the first time. A thorough study of the energy spectra of the pions and the secondary protons accompanying them has led, furthermore, to the conclusion that this resonant state plays an important role also in other pion production processes in pp collisions. These results, which became widely known and were confirmed in other investigations made a major contribution to elementary-particle physics.

Another field of research by Mescheryakov and his co-workers was connected with a detailed study of elastic proton-proton scattering in the energy interval 460–660 MeV. In these investigations, outstanding for the perfection of their experimental technique, it was shown for the first time the elastic proton-proton interaction assumes features of diffraction scattering above the pion production threshold. This was followed by a series of experiments on polarization effects in processes of double and triple scattering of protons at 660 MeV. The aggregate of the obtained results has made it possible to carry out a phase shift analysis and to determine the elements of the pp scattering in a hitherto uninvestigated energy region.

In 1955, Mescheryakov called attention to the great promise offered by research on nuclear structure by observing, under strictly controlled conditions, the scattering of high-energy protons by nuclei. The corresponding experiments, soon performed by him and his associates with the six-meter synchrocyclotron, led to the observation of a new nuclear process, the direct knock-out of deuterons from nuclei by 675-MeV protons. This result, confirmed ten years later in Brookhaven with acknowledgement of the priority of the Soviet physicists, offered direct evidence of the existence of short-time close-correlated two-nucleon groups in nuclei. A similar conclusion was obtained also from experiments in which the momentum distribution of the nucleons inside the nuclei was measured. The same cycle of investigations included also a detailed investigation of the effect of proton polarization in scattering by carbon nuclei at 660 MeV, which made it possible to observe the different radial lengths of spin and spinless scattering. The research initiated by Meshcheryakov on the effects of nuclear structure by scattering of protons by nuclei is presently continued successfully with the six-meter synchrocyclotron in Dubna.

In recent years, without abandoning his physical researches, Meshcheryakov has embarked with amazing energy on the development of the presently very urgent problem of automatization of research on the physics of nuclei and elementary particles. In 1966 there was organized under his direction, as part of the Joint Institute, a Laboratory for computation techniques and automation, in which a measuring-computing complex, equipped with powerful computers and automatic scanning devices, was constructed within a very short time for the processing of photographs from large bubble and spark chambers.

The results of Meshcheryakov's research on the physics of nuclei, elementary particles, and accelerators, are published in more than 70 scientific articles.

Meshcheryakovs creative profile is characterized by originality of ideas, high experimental mastery, ability to use new technical means in his investigations, thoroughness and rigor of the mathematical analysis of the experimental results. One can envy his energy, uncompromising attachment to science, and strong sensitivity to its frontiers.

Meshcheryakov combines his fruitful scientific activity with pedagogical work. He has been professor of the Moscow University since 1953, and teaches there a course of "Elementary Particle Physics" to

the graduates of the physics department. Many of his students have defended dissertations and have become independent researches.

Meshcheryakov's scientific activity is highly valued by the Fatherland: he received three orders of Lenin, the order of Red Star and Sign of Merit with medals. In 1953 he was elected a corresponding member of the USSR Academy of Sciences.

Noting his sixtieth birthday, his students, friends, and associate wish him health and further creative success.

Translated by J. G. Adashko