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OBITUARY

Boris Aleksandrovich Mamyrin—In Memorium

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Boris Aleksandrovich Mamyrin, D.Sc., corresponding member of the Russian Academy of Sciences, passed away on March 5, 2007.

Mamyrin was born May 25, 1919, in Lipetsk. After finishing high school in 1937, he joined the Physics and Mathematics Faculty of the Leningrad Polytechnic Institute. As a third-year student, Mamyrin volunteered for active service during the Finnish war. He saw active service and worked in the Academy of Communications during the Second World War.

In 1948, Mamyrin was discharged from the Soviet Army and was invited by A.F. Ioffe to work at the Physicotechnical Institute. One of the main topics of research at the Institute in those days was isotope separation for the atomic project. This activity required the development of mass spectrometry. As a senior research associate, Mamyrin started working in this field and successfully defended his Ph.D. thesis in 1949 on modulating devices of setups for separating uranium isotopes by the rf technique.

The talents of Boris Aleksandrovich were exposed to the fullest extent at the Physicotechnical Institute. With unwavering enthusiasm and invariably successful outcome of their practical research activity, Mamyrin with coworkers and colleagues from other organizations developed wide-band amplifiers, stroboscopic devices for detecting weak signals, electrometric amplifiers, open-type diode multipliers, vacuum packings permitting a large number of closures, and inlet valves, as well as other components and systems for mass spectrometers.

In 1966, Mamyrin successfully defended his D.Sc. thesis on "Investigations of Time-of-Flight Ion Separation." In the middle of the 1970's, he was appointed a professor, and in 1981, he organised at the Ioffe Physicotechnical Institute the first mass-spectrometer laboratory of the USSR Academy of Sciences. Professor Mamyrin made a significant contribution to science in the field of dynamic mass spectrometry and its applications. From the beginning of the 1950's, research has been carried out at the Ioffe Physicotechnical Institute on the creation of an entirely new type of devices, i.e., the magnetic resonance mass spectrometer (MRMS), and Mamyrin played a leading role in the development of such instruments. Only six such devices exist at present in the world, and three of them (MI-9301, MI-9302, and MI-9303) were developed at the special design bureau of analytic instrumentation, Russian Academy of Sciences. Owing to their extremely high analytic parameters (resolving power, absolute and isotopic sensitivity, dynamic range and precision of mass evaluation), these devices are being used for isotope research of helium and other inert gases.

Research in the field of helium isotopes led to the discovery of relict ^{3}He in the Earth mantle, thermal flows in the Earth's crust, and the effect of dynamic-dislocation diffusion of helium in solids during deformation; these results were registered as discoveries.

One more application of MRMS was the measurement of fundamental physical constants. The operating principle of resonance instruments enabled Mamyrin and his colleagues to measure the ratio of proton magnetic moment in nuclear magnetons with the highest degree of precision ever attained in the world (with a relative measuring error of 0.43 ppm). This result was included without modification in the official table of physical constants in 1973 and was used for many years for determining the values of many electromagnetic physical constants. After the recognition of Mamyrin's

results by the world scientific community, he was inducted into the working group on fundamental physical constants in the Committee on Scientific and Technical Data (CODATA) and remained its member until his last days.

Another important application of MRMS is associated with its extremely high absolute sensitivity (~3×10^4 ^{3}He atoms in the analyzer volume) and a wide dynamic range (~10^{11}). In the middle of the 1970's, a need arose to refine the half-life of tritium. All the measuring techniques prevailing at that time required absolute measurement of the quantity of the parent element tritium or the daughter element ^{3}He, or the energy released during β-decay of tritium. Mamyrin and his colleagues proposed a method for measuring $T_{1/2}$ of tritium through relative measurements of the ratio ^{3}He/^{4}He. An important advantage of the method is that the time of exposure of the sample containing tritium-^{4}He mixture is just 1–2 years, while the corresponding period in other methods is measured in decades. The results of measurements of $T_{1/2}$ of tritium obtained by Mamyrin and his colleagues are quite significant. It was experimentally shown that the half-lives of the tritium nucleus, atom and molecule are different, thus showing that the orbital electrons affect the half-life of tritium. These results led to the value of free neutron lifetime and the ratios of axial-vector and vector constants of weak interaction.

The best-known scientific achievement of Mamyrin and his colleagues was the development of a nonmagnetic time-of-flight mass spectrometer in 1973, which later came to be known as the Mamyrin mass reflectron. This instrument has a high resolving power and sensitivity, quick response and an unlimited range of masses that can be measured with its help. Owing to their unique analytic parameters, mass reflectrons found the widest applications in various fields of science (organic chemistry, biology, ecology, proteomics, pharmacology, etc.) and engineering for monitoring fast technological processes. Mass reflectrons are now being produced by instrument makers all over the world. Instruments like FTIAN-3, FTIAN-4, FTIAN-5 and MKh-5302 were mass-produced in Russia. Such serial production made it possible to equip most of the metallurgical plants in Russia and CIS countries with systems of continuous monitoring of the processes of converter production of steel, copper, and nickel, as well as blast-furnace production and vacuum remelting of steel. For his contribution towards the organization of industrial production and large-scale implementation of mass-reflectrons in metallurgy, Mamyrin was awarded the B.P. Konstantinov Award of the Presidium of the USSR Academy of Sciences in 1982. In 2000, the American Society of Mass Spectroscopy (ASMS) decorated Mamyrin with a medal to place on record his outstanding contribution in the field of mass spectrometry.

Prof. Mamyrin paid considerable attention to the training of scientific workers. From 1948 to 1971, he delivered a course of lectures on radiophysics at the Leningrad Polytechnic Institute. He guided the research work of about 20 Ph.D's and 3 D.Sc's. He played a significant role in organizing research activity and was a member of the Academic Councils of the Ioffe Physicotechnical Institute and the Mendeleev Metallurgical Research Institute. He was also a member of the Editorial Boards of the journals of *Technical Physics* and *Technical Physics Letters*, a member of the Mass Spectroscopy Commission and a member of the Councils of Scientific Instrumentation and Metrology under the Russian Academy of Sciences, and chairman of the National Working Group and the Representative of Russia to the International Committee on Scientific and Technical Data (CODATA).

In the course of his research activity, Mamyrin published two monographs and hundreds of research papers and obtained two patents and more than 30 author's certificates. In 1994, he was elected a corresponding member of the Russian Academy of Sciences in the field of physics.

Boris Aleksandrovich had many talents. He had a broad view on all kinds of problems and derived immense pleasure by solving them. He was a connoisseur in many matters, be they scientific research or an aria in an opera or art. His blessed memory will remain forever in the hearts of his pupils and colleagues.

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